USER MANUAL

Vision SYSTEM

SYNNER-VF

3G/HD/SD video synchroniser, tracking audio delay and embedder/de-embedder

Crystal Vision

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Revision 1	Removed external analogue reference mentions from pages 3, 4, 5 and 6.	03/01/17

1 Introduction

SYNNER-VF is a synchronising audio embedder/de-embedder for use in the Vision 3 rack frames from Crystal Vision. It provides a versatile solution for audio embedding and de-embedding with built-in video delay and synchronising. The SDI video signal passes through a de-embedder and an embedder which allows the extraction and insertion of up to 16 channels (four groups) of audio. The video path can be delayed by up to ten frames and synchronised to one of two analogue Black and Burst or tri-level references connected via the Vision 3 frame.

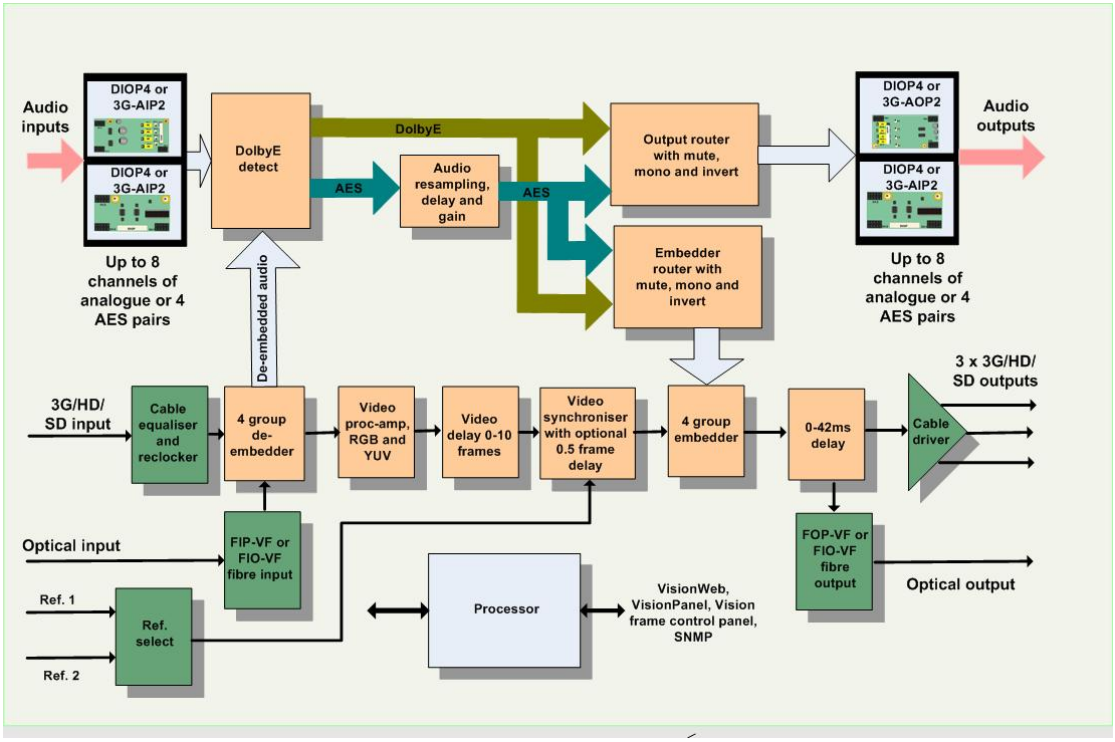
Embedded audio signals can be extracted and output as analogue or AES, then re-sampled and re-embedded into the video signal in the same or different channel positions with user-controlled gain, fixed delays and tracking delays to match the video synchroniser. Additionally, external analogue and AES audio inputs can be embedded into the video signal in any channel position.

There are two locations for optional analogue and digital I/O piggybacks of which there are three types: 3G-AIP2, 3G-AOP2 and DIOP4. The 3G-AIP2 piggyback has four analogue inputs; 3G-AOP2 has four analogue outputs; DIOP4 has four stereo AES pairs which can be individually configured as an input or output.

The main features are as follows:

- **Use with any source –** works with 3Gb/s, HD and SD.
- **Supports the following video standards:** 625, 525, 720p 50, 720p 59.94, 1080i 50, 1080i 59.94, 1080p 50, 1080p 59.94, 1080psf 23.98, 1080psf 24.
- **Versatile audio:** will de-embed and embed up to four audio groups and input or output up to eight external AES stereo pairs or four analogue stereo pairs which can be fully shuffled with the powerful 32 x 16 audio routers.
- **Optimise the video:** video proc-amp allows adjustment of video gain, black level and independent RGB and YUV gains. **SYNNER-VF** features a full-frame synchroniser that re-times the video output and embedded signals to match one of two analogue Black and Burst or tri-level references connected via the Vision 3 frame. Additionally, there is a switchable 0-10 frame video delay - useful for matching Dolby E or other audio processing delays.
- **Tracking audio delay:** TAD allows audio signals to automatically track the dynamic delays of the video frame synchroniser by resampling or sample drop/repeat.
- **Align Dolby E:** Dolby E guardbands can be automatically aligned to the video switching point prior to synchronisation and embedding.
- **Optimise the audio:** each channel has individual gain control and stereo to mono conversion. The audio level can be increased or decreased to match the rest of the system: each mono audio channel offers individual gain control, adjustable between +18dB and -18dB in 0.1dB steps. Audio channels can be muted and stereo pairs converted to mono. PCM Audio channels can be delayed with respect to the video by a fixed amount of up to 400mS and Dolby E channels by up to 40 samples.
- **Control of SYNNER-VF** is most easily achieved by Crystal Vision's VisionWeb PC software. Control can additionally be from an active front panel on the Vision frame, remote VisionPanel or SNMP.

- **Optical connectivity –** send signals beyond the local equipment bay with the fibre input and output options
- **VANC** blanking option.
- **EDH** insertion.
- **Supports the following Vision Rear Modules:** VR02, VR12 and VR13.
- **Compatible** with 'Vision' frames from Crystal Vision.
- **Passes** all timecode, AFD and subtitling information.



SYNNER-VF functional block diagram

Block Diagram Description

SDI video is cable-equalised, re-clocked and passed through a de-embedder block where up to 16 channels of audio are extracted. The video signal is then processed allowing for adjustment of video gain, black level and independent RGB and YUV gains. This is followed by up to ten video frames of delay and optional synchronisation to one of two analogue Black and Burst or tri-level references connected via the Vision 3 frame. Following additional delay, the video is then passed to the embedder block where up to 16 audio channels are inserted.

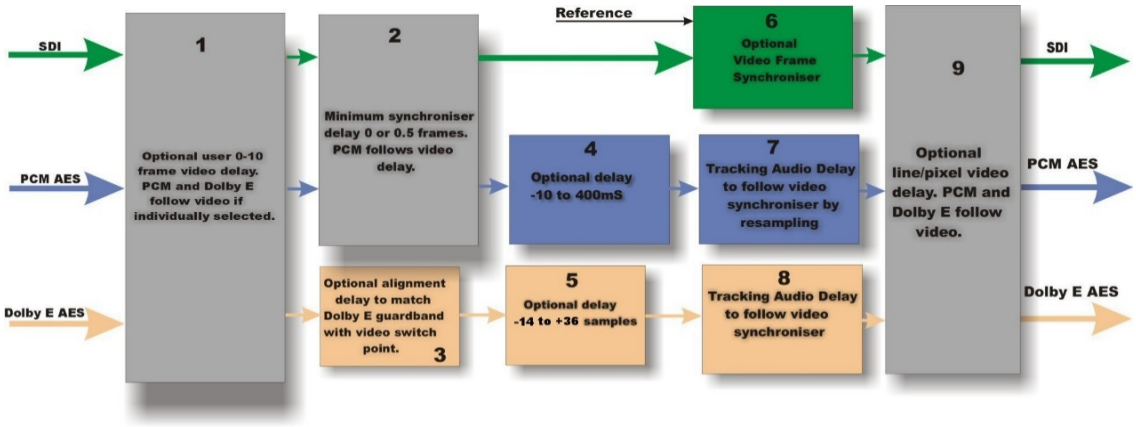
All input audio from both external (up to 16 channels via the optional plug-in input piggyback) and de-embedded sources (16 channels) are passed to:

Audio processing blocks where gain and fixed delay and/or automatic tracking delay for non-Dolby encoded signals, or alignment delay for Dolby E signals are made after resampling.

The outputs of the audio processing block are input to two independent 32 x 16 routers which feed the optional plug-in output piggybacks and the embedding block. In this way any of the 32 sources can be output or embedded.

1.1 Video and audio delays in SYNNER-VF

SYNNER-VF has a variety of video and audio delays, some of which are of fixed length and others are dynamic.



SYNNER-VF Delay Paths

When reference video is selected as the genlock source the video path is synchronised to one of two analogue Black and Burst or tri-level references connected via the Vision 3 frame and audio signals can optionally be made to track this dynamic delay to maintain lip-sync. When the video input is the genlock source (i.e. itself) the synchroniser is effectively bypassed and just the bulk delays active. In the following description of delay blocks, the paragraph number refers to the delay block number in the 'SYNNER-VF Delay Paths' drawing above. The input signals in the Delay Paths block diagram are from the de-embedder and external AES inputs. AES signals with Dolby E encoding are treated differently to PCM signals. The output of the delay block goes to the embedder and external output piggybacks. The following is a description of the function of each delay block from 1-9 with reference to VisionWeb controls.

1. This delay block will delay the video path by the value selected by the '*Delay'* controls in the *Delay & output* menu and can be from 0 to 10 frames. De-embedded audio can be delayed by the same amount if the '*Match video frame delay'* control in the *DeEmbedded input delay* menu is set. Similarly, PCM and Dolby E audio signals will also be delayed from the *Discrete input delay* menu. This fixed delay is useful for delaying the video with respect to the audio or to compensate for timing errors elsewhere.

2. This block introduces a fixed delay to both video and PCM signals of either 0 or 0.5 frame depending on the value of '*Min sync delay'* control in the *Delay & output* menu. This delay can be useful to help overcome synchroniser disturbances and to minimise Dolby E alignment delays.

   If a reference is selected as the genlock source in the *Delay & output* menu, the amount of delay through the following video frame synchroniser (see 6.) will vary according to the difference in timing between the video and reference signals and can be anywhere from 0

to 1 frame. If the reference signal is not locked to the input video, the synchroniser delay will increase or reduce to follow the reference. When the delay goes beyond its minimum or maximum range it will jump instantaneously to the opposite end of its range, either skipping or repeating a frame, possibly causing a motion disturbance for non-static pictures. If the input video is nominally locked to the reference but drifting slowly backwards and forwards or jittering, then it is sometimes better to introduce an additional delay to the video path to centre the synchroniser delay half-way through its range. Although the synchroniser control logic has hysteresis to minimise this problem, in extreme cases of jitter the '*Min sync delay'* delay can help give the synchroniser +/- 0.5 frame of dynamic delay adjustment before hitting the end stops.

As Dolby E signals are not routed through this delay they will be advanced by up to 0.5 frames with respect to the video path. This can help minimise delays caused by the alignment process (see 3.).

3. Dolby E is sensitive to any disturbances to the data stream such as those introduced during editing or routing. To overcome this, Dolby E includes a part of the signal called the 'guardband' that is insensitive to disturbance and should be aligned with the video switching point prior to editing, routing or synchronising. If '*DolbyE align'* is selected in the *Discrete input delay* or *DeEmbedded input delay* menus, the alignment delay block will automatically delay the Dolby signal by up to one frame to match the guardband and video switch point. If the Dolby E channel is put through a series of embedding/de-embedding sequences the alignment delay can be magnified to several frames but if the '*Min sync delay'* control is set to 0.5 frames the overall Dolby E delay with respect to the video will be minimised.

4. If the '*User delay'* control in the *DeEmbedded input delay* or *Discrete input delay* menus is selected, a delay is added to de-embedded or PCM signals by the amount set by the *User delay* controls from -20 to +400mS. Note that for negative audio delay, at least one frame of video delay must be selected.

5. If the '*User delay'* control in the *DeEmbedded input delay* or *Discrete input delay* menu is selected, this delay block introduces a delay to Dolby E encoded signals by the amount set by the '*DolbyE'* control in the *User delay* menu from -14 to +36 samples. This range is chosen so the user cannot move the Dolby E guardband away from the video switch point after alignment. Note that for negative delay values at least one frame of video delay must be selected.

6. If the output timing reference control in the *Delay & output* menu is set to lock to either reference, then this block synchronises the incoming video signal to that reference by setting a dynamic delay of up to one frame. If 'Tracking audio delay' is selected, then the audio signals will be delayed by the same amount to maintain lip-sync and Dolby E alignment (see 7 and 8).

7. When '*Tracking audio delay'* is selected in the *DeEmbedded input delay* or *Discrete input delay* menus, this delay is slaved to the video frame synchroniser to provide the same delay for PCM signals as the video path. Variable delay is achieved by either resampling if '*Resample'* is selected in the *DeEmbedded input* or *Discrete inputs* menus or audio sample drop/repeat if not.

8. If '*Tracking audio delay'* is selected in the *DeEmbedded input* or *Discrete inputs* menu for Dolby E signals, then this delay will produce the same delay as the video frame synchroniser. Frames will be dropped or repeated at the same time as the video. Dolby E encoded signals cannot be resampled or samples dropped/repeated.

9. This delay is after the frame synchroniser and TAD delays. If either reference is selected as the output timing reference source, the values set by the '*0-42ms,0-100us and 0-1us'* controls in the *Delay & output* menu will delay the video and audio signals with respect to the reference. Otherwise, this block will introduce a further delay to the video and audio paths

2 Hardware installation

All of the links and potentiometers on the card are factory set and should **NOT** be adjusted.

SYNNER-VF cards are intended for use **only** in the Crystal Vision 'Vision' frame range and not in older style frames such as 'Indigo'.

