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REVISION HISTORY

REVISION	DESCRIPTION	DATE
0.0	Preliminary	Mar 02
1.0	First release without all features tested	Aug 02
1.1	Added LED and Jumper Drawings	Feb 04
1.1.1	Fixed formatting and typos	Jul 07

WARNING: This version contains areas of gray text that are indicative of future software releases. These sections are to be used as information only and are subject to change. Some features will never be released. Some of these features may seem to work but they have not been completed and have not been verified by Evertz.

1. OVERVIEW

The 7735CEM line of component serial digital to composite analog video converters are broadcast quality encoders with an extensive list of additional features. An audio de-embedder with high quality audio digital to analog conversion or AES inputs/outputs can be purchased with the encoder to create a video/audio frame synchronizer/conversion package. In addition, Evertz fault monitoring processing will analyze and report video and audio problems via an On-Screen-Display (OSD), or remotely via VistaLINK® SNMP.

The 7735CEM product features various video processing functions such as VITC, closed captioning and SID extraction during the encoding process, as well as monitoring video for black and freeze conditions. The audio is processed, to extract level information for creating and displaying level and phase bar graphs. In addition, the audio is analyzed for periods of high level, silence, mono, and out-of-phase conditions. All of this status information is displayed on the monitoring analog output via on-screen display (OSD) overlay.

The features of all 7735CEM's are:

- One component serial digital input (525 or 625).
- EDH analysis on SDI input.
- One composite analog video output WITHOUT OSD text or audio bargraphs.
- Internal processing to maintain 10 bit digital video quality.
- 10 bit output video digital to analog conversion.
- One monitoring quality video output with OSD text and bargraph graphics.
- User adjustable output video processing functions: black level (brightness), gain (contrast), hue, and saturation.
- One composite analog reference input (NTSC or PAL-B) on BNC. 75 Ohm or high-Z, jumper configurable input impedance.
- One frame video synchronizer (with +S option).
- Infinitely variable output phase.
- Freeze modes: black, freeze.
- Adjustable free running frequency.
- VU/PPM bargraph level Indicators.
- Decodes vertical interval time code (VITC) and "burns" the time code into the picture.
- Decodes PESA format Source ID (8 characters) or Evertz format VITC Source ID (5 or 9 characters) and burns the ID into the picture.
- A comprehensive on screen display is available to configure the various features of the module.
- Flexible configuration of the text and audio bar graph information displays.
- An extensive list of error conditions can be monitored and fault conditions can be configured from these conditions.
- On screen messages can be triggered by the configured fault conditions.
- Two GPI inputs are available to modify the display characteristics.
- Two GPO output to indicate user definable fault conditions.
- GPI/Os are available on a DB9 connector.

The Features of "-A4" option are:

- One group (4 channels) of synchronous 20-bit audio is de-multiplexed from the incoming digital video.
- 2 unbalanced AES audio inputs (up to 48kHz, 24 bits) on BNC.
- User selects EITHER the de-embedded audio or the input AES audio.
- The selected audio is delayed equivalently to the video delay with the +S option.
- 4 high quality 24 bit audio channels are output (analog) as balanced on 2 removable barrier strips.
- Low impedance outputs (66Ω).
- Analog audio output levels are adjustable.
- Additional audio delay of up to 5 seconds.
- Additional audio advance of up to 1 frame, depending on video delay.
- Loss of video modes: pass audio, mute audio.

The Features of "-AES" option are:

- 75-Ohm coaxial (unbalanced) AES inputs (2) on BNC.
- Audio delay equivalent to video delay (with +S option).
- Additional audio delay of up 5 seconds.
- One group (4 channels of audio) is de-multiplexed from the incoming digital video.
- 2 unbalanced AES audio outputs.
- Loss of video modes: pass audio, mute audio
- Bypass relay protection that allows removing the card without re-wiring AES audio.

1.1. FUNCTIONAL DESCRIPTION

270Mbps component SDI video is converted to 10 bit parallel data and encoded to high quality composite analog video. Various video processing functions (gain, saturation, black level, etc) are performed during the encoding process.

Digital audio is de-multiplexed from the incoming SDI video. External digital AES audio is also received via input BNC's. The user can select either of these two sources for further processing. The selected digital audio is delayed (with +S option) to match the delay experienced by the video in the video synchronizer. In addition, the user can select additional audio delay. On the 7735CEM-AES, this delayed audio is formatted properly and delivered to the user as unbalanced 75 Ohm AES audio on BNC. On the 7735CEM-A4, the audio is converted to balanced analog audio through a high quality 24 bit D to A converter and delivered to the outside world via removable terminal strips.

The audio is also processed to extract level and phase information. The CPU creates the level and phase bar graphs and writes them out to the on screen display (OSD) memory.

VITC, closed captioning and Source ID are extracted from this input stream. In addition, the video is monitored for black and freeze conditions. The CPU reads this raw data and extracts time code, program rating and the closed captioning information. In addition, analysis of the data is performed to determine fault or error conditions. The time code, program rating, source ID message and faults are also written to the OSD memory for display on the monitoring output.

This video goes out through two paths; a high quality component to composite converter (composite encoder) and a monitoring quality composite encoder with the OSD "burn-ins". The hardware mixes (keys) the on screen text and bar graphs display information onto the monitoring output video stream.

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.

General-purpose inputs are used for remote control of some features and general-purpose outputs are generated under error conditions.

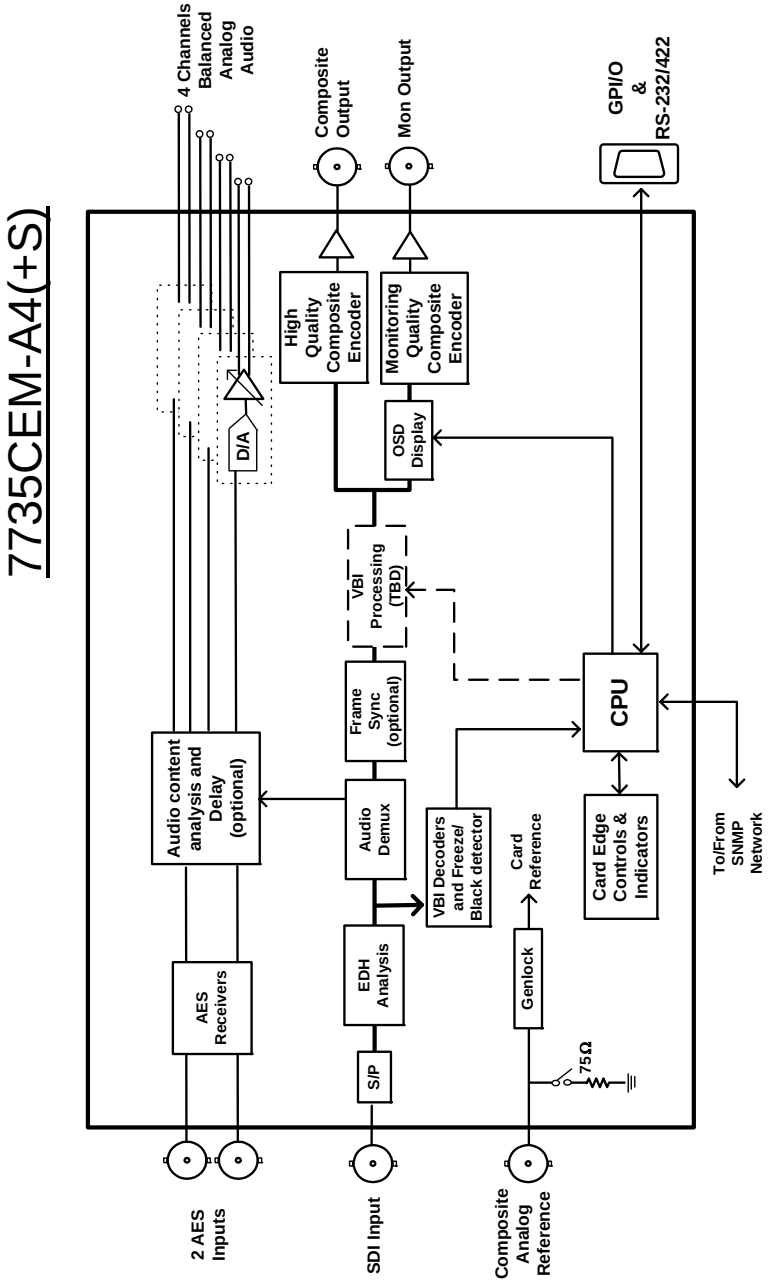

Figure 1-1: 77CEM Block Diagram

2. INSTALLATION

The 7735CEM modules come with a companion rear plate and occupies 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 the 7700FR chapter section 3.

The 7735CEM cards must be inserted into slots with the correct rear panel. Some cards have physical differences and some have functional differences and the associated labels will be misleading.

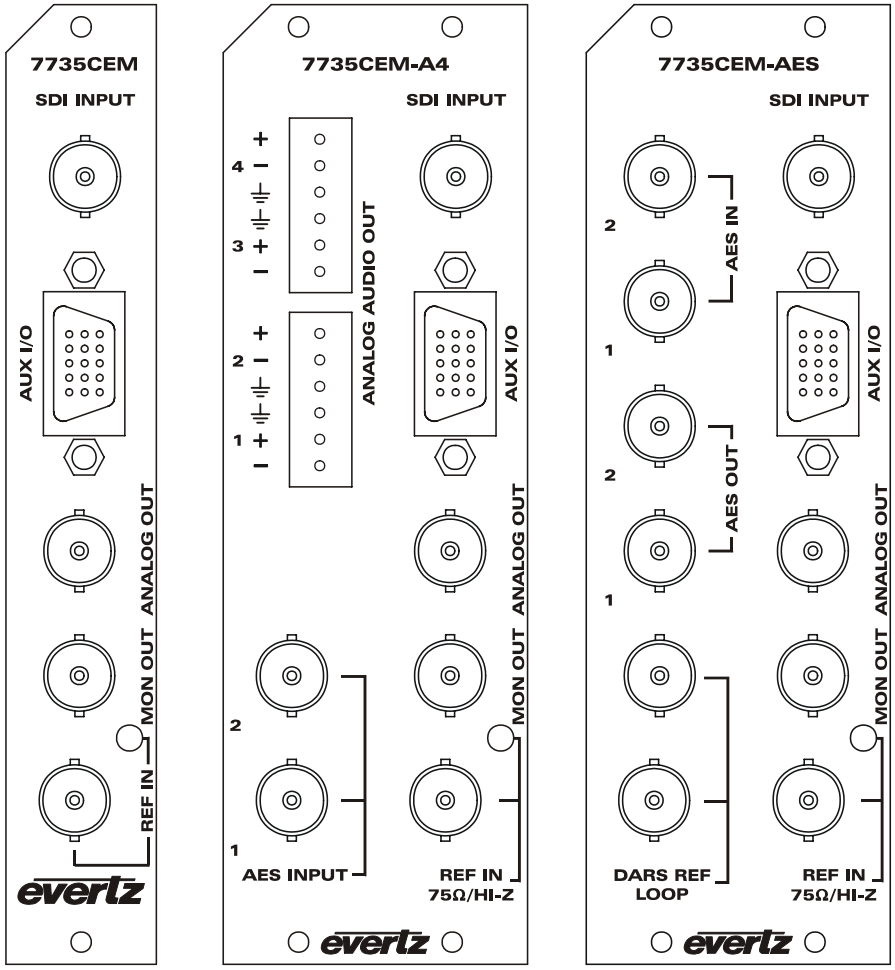

Figure 2-1: 7735CEM Rear Panels

2.1. VIDEO IN AND OUT

Connect a source of component serial digital (525 or 625 line) video to the top BNC labeled SDI INPUT. Connect a reference black signal to the REF BNC. Broadcast quality composite analog video is available on the ANALOG OUT BNC. Monitoring quality video with text and audio bar graphs are 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.

2.2. COMMUNICATIONS AND AUX I/O

The rear female DB-9 connector has RS-232 DCE connections and also contains GPIs and GPOs.

Name	Description	DB-9
GPI1	General Purpose Input 1	1
GPI2	General Purpose Input 2	6
GPO1	General Purpose Output 1	4
GPO2	General Purpose Output 2	9
Rx	RS-232 (output)	2
Tx	RS-232 (input)	3
NC	Reserved	7
NC	Reserved	8
gnd	Ground	5, Shell

Table 2-1: Comm and Aux I/O Pinout

The physical layout is similar to the following:

1	GPI 1		6	GPI 2
2	TxD (out)		7	NC
3	RxD (in)		8	NC
4	GPO 1		9	GPO 2
5	gnd			

The shell is also grounded.

Table 2-2: Comm and Aux I/O Physical Layout

2.2.1. General Purpose Inputs and Outputs

The GPI's are active low with internal pull up resistors (4.7k Ohms) to +5V. To make an input active, lower the signal to near ground potential (i.e. connect to shell or chassis ground). This can be done with a switch, relay, TTL drive, GPO output or other similar method. Figure 2-2 shows the input circuit for the General purpose inputs.

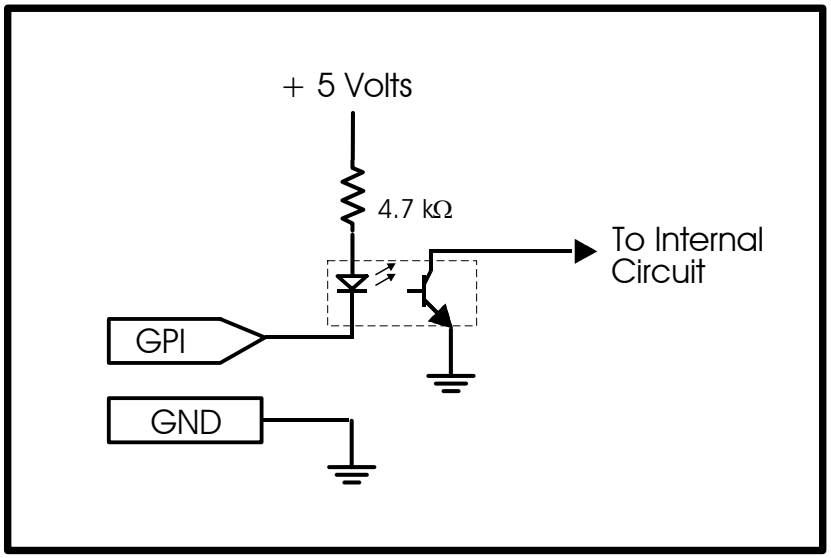

Figure 2-2: GPI Input Circuitry

The GPO's are software programmable active high or low with internal pull up (10k Ohm) resistors to +5V. When the output goes low it is able to sink up to 10mA. When high, the signal will go high (+5V). **Do not draw more than 100μA from the output.** Figure 2-3 shows the circuit for the general purpose output.

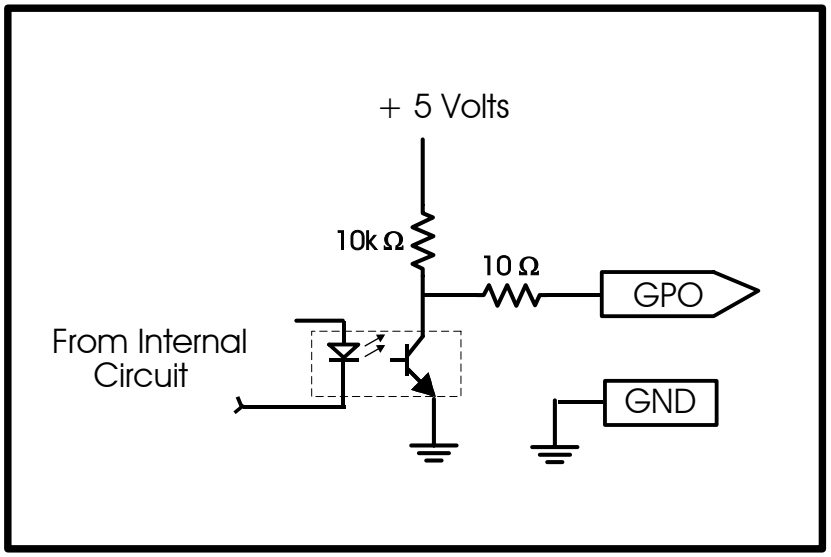

Figure 2-3: GPO Output Circuitry

2.2.2. RS-232 Serial Port Connections

The COM port signals are standard RS-232 without hardware flow control. The directions of the signals are indicated in Table 2-1. The RS-232 port on the Aux I/O connector is used for data logging of the status and fault conditions. Connect this port to a COM port on your PC running a terminal application such as Windows HyperTerminal. Configure the port to 57600 baud, 8 bits, no parity, 2 stop bits, and no flow control.

3. SPECIFICATIONS

3.1. SERIAL VIDEO INPUT

Standard:	SMPTE 259M-C – 525 or 625 line component.
Number of Inputs:	1
Connector:	BNC per IEC 169-8
Return Loss:	>15dB to 270MHz
Embedded Audio:	SMPTE 272M-A
Frequency Lock Range:	±75ppm from nominal
Lock up time on a hot switch:	TBD

3.2. ANALOG BROADCAST VIDEO OUTPUT

Standard:	NTSC, SMPTE 170M PAL, ITU624-4
Number of Inputs:	1
Connector:	BNC per IEC 169-8
Signal Level:	1V nominal
Output Impedance:	75 Ohm
DC Offset:	0V +/- 50mV
Return Loss:	>35dB to 10MHz
Frequency Response:	<+/- 0.1dB to 4 MHz (response will depend on selected filtering)
Differential Phase:	< 0.5° (< 0.3° typical)
Differential Gain:	< 0.5% (< 0.3% typical)
SNR:	>75dB (black video, 100kHz to 5MHz)
Output level control range:	±10%
Black level control range:	±7.5 IRE
Chroma level control range:	±10%
Hue control range:	±15 deg. (NTSC only)
Minimum Delay:	3 µs
Maximum Delay:	1 frame + 3 µs (+S option only)

3.3. REFERENCE VIDEO INPUT

Standard:	NTSC, SMPTE 170M PAL, ITU624-4
Number of Inputs:	1
Connector:	BNC per IEC 169-8
Signal Level:	1V nominal (0.5V to 1.5V)
Frequency Lock Range:	±75ppm from nominal
Input Impedance:	75 Ohm or High impedance (jumper selectable)
Return Loss:	>25dB to 10MHz
Max Subcarrier Jitter:	< 3 degrees
Free-Running Frequency Control Range:	> +/- 10ppm (> +/- 270Hz)

3.4. ANALOG MONITORING VIDEO OUTPUT

Standard:	NTSC, SMPTE 170M PAL, ITU624-4
Number of Outputs:	1
Connector:	BNC per IEC 169-8
Signal Level:	1V nominal
Output Impedance:	75 Ohm
Return Loss:	>35dB to 10MHz

3.5. ANALOG AUDIO OUTPUTS (-A4 only)

Number of Outputs:	4
Type:	Balanced analog audio
Connector:	Two 6 pin removable terminal strips
Output Impedance:	66Ω balanced
Sampling Frequency:	48kHz
Signal Level:	0dBFS => 12 to 25dBu (user settable)
Frequency Response:	<+/- 0.05dB (20Hz to 20kHz)
Dynamic range:	24 bits when AES inputs selected, 20 bits when embedded audio selected
THD+N:	<0.001% (>100dB) @ 1kHz, -1dBFS
Crosstalk:	<-105dB (20Hz to 20kHz)
DC Offset:	<+/- 30mV
SNR:	>110dB "A" Weighting
Inter-Channel Phase Error:	<+/-1° (20Hz to 20kHz)

3.6. AES AUDIO INPUTS AND OUTPUTS (-AES only)

Number of Inputs:	2
Number of Outputs:	none on –A4 versions, 2 on –AES versions
Input Standard:	SMPTE 276M, single ended synchronous or asynchronous PCM AES
Output Standard:	SMPTE 276M, single ended synchronous AES
Connectors:	BNC per IEC 169-8
Resolution:	24 bits when AES inputs selected, 20 bits when embedded audio selected
Input Sampling Rate:	32kHz to 48 kHz when AES inputs selected, Synchronous 48kHz when embedded audio selected
Output Sampling Rate:	Synchronous 48kHz
User Bits:	Transferred to output in a non-real-time, non-block-contiguous manner on –AES versions
Minimum I/O Delay:	3.5msec on –A4 versions 4.5msec on –AES versions

3.7. GENERAL PURPOSE IN/OUT

Number of Inputs:	2 (behavior is assigned via. on-screen menu items)
Number of Outputs:	2 (behavior is programmable via. on-screen menu items)
Type:	Opto-isolated, active low with internal pull-ups to +5V
Connector:	Female DB-9
Signal Level:	+5V nominal

3.8. SERIAL PORT

Standard:	RS 232
Connector:	Female DB-9
Baud Rate:	57600
Format:	8 bits, no parity, 2 stop bits, no flow control

3.9. ELECTRICAL

Voltage:	+ 12VDC
Power:	9.25 Watts (7735CEM) 16.75 Watts (-A4 option)
EMI/RFI:	Complies with FCC Part 15, class A and EU EMC directive.

3.10. PHYSICAL

7700 frame mounting:	
Number of slots:	1 for non-audio versions 2 for audio versions (-AES, -A4)

4. STATUS LEDS

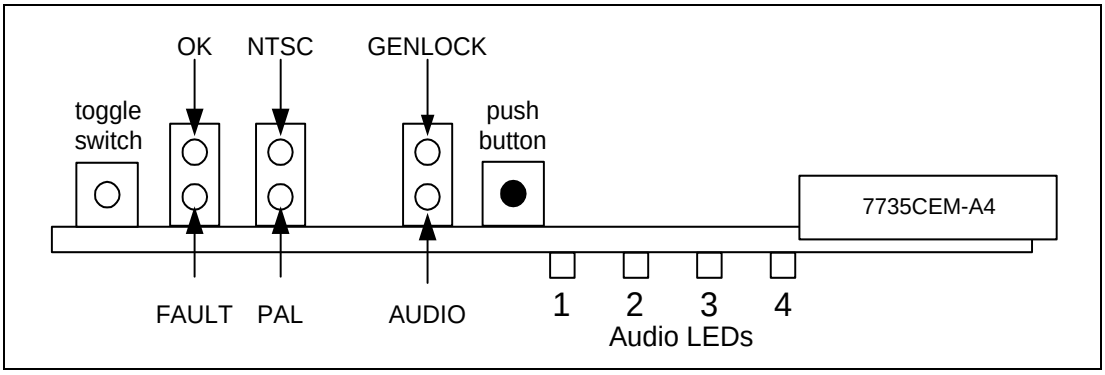

Figure 4-1: LED Locations

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

NTSC/PAL: The NTSC/PAL Green LEDs (NTSC on the top, away from the PCB and PAL on the bottom, closest to the PCB) will indicate the video standard of the SDI video input. If video is removed, both LEDs will go off. If the input standard is opposite to the user selected standard, the LED will flash.

GENLOCKED: This Green LED is on solid if the genlock source is present and the user has turned on genlocking.

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

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

AUDIO: This Green LED is on solid when the user selected audio is present. It will flash when some, but not all, of the audio channels are present. If no audio is present, it will be off.

For instance, if external AES audio is selected (via. the OSD menu) and only one of the two AES channels is present, then this LED will flash.

REF:
(on rear panel) This yellow LED on the rear panel by the reference BNC will be on when this input is being used as the reference for the card.

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. Digital audio presence is determined by the AES receiver lock indicator (when AES input is selected). When embedded audio is selected, the channel must be present on the selected group for the LED to illuminate.