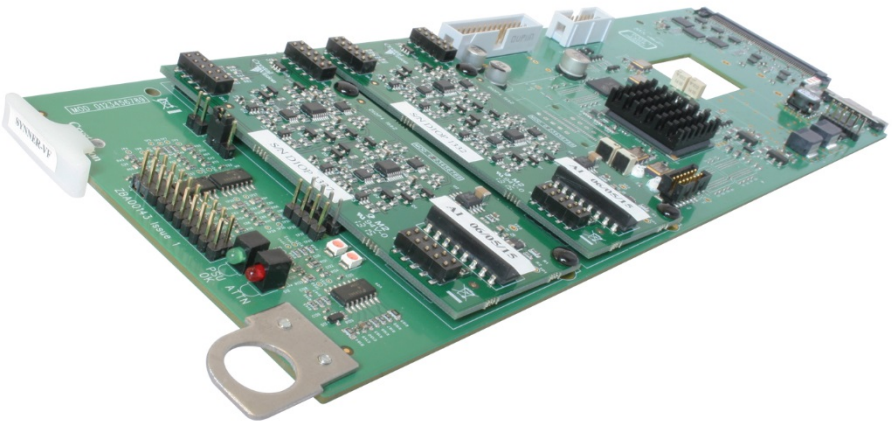
The card should be inserted and removed from the Vision Frame by gently pushing or pulling the metal ring at the bottom of the card, being careful to ensure the card is inside the guide rails. Do not force the card if resistance is met as the card may not be correctly aligned with the rear connectors. The white tab at the top of the board is a label only and should not be pulled.

Ensure that the Vision frame has the correct rear module fitted. Only the VR02, VR12 and VR13 rear modules offer the correct input/output functionality for this card.

2.1 Piggyback boards

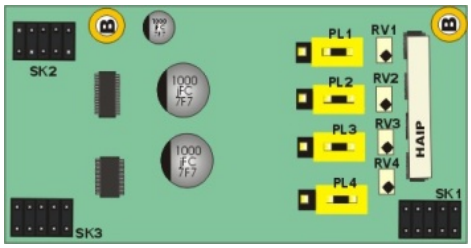
The SYNNER-VF board has two positions where one of three types of piggy-backed I/O module can be plugged to enable analogue or digital input and output.

The three types of piggybacks are 3G-AIP2, 3G-AOP2 and DIOP4.



SYNNER-VF card with two piggyback boards fitted

3G-AIP2 Analogue Input

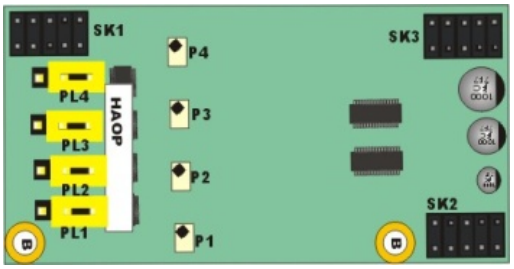


This analogue module has four balanced audio inputs. The links PL1-4 allow 0dBFS to be set to +18dBu (to the right, towards SK1) or +24dBu (to the left, towards SK2/3). The adjacent potentiometers RV1-4 are factory set and should **NOT** be adjusted.

3G-AIP2 Channel number	Link number
CH1	PL1
CH2	PL2
CH3	PL3
CH4	PL4

Table showing links controlling the input gain of the 3G-AIP2 channels

3G-AOP2 Analogue Output

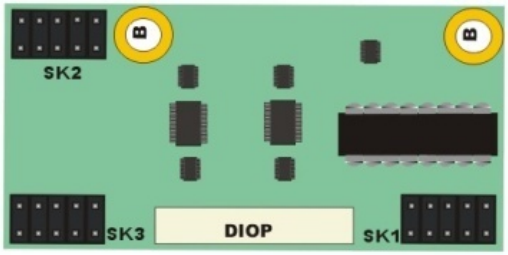


This analogue piggyback has four balanced audio outputs. The links PL1-4 set 0dBFS to +18dBu (to the right, towards SK2/3) or +24dBu (to the left, towards SK1). The four potentiometers P1-P4 are factory set and should **NOT** be adjusted.

3G-AOP2 Channel number	Link number
CH1	PL1
CH2	PL2
CH3	PL3
CH4	PL4

Table showing links controlling the output gain of the 3G-AOP2 channels

DIOP4 AES I/O



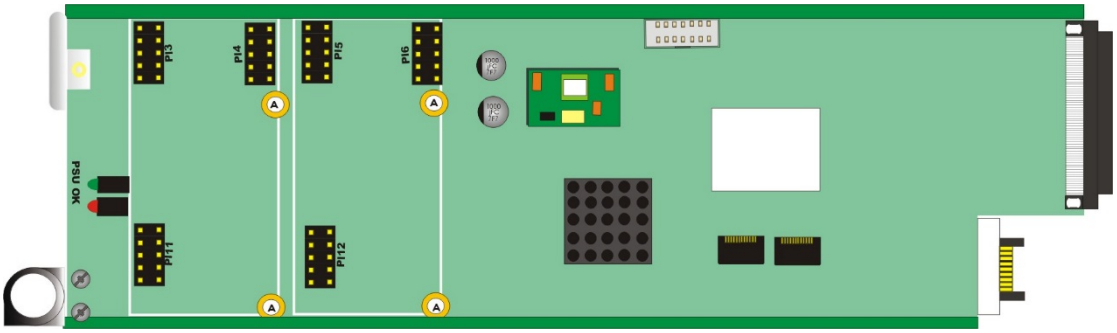
This digital audio piggyback has four AES stereo pairs that are individually configured as inputs or outputs by software. There are no links or user-adjustments on this card.

Legal combinations

Not all combinations of piggyback boards are allowed. The following table shows the only legal combinations that can be fitted into front (nearest handle) and rear (nearest edge connector) positions:

FRONT	none	DIOP4	3G-AIP2	3G-AOP2	DIOP4	DIOP4	DIOP4	3G-AIP2	3G-AIP2	3G-AOP2
REAR	none	none	none	none	DIOP4	3G-AIP2	3G-AOP2	3G-AIP2	3G-AOP2	3G-AOP2

Fitting the I/O piggybacks onto the main board



SYNNER-VF main board showing piggyback fixing holes and sockets

The I/O piggybacks plug onto the main board such that main board plugs PL6, PL5, PL12 and PL4, PL3, PL11 align with piggyback sockets SK2, SK3, SK1. With the component side of the module top-most, align the piggyback sockets carefully with the plugs and push firmly. Insert the plastic rivets supplied with the fitting kit through the main board (holes 'A') from the underside so they protrude through the piggyback board, then push the rivet peg firmly to splay the end to lock the piggyback board in position. ***Note: The position that the piggyback is fitted determines the function of the rear module connectors***. ***See*** *Rear modules and signal I/O* ***for more information.***

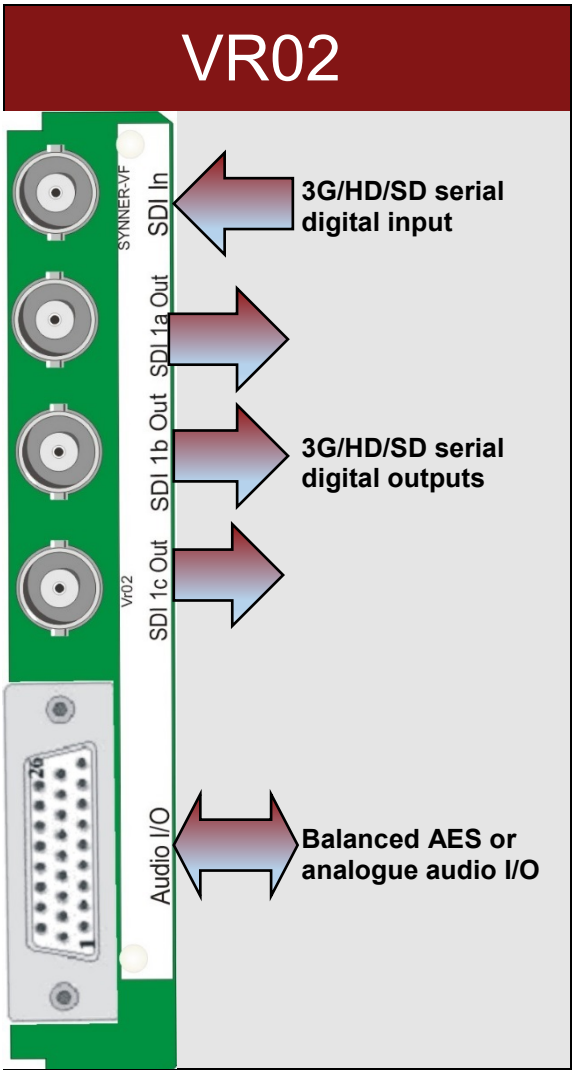
3 Rear modules and signal I/O

The Vision 3 frame will house up to 20 single height cards and dual power supplies or ten double height modules. All modules can be plugged in and removed while the frame is powered without damage.

Note: *For details of fitting rear connectors please refer to the appropriate frame manual.*

The SYNNER-VF can support the following rear modules: **VR02**, **VR12**, and **VR13**.

3.1 Rear module connections with VR02

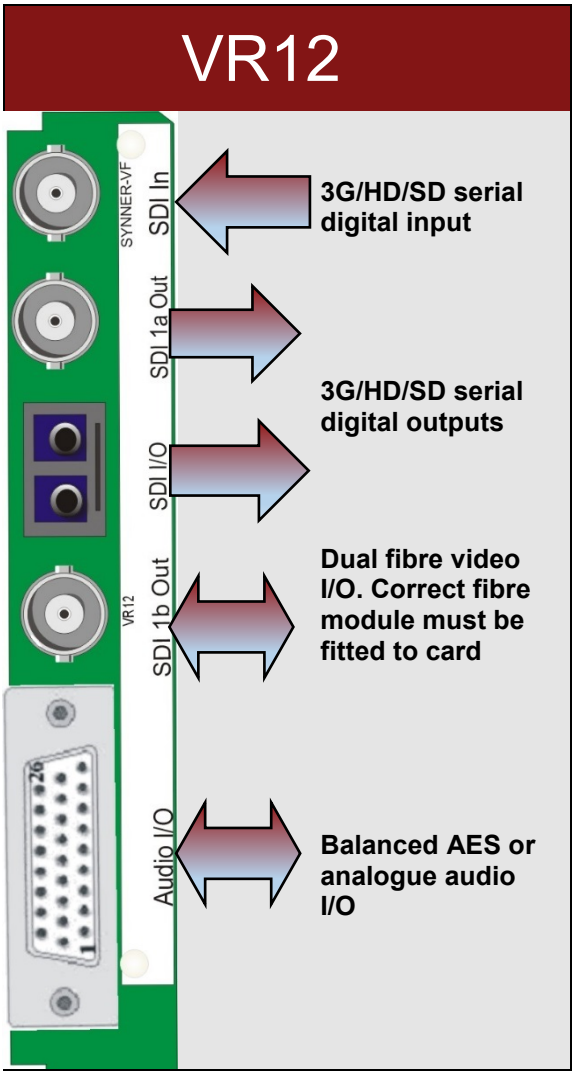


The VR02 single-slot rear module allows maximum packing density with the maximum number of inputs and outputs available. The VR02 has one 3G/HD/SD serial digital BNC video input and three 3G/HD/SD serial digital BNC video outputs. The D-Type connector allows eight AES stereo pairs or eight mono analogue channels as balanced I/O.

The 26-way high-density audio 'D' socket on the VR02 module can be used for analogue or digital, inputs or outputs - or a mixture of both depending on the I/O piggybacks fitted. Half of the I/O channels on the rear module are connected to the front I/O (nearest handle) piggyback position and the remainder to the rear. The DIOP4 will normally be configured as 110 ohm balanced operation when using this rear module.

Up to 20 VR02 rear modules can fit into a Vision 3 frame.

3.2 Rear module connections with VR12

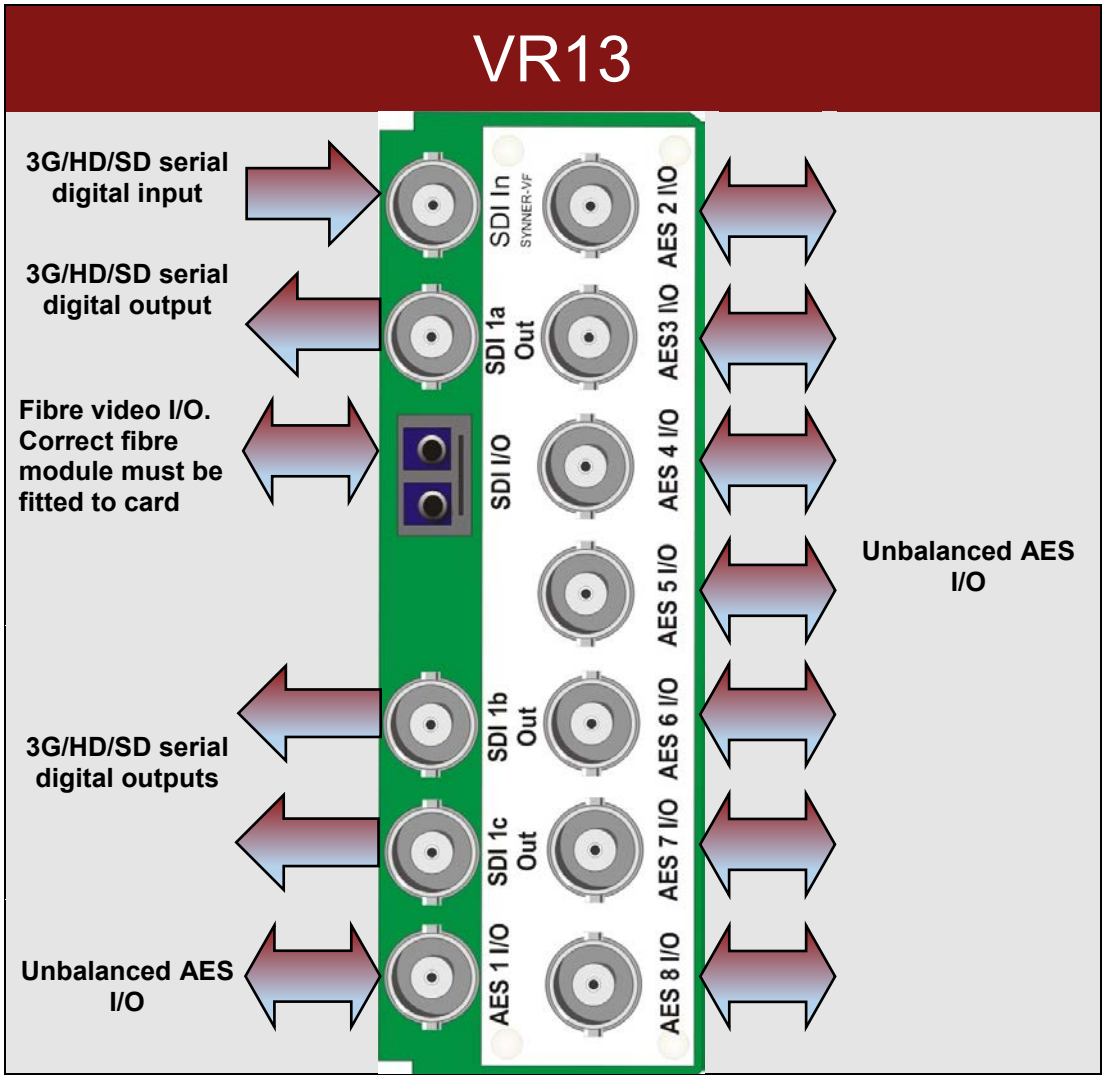


The VR12 single-slot rear module has one 3G/HD/SD serial digital video input plus two 3G/HD/SD serial digital video outputs on BNC and eight AES stereo pairs or eight mono analogue channels as balanced I/O on the D-Type connector. The dual fibre I/O can be configured as a video input, a video output or a video input and output depending on the fibre modules fitted to the SYNNER-VF card.

The 26-way high-density audio 'D' socket on the VR12 module can be used for analogue or digital, inputs or outputs – or a mixture of both depending on the I/O piggybacks fitted. Half of the I/O channels on the rear module are connected to the front I/O (nearest handle) piggyback position and the remainder to the rear. The DIOP4 will normally be configured as 110 ohm balanced operation when using this rear module.

Up to 20 VR12 rear modules can fit into a Vision 3 frame.

3.3 Rear module connections with VR13



The VR13 double-slot module has BNC connectors for eight channels (stereo pairs) of unbalanced AES audio. One 3G/HD/SD serial digital video input plus three 3G/HD/SD serial digital video outputs on BNC. The dual fibre I/O can be configured as a video input, a video output or a video input and output depending on the fibre modules fitted to the SYNNER-VF card.

AES I/O channels 1-4 on the rear module are connected to the front I/O (nearest handle) piggyback position and the remainder to the rear. DIOP4 piggyback(s) must be used as there is no provision for analogue audio, and will normally be configured for 75 ohm unbalanced operation.

When using this rear module, the SYNNER-VF card must be fitted into the right hand slot position when viewed from the front of the frame.

Up to ten VR13 rear modules can fit into a Vision 3 frame.

3.4 VR02 and VR12 audio pin-out

The 26-way high-density audio 'D' connector on the VR02 and VR12 modules can be used for analogue or digital, inputs or outputs – or a mixture of both depending on the I/O piggybacks fitted. Half of the I/O channels on the rear module are connected to the front I/O (nearest handle) piggyback position and the remainder to the rear. The DIOP4 will normally be configured as 110 ohm balanced operation when using these rear modules.

Piggyback position	Function		Pin-out
	GND		1
Front	Analogue audio 1/ AES1	+	2
		-	3
	Analogue audio 2/ AES2	+	4
		-	5
	Analogue audio 3/ AES3	+	6
		-	7
	Analogue audio 4/ AES4	+	8
		-	18
	GND		9
Rear	Analogue audio 5/ AES5	+	14
		-	15
	Analogue audio 6/ AES6	+	10
		-	11
	Analogue audio 7/ AES7	+	16
		-	17

Piggyback position	Function		Pin-out
	Analogue audio 8/ AES8	-	12
		+	13
	GND		19, 20, 23, 24
	NC		21, 22, 25, 26

VR02 and VR12 audio I/O connector wiring - *All audio balanced signals can be either input or output depending on I/O module fitted.*

4 Control and Status monitoring

SYNNER-VF status and controls can be accessed most easily by VisionWeb remote control PC software but also by VisionPanel, the Vision frame's front panel and SNMP.

4.1 Controlling cards via VisionWeb

Accessing the 'Vision' frame homepage with a PC browser via the Ethernet connector of a frame will display a list of the cards fitted (See Vision frame User Manual for more details).

Typical Vision frame home page

The example above shows a SYNNER-VF card fitted in slot 1 and other Vision cards in slots 2, 3, 5 and 7. Clicking on the SYNNER-VF card will bring up the card's **Status** page, for example:

SYNNER-VF Status Page

4.2 Control Descriptions

Crystal Vision cards use an XML file to create a control database that is common to all controllers. Although the description of controls used in this manual is based on VisionWeb GUI screen grabs, the menu tree for VisionPanel and Vision frame front panel operation is the

same, although the appearance and labelling of some controls may vary according to the available space. See *Menu Structure* for a more detailed menu tree.

VisionWeb GUI controls are accessed by tabs at the bottom of the page: **Status, Video, Audio, Audio router and Presets, default, alarms**. These tabs, when selected, offer menus containing a number of controls. Some controls are simulated LEDs that are used to show status, others are check boxes, buttons or sliders which change various SYNNER-VF settings.

What follows are VisionWeb menu screenshots with a description of each control's function. Note that VisionWeb adjusts the number and type of controls displayed to suit the piggybacks fitted, so the following screen grabs may not correspond exactly to a user's own configuration.

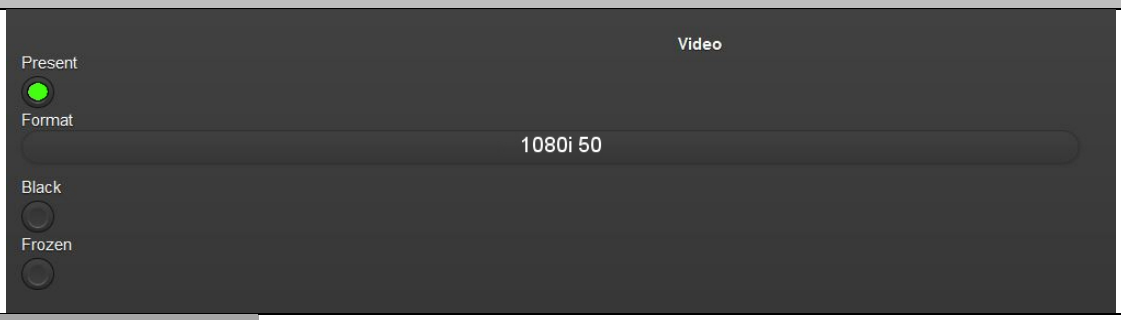
The description of the menus is in the order displayed in the VisionWeb GUI:

Video, Audio, Reference, Sub PCB type, Delay & output, RGB proc, YUV proc, VANC & Dolby E sequence, Fibre enable, DeEmbedded input, Discrete inputs, Audio gain, DeEmbedded input delay, Discrete input delay, User delay, AES I/O configure, Embedded output router, Discrete output router, Mute & group enable, Presets, Card defaults, Alarm delays.

4.3 Status

Video

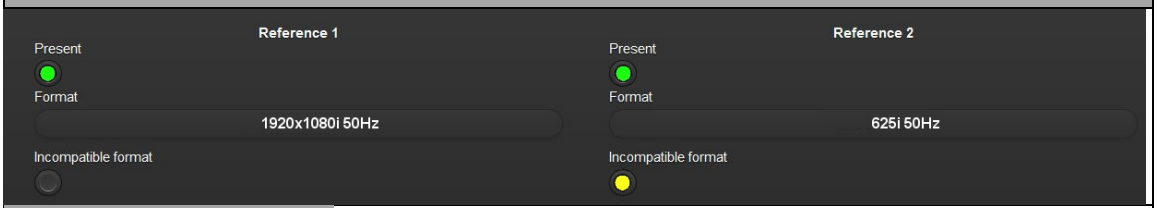
Display presence, standard and status of incoming video signal.



Present	**On when input video is present.**
Format	**Displays video standard of incoming video i.e. 1080i 50, 1080p 50, 720p 50, 625, 525 etc.**
Black	**On if video input is permanently at black level.**
Frozen	**On if video input is a permanent still frame.**

Reference

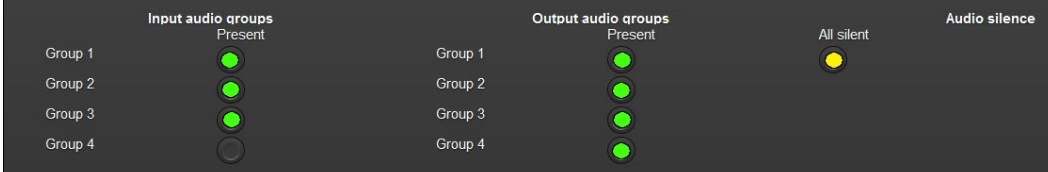
Displays status of reference signals.



Present	**On if a valid video reference signal is connected.**
Format	**Displays video standard of incoming reference i.e. 1080i 50, 1080p 50, 720p 50, 625, 525 etc.**
Incompatible format	**On if applied reference is incompatible with the input standard e.g. 59.94Hz reference but 50Hz video input.**

Audio status

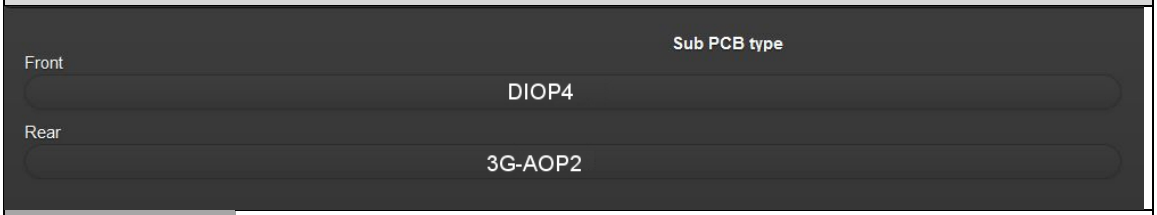
Displays presence of audio embedded in incoming and outgoing video signal.



Input audio groups - Present	**On when audio group detected in incoming video.**
Output audio groups - Present	**On when audio group detected in outgoing video.**
All silent	**On if the sound level of all the channels of all the groups is consistently below the threshold set by the 'Audio silence level' control' for the time period set by the 'Audio silence (seconds)' control. Both of these controls are in the *Presets, default, alarms* menu.**

Sub PCB type

Displays type of piggybacks fitted. In the example below, a DIOP4 piggyback is fitted in the front position and a 3G-AOP2 in the rear.

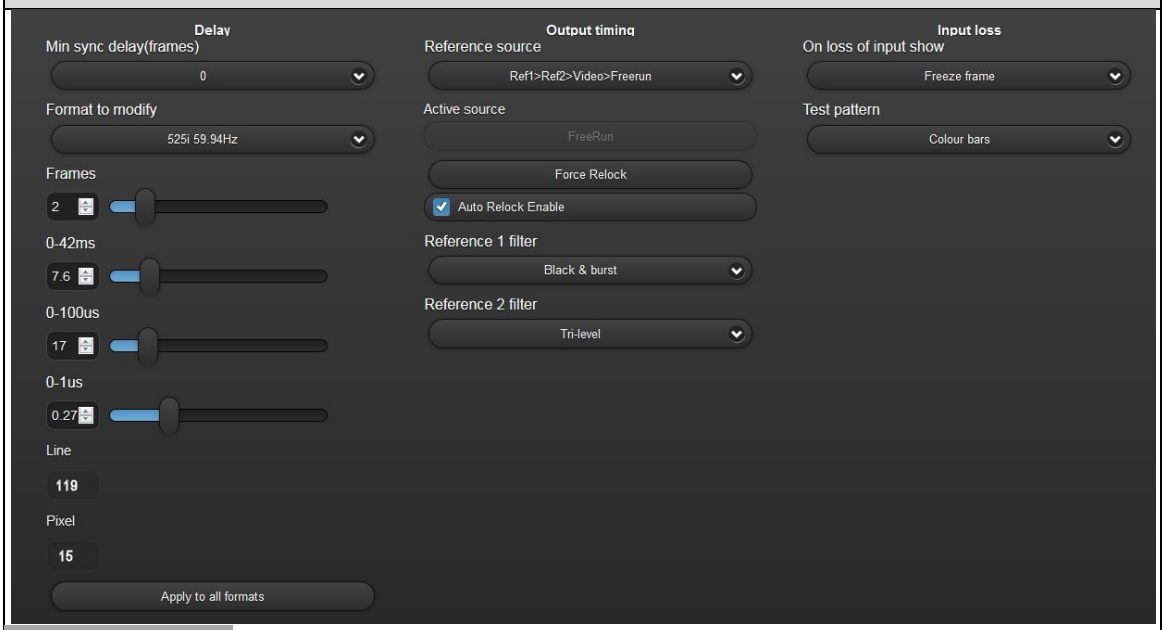


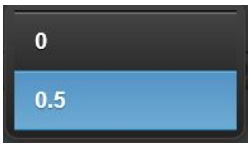
Front	**Displays type of piggyback in front position (nearest handle) i.e. DIOP4, 3G-AIP2, 3G-AOP2 or none.**
Rear	**Displays type of piggyback in rear position (nearest edge connector) i.e. DIOP4, 3G-AIP2, 3G-AOP2 or none.**

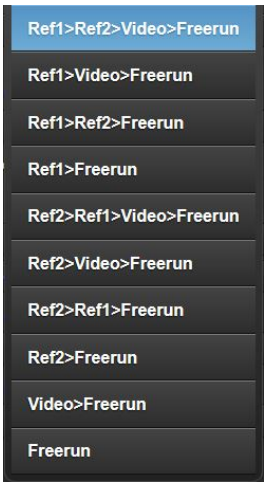
4.4 Video

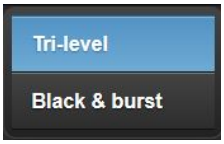
Delay & output

Set up the synchroniser and frame, line and pixel delays.