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

5. AUDIO LEVELS, HEADROOM, CLIPPING AND THE BAR GRAPHS

This section contains notes to understand how the 7735CEM-A4 relates analog audio levels, digital audio levels, and the displayed bar graph levels.

Before you can calibrate the audio digital to analog converter, you must know a couple of system issues specific to your application. What is your analog reference level and how much headroom is there in the digital audio signal? By adding these two values together, you will get the analog output 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 0dB FS (FS stands for "full scale"). For instance, if your analog program reference level is 4dBu and you have 20dB of headroom in the "digital world", then 0dB FS will correspond to an analog level of 24dBu. Once the audio output level is calibrated, when you apply a digital level of –20dB FS, the analog output signal will be 4dBu .

The SDI embedded audio, the AES input audio and the bargraphs are all based on the same digital quantized signal level. The AES/EBU bargraph ballistics mode is scaled to 0dB FS while the other modes have a user selectable headroom. For this reason, use the AES/EBU mode for calibrating audio levels.

When a full-scale digital signal is input, you will get a peak analog output signal level that is set by the *analog level* controls. The *Headroom* control sets the 100% program reference level (0 dB on the scale) with respect to the Peak Output Level set by the *analog level* controls. For example, if the Peak Output Level is set to 24 dBu and the *Headroom* is set to 20 dB, then the 0 dB reference on the bar graphs will correspond to an output level of 4 dBu. This level will be achieved when a digital input signal of –20 dB FS is applied at the input. Therefore, the following relationship is always maintained:

PGM reference level + headroom = peak output level

The VU and PPM standards were set before the digital revolution. These standards deal with headroom levels that are quite a bit lower than what should be used in the digital world. Also, most of the bar graphs only display a few dB above the program reference level. In a digital world, one needs to leave around 20 dB of headroom to keep most material away from clipping.

For best results, follow these steps when setting up the audio bar graphs and output levels:

1. Set the *Headroom* control to the desired value. Remember that this is the value in dB between the 100% reference level (expressed in dB FS) and saturation level of the digital input word (0 dB FS). It will also correspond to the value in dB between the analog output level when a reference level is input and the maximum output level set by the *analog level* controls.
2. Pick the bar graph type and mode. This selection will configure the bar graphs with the defaults dictated by the standards. It will also set the Peak Output Level and the 0dB reference level to adhere to the standard and the desired headroom.
3. Adjust any of the bar graph configuration parameters to customize the display of the graphs.
4. Save the card configuration into a preset so that you can recall it if any card parameter is tampered with.

6. AUDIO ALARM CALIBRATION PROCEDURE

This section contains a detailed description on setting the various audio warning/error detection parameters.

Some of the audio alarm detection algorithms are dependent on the state of other audio alarm detectors. For instance, the mono detection algorithm will not use periods of silence as determined by the silence detection. For this reason, the following sequence should be used to calibrate the audio alarms. The items in *italics* refer to menu items in the CEM. See section 7.10 for a complete description of the fault definition menu items.

6.1. CALIBRATE AUDIO SILENCE DETECTION

1. Supply the card with your plant's noisiest audio feed without any audio program material present. This will be a baseline noise level to calibrate the silence detector.
2. Turn off all sources of errors in a *Fault Condition* and assign *Audio Silence* as the only error. Also, make sure that you set the *Fault Duration* to a small number of frames so that you will see when the error condition disappears.
3. Set the *Silence Duration* to 0.5 sec so that you can see the results of adjusting the *Silence Level* parameter without getting confused with the detection time.
4. Adjust the audio *Silence Level* until the *Fault Condition* begins to go active. This will be the noise floor level. Raise the *Silence Level* a few dB to make the detector insensitive to this noise level.
5. Set the *Silence Duration* to a time appropriate to your application. This should be set to a value longer than your worst case acceptable quiet period.

6.2. CALIBRATE AUDIO PHASE REVERSAL DETECTION

1. Supply the card with a stereo signal that has the phases reversed. Make sure that the material is typical of normal content for this channel.
2. Turn off all sources of errors in a *Fault Condition* and assign *Phase Reversal* as the only error. Also, make sure that you set the *Fault Duration* to a small number of frames so that you will see when the error condition disappears.
3. Set the *Phase Reversal Duration* to 0.5 sec so that you can see the results of adjusting the *Phase Reversal Level* without getting confused with the detection time.
4. Adjust the *Phase Reversal Level* so that the *Fault Condition* detects the phase reversal.
5. Set the *Phase Reversal Duration* to a time period appropriate to your application. **Warning:** Periods of silence (below the *Silence Level*) will extend this duration. In other words, periods without audio content are not included in the phase reversal detection. **Warning:** Stereo material with long periods of dissimilar left/right content (i.e. music with plenty of panning) may cause the phase reversal detector to fire. It is best to set the *Phase Reversal Duration* to a value larger than what you would expect.

6.3. CALIBRATE AUDIO MONO DETECTION

1. Supply the card with a stereo signal that originated from mono material and that has a large amount of un-correlated noise added to each channel. This will allow you to set the *Mono Threshold* to a value that will detect the mono condition in the presence of noise.

   Warning: Make sure that the material is in-phase. Mono material will not be detected if it is out of phase.

2. Turn off all sources of errors in a *Fault Condition* and assign *Mono* as the only error. Also, make sure that you set the *Fault Duration* to a small number of frames so that you will see when the error condition disappears.
3. Set the *Mono Duration* to 0.5 sec so that you can see the results of adjusting the *Mono Threshold Level* without getting confused with the detection time.
4. Adjust the *Mono Threshold Level* so that the *Fault Condition* detects the mono material in the presence of noise.
5. Set the *Mono Duration* to a time period appropriate to your application.
   Warning: Periods of silence (below the *Silence Level*) will extend this duration. In other words, periods without audio content are not included in the mono detection.

   Warning: Stereo material with long periods of similar left/right content (i.e. talking heads in a news cast) may cause the mono detector to fire. It is best to set the *Mono Duration* to a value larger than what you would expect.

6.4. DEFINE THE FAULT CONDITION(S)

1. A *Fault Condition* is defined as a group of one or more problems grouped together that will create a fault when any one of the problems exist. Decide what grouping of error conditions will generate a fault by setting the appropriate condition to *Yes* in the *Fault Condition* menu.
2. Set the *Fault Duration* to either *Until Reset* or to a time value. This is how long the condition will stay active after the conditions generating the fault go away.
3. Configure a *Fault Message*. Enter the text to display on screen, it's H and V position, and it's characteristics (opacity, colour, etc).
4. Assign the *Fault Condition* to an output contact closure (GPO) if it is desired.

7. ON SCREEN MENUS

7.1. NAVIGATING THE ON SCREEN MENU SYSTEM

A toggle switch and pushbutton allow card edge navigation of a set of on-screen menus used to configure the card.

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 choices, 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 choices, 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.

7.2. CHANGING TEXT FIELDS

Some of the controls of the OSD menu allow you to adjust a text-based field. Editing a line of text can be a little tedious with a toggle switch and a pushbutton, but it can be done with the following procedure:

1. Select the text to edit by pressing the pushbutton when the menu item is selected. This will take you to a screen that has the label/name of the text being edited and a white box. The white box contains the text to change and is drawn to the maximum size of the text field.

   ```
   SAMPLE TEXT
   ^
   ```

   Note the arrow (^) under the character. This indicates which character you will be changing with the toggle switch.

2. Use the toggle switch to change the first character of the text message.

3. Once you have selected the desired character, press the pushbutton. This will advance the arrow to the next character. Continue changing the remainder of the characters in the same way.

4. There are two special characters to help you enter the text: a backspace character (left pointing arrow), and an end of line character (stop sign):

Left Arrow: If you have accidentally advanced to the next character and want to go back, select the left arrow with the toggle switch. When you press the pushbutton, you will go back to the previous character. This will save you from having to complete the editing and re-edit it to change the mistake.

Stop sign: If you are done changing the text, and the new text is shorter than old text, you can terminate the line with a stop sign. When you use the pushbutton after selecting the stop sign, any remaining characters in the text field will be erased and you will return to the menu structure.

5. You are done editing when you reach the end of the field (maximum length), or you select the stop sign and press the pushbutton.

7.3. ON SCREEN DISPLAY – MAIN MENU

Audio	Configuration of the parameters associated with analog audio inputs and audio multiplexing.
Video/SID	Controls for the operation of video processing.
Bar graphs	Configuration of the audio level and phase bar graphs.
On-screen display configuration	Positioning controls and the on/off state of all windows and bar graphs. Configuration of the text window colours and opacity levels. Configuration of the GPI functions and how they affect the window and bar graph displays.
GPO configuration	Configuration of the General Purpose Outputs and the frame status control.
Fault definitions	Definition and calibration of the fault conditions. Configuration of the fault message windows.
Utilities	Card preset management, data logging and various debug and maintenance features.
Clear faults and peaks	An easy to access “clear fault state and bar graph peaks” command.

The OSD menu is arranged in a layered structure that groups similar configuration items together. The following section gives a brief description of the first level of menus that appear when you enter the OSD screens. Selecting one of these items will take you to the next menu level. Sections 7.4 to 7.12 provide detailed descriptions of each of the sub-menus. The tables in sections 7.4 to 7.12 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.

7.4. CONFIGURING THE AUDIO CONTROLS

The *Audio* menus are used to configure parameters associated with the analog audio outputs and the audio de-multiplexing. The chart below shows the items available in the *Audio* menu. Sections 7.4.1 to 7.4.6 give detailed information about each of the parameters. Many of the menu items are the same for the channel 1/2 and 3/4 channel pairs. For simplicity only the menu items for the channel 1/2 channel pair are shown in the manual.

Audio source	Selects the source of audio. It will either be the source group or external AES signals.
Audio freeze mode	Selects what action to take when video is gone.
Audio delay	Add/remove audio delay.
Audio buffer	Monitor audio delay buffer state.
Ch1 processing	Configures audio routing and processing for channel 1.
Ch2 processing	Configures audio routing and processing for channel 2.
Ch3 processing	Configures audio routing and processing for channel 3.
Ch4 processing	Configures audio routing and processing for channel 4.
Ch 1 gain	-A4: Channel 1 output level control. -AES: Channel 1 gain control.
Ch 2 gain	-A4: Channel 2 output level control. -AES: Channel 2 gain control.
Ch 3 gain	-A4: Channel 3 output level control. -AES: Channel 3 gain control.
Ch 4 gain	-A4: Channel 4 output level control. -AES: Channel 4 gain control.

7.4.1. Selecting the Audio Source

Audio *Audio Source* *Group 1* *Group 2* *Group 3* *Group 4* *AES* (-A4 and –AES only)	Up to 4 groups of audio may be embedded on SDI video. This control selects the group ID of the de-multiplexed audio. In addition, the external AES source may be selected.

7.4.2. Audio Freeze Mode (-A4 and –AES only)

Audio *Audio freeze mode* *pass* *mute*	Two selectable actions can take place when input video is removed; pass and mute. If it is desirable to maintain audio through the encoder (only valid with AES inputs), then set this control to *pass.* When set to mute, the audio will automatically be muted when video is removed.

7.4.3. Additional Audio Delay (-A4 and –AES only)

Audio
Audio delay
0 *-37ms to 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 analog audio AND the 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.

7.4.4. Monitoring the Audio Buffer Tracking (-A4 and –AES only)

Video/SID
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 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 to help in debugging system issues.

7.4.5. Audio Channels Processing (-A4 and –AES only)

There are 4 menu items to adjust the routing and processing of the audio outputs. For simplicity only the menu for channel 1 will be shown in the manual.

Audio
Ch1 processing
Ch1
Ch2
Ch3
Ch4
(Ch1+Ch2)/2
(Ch3+Ch4)/2
Mute

Basic audio channel manipulation is possible with this control.

Any input channel can be routed to any output channel. A mono mix of either L/R input pair can also be performed. Muting an output is also possible.