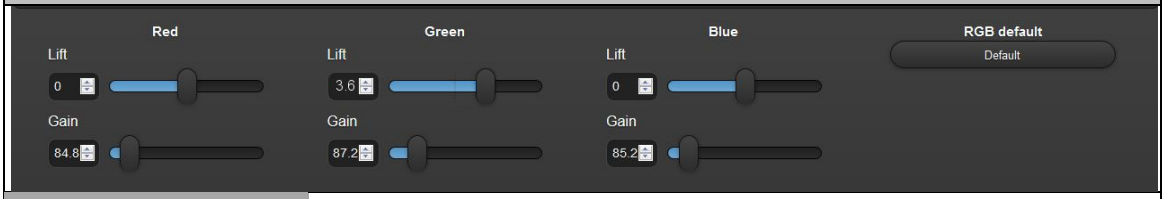
Min sync delay (frames)		**Select an additional 0.5 frame delay for the video path and PCM (non-Dolby E encoded) audio channels. Used in synchroniser mode to advance reference signal +0.5 frame with respect to video path to help centre synchroniser delay and/or for Dolby E channels to advance them +0.5 frame with respect to video thereby reducing alignment delays.**
Format to modify		**Select which input standard the fixed delays should be applied to. Other input standards are unaffected. The four slider delay controls will change to reflect the values previously set for that format.**

Frames	**Select a delay of between 0-10 video frames for the video path. As the audio path is not affected by this delay, this control will delay the video with respect to the audio. Audio channels will be delayed by the same amount if 'Match video frame delay' is selected by the *DeEmbedded input delay* or *Discrete input delay* controls.**
0-42ms	**Select a delay from 0 to 42ms in 0.1ms steps that will delay the video and audio with respect to the reference source if the output timing reference source is Ref1 or Ref2 – otherwise, this delay is an additional delay.**
0-100us	**Select additional delay from 0 to 100us in 1us steps. See '0-42ms' above.**
0-1us	**Select additional delay from 0 to 1us in 5ns steps. See '0-42ms' above.**
Line / Pixel	**Displays current delay between video input and reference in video lines and pixels.**
Apply to all formats	**Selecting this will apply the currently displayed delay to all possible input video formats.**
Reference source	 **Select the options for the synchroniser reference video. The hierarchy runs from left to right, so Ref1>Ref2>Video>Freerun will attempt to use Ref1 initially and if that fails to use Ref2 and so on. If the reference and video frame rate become incompatible, the card will attempt to use the other reference source and if that is not compatible, lock to the input video. With the video input selected as reference, the synchroniser is effectively disabled.**
Active source	**The source being used as the synchroniser reference is displayed here i.e. 'Ref1, Ref2, Video or Freerun'.**
Force relock	**Applicable when 'Auto Relock Enable' control is de-selected. Selecting this will force the synchroniser to relock after a reference is restored. When this control is operated, the card internal logic will start at the top of the currently selected list and move down it, picking the highest available timing reference source. As video output is disturbed during the relocking process, this control gives the user the opportunity to relock at a non-critical time.**

Auto Relock Enable	**When selected, the card will automatically relock when a lost reference is restored. This control is on by default.**
Reference 1 & 2 filter	 **Select either analogue Black & Burst or tri-level sync as the reference input type.**
On Loss of Input Show	 **In the event of the input signal missing, choose which picture to output. If a 'freeze then..' option is selected, the video output will freeze with the last good frame for three seconds before changing.**
Test pattern	 **Select a test pattern output to replace the normal video output. The format will be the same as the input video, or the last input received.**

RGB proc

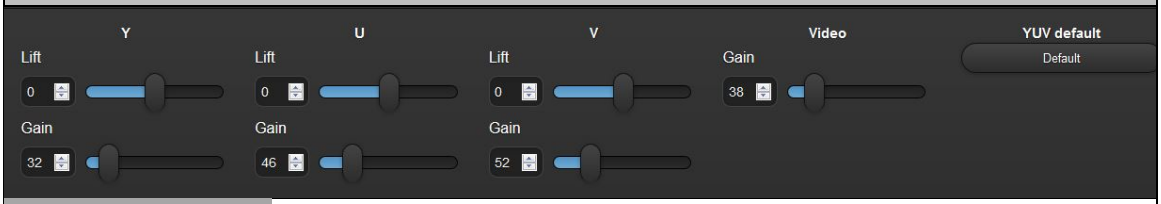
Apply varying amounts of lift and gain to the Red, Green and Blue channels of the video path.



Red/Green/Blue Lift	**Apply a positive or negative DC offset to the black level of the Red, Green and Blue components of the video path.**
Red/Green/Blue Gain	**Apply 80% to 120% gain to the Red, Green and Blue components of the video path.**
Default	**Return Lift and Gain for all components to their calibrated values of 0 lift and 100% gain.**

YUV proc

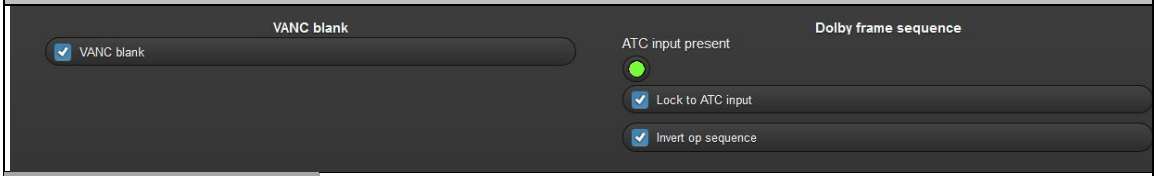
Apply varying amounts of lift and gain to the YUV channels of the video path.



Y/U/V Lift	**Apply a positive or negative DC offset to the black level of the Y, U and V components of the video path.**
Y/U/V Gain	**Apply 0 to 200% gain to the Y, U and V components of the video path.**
Video Gain	**Apply 0 to 200% overall gain to the video path.**
YUV default	**Return Lift and Gain for all components to their calibrated values of 0 lift and 100% gain.**

VANC & Dolby E sequence

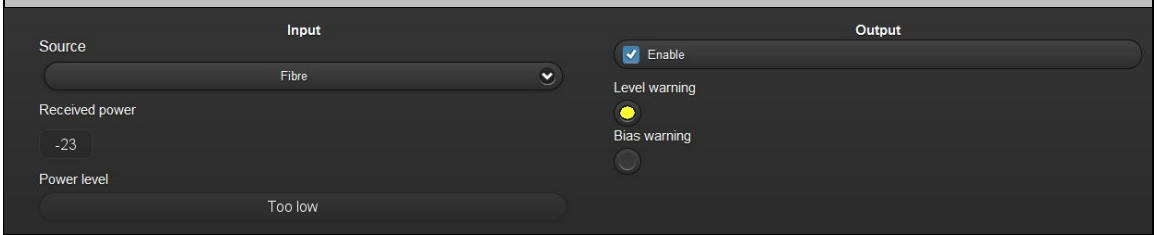
Blank ancillary data and lock progressive HD video output to ATC, or invert sequence to help ensure that Dolby E has its guardband correctly positioned.

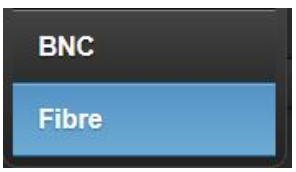


VANC blank	**Select to blank the vertical ancillary data in the video signal vertical interval.**
ATC input present	**On when Ancillary Timecode is present.**
Lock to ATC input	**Set to lock the HD progressive video output field sequence to Ancillary Timecode**
Invert op sequence	**Invert HD progressive video output field sequence.**

Fibre enable

Select optical or BNC as the video source. Enable fibre output and display laser fail warnings.



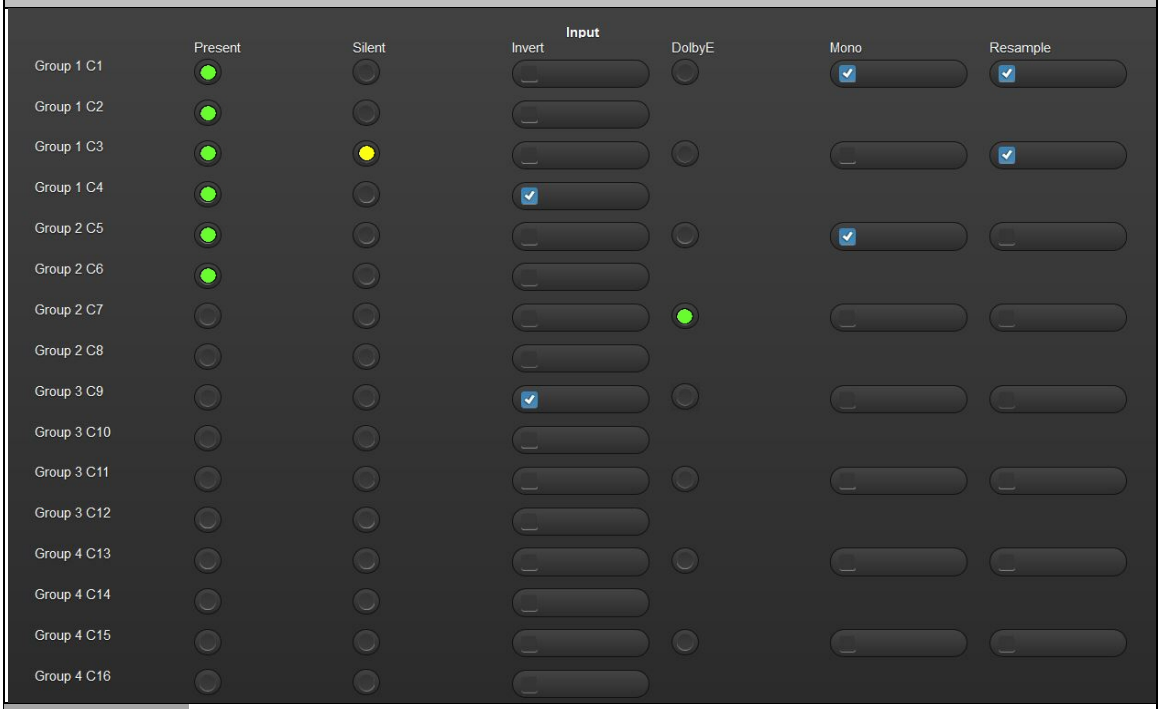
Source	 **Select fibre or BNC as the video input source. FIP-VF or FIO-VF module must be fitted for fibre input.**
Received power	**Displays received optical power in dBm in the range -25 to 0dBm in 1dBm steps.**

Power level	**Displays one of the following depending on the received power level: 'OVERLOAD', 'HIGH', 'GOOD', 'LOW', 'TOO LOW'.** **'OVERLOAD' or 'HIGH' may cause the receiver to saturate with poor or no video output. In extreme cases the receiver may even be damaged – consider using an optical attenuator or a longer fibre cable.** **'TOO LOW' or 'LOW' may be the result of dirty optical connectors – if in doubt, clean. Excessive fibre cable runs will also cause these warnings. Although transmission distances of up to 50km is possible with single-mode fibre, this distance is dependent on minimal attenuation from junctions etc. Multi-mode fibre installations can expect considerably shorter transmission distances. Single-mode fibre, or any single-mode components should never be used downstream of multi-mode fibre.**
Enable	**Enable fibre optic output if FOP-VF or FIO-VF module fitted.**
Level warning	**On if the laser is producing low output power. This indicates that the laser has failed and should be replaced immediately.**
Bias warning	**On if the laser bias current has risen above a threshold which indicates imminent failure of the device. The laser should be replaced as soon as possible.**

4.5 Audio

DeEmbedded input

Monitor de-embedder channel status, invert channels, detect Dolby E encoded channel pairs, mono and resample stereo pairs.

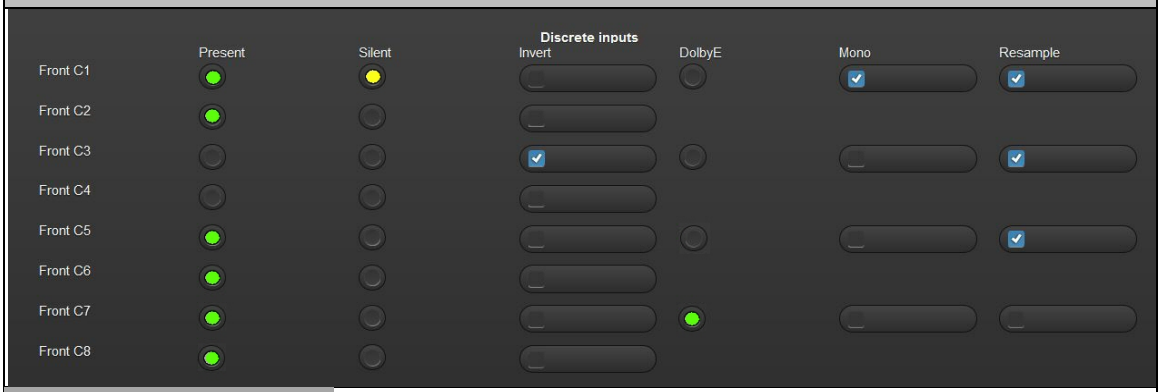


Present	**On when embedded channel detected.**
Silent	**On if the audio channel is silent i.e. consistently below the threshold set by the 'Audio silence level' control for a period set by the 'Audio silence (seconds)' control – see** *Alarm delays.*
Invert	**Select to enable inversion of the de-embedder output for the selected channel.**
Dolby E	**On if the channel pair has Dolby E encoding.**
Mono	**Select to mono the channel pair.** ***N.B. Only the first channel of the stereo pair is converted to mono, the second channel is unchanged. The mono output is gain corrected to maintain unity gain.***

Resample	**Select to enable resampling of the selected stereo pair output from the de-embedder. Resampling is used to seamlessly match the timing of audio signals when the user-controlled delay is altered and is the default condition. If resampling is deselected it is essential that the input and output source is derived from the same source and the timing should not be adjusted while on air. Without resampling, an adjustment in timing will cause a number of audio samples to be dropped or repeated. As Dolby E signals cannot be resampled, the control will be ignored.**

Discrete inputs

Monitor external analogue or AES input channel status, invert channels, detect Dolby E encoded channel pairs, mono and resample stereo pairs. Screen grab below shows a DIOP4 in the front piggyback position with eight digital inputs.

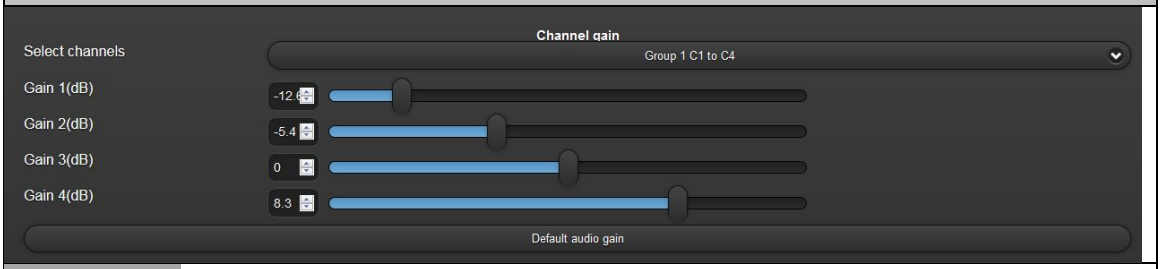


Present	**On when embedded channel detected.**
Silent	**On if the audio channel is silent i.e. consistently below the set threshold.**
Invert	**Select to enable inversion of the de-embedder output for the selected channel.**
Dolby E	**On if the channel pair has Dolby E encoding (AES inputs only).**
Mono	**Select to mono the channel pair. *N.B. Only the first channel of the stereo pair is converted to mono, the second channel is unchanged. The mono output is gain corrected to maintain unity gain.***

Resample	**Select to enable resampling of the selected stereo pair output from the de-embedder. Resampling is used to seamlessly match the timing of audio signals when the user-controlled delay is altered and is the default condition. If resampling is deselected it is essential that the input and output source is derived from the same source and the timing should not be adjusted while on air. Without resampling, an adjustment in timing will cause a number of audio samples to be dropped or repeated. As Dolby E signals cannot be resampled, the control will be ignored.**

Audio gain

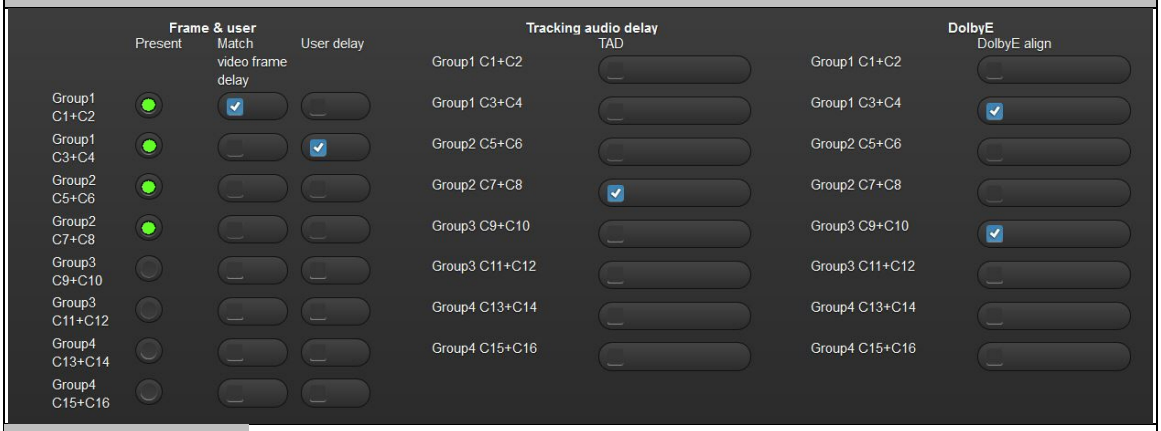
Change the gain of the audio inputs by +/- 18dB.



Gain 1-4 (dB)	**In total there are 32 audio gain controls, one for each of the 16 channels of de-embedded audio and 16 channels of external audio. The gain controls will give ± 18dB of gain relative to the input level up to the point where digital clipping will occur.**
Select channels	 **Select the group of channels to control. The options available will depend on the option sub-boards fitted. The screen grab shown here is for a single DIOP4 piggyback fitted in the front position offering eight AES inputs.**
Default Audio Gain	**Select to return all channels to the default gain level.**

DeEmbedded input delay

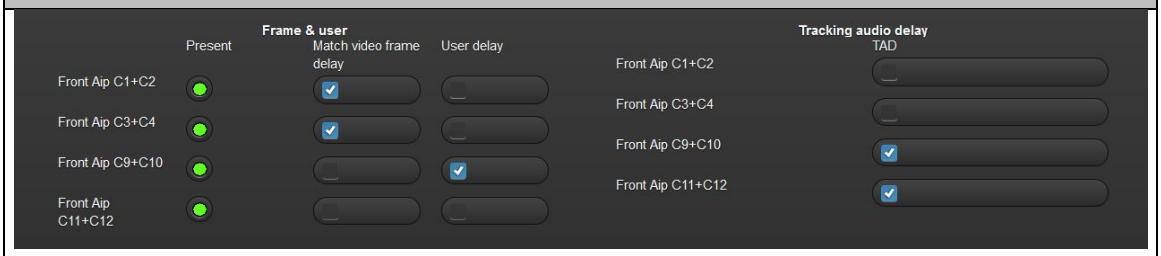
These controls can be used to match the video 0 to 10 frame delay, or to delay the de-embedded audio with respect to the video and compensate for any delay between the incoming video and audio signals.



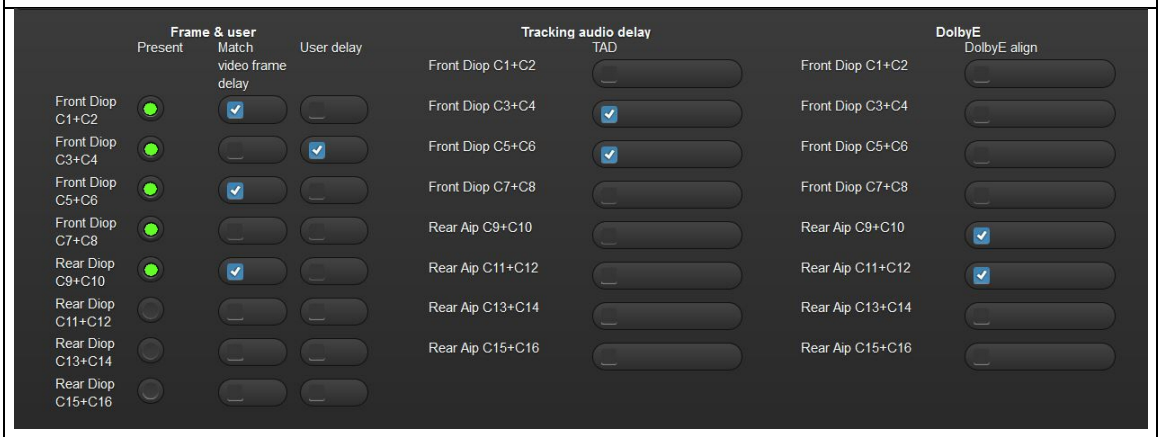
Present	**On if the audio channel pair is present.**
Match video frame delay	**For each channel pair, select to enable delay to match the video frame delay set by the *Delay & output* controls.**
User delay	**For each channel pair, select to enable the variable delays set by the *User delay* controls. For PCM signals this is -20 to +400mS and for Dolby E signals -14 to +36 samples. *N.B. Negative values of delay can only be set if at least one frame of video delay selected.***
TAD	**Select to enable automatic tracking of video delay. The audio delays will follow the video path delays through the synchroniser.**
DolbyE align	**Delay Dolby E channel pair by up to one frame so that the Dolby guardband is automatically aligned with the video switch point.**

Discrete input delay

These controls can be used to match the video 0 to 10 frame delay or to delay the de-embedded audio with respect to the video and compensate for any delay between the incoming video and audio signals. The number of inputs will depend on the type of piggyback(s) and sub-board fitted. Screen grabs below show two different configurations.



3G-AIP2 piggyback fitted in front position

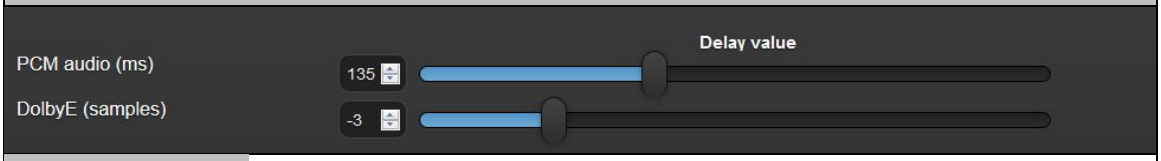


DIOP4 piggyback fitted in front and rear positions

Present	**On if the audio channel pair is present.**
Match video frame delay	**For each channel pair, select to enable delay to match the video frame delay set by the *Delay & output* controls.**
User delay	**For each channel pair, select to enable the variable delay set by the *User delay* control. For PCM signals this is -20 to +400mS and for Dolby E signals -14 to +36 samples. *N.B. Negative values of delay can only be set if 'Frame Delay' is also enabled for that channel and at least one frame of video delay selected.***
TAD	**Select to enable automatic tracking of video delay. The audio delays will follow the video path delays through the synchroniser (AES sources only).**
Dolby E Align	**Delay Dolby E channel pair by up to one frame so that the Dolby guardband is automatically aligned with the video switch point (AES sources only).**

User delay

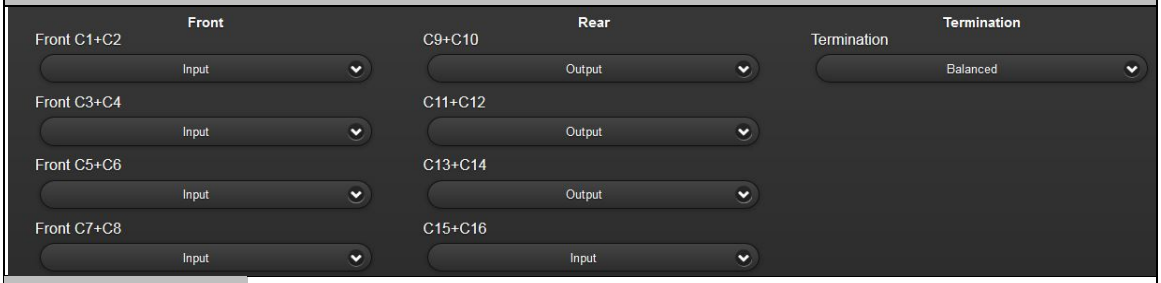
Set the delay value for de-embedded and external audio signals.

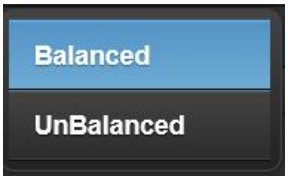


PCM audio (mS)	**Set the delay value between -20 to +400mS for all channel pairs (de-embedded or discrete) with the 'User delay' control selected. See *Discrete input delay*.**
DolbyE (samples)	**Set the delay value between -14 to +36 samples for all Dolby E encoded channel pairs with the 'User delay' control selected. See *Discrete input delay*.**

AES I/O configure

Configure the optional DIOP4 piggyback AES I/O channels as input or output.

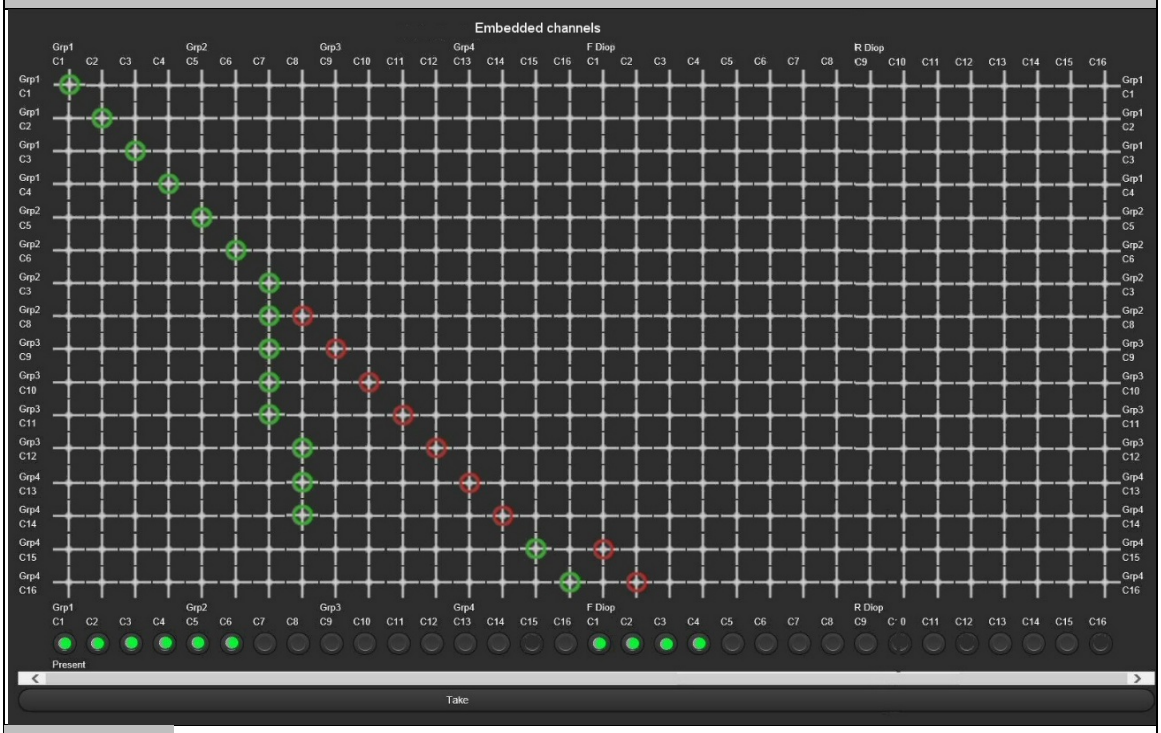


Front/Rear Channel Pair		**DIOP4 piggybacks can be configured as either inputs or outputs for each channel pair. For all fitted DIOP4 piggybacks, set the selected AES channel pair to be input or output.**
Termination		**Set those AES channel pairs selected as inputs to be balanced or unbalanced. The correct rear module must be used for either option.**

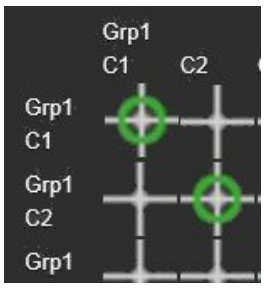
4.6 Audio Router

Embedded output router

Select the channels that will be embedded into the output video. In addition to the already embedded audio channels, additional or alternative audio sources are available for selection depending on the optional piggyback boards fitted. The screen grab below shows a DIOP4 piggyback in the front and rear positions giving a potential of 16 external AES inputs.