Warning: This processing takes place before going to the audio analysis and bargraph display section. This means that you will be monitoring the processed version of the audio and not the input audio.

7.4.6. Setting the Analog Levels (-A4 only)

There are 4 menu items to adjust the levels of each of the analog audio outputs. For simplicity only the menu for channel 1 will be shown in the manual.

Audio
Ch1 gain
12 to 24
24

The channel output level (-A4 only) is adjusted with this control. It has a range of approximately 12 dB with 1/10 dB resolution. The displayed value is the analog output level (dBu) corresponding to a 0dB FS digital input signal.

7.4.7. Audio Gain Control (-AES only)

There are 4 menu items to adjust the levels of each of the digital audio channels. For simplicity only the menu for channel 1 will be shown in the manual.

Audio
Ch1 gain
-24dB to 24dB,
0dB

This control will adjust the level of channel 1. It has a range of +/-12 dB with 1/10 dB resolution. The displayed value is the amount of gain (+ve), or attenuation (-ve), in decibels, where 0dB corresponds to unity gain.

Warning: Whenever +ve gain is configured, there is the possibility of distortion due to clipping. If the input audio level is increased to greater than 0dB FS, by adding gain, then the output audio will be limited at 0dB FS.

Warning: This processing takes place before going to the audio analysis and bargraph display section. This means that you will be monitoring the processed version of the audio and not the input audio.

7.5. CONFIGURING THE VIDEO AND SOURCE ID CONTROLS

The *Video/SID* menus are used to configure parameters associated with the video processing functions and the VBI decoders. The chart below shows the items available in the *Video/SID* menu. Sections 7.5.1 to 7.5.20 give detailed information about each of the parameters.

Video processing	Selecting this item takes you into the Video Processing Menu.
Video standard	Selects the input video standard.
Loss of video	Selects the action to take when the input video is missing.
Genlock source	Selects the source of genlock timing including free-running.
Free-run freq	Sets the VCXO free-running frequency.
525 Fine phase	Sets the fine phase position of the output signal with respect to NTSC Genlock reference input.
625 Fine phase	Sets the fine phase position of the output signal with respect to PAL Genlock reference input.
525 H phase	Sets the horizontal phase of the output signal to the NTSC Genlock reference input.
625 H phase	Sets the horizontal phase of the output signal to the PAL-B 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 the NTSC Genlock reference input.
625 V phase	Sets the vertical phase of the output signal to the PAL Genlock reference input.
V Delay	Status display that shows the current vertical input to output delay.
NTSC Colour Field Phase	Sets the colour field phase of the NTSC output video.
PAL-B Colour Field Phase	Sets the colour field phase of the PAL-B output video.
Audio buffer	Status of audio delay buffer.
525 VITC line	Sets the line number for decoding Vertical Interval Time Code in NTSC/525 line video.
625 VITC line	Sets the line number for decoding Vertical Interval Time Code in PAL/625 line video.
525 PESA line	Sets the line number for decoding PESA format Source ID in NTSC/525 line video.
625 PESA line	Sets the line number for decoding PESA format Source ID in PAL/625 line video.
Default SID mode	Selects whether the *Default SID msg* will be shown when there is no source ID on the incoming video.
Default SID mode	Sets the message that will be shown when *Default SID mode* is enabled and the SID window is turned on.

7.5.1. Setting the Video Standard

Video/SID
Video standard
NTSC/525
PAL-B/625

The video standard is selected with this control.

Warning: If you power up the card in a standard opposite to the standard that is being applied as the genlock source, the OSD will not be readable to change the standard. You must remove the genlock signal change the standard, then re-apply the genlock.

7.5.2. Selects the Action to Take when Input Video Is Missing

Video/SID
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.

7.5.3. Genlock Source Selection

Video/SID
Genlock source
Ref. in,
input video,
none

This control allows you to set the reference input to the frame synchronizer. The reference may either be an externally supplied colour black or you may use the input video as a reference. The latter option allows decoder operation in applications where synchronizing is not required. Make sure to adjust the video H and V output phase controls to set the total processing delay.

Optionally, the synchronizer can be free-run if the "none" option is selected

7.5.5. Setting the Free-Running Frequency

Video/SID
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 it's 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.

7.5.6. Setting the Fine Phase of the Output Video – NTSC/525 Video

Video/SID
525 fine phase
-128 to 127
0

With this control, you can set the horizontal fine phase timing of the output video with respect to the Genlock when operating in NTSC/525 video mode and locking to the reference input (this control is not available when locking to the input video). Increasing the value will delay the output video. There is approximately 250 ns range on this control.

Warning: For a set output horizontal phase, there are a few *fine phase/H phase* combinations that will achieve the same position. For best results, set this control to 0, set the H phase to get within 37ns of the desired position, then adjust this control to get closer.

7.5.7. Setting the Fine Phase of the Output Video – PAL-B/625 Video

Video/SID
625 fine phase
-128 to 127
0

With this control, you can set the horizontal fine phase timing of the output video with respect to the Genlock when operating in PAL/625 video mode and locking to the reference input (this control is not available when locking to the input video). Increasing the value will delay the output video. There is approximately 250 ns range on this control.

Warning: For a set output horizontal phase, there are a few *fine phase/H phase* combinations that will achieve the same position. For best results, set this control to 0, set the H phase to get within 37ns of the desired position, then adjust this control to get closer.

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

Video/SID
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. Increasing the value will delay the output video in one-sample increments.

Warning: For a set output horizontal phase, there are a few *fine phase/H phase* combinations that will achieve the same position. For best results, set the fine phase control to 0, set this control to get within 37ns of the desired position, then adjust the fine phase control to get closer.

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

Video/SID
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. Increasing the value will delay the output video in one-sample increments.

Warning: For a set output horizontal phase, there are a few *fine phase/H phase* combinations that will achieve the same position. For best results, set the fine phase control to 0, set this control to get within 37ns of the desired position, then adjust the fine phase control to get closer.

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

Video/SID
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.

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

Video/SID	
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. Increasing the value will delay the output video in one-line increments.

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

Video/SID	
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. Increasing the value will delay the output video in one-line increments.

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

Video/SID
V Delay

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

7.5.14. Setting the Colour Field Phase of the Output Video – NTSC Video

Video/SID	
NTSC C phase	
	0 to 1
	0

With this control, you can set the colour field phase of the output video with respect to the Genlock reference input when operating in NTSC/525 video mode.

The correct value for this register will depend on the reference to output video phase. If the output video is later than the reference video, but less than one field, then setting this control to "0" will make the output video have the same colour field relationship to the genlock.

7.5.15. Setting the Colour Field Phase of the Output Video – PAL-B Video

Video/SID	
PAL-B C phase	
	0 to 3
	0

With this control, you can set the colour field phase of the output video with respect to the Genlock reference input when operating in PAL-B/625 video mode.

The correct value for this register will depend on the reference to output video phase. If the output video is later than the reference video, but less than one field, then setting this control to "0" will make the output video have the same colour field relationship to the genlock.

7.5.16. Monitoring the Audio Buffer Tracking (-A4 and –AES only)

Video/SID
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 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 to help in debugging system issues.

7.5.17. Setting the VITC Line Number – 525 Line Video

Video/SID
525 VITC line
10 to 32
10

With this control, set the VBI line number that contains the VITC information when operating in NTSC video mode.

If the VITC contains Source ID (SID) information, the card will automatically decode it, and turn on the SID window if the user has enabled this window (see “GPI, GPO and Window State Setup”).

If the wrong line number is set, no time code (or SID) will be decoded.

7.5.18. Setting the VITC Line Number – 625 Line Video

Video/SID
625 VITC line
6 to 32
10

With this control, set the VBI line number that contains the VITC information when operating in PAL-B video mode.

If the VITC contains Source ID (SID) information, the card will automatically decode it, and turn on the SID window if the user has enabled this feature (see "GPI, GPO and Window State Setup").

If the wrong line number is set, no time code (or SID) will be decoded.

7.5.19. Setting the PESA Source ID Line Number – 525 Line Video

Video/SID
525 PESA line
10 to 21
11

With this control, set the VBI line number that contains the PESA SID information when operating in NTSC video mode. If the wrong line number is set, no SID will be decoded.

7.5.20. Setting the PESA Source ID Line Number – 625 Line Video

Video/SID
625 PESA line
7 to 22
11

With this control, set the VBI line number that contains the PESA SID information when operating in PAL-B video mode. If the wrong line number is set, no SID will be decoded.

7.5.21. Setting the Default SID Mode

Video/SID
Default SID mode
Disable
Enable

Determines if the Default SID message will be displayed in the SID window when there is no incoming source ID on the VITC.

Set to *Disable* to blank the SID window when there is no incoming source ID.

Set to *Enable* to show the Default SID message in the SID window when there is no incoming source ID. The SID window must also be turned On to display the default SID message. See section 7.8.3 for information on turning the SID window On.

7.5.22. Setting the Message to be Displayed When There Is No Incoming SID

Video/SID
Default SID msg
No SID

This control sets the message that will be displayed in the SID window when there is no incoming source ID on the VITC. The text of the message can be changed. See section 7.2 for information on changing text fields.

7.6. CONFIGURING THE VIDEO PROCESSING CONTROLS

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

NTSC setup pedestal	Selects whether the NTSC 7.5 IRE pedestal will be added to the composite analog output video
Line 21 setup	Controls line 21 processing
Composite display mode	Selection of colour or B/W modes
Video level	Controls the output video level
Hue	Controls the output video hue
Saturation	Controls the output video saturation
Contrast	Controls the output video white level
Brightness	Controls the output video black level

7.6.1. Adding the NTSC Setup Pedestal

Video/SID
- *Video Processing*
  - *NTSC setup pedestal*
    - *Off*
    - *On*

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

7.6.2. Line 21 Processing

- *Video/SID*
  - *Video Processing*
    - *Line 21 setup*
      - *Off,*
      - *On,*
      - *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. The upstream closed captioning encoder should not have generated a setup pedestal. When encoding composite video with properly keyed captioning, a pedestal must not be generated.

This control, when set to *Off*, will not create the 7.5 IRE pedestal on line 21. This is the default state for properly generated captioning.

When set to *On*, the 7.5 IRE pedestal will be generated on line 21. Use this state when there are no input captions.

Note: The *On* condition will only take effect if the *NTSC Setup Pedestal* control is set to *On*.

Blank is used to remove captioning from line 21.

Note: The captions are *Blank*ed from the main, high quality, output only. This will allow the monitoring of upstream captioning on the *monitoring output* even when it is not desirable to have them passed downstream on the program video.

7.6.3. Setting the Composite Display Mode – Colour or Monochrome

- *Video/SID*
  - *Video Processing*
    - *Composite display mode*
      - *Colour*
      - *B/W*

If monochrome operation is desired on the composite output, colour may be turned off with this control.

7.6.4. Video Level

- *Video/SID*
  - *Video Processing*
    - *Video level*
      - *90 IRE to 110.5 IRE*
      - *100 IRE*

This control allows the user to adjust the output level of the analog video (including sync). When set to 0, the nominal output video level will be 140 IRE.

Warning: The brightness and contrast controls will also affect video level. Set this control by measuring sync level rather than video level. After calibrating the brightness and contrast, come back to this control and verify the video level.

7.6.5. Setting the Hue

Video/SID
Video Processing
Hue
-17.5 to 17.5
0.0

This control allows the user to adjust the Hue of the analog video in steps of 0.5 degrees.

7.6.6. Setting the Saturation

Video/SID
Video Processing
Saturation
-10 to 10
0%

This control allows the user to adjust the saturation level of the analog video in steps of 1%.

7.6.7. Setting the Contrast

Video/SID
Video Processing
Contrast
0 to 20
0

This control allows the user to adjust the contrast (white level) of the analog video in steps of 1%.

7.6.8. Setting the Brightness

Video/SID
Video Processing
Brightness
-7.5 to 15.0
0.0

This control allows the user to adjust the brightness (black level) of the analog video in steps of 0.1 IRE.

7.7. CONFIGURING THE BAR GRAPH CONTROLS

The *Bar Graphs* menu items deal with the configuration and operation of the audio bar graphs; modes, ballistics, display properties, etc. The chart below shows the items available in the *Bar Graphs* menu. Sections 7.7.1 to 7.7.15 give detailed information about each configuration item for the audio bar graphs. Sections 7.7.1 to 7.7.3 show the items in the bar graphs 1 and 2 menu tree. These sections apply also to the items in the bar graph 3 and 4 menu tree. Sections 7.7.13 to 7.7.15 apply globally to all bar graphs.

Bar graphs 1 and 2	Setup items for bar graphs 1 and 2.
Bar graphs 3 and 4	Setup items for bar graphs 3 and 4.
Size	Sets bar graph size.
Background opacity	Sets the background opacity or how much video picture content will be visible through the bar graph backgrounds.
Bars opacity	Sets the background opacity or how much video picture content will be visible through the bar graph bars.

When many windows are turned on, the on-screen information can get very crowded. The bar graphs and text windows are layered to keep the most important information from being covered by other not-so important windows. The priority is as follows:

Priority Level	Display Type
1 (top)	Fault Messages
2	Time Code Source ID Program Rating
3	Status window
4	Phase bar graphs
5 (bottom)	Level bar graphs

7.7.1. Selecting the Bar Graph Operating Mode

Bar graphs
- *Bar graphs 1 and 2*
  - *Bar mode*
    - *Normal,*
    - *Sum + diff*

In *Normal* mode, stereo bar graphs are displayed.

In *Sum + diff* mode, bar graph 1 is the absolute value of the sum of both channels and bar graph 2 displays the absolute value of the magnitude of the difference of the two signals.

7.7.2. Setting the Headroom

Bar graphs
- *Bar graphs 1 and 2*
  - *Headroom*
    - *0 to 30db*
    - *0db*

The *headroom* is the level difference between a maximum amplitude signal that can be represented in the digital world (this is called 0 dB FS or 0 dB Full Scale) to a nominal, user defined operating level, represented in Decibels. In modern digital studios and broadcast stations this is on the order of 20 dB.

This control is used to position the 0 dB point for the VU and PPM meters (excluding AES/EBU ballistics mode that always uses 0 dB FS). For example, if you set this control to 15dB and input a signal that is –15 dB FS, then the bar graph top will be at 0dB. If you are in PPM mode with AES/EBU ballistics, then the meter will read –15dB. When you adjust this level, you are changing the 0dBr or program reference point on the bar graphs.

After you set the headroom and select the bar type/mode, you can adjust the bar graph coloured area sizes with the *Error region* and *Warning region* controls.

7.7.3. Setting the Bar Graph Type

Bar graphs
Bar graphs 1 and 2
Bar type
PPM
PPM peak
VU
VU peak
VU PPM

This control sets the bar graph to one of five basic types. The ballistics and display characteristics of the bar graphs are configured with other items in this section of the menu structure.

PPM:
Peak Program Meter tracks the peaks of the audio content rather than the perceived loudness or the power content of the material.

PPM with peak hold: (PPM peak)
The peak hold feature allows the user to keep track of the audio peak. A floating mark is pushed up by audio peaks and is reset with either a programmed GPI input (see the section on “GPI, GPO and Text Window Setup”) or a menu command (see the “Clear Faults” menu).

VU:
Volume Unit meter follows, approximately, the perceived loudness of human hearing.

VU with peak hold: (VU peak)
The peak hold feature allows the user to keep track of the peak VU reading. A floating mark is pushed up by audio VU peaks and is reset with either a programmed GPI input (see the section on “GPI, GPO and Text Window Setup”) or a menu command (see the “Clear Faults” menu).

VU with floating PPM: (VU PPM)
This mode displays both VU levels and PPM levels on the same bar graph. The VU level is indicated by the solid bar going up and down, while the PPM reading is indicated by a floating white bar. The scale displayed is a decibel scale with 0 corresponding to program reference level (for all modes except AES/EBU).

7.7.4. Setting the PPM Mode and Ballistics

Bar graphs
Bar graphs 1 and 2
PPM mode
DIN,
BBC,
Nordic N9,
AES/EBU

This parameter selects one of four industry standard of Peak Program Meter (PPM) display modes.

When one of these modes is selected, a number of items are set to adhere with predefined industry standards. The items affected include; meter attack time, meter decay time, min level displayed, max level displayed, analog reference (100%) level and, in some instances, region colouring and phase graph representation. Table 7-1 illustrates the values set by the standards.

Mode	***Attack Time***	***Decay Time***	***Ref. Level***	***Min Level***	***Max Level***	***Peak Output Level***	***Notes***
DIN 45 406 (IRT Rec. 3/6)	10 ms	1.5 sec for 20 dB	6 dBu	-50 dB	5 dB	6 + headroom	1 dB per div until –10 dB, logarithmic to bottom -50dB. Associated DIN phase correlation scale: • both the same => 1 r, • only 1 signal => 0 r, • both out of phase => -1r.
BBC "IEC 128-10, type IIa, fast mode	10 ms	2.8 sec for 7 to 1	8 dBu	1 -12 dB	7 +12 dB	8 + headroom	# 6 on the scale is the reference level
Nordic N9	5 ms	1.7 sec for 20 dB	6 dBu	-42 dB	+12 dB	6 + headroom	
AES/ EBU	1 sample period	1.5 sec for 20 dB	User defined	-60 dB	0 dB	User defined	100% reading is user definable. 0 dB corresponds to 0 dB FS.

Table 7-1: PPM Bar Graph Characteristics

The phase correlation scale on the DIN type is different from our other phase indicators (*Sum* + *Diff* and phase bar graphs).

7.7.5. Setting the VU Display Range

Bar graphs
Bar graphs 1 and 2
VU range
Normal
Extended

This parameter selects the VU display range when VU modes are active.

Most VU meters have two possible ranges. These are:

Normal range: +3 to –20dB
Extended range: +3 to –57dB

The bar graphs will be re-scaled to represent the selected range.

When using VU and BBC PPM mode, the VU scale is truncated to –6dB to match the scaling of BBC mode.

7.7.6. Setting The Phase Bar Graph Type

- *Bar graphs*
  - *Bar graphs 1 and 2*
    - *Phase type*
      - *Stereo*
      - *DIN*

There are two types of phase bar graphs available: one that has a focus of presenting the amount and L/R distribution of stereo content (STEREO), and one that presents in-phase/out-of-phase proportions (DIN).

7.7.7. Setting the Bar Graph Error Region

- *Bar graphs*
  - *Bar graphs 1 and 2*
    - *Error region*
      - *-1 to –20 dB FS*
      - *-6 dB FS*

The bar graph "error" region is the area from clipping (0 dB FS) down to the level selected by this control. It is intended to tell the user when the audio signal is getting close to clipping.

Warning:
Some bar graph types (and ballistics) have this region defined. When you select one of these types, this value will automatically be set. After you choose the type, you can adjust this value to your desired level.

7.7.8. Setting the Bar Graph Warning Region

- *Bar graphs*
  - *Bar graphs 1 and 2*
    - *Warning region*
      - *-2 to –40 dB FS*
      - *-20 dB FS*

The bar graph "warning" region is the area between the "OK" region and the "error" region. It is intended to indicate when the audio level is approaching the "error" region. This control sets the bottom of the "warning" region. Normally, it is set to the audio program level. The upper boundary of this region is always set with the "error" region control.

This value cannot be higher than the "error" region value. If the "error" region is lowered below the value of this parameter, the "warning" region will also be lowered.

Warning:
Some bar graph types (and ballistics) have this region defined. When you select one of these types, this value will automatically be set. After you choose the type, you can adjust this value to your desired level.

7.7.9. Setting the Level Bar Graph Scale Position

- *Bar graphs*
  - *Bar graphs 1 and 2*
    - *Scale position*
      - *Off*
      - *Left*
      - *Right*

This control allows you to enable and position the level bar graph scale tick marks and the scale labels with respect to the bar itself. When off, there will not be any ticks or numerical labels while left or right will position them to the left or the right of the graphs respectively.

If a combination VU/PPM mode is selected, then "left" will select VU scale on the left, PPM scale on the right and "right" will select VU scale on the right and PPM scale on the left.

7.7.10. Setting The Phase Bar Graph Scale Position

Bar graphs
- *Bar graphs 1 and 2*
  - *Phase scale*
    - *Top*
    - *Bottom*
    - *None*

This control allows you to enable and position the phase bar graph scale tick marks and the scale labels with respect to the bar itself. When off, there will not be any ticks or numerical labels while top or bottom will position them to the top or the bottom of the phase bar graph respectively.

7.7.11. Setting The Window And Bar Graph Positions

Bar graphs
- *Bar graphs 1 and 2*
  - *Window position*

This control allows you to change the window positions of all windows and bar graphs. The window positions can also be set from the *Window position* menu item on the *On-screen display configuration menu.* See section 7.8.2 for detailed information on the position of the windows and bar graphs.

7.7.12. Setting the Colours of the Bar Graphs

Each of the level bar graphs consists of three regions: the OK, warning and error regions. The *Colours* menu items allow you to select one of a group of standard colours, or choose your own custom colours for each of the regions. The controls for each region operate the same way so for simplicity only the controls for the OK region will be shown in the manual.

Tip: The colours of the various regions are defined by three 8 bit R, G, B values very similar to the values used in most paint programs like Microsoft Paint. When you choose one of the predefined colours, the card automatically sets the R, G, and B values. If you choose the custom colour, you will be able to set the R, G, and B values independently to give you the desired colour. If you are having problems setting these values with the menu system, open a paint program, select the colour you like (usually from a colour wheel) and set the R, G, and B values into the card using the respective *Custom colour* menu items for the region.

7.7.12.1. Setting the Level Bar Graph Region Colour

Bar graphs
- *Bar graphs 1 and 2*
  - *Colours*
    - *OK region*
      - *White*
      - *Black*
      - *Grey*
      - *Yellow*
      - *Red*
      - *Green*
      - *Custom…*

This control sets the colour of the bottom, “OK”, region of level bar graphs. You can choose from one of the predefined colours or define a custom colour.

7.7.12.1.1. Selecting a Bar Graph Region Custom Colour

There are three menu items used to set the custom colour. The menu item for each colour component works in the same way so for simplicity only the menu item for the *Red* component will be shown in the manual.

Bar graphs *Bar graphs 1 and 2* *Colours* *Custom ok red:* *0 to 255*	This control defines one of the component colours for a custom colour for one of the regions of level bar graphs. When the menu item is selected you are shown a screen, which displays all three colour components, with an arrow (<) to the right of the colour component you will be adjusting. In addition you are shown two boxes on the screen, which show you the current custom colour value to aid you in selecting the desired colour. The box on the left side of the screen shows the colour with the bar graph background opacity value applied, while the box on the right shows the colour with the bar graph bar opacity value applied.

7.7.13. Setting the Level Bar Graph Size

Bar graphs *Size* *Small,* *Big*	This control sets the vertical size of the level bar graphs. Two sizes of bar graphs are available. The *Big* size is about ¾ of the screen height while the *Small* size is about ½ of the screen height.

7.7.14. Setting the Transparency (Opacity) of Bar Graph Background

Bar graphs *Background opacity* *0 to 64,* *32*	This control sets the bar graph background opacity or how much video picture content will be visible through the bar graph backgrounds. When set to the minimum value, very little of the bar graph background colour will be visible over the video content. At the maximum value, very little of the background video will be visible through the bar graph.

7.7.15. Setting the Transparency (Opacity) of the Bar Graph Bars

Bar graphs *Bars opacity* *0 to 64,* *64*	This control sets the bar graph foreground opacity or how much video picture content will be visible through the bar graph backgrounds. When set to the minimum value, very little of the bar graph colour will be visible over the video content. At the maximum value, very little of the background video will be visible through the bar graph.