Embedded channels



Displays current selections as green circles, and pre-selected crosspoints as red circles. Pre-selected crosspoints will be routed when the 'Take' button is pressed. The inputs are shown along the top of the matrix and are available to be routed to the embedded channels shown on the left hand side. The example above has 16 de-embedded inputs Grp1-Grp4, C1-C16 and 16 external AES inputs 'F Diop' and 'R Diop' C1-C16. Different piggybacks will show alternative router inputs. Clicking on the intersection of the input and output will show a red circle which will change green when the 'Take' control is selected. All crosspoints can be pre-selected. The screen grab above shows de-embedded inputs C8-C14 pre-selected to embedded channels C8-14 and front DIOP4 channels C1 and C2 pre-selected to embedded channels C15 and C16.

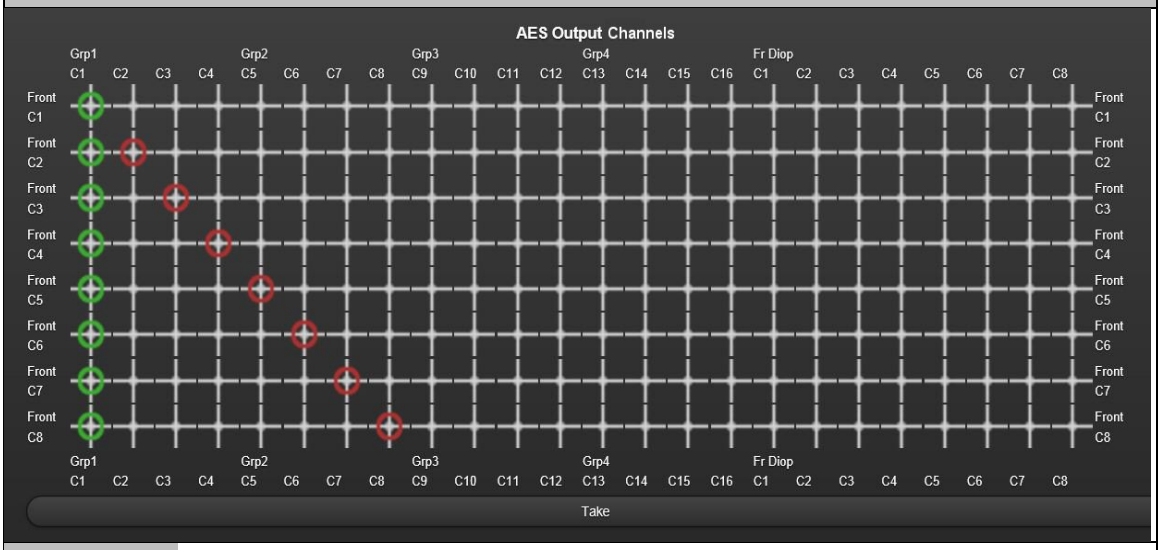
Take

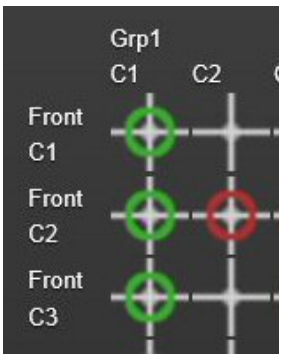
Switch all pre-selected crosspoints in one go.

Present	**On if audio channel is present.**

Discrete output router

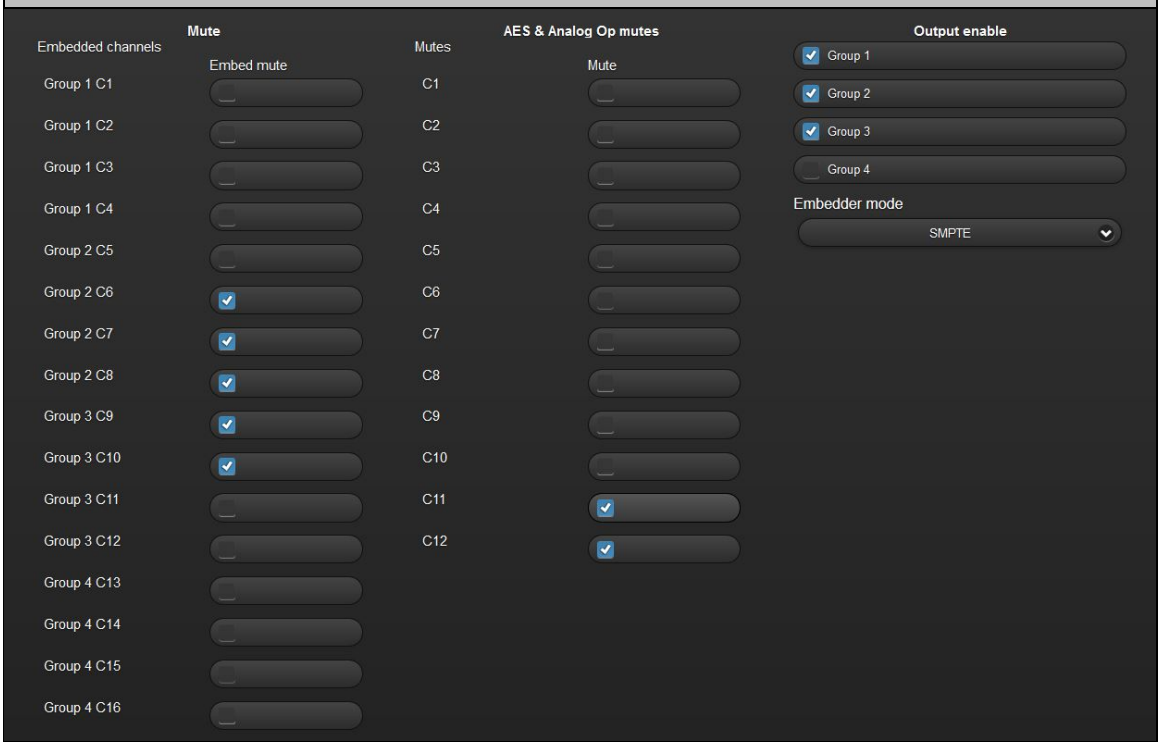
Select the channels that will be output as AES or analogue signals. This menu is only available when a DIOP4 or 3G-AOP2 piggyback is fitted. The number of output channels available for routing will depend on the number and type of piggybacks fitted. The screen grab below shows a single DIOP4 piggyback in the front position configured as all outputs.



AES Op Channels	 **Display current selections as green circles and pre-selected crosspoints as red circles. Pre-selected crosspoints will be routed when the 'Take' button is pressed. The inputs are shown along the top of the matrix and are available to be routed to the AES output channels shown on the left hand side. The screen grab above has a DIOP4 piggyback fitted in the front position configured as all outputs (C1-8). Clicking on the intersection of the input and output will show a red circle which will change green when the 'Take' control is selected. All crosspoints can be pre-selected. The screen grab above shows de-embedded inputs 2-8 pre-selected to front DIOP4 channels C2-C8.**
Take	**Switch all pre-selected crosspoints in one go.**

Mute & group enable

Mute embedder output and AES and analogue outputs; enable embedder groups and select embedder encoding mode. The screen grab below shows a DIOP4 configured as outputs and a 3G-AOP2, giving a total of 12 audio outputs.

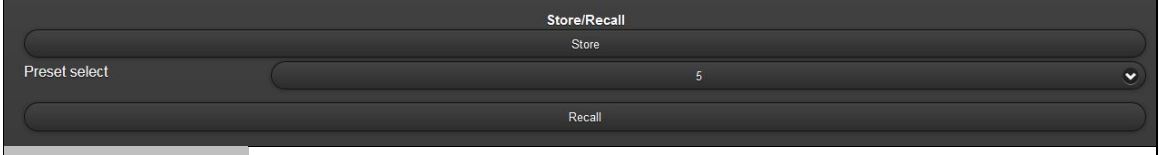


Embed mute	**Select to mute embedder output channels.**
Aes & Analog Op mutes	**Mute AES and analogue output audio. AES outputs only available if a DIOP4 piggyback is fitted. Analogue audio outputs only available if a 3G-AOP2 piggyback fitted.**
Output enable	**Select to enable embedder output for that group.**
Embedder mode	 **Select either SMPTE or Sony embedder format (for SD video only).**

4.7 Presets, default, alarms

Presets

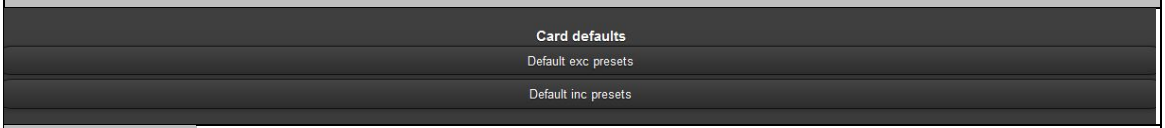
Up to 16 user-defined configurations may be stored and recalled remotely by VisionWeb. Presets store the card setup data including operating mode card status. The presets are numbered 1-16.



Preset select	 **Store or recall SYNNER-VF's configuration from one of 16 memory locations.**
Store	**Store the current configuration in the selected preset memory.**
Recall	**Recall a configuration from the selected memory. This will overwrite the current SYNNER-VF configurations.**

Card default

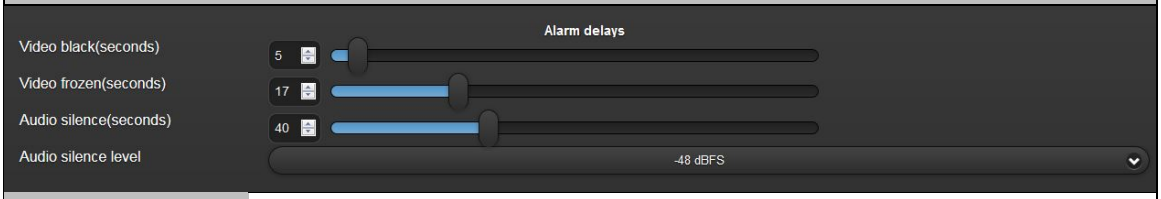
Reset the card to its default settings.



Default exc presets	**Reset the card to default settings but leave preset memories unaffected.**
Default inc presets	**Reset the card to default settings and erase preset memories.**

Alarm delays

Set the time that an alarm condition should be present before indicating a fault. Set the audio level that indicates a 'silent' condition.



Video black (seconds), Video frozen (seconds), Audio silence (seconds)	**Set the time that the alarm condition must be present before a fault indication. For an audio 'silence' fault, the audio level must be consistently below the threshold set by the 'Audio silence level' control (below) for the period set by the 'Audio silence' control.**
Audio silence level	 **Select the level that, below which, the audio is considered 'silent' from -90dBFS to -48dBFS.**

4.8 'Live' button

In the top right hand corner of the VisionWeb GUI there is an icon labelled 'Live'. Clicking on this button will display the following menu:

With the 'Live' option selected, any changes to any of the controls will affect the output of SYNNER-VF as normal. Selecting any of the preset edit options, from Preset edit 1 to Preset edit 16, will only edit the stored settings of the selected preset memory, and NOT affect the immediate output. Selecting any of the preset edit options will cause SYNNER-VF controls to initially reflect the values stored in that preset memory. Deselecting that preset will cause any changes made to controls to be stored in that preset memory, to be recalled from the *Presets* menu later.

5 Troubleshooting

5.1 Card edge monitoring

The green LED on the front edge of the card provides power rail monitoring. The red LED, if fitted, currently has no function.

5.2 Basic fault finding guide

- **Power OK LED not illuminated:** Check that the frame PSU is functioning – refer to the Vision frame manual for detailed information.
- **There is no output:** Check that a valid input is present and that any cabling is intact. Check that the 'Fibre enable' menu is set correctly.
- **The video output exhibits jitter:** Check that the input SDI stability is within normal limits.
- **The card no longer responds to front panel control:** Check that the card is seated correctly and that the Power OK LED is lit. Check if the control panel can control another card in the same rack. If necessary reset the card.
- **Resetting the card:** If required, the card may be reset by removing the card from the rack and then re-inserting it. It is safe to re-insert the card whilst the rack is powered. Any previous configuration will be retained.

6 Specification

General

Dimensions	96mm x 325mm card with connector.
Weight	180g with no piggybacks fitted; 220g with two piggybacks fitted.
Power consumption	SYNNER-VF 10 Watts. 3G-AIP2 – 2 Watts; 3G-AOP2 – 2 Watts; DIOP4 – 1 Watt. FIP-VF – 0.6 Watts; FOP-VF – 0.6 Watts; FIO-VF – 1 Watt.

Inputs

Video	HD or SD SDI 270 Mb/s to 2.970 Gb/s serial digital compliant to SMPTE 259, SMPTE 292-1 and SMPTE 424/425-A. Cable Equalisation: 3G (2.970Gb/s) – 100 metres, Belden 1694A or equivalent. HD (1.485Gb/s) – 140 metres, Belden 1694A or equivalent. SD (270Mb/s) >250 metres, Belden 8281 or equivalent. Automatic de-embedding to SMPTE 272M or SMPTE 299M. LC optical input.
Video standards supported	1080p 50/59.94, 1080i 50/59.94, 720p 50/59.94, 1080psf 23.98/24, PAL, NTSC. Input format auto selected.
Audio	Up to eight 24 bit stereo pairs (total of eight inputs and outputs). AES3 110 ohm or HiZ (balanced) D-Type, or AES3-id (unbalanced) 75 ohm BNC. Synchronous 48kHz audio to video.

Outputs

Video	Serial output: 270Mb/s to 2.970Gb/s serial compliant to SMPTE 259, SMPTE 292-1 and SMPTE 424/425-A. Output follows the input format. Audio is embedded to SMPTE 272M or SMPTE 299M. LC optical outputs.
Audio	Up to eight 24 bit stereo pairs (total of eight inputs and outputs). AES: 110 ohm balanced D-Type or 75 ohm unbalanced BNC.

Rear Module I/O

VR02	One BNC video input and three BNC video outputs, plus 110 ohm balanced audio I/O on a high density D-Type.
VR12	One BNC video input, two BNC video outputs and dual LC optical I/O,

	plus 110 ohm balanced audio I/O on a high density D-Type.
VR13	One BNC video input, three BNC video outputs and dual LC optical I/O, plus eight 75 ohm unbalanced AES audio I/O on BNC.

Delays

Audio Delay	Adjustable audio delay from -20 to 400ms on each PCM channel and from -14 to 36 samples for Dolby E channels. Delay is either on or off for any given channel.
Delay through board	Selectable ten frame video delay can be used to compensate for audio delays from Dolby E decoding.