7.8. CONFIGURING THE ON-SCREEN DISPLAY CONTROLS

The *On-screen display configuration* menu items is used to configure the position and display characteristics of the text windows. It is also used to program the GPIs, and the on/off states of the text and bar graph windows. The chart below shows the items available in the *On-screen display configuration* menu. The following sections give detailed information about each of the menu items.

Window position	Controls used to position each one of the On Screen windows.
Window enable	Controls used to configure the GPI functions, and the on/off states of the text and bar graph windows.
Text windows	Controls used to set the text style, background colour and opacity for the On screen windows.

When many windows are turned on, the on-screen information can get very crowded. The bar graphs and text windows are layered to keep the most important information from being covered by other not-so important windows. The priority is as follows:

Priority Level	Display Type
1 (top)	Fault Messages
2	Time Code Source ID Program Rating XDS
3	Status window
4	Phase bar graphs
5 (bottom)	Level bar graphs

7.8.1. Descriptions of the On-Screen Windows

The following sections describe the different windows, what is displayed in them and various aspects of their purpose.

7.8.1.1. Video/Audio Status

The purpose of the Video/Audio status screen is to show as much status information about the video and audio as possible in a small, concise table. Table 7-2 shows each item that may appear in the status screen. The Status window may be operated on one of two modes. In *normal* mode, all lines are controlled by the text window attributes. In *Fault* mode, those lines whose associated fault triggers are used to activate a CEM fault, will be displayed using fault window properties. All other lines use the text window properties. If the Status window is enabled by a CEM fault, only those lines associated with the fault triggers that enable the fault window will be displayed using fault window properties. All other lines use text window properties.

Item	*Value(s)*	*Description*
Video	525/625/not present/ 525 (wrong std)/625 (wrong std)	Input video standard detected. If the card is a different standard than what is on the input, *(wrong std)* will be displayed.
Picture Content	Moving/frozen/frozen,black	Shows the status of the picture content. Shows *moving* if the picture is active, *frozen* if the card detects no motion, or *frozen,black* if the picture is black
VITC	TC Value/not present	If present, the time code value is displayed here.
VITC SID	SID value/not present	If present, the VITC SID is displayed here.
PESA SID	SID value/not present	If present, the PESA SID is displayed here.
PR	Value/not present	The program rating of Closed Captioning is indicated, if present.
CC	Present/not present	The presence/absence of Closed Captioning is indicated.
Ch. 1 and 2	Not present/[(silent/over), (mono/out of phase)]	Status information about channels 1 and 2 are shown here.
Ch. 3 and 4	Not present/[(silent/over), (mono/out of phase)]	Status information about channels 3 and 4 are shown here.

Table 7-2: Video/Audio Status Screen Items

7.8.1.2. Audio Bar Graphs

Audio level (peak and/or average) and phase information can be displayed in a number of different forms. See section 7.7 for information on configuring the bar graphs. The source is selectable between the embedded audio (all versions of hardware) and the external AES audio (–A4 and –AES versions).

On the 7735CEM-A4, the audio level/phase information is displayed after the source selection, routing but before the output gain control (gain is controlled in the D to A conversion).

On the 7735CEM-AES, the audio level/phase information is displayed after the source selection, routing and the gain control.

On the 7735CEM, the audio level/phase information is displayed as it is embedded.

7.8.1.3. VITC Time Code Window

The VITC time code window shows the vertical interval time code present at the input to the CEM module. Use the VITC line select items on the Video menu to configure the lines that the CEM will use for reading VITC. (See sections 7.5.17 and 7.5.18 for information about setting the VITC line numbers.)

Warning: Because the video goes through a frame synchronizer, the time code displayed will not necessarily be the correct time code number for that particular frame of video. However, it will not be more than one frame in error.

The *TC window size* menu item controls whether the time code window will be displayed in the normal or large font size.

7.8.1.4. Program Rating Window

The Program rating window shows data decoded from the Line 21 XDS Program rating packet. This information is usually encoded by the user to control the operation of V-Chip decoders in the viewer's receiver. The *PR window size* menu item controls whether the time code window will be displayed in the normal or large font size.

7.8.1.5. CC Window

The CC window is only available on CEM models that have an analog monitoring video output. It contains caption information from the CC1 data stream.

7.8.1.6. XDS Window

The XDS window contains 2 lines with the following information: network name, call letters, program name, time of day. Only the information found in the XDS stream will be displayed. An item is considered to be missing if it does not appear in the XDS stream for 15 seconds. There is no ability to trigger faults on the absence of XDS.

7.8.1.7. Source Identification Window

The CEM module has the ability to decode source identification (SID) information from the vertical interval time code present at the input to the module. When no VITC SID is encoded on the input, the CEM module will decode SID that has been encoded in the PESA format if it is present. The Source Identification window is used to display the decoded SID information. When there is neither VITC SID or PESA SID encoded, on the input video, the *Default SID message* will be displayed if *Default SID mode* is enabled, otherwise the SID window will be turned off. See sections 7.5.21 and 7.5.22 for information about setting the *Default SID message*. Use the VITC line select items on the Video menu to configure the lines that the CEM will use for reading VITC. See sections 7.5.17 and 7.5.18 for information about setting the VITC line numbers. Use the PESA line select items on the Video menu to configure the lines that the CEM will use for reading PESA format source ID. See sections 7.5.19 and 7.5.20 for information about setting the VITC line numbers. The *SID window size* menu item controls whether the time code window will be displayed in the normal or large font size.

7.8.1.8. Fault Message Windows

The Fault 1 and Fault 2 window shows user text messages when the Fault 1 or Fault 2 conditions are triggered. The Fault message windows have their own set of colour, opacity and size attributes, they can be set to come on steady or blinking and they contain fully programmable messages. See section 7.10 for more information on setting up the fault conditions and configuring the fault windows.

7.8.2. Setting the Position of On Screen Windows

To set the horizontal and vertical position of the Bar Graphs, Status, VITC, Program Rating, SID, or one of the Fault windows use the *WINDOW H* and *WINDOW V* menu items for the respective window. The controls for all of the windows work in the same way so, for simplicity only the menu items for the *STATUS WINDOW* will be shown.

7.8.2.1. Setting the Horizontal Position of On Screen Windows

On-screen display configuration
- *Window position*
  - *Status window H*
    - *0 to 39*
    - *7*

The *Window H* position menu item sets the leftmost character position for the respective window.

When you select this parameter, the screen text will disappear and a box of the correct size will appear. Move it around to the desired position with the toggle switch. Press the pushbutton when done.

7.8.2.2. Setting the Vertical Position of On Screen Windows

On-screen display configuration
- *Window position*
  - *Status window V*
    - *0 to 19*
    - *7*

The *Window V* position menu item sets the top row for the respective window.

When you select this parameter, the screen text will disappear and a box of the correct size will appear. Move it around to the desired position with the toggle switch. Press the pushbutton when done.

7.8.3. Selecting What Bar Graphs And Windows To Display

The CEM has two general purpose inputs that can be programmed to turn the Level or Phase bar graphs or the Status, VITC, Program Rating, SID, CC/XDS, or XDS windows on or off, and to clear the level bar graphs *PEAK HOLD* or the Fault Displays. The windows and bar graphs can also be turned permanently on or off. The *Window enable* menu item is used to program the GPIs, and the on/off states of the text and bar graph windows. To display the Fault windows use the *Fault condition* menu item on the *Fault definitions* menu. (See section 7.10.1.4)

When you select the *Window enable* menu item you are presented with a list of the possible functions that can be controlled using the GPIs as shown in Table 7-3. Select the desired function using the toggle switch. When the pushbutton is pressed, the cell cycles through the valid values for the field. Each of the windows and bar graph displays can be set to *On*, *Off* or *GPI*. When set to *On*, the corresponding window or bar graph is always displayed. When set to *Off*, the window or bar graph is always off. When set to *GPI*, the window will be on when the configured GPI is active. The GPI columns will either be blank or will contain the *GPI1* or *GPI2*. When they are set to *GPI1* or *GPI2* the window will be turned on when the respective GPI goes active.

Note that the *Peak holds* and the *Clear faults* items cannot be set to *On* or *Off*. They must be cleared with the GPI's or the main menu *Clear faults and peaks* menu item (see section 7.12).

Item	State	GPI1	GPI2	Fault 1	Fault 2
Ch 1/2 level bars					
Ch 3/4 level bars					
Ch 1/2 phase bars					
Ch 3/4 phase bars					
Ch 1/2 clear peak					
Ch 3/4 clear peak					
Status					
Time code					
Program Rating					
CC					
XDS					
SID					
Clear fault 1					
Clear fault 2					

Table 7-3: Methods of turning Windows and Bar graphs On and Off

7.8.4. Setting the Text Window Attributes

The On screen text windows can be displayed as white characters with or without a coloured background. In addition the text and background opacity or how much video picture content will be visible through the text or background is adjustable. The *Text window config* menu items are used to set these parameters for all the text windows except the Fault windows. See section 7.8.5 for information on setting the *Fault window* attributes.

7.8.4.1. Turning on the Text Window Backgrounds

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *Text type*
      - *White on bkgrn*
      - *White with no bkgrnd*

The text displayed in the Text windows may either have a background box or if too much video information is hidden, it may be inserted with a thin black outline.

7.8.4.2. Setting the Text Window Background Colours

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *Background colour*
      - *Black*
      - *Grey*
      - *Yellow*
      - *Red*
      - *Green*

Select the desired background colour around the text in the Text windows.

7.8.4.3. Setting the Text Window Background Opacity

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *Background opacity*
      - *0 to 64*
      - *32*

This control sets the Text window background opacity or how much video picture content will be visible through the window background.

When set to the minimum value, very little of the window background colour will be visible over the video content. At the maximum value, very little of the background video will be visible through the window background.

7.8.4.4. Setting the Text Window Text Opacity

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *Text opacity*
      - *0 to 64*
      - *64*

This control sets the Text window text opacity or how much video picture content will be visible through the text characters.

When set to the minimum value, very little of the white window text will be visible over the video content. At the maximum value, very little of the background video will be visible through the white window text.

7.8.4.5. Setting the Time Code Window Font Size

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *TC window size*
      - *Normal*
      - *Big*

This control sets the font size of the VITC time code window.

When it is set to *Big* the font size will be double the height and width of the *Normal* font size.

7.8.4.6. Setting the Program Rating Window Font Size

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *PR window size*
      - *Normal*
      - *Big*

This control sets the font size of the program rating window.

When it is set to *Big* the font size will be double the height and width of the *Normal* font size.

7.8.4.7. Setting the Source ID Window Font Size

On-screen display configuration
- *Text windows*
  - *Text window config*
    - *SID window size*
      - *Normal*
      - *Big*

This control sets the font size of the source ID window.

When it is set to *Big,* the font size will be double the height and width of the *Normal* font size.

7.8.4.8. Setting the Status Window Mode

- *On-screen display configuration*
  - *Text windows*
    - *Text window config*
      - *Status window mode*
        - *Normal*
        - *Fault*

This control determines the display properties of the status window.

When it is set to *Normal* the status window will use the text window properties.

When it is set to *Fault*, items in the status window that have been selected for fault generation using the *Fault Trigger* menu item will use the *Fault window* properties when the fault is active. If the status window is enabled by either Fault 1 or Fault 2 triggering, then only the faults that actually enabled the window will be shown in the *Fault window* properties. The rest of the items on the status window will be shown in the *Text window* properties.

For example, if "program rating" is set up as a fault trigger, and the rating disappears, then the "program rating" line of text on the status screen will take up the characteristics of the "fault text". Usually this is white text on a red background.

7.8.5. Setting the Fault Window Attributes

The On screen Fault windows can be displayed as white characters with or without a coloured background. In addition the text and background opacity or how much video picture content will be visible through the text or background is adjustable. The *Fault window config* menu items are used to set these parameters for the Fault windows.