Audio

Audio Replace	Routing of input audio together with audio or Dolby E from up to four de-embedded groups present on video input to any channel of up to four output embedder groups. HANC cleaning means that there is no remnant of the original version of old groups. If group 1 is replaced there is not an old group 1 with the “mark for deletion” flag set. Instead there is just the new modified group 1.
Audio Processing	Gain level adjustment on each channel between +18dB and -18dB in 0.1dB steps with 0dB calibration.
	Mute.
	Stereo to mono conversion.

Misc.

Auxiliary data	Auxiliary data passed unless set to blank.
Presets	Store and recall of 16 presets.

Input fail output

Type:	Freeze frame, colour bars, black or dark blue.

Control

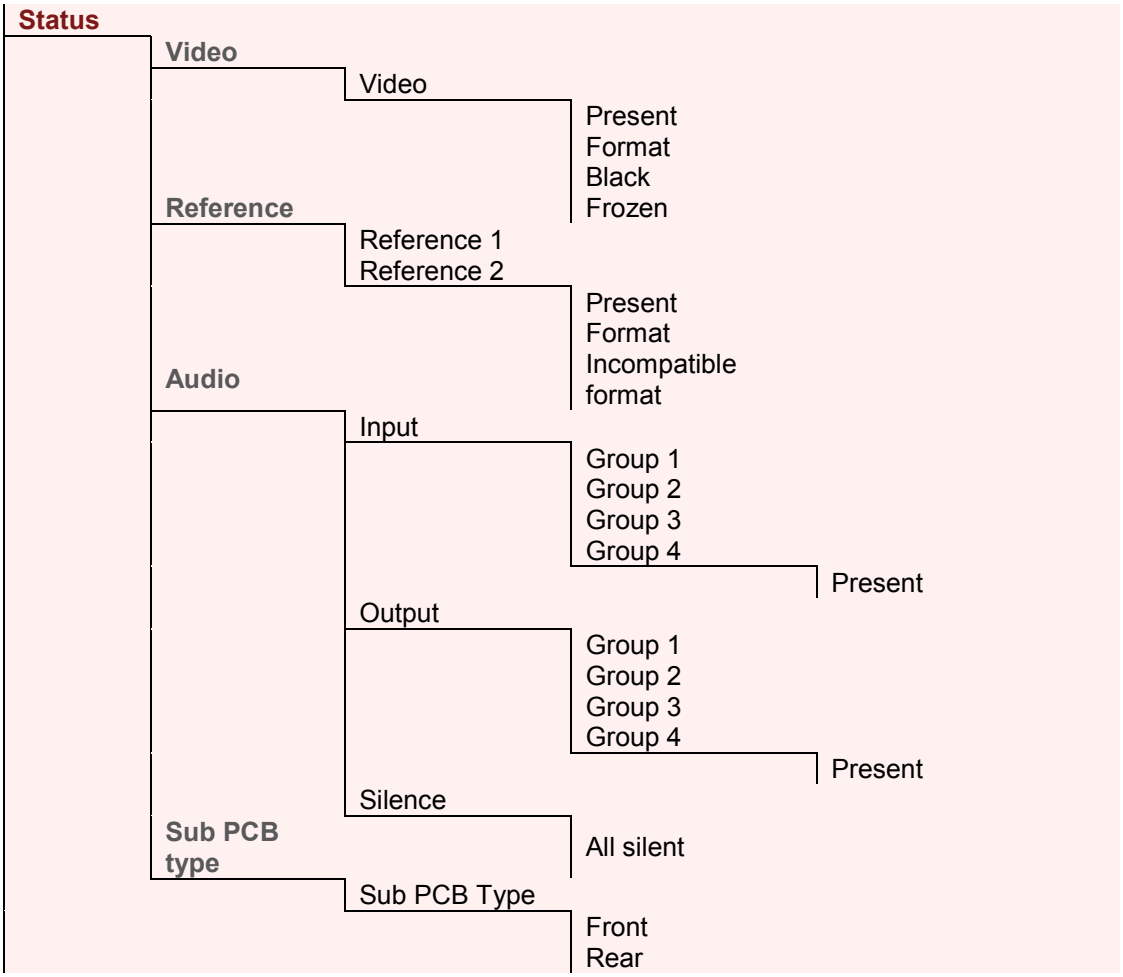
Remote:	Monitor and control from Vision frame front panel, VisionPanel remote panel and VisionWeb Control which is available via the web server on the frame and allows operation using a standard web browser on a computer, tablet or phone. Complimentary SNMP control and monitoring via frame CPU and Ethernet connection.

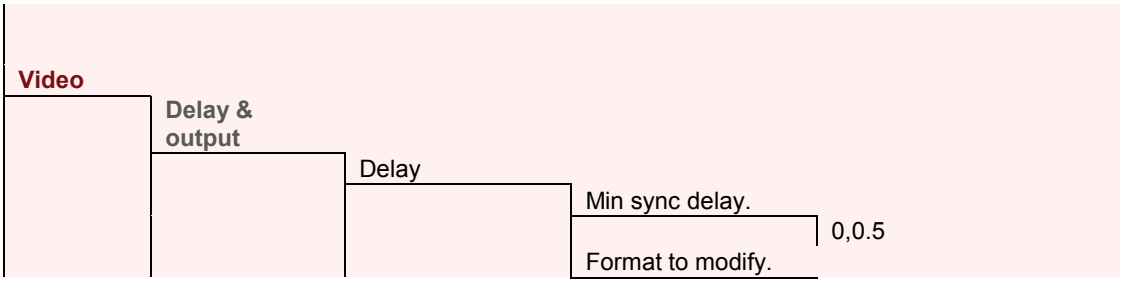
7 Appendix 1

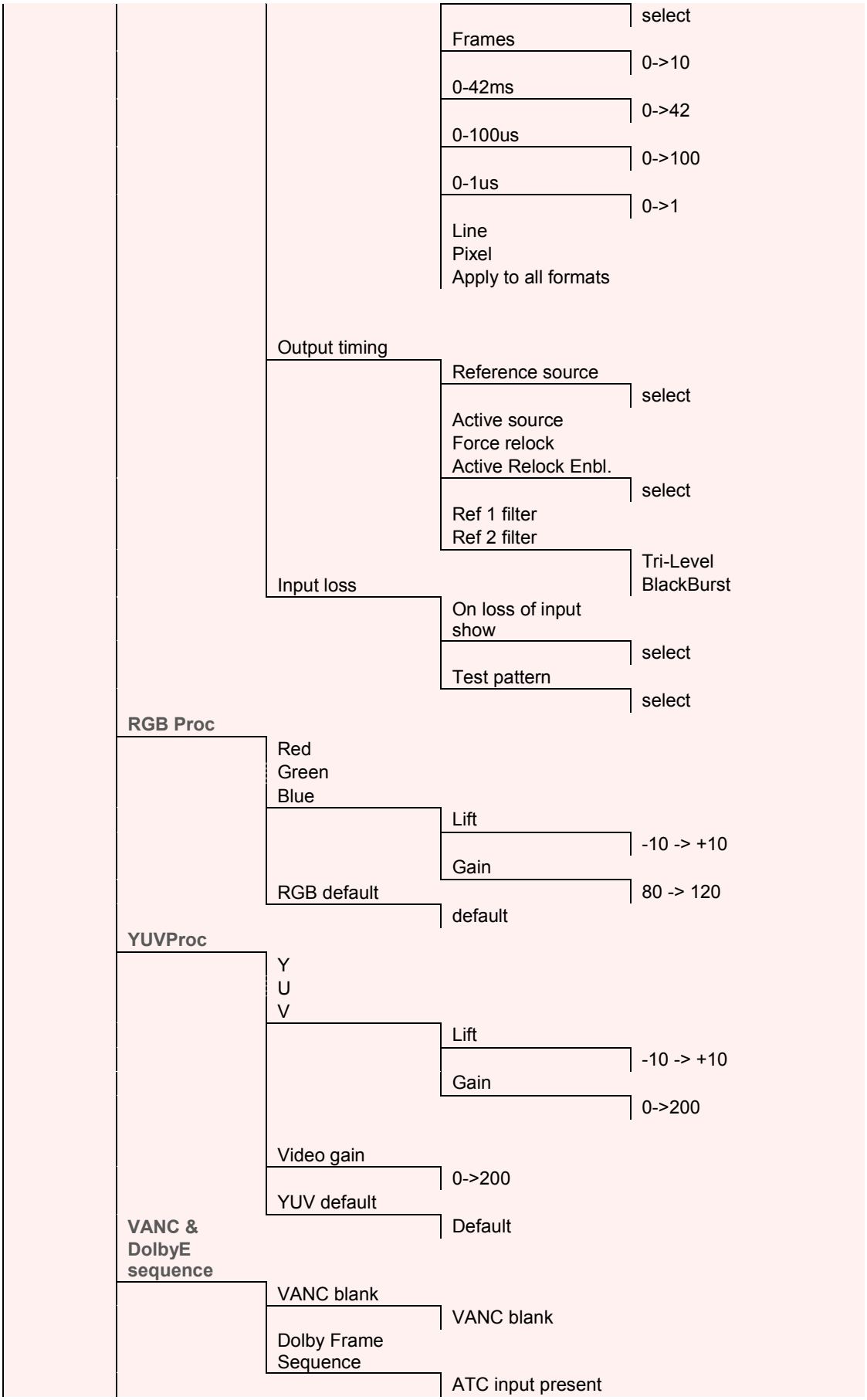
7.1 Menu Structure

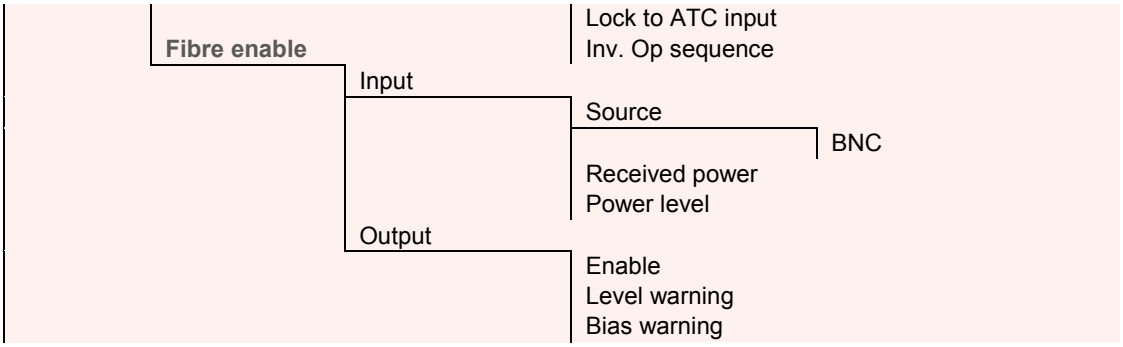
Operators of a Vision frame active front panel can use the following tree to help negotiate the SYNNER-VF menus. Items shown in red are tabs in VisionWeb and panels in VisionPanel, and items shown grey are menus in both.

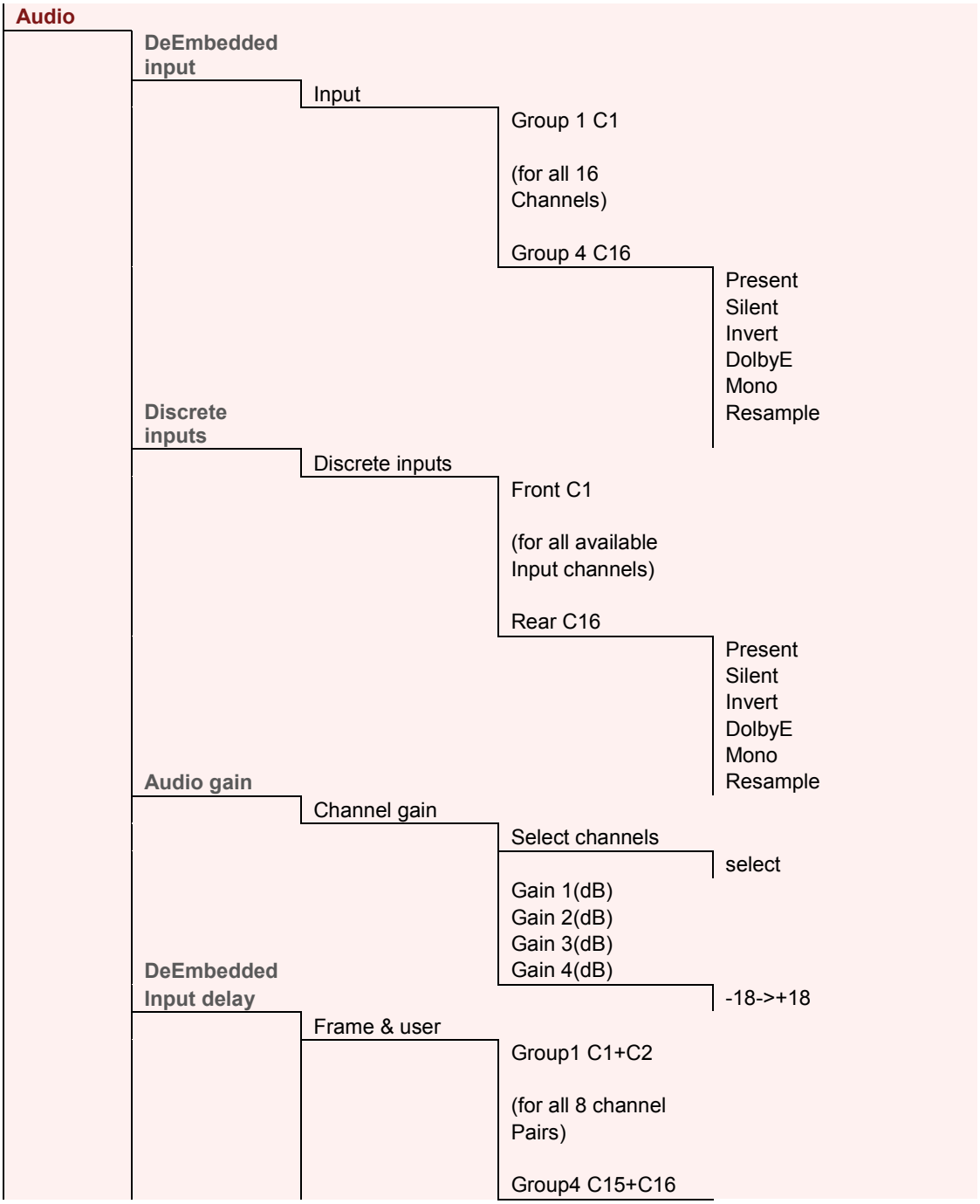
Note that some of these menus will change according to the optional boards fitted – for example, references to 'Front' or 'Rear' channels will only appear if the appropriate piggyback is fitted.