7.8.5.1. Turning on the Fault Window Backgrounds

- *On-screen display configuration*
  - *Text windows*
    - *Fault window config*
      - *Text type*
        - *White on bkgrn*
        - *White with no bkgrnd*

The text displayed in the fault window may either have a background box or if too much video information is hidden, it may be inserted with a thin black outline.

7.8.5.2. Setting the Fault Window Background Colours

- *On-screen display configuration*
  - *Text windows*
    - *Fault window config*
      - *Background colour*
        - *Black*
        - *Grey*
        - *Yellow*
        - *Red*
        - *Green*

Select the desired background colour around the text in the fault windows.

7.8.5.3. Setting the Fault Window Background Opacity

On-screen display configuration
Text windows
Fault window config
Background opacity
0 to 64
64

This control sets the Fault window background opacity or how much video picture content will be visible through the window background.

When set to the minimum value, very little of the window background colour will be visible over the video content. At the maximum value, very little of the background video will be visible through the window background.

7.8.5.4. Setting the Fault Window Text Opacity

On-screen display configuration
Text windows
Fault window config
Text opacity
0 to 64
64

This control sets the Fault window text opacity or how much video picture content will be visible through the text characters.

When set to the minimum value, very little of the white window text will be visible over the video content. At the maximum value, very little of the background video will be visible through the white window text.

7.8.5.5. Setting the Fault Window Font Size

Similar window size menu items are available for the Fault 1 and Fault 2 windows.

On-screen display configuration
Text windows
Fault window config
Fault 1 window size
Normal
Big

This control sets the font size of the program rating window.

When it is set to *Big* the font size will be double the height and width of the *Normal* font size.

7.8.5.6. Setting the Blink Mode of the Fault Windows

Similar blink mode menu items are available for the Fault 1 and Fault 2 windows.

On-screen display configuration
Text windows
Fault window config
Fault 1 blink
Disable
Enable

This control determines if the Fault 1 window will blink or be on solid when the fault is active.

When it is set to *Disable* the fault window will be on steady when it is active.

When it is set to *Enable* the fault window will blink when it is active.

7.9. GPO CONFIGURATION

The CEM module has two general purpose outputs available on the DB-9 connector which can be used to signal several conditions to the user. In addition this output can be configured to be active high or low. The 7700 frame also has a fault monitoring LED and general-purpose output. The user also has the ability to configure which faults the CEM will assert onto the frame status system. The *GPO configuration* menu contains the controls used to configure the GPOs. Sections 7.9.1 to 7.9.3 give detailed information about each of the menu items.

GPO1 active state	Controls whether the general-purpose output is active high or low.
GPO1 trigger	Controls what events will trigger the general-purpose output.
GPO2 active state	Controls whether the general-purpose output is active high or low.
GPO2 trigger	Controls what events will trigger the general-purpose output.
Frame stat trigger	Controls what events will trigger the Frame Status Fault line and the Fault Status LED.

7.9.1. Setting the General Purpose Output Active State

GPO configuration
- *GPO1(2) active state*
  - *High*
  - *Low*

This control sets the output level for active state of the General-Purpose output.

NOTE: The output will power up in a high state until the software has had sufficient time to update the output with the appropriate condition.

7.9.2. Configuring what Condition will Activate the General Purpose Output

GPO configuration
- *GPO1(2) trigger*
  - *None*
  - *Fault 1*
  - *Fault 2*
  - *Fault 1 or 2*

This control configures what condition will cause the general-purpose output to go to the active state.

7.9.3. Frame Status Fault Trigger Condition

GPO configuration
- *Frame status trigger*
  - *None*
  - *Fault 1*
  - *Fault 2*
  - *Fault 1 or 2*

The 7700 frame has a global status line that any card can pull active. With this control, you can select the condition for the card to cause the line to go active. Also included on the frame status signal is card power supply monitoring. This is derived with hardware and cannot be disabled from the status signal.

If it is desired to use this feature, the frame status jumper J3 (located near the card extractor) must also be set to the *On* position. See section 9.2

The Red *Local Fault* LED will be On when the global status line is active regardless of the position of jumper J3.

7.10. FAULT DEFINITIONS

When many windows are turned on, the on-screen information can get very crowded. The bar graphs and text windows are layered to keep the most important information from being covered by other not-so important windows. The Fault windows have the highest priority. The priority of the other windows is shown in section 7.8.

The *Fault definition* menu items are used to configure the fault settings, and the presentation of the fault conditions. The chart below shows the items available in the *Fault definition* menu. Sections 7.10.1 to 7.10.12 give detailed information about each configuration item for the fault definitions.

Fault condition 1	Controls used to configure the Fault Condition 1 display.
Fault condition 2	Controls used to configure the Fault Condition 2 display.
Fault window config	Controls used to set the Fault Window text style, background colour and opacity. These parameters may also be set using the *On-screen Display Text window* menu.
Video error duration	Sets the duration of missing video beyond which is considered a fault or error condition.
Audio error duration	Sets the duration of missing audio (embedded or AES) beyond which is considered a fault or error condition.
Over level	Sets the level of audio over which is considered a fault or error condition.
Over duration	Sets the duration of audio, over the above level which is considered a fault.
Silence level	Sets the level of audio under which is considered silence.
Silence duration	Sets the duration of audio in seconds under the above level which is considered a fault.
Phase reversal level	Sets the level of L/R audio difference over which is considered phase reversal.
Phase reversal duration	Sets the duration of audio in seconds over the above phase reversal level which is considered a fault.
Mono threshold level	Sets the level of L/R audio difference under which is considered mono.
Mono duration	Sets the duration of mono audio in seconds which is considered a fault.
Loss of CC duration	Sets the duration of no primary CC1 captions, in seconds which is considered a fault.
Loss of PR duration	Sets the duration of no program rating XDS packet, in seconds which is considered a fault.
Picture noise level	Sets the noise level threshold for use in detection frozen pictures.
Freeze Duration	Sets the duration of no picture activity above the *Picture noise level*, in seconds which is considered a fault.
Black Duration	Sets the duration of no active picture content above 7 IRE, in seconds which is considered a fault.

7.10.1. Setting Up How A Fault Is Triggered And How It Is Presented

The CEM has two fault conditions that can be configured to warn the user of numerous conditions. The *Fault condition 1* and *Fault condition 2* menu items are used to configure when fault 1 or fault 2 are triggered, and how the fault should be presented. The controls for each fault condition operate the same way so, for simplicity, the manual shows only the menu items for *Fault condition 1*.

7.10.1.1. Fault Status

Fault definitions
- *Fault condition 1*
  - *Fault status*

This menu item displays a screen that shows the current status of all faults that can be used to define a fault condition.

7.10.1.2. Setting the position of the Fault Windows

Fault definitions
- *Fault condition 1*
  - *Window position*

This control allows you to change the window positions of all windows and bar graphs. The window positions can also be set from the *Window position* menu item on the *On-screen display configuration menu.* See sections 7.8.2 for detailed information on the position of the windows and bar graphs.

7.10.1.3. Setting the Message Associated with a Fault

Fault definitions
- *Fault condition 1*
  - *Fault 1 message*
    - *Video error*

This control sets the message to display when the fault condition is active. The text of the message can be changed. See section 7.2 for information on changing text fields.

7.10.1.4. Determining If The Fault Message Will Be Displayed

Fault definitions
- *Fault condition 1*
  - *Fault 1 mode*
    - *Disable*
    - *Enable*

This control sets whether the fault message will be displayed when the fault condition is active.

When enabled, the fault message will be displayed until the condition is reset. When disabled, it will never be displayed. See section 7.10.1.5 for information on setting the duration of the fault condition.

7.10.1.5. Setting the Duration of the Fault Condition

Fault definitions
- *Fault condition 1*
  - *Fault duration*
    - *Until reset*
    - *1 to 254 frames*
    - *30 frames*

This control sets how long the fault condition will be held. The fault display will be displayed as long as the fault condition is active and the *Fault mode* is set to *Enable*. The fault condition can either be held until the user clears the condition or until a programmable timer expires.

Note: You can assign a GPI to clear the fault by assigning a GPI in the *On-screen display configuration => Window enable* menu.

7.10.1.6. Determining What Items Will Generate The Fault Condition

Fault definitions
Fault condition 1

This control provides a list of items that may generate a fault condition. Use the toggle switch to travel up and down this list and the pushbutton to enable or disable the item from the fault condition criteria. Enabled items will be shown with a check mark.

A fault condition will exist when any of the selected items occurs.

Input video error	Video absent or wrong standard
Genlock error	Reference absent or wrong standard
Loss of audio ½	Audio 1 and 2 absent
Loss of audio ¾	Audio 3 and 4 absent
Phase reversal ½	Audio 1 and 2 out of phase
Phase reversal ¾	Audio 3 and 4 out of phase
Audio over ½	Audio 1 or 2 over level
Audio over ¾	Audio 3 or 4 over level
Audio silence ½	Audio 1 and 2 silent
Audio silence ¾	Audio 3 and 4 silent
Audio mono ½	Audio 1 and 2 mono
Audio mono ¾	Audio 3 and 4 mono
Loss of VITC	VITC absent
Loss of SID	SID absent
Loss of program rating	Program rating absent
Loss of CC	Primary CC1 Closed captioning absent
GPI1	General Purpose Input 1 closed to ground
GPI2	General Purpose Input 2 closed to ground
Picture Freeze	No activity above preset noise level in active picture
Picture Black	No active picture above 7 IRE

Table 7-4: Possible Error Conditions to Produce a Fault

7.10.2. Setting the Fault Window Attributes

The Fault windows can be displayed as white characters with or without a coloured background. In addition the text and background opacity or how much video picture content will be visible through the text or background is adjustable. The Fault window config menu items are used to set these parameters for the Fault windows.

Fault definitions
Fault window config

This control is used to change the fault window colours. These parameters can also be set using the *Fault window config* menu items on the *On screen display* menu. See section 7.8.5 for a complete description of the *Fault window config* menu items.

7.10.3. Setting the Video Error Duration

Fault definitions
Video error duration
0 to 255 frames *0*

This control sets the duration, in number of consecutive frames of video, that video needs to disappear before the *Video error* fault condition exists.

This control is included so that you can have a few frames of missing/bad video before the fault occurs. This is useful to eliminate fault generation when upstream non-synchronous switching occurs.

7.10.4. Setting the Audio Error Duration

Fault definitions
Audio error duration
0 to 255 frames *0*

This control sets the duration, in number of consecutive frames of video, that audio needs to disappear before the *Loss of audio* fault conditions exists.

This control is included so that you can have a few frames of missing/bad embedded or external audio before the fault occurs. This is useful to eliminate fault generation when upstream non-synchronous switching occurs.

7.10.5. Detecting Audio Over Level Faults

The Over level and Over duration controls are used to detect when an audio amplitude is close to a dangerous level (i.e. clipping a downstream device, or saturating the digital word length). The Over level control sets the audio level over which there is considered to be a fault. The audio must be over this level for the duration set by the Over duration control before the fault condition exists. A fault will be generated when any channel has generated an over condition.

7.10.5.1. Setting the Audio Over Level

Fault definitions
Over level
-30dB to 0dB FS in 1/4dB increments *-6dB FS*

This control sets the audio level over which there is considered to be over level. This value is expressed in dB full scale (FS) and can even be used to detect digital clipping. If set to 0 dB FS, then if 3 or more consecutive samples (set with the duration control) are at digital saturation (max or min), then the digital word length has been exceeded.

7.10.5.2. Setting the Audio Over Duration

Fault definitions
Over duration
3 to 255 SAMPLES *3*

This control sets the duration, in number of consecutive samples that are at or above the *Over level* before a fault condition exists.

Note that as longer durations are configured, you are eliminating the detection of higher frequency content over the set *Over level*.

7.10.6. Detecting Audio Silence Faults

The *Silence level* and *Silence duration* controls are used to detect when the audio is considered to be silent. The *Silence level* control sets the audio level under which the audio is considered to be silent. The audio must be under the *Silence level* for the duration set by the *Silence duration* control before the fault condition exists. When the fault condition exists, the audio must be over the *Silence level* for the duration set by the *Silence duration* control before the fault condition will be removed. A fault will be generated when both channels in a pair (1 and 2 or 3 and 4) has satisfied a silence condition.

7.10.6.1. Setting the Audio Silence Level

Fault definitions	
Silence level	
-96dB to –20dB FS	This control sets the audio level under which it is considered to be silent. This value is expressed in dB full scale (FS).
-60dB FS	

7.10.6.2. Setting the Audio Silence Duration

Fault definitions	
Silence duration	
0.5 to 127 sec	This control sets the amount of time the audio is silent in seconds before a fault occurs.
10 sec	

7.10.7. Detecting Audio Phase Reversal Faults

All stereo audio material has a varying amount of phase difference between the two channels. If there is significant phase reversal for a period of time, then this is a sign that the audio signals may be out of phase.

The *Phase reversal level* and *Phase reversal duration* controls are used to detect when the left and right audio channels are considered to be out of phase. The *Phase reversal level* control sets the amount of phase difference that is considered to be out of phase. The audio must be out of phase by more than the *Phase reversal level* amount for the duration set by the *Phase reversal duration* control before the fault condition exists. When the fault condition is active, the audio must be out of phase by less than the *Phase reversal level* amount for the duration set by the *Phase reversal duration* control before the fault condition will be removed.

7.10.7.1. Setting the Audio Phase Reversal Level

Fault definitions	
Phase reversal level	
0.5 to 1 in 0.01 increments	This control sets the amount of phase difference before the audio is considered to be out of phase. This phase reversal is calculated by comparing the difference of the two channels to the average of the two. If a signal is always out of phase, then the difference between the two will be high compared to the average of the two. This corresponds to 1 in this control. If there is only content on one of the channels (i.e. left only or right only), then the difference is equivalent to the average of the two channels. This corresponds to 0.5 in this control.
0.9	

7.10.7.2. Setting the Audio Phase Reversal Duration

Fault definitions
Phase reversal duration
0.5 to 127 sec *10 sec*

This control sets the period over which to analyze the audio content for phase reversal.

Note that conditions of silence are not included in this value. This means that if the audio is 50% quiet then it will take twice the period set with this control to detect a phase reversal condition.

7.10.8. Detecting Audio Mono Faults

Mono audio material can take two forms: one channel with information and the other quiet or both channels with the same information. Both types of mono material are considered mono faults.

If there is only a small amount of phase difference between the two channels (perhaps caused by the noise present on the audio) then the content may be mono. If there is no significant difference for a period of time, then this is a sign that the audio signals are mono.

Mono is detected by comparing the difference of the two channels to the average of the two. If a signal always has no out of phase information (or just a small amount) for a period of time, then the signal may be mono.

The *Mono threshold level* and *Mono duration* controls are used to detect when two audio channels are considered to be mono. The *Mono threshold level* control sets the threshold that decides whether the signals are the same. The audio difference must be less than the *Mono threshold level* amount for the duration set by the *Mono duration* control before the fault condition exists. When the fault condition exists, the audio difference must be more than the *Mono threshold level* amount for the duration set by the *Mono duration* control before the fault condition will be removed.

Material that is both mono and out of phase will be detected as being out of phase and not mono. Once the phase polarity is fixed, then the card will detect mono material.

7.10.8.1. Setting the Audio Mono Threshold Level

Fault definitions
Mono threshold level
0.2 to 0.5 in 0.01 increments *0.2*

This control sets the level of L/R audio difference under which is considered mono.

0 corresponds to both channels being identical while 1 corresponds to both channels being exactly out of phase.

7.10.8.2. Setting the Audio Mono Duration

Fault definitions
Mono duration
0.5 to 127 sec *10 sec*

This control sets the duration of mono audio in seconds, which is considered a fault.

7.10.9. Detecting Loss of Primary Captioning

Fault definitions
Loss of CC duration
2 to 512 sec in 2 sec increments *180 sec*

This control sets the amount of time in seconds with no primary CC1 captions encoded, which is considered a fault.

This fault condition will also be generated if the closed caption signal is missing on the input video.

7.10.10. Detecting Loss of Program Rating Duration

Fault definitions
Loss of PR duration
1 to 255 sec *30 sec*

This control sets the amount of time in seconds with no program rating packet encoded in the Line 21 XDS data stream, which is considered a fault

This fault condition will also be generated if the closed caption signal is missing on the input video.

7.10.11. Detecting Picture Freeze

The *Picture noise level* and *Picture freeze duration* controls are used to detect when a video picture is considered to be frozen. The *Picture noise level* control sets the threshold that decides whether activity in the picture is considered to be noise. The picture activity must be greater than this amount for the duration set by the *Picture freeze duration* control before the fault condition exists.

7.10.11.1. Setting the Picture Noise Level

Fault definitions
Picture noise level
1 to 10 *7*

This control sets the approximate level of noise expected in the video signal feed. It is used by the freeze detect feature to distinguish motion from background noise on top of a video feed.

For noisy video feeds, higher numbers are needed.

As a guide, the following chart is the approximate picture noise level that starts to be interpreted as motion for each of the *Picture noise level* settings:

Picture noise level	**Noise that starts to be interpreted as motion * (dBrms)**
1	-43
2	-42
3	-41
4	-39
5	-38
6	-37
7	-36
8	-34
9	-31
10	-28

* RMS noise relative to 714mV, 15kHz to 4.2Mhz bandwidth, VHF noise added to a static test signal, noise duration set to 30 frames.

7.10.11.2. Setting the Picture Freeze Duration

Fault definitions *Picture freeze duration* *6 to 902 frames* *302 frames*	This control sets duration of video activity under the *Picture noise level* that is considered a fault.

When increasing *Picture noise level*, it is recommended that you increase *Picture freeze duration* as well. This is because higher Picture noise level settings also lowers the motion sensitivity, thus long periods without significant on-screen movement are more likely to trigger a “false” freeze alarm.

7.10.11.3. Optimizing the Picture Noise Level and Picture Freeze Duration Parameters

Setting up the optimum *Picture noise level* and *Picture freeze duration* parameters will depend on the amount of noise in the video path from the first equipment with freeze-frame capability to the monitoring point. The system designer should determine the maximum amount of time permissible between the moment of freeze and the alarm.

Setting this time as high as tolerable has two benefits:

- It lowers the frequency of “false” freeze alarms generated when a perfectly valid content contains long motionless periods.
- It allows raising the *Picture noise level* parameter, without increasing frequency of “false” freeze alarms.

It is suggested that *Picture noise level* should be set after setting the *Picture freeze duration*.

If the user can place the equipment farthest upstream in the video path to go to a ‘freeze frame’ mode, then the *Picture noise level* should be optimized by initiating the ‘freeze frame’ mode in the upstream equipment and adjusting *Picture noise level* as low as possible, without losing the freeze alarm generated by the card. The user should note that because of the random nature of noise, the freeze alarm may be intermittent at some *Picture noise level* settings. The optimal *Picture noise level* setting is obtained when the loss of freeze alarm in the card occurs no more then once every 5 minutes.

If the equipment farthest upstream in the video path cannot go to a ‘freeze frame’ mode, then *Picture noise level* should be optimized by adjusting it as high as possible. If you trigger false freeze alarms more often than acceptable; lower the *Picture noise level* setting. Since the acceptable rate could be on the order of a day perhaps (depending on the facility), this adjustment procedure may consume a couple of days.

Failing to accomplish optimal adjustment of the *Picture noise level* will result in either:

- A large number of false alarms, or
- Lack of alarm condition when the video is frozen.

The *Picture noise level* and *Picture freeze duration* controls have been designed to be able to detect short-term "digital" freezes such as MPEG or motion JPEG server artifacts. When these devices have a significant problem with the content that they are de-compressing, they will typically start to produce a "blocky" effect. If the problem is severe enough, they will freeze a frame of video and play it out for a number of frames. With the *Picture noise level* set to 1 (i.e. only detect exact, or nearly exact pictures) and the *Picture freeze duration* set to *minimum*, the card can detect these quick "digital freezes". You cannot however detect both this type of freeze and a freeze from a link that has added noise to the picture.

7.10.12. Detecting Picture Black Duration

Fault definitions
Picture black duration
4 to 900 frames
88 frames

This control sets duration, in seconds, of active picture content below 7 IRE that is considered a fault.

A Fault is generated when the video level within the active picture area falls below the preset black level (7 IRE) and remains for the specified duration.

7.11. UTILITIES

7.11.1. 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.

7.11.1.1. 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.

7.11.1.2. 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.

7.11.2. 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.

7.11.3. Restoring the CEM to its 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.

7.12. CLEAR FAULTS AND PEAKS

Clear faults and peaks
- *Clear,*
- *Cancel*

This menu item on the top level menu provides a convenient method to clear any fault conditions and reset audio peak holds. You can also perform the clear by pressing the toggle switch up or down when not in the menu structure or use a GPI if it is programmed to do so.

9. JUMPERS

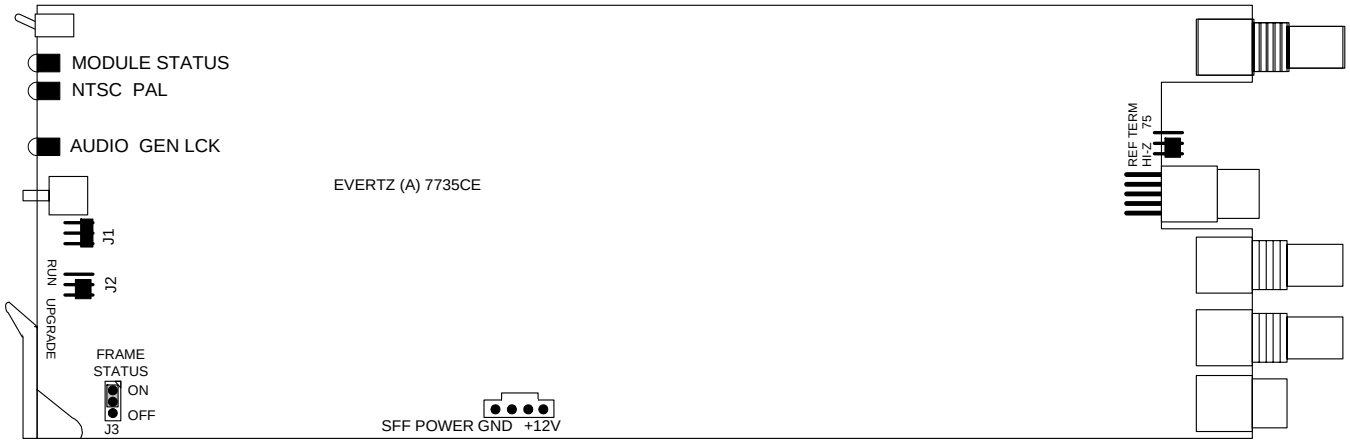

Figure 9-1 : Location of Jumpers on 7735CE Boards

9.1. TERMINATION JUMPERS

REF TERM The REF TERM jumper J19 located on the rear of the card near the white multi-pin connector, 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.

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

FRAME STATUS The FRAME STATUS jumper J3 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 moved to the OFF position, local faults on this module will not be monitored.

The *Frame stat trigger* menu item on the *GPO configuration* menu is used to configure whether *Fault condition 1* or *Fault condition 2* will assert the frame status fault line. Power supply faults will always assert the frame status fault line when J3 is installed in the ON position.

9.3. CONFIGURING THE MODULE FOR FIRMWARE UPGRADES

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

UPGRADE

The UPGRADE jumper J2, 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* 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 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* chapter in the front of the binder. 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.

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