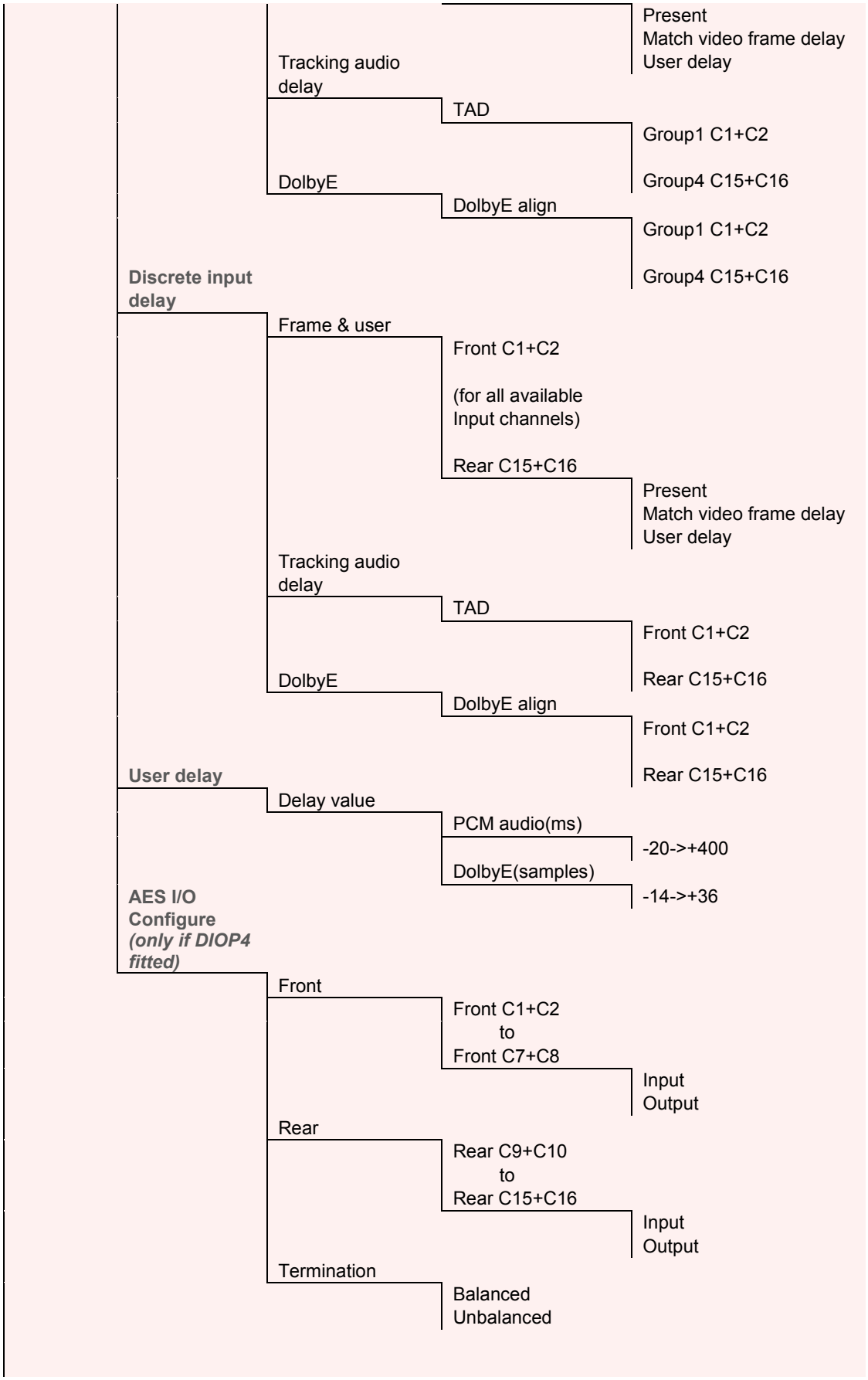


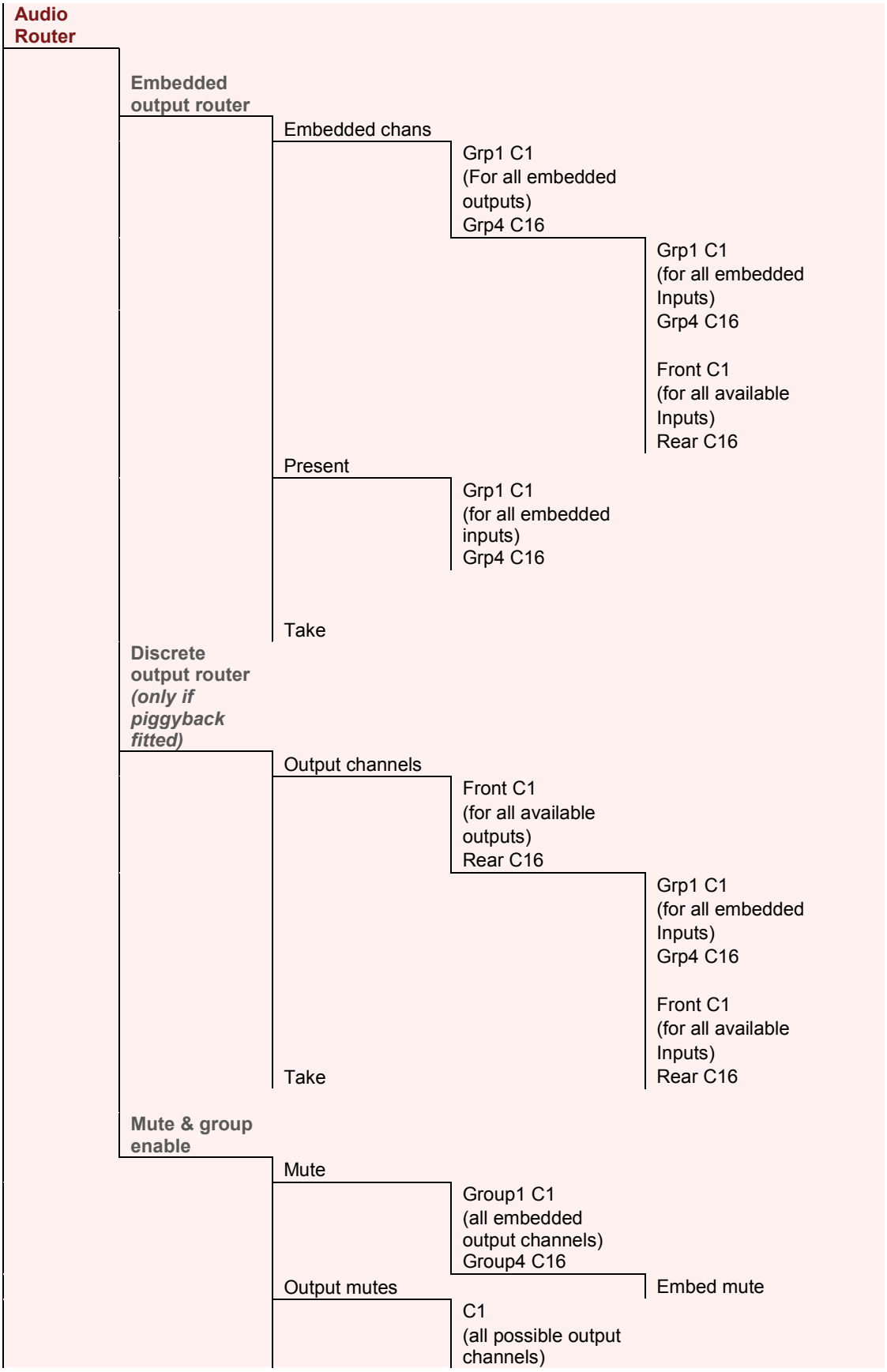


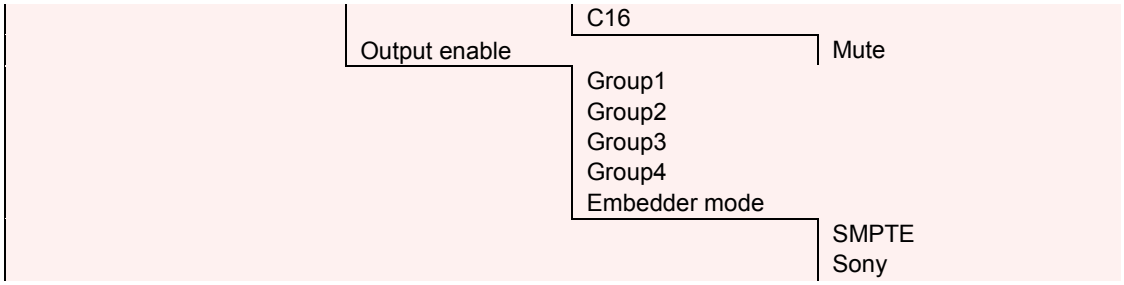

select
Frames
0->10
0-42ms
0->42
0-100us
0->100
0-1us
0->1
Line
Pixel
Apply to all formats
Output timing
Reference source
select
Active source
Force relock
Active Relock Enbl.
select
Ref 1 filter
Ref 2 filter
Tri-Level
BlackBurst
Input loss
On loss of input
show
select
Test pattern
select
RGB Proc
Red
Green
Blue
Lift
-10 -> +10
Gain
80 -> 120
RGB default
default
YUVProc
Y
U
V
Lift
-10 -> +10
Gain
0->200
Video gain
0->200
YUV default
Default
VANC &
DolbyE
sequence
VANC blank
VANC blank
Dolby Frame
Sequence
ATC input present

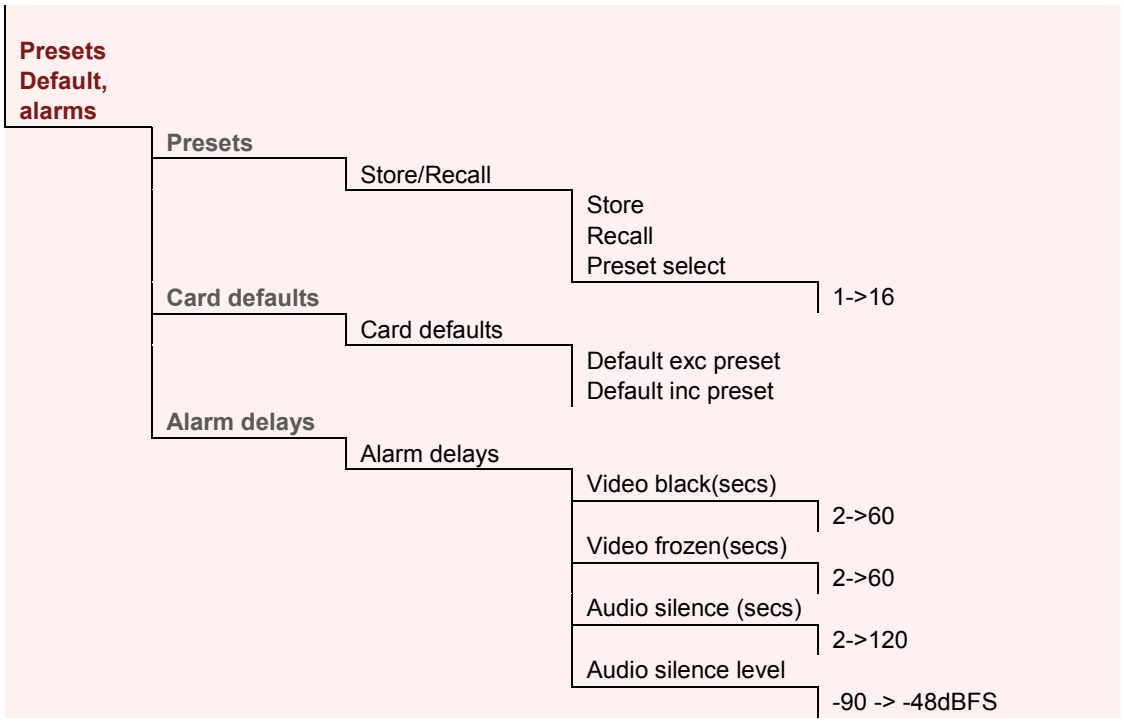

Fibre enable
Lock to ATC input
Inv. Op sequence
Input
Source
BNC
Received power
Power level
Output
Enable
Level warning
Bias warning


Audio
DeEmbedded input
Input
Group 1 C1
(for all 16 Channels)
Group 4 C16
Present
Silent
Invert
DolbyE
Mono
Resample
Discrete inputs
Discrete inputs
Front C1
(for all available Input channels)
Rear C16
Present
Silent
Invert
DolbyE
Mono
Resample
Audio gain
Channel gain
Select channels
select
Gain 1(dB)
Gain 2(dB)
Gain 3(dB)
Gain 4(dB)
DeEmbedded Input delay
-18->+18
Frame & user
Group1 C1+C2
(for all 8 channel Pairs)
Group4 C15+C16


Present
Match video frame delay
User delay
Tracking audio delay
TAD
Group1 C1+C2
Group4 C15+C16
DolbyE
DolbyE align
Group1 C1+C2
Group4 C15+C16
Discrete input delay
Frame & user
Front C1+C2
(for all available Input channels)
Rear C15+C16
Present
Match video frame delay
User delay
Tracking audio delay
TAD
Front C1+C2
Rear C15+C16
DolbyE
DolbyE align
Front C1+C2
Rear C15+C16
User delay
Delay value
PCM audio(ms)
-20->+400
DolbyE(samples)
-14->+36
AES I/O Configure (only if DIOP4 fitted)
Front
Front C1+C2 to Front C7+C8
Input
Output
Rear
Rear C9+C10 to Rear C15+C16
Input
Output
Termination
Balanced
Unbalanced


Audio Router
Embedded output router
Embedded chans
Grp1 C1 (For all embedded outputs) Grp4 C16
Grp1 C1 (for all embedded Inputs) Grp4 C16
Front C1 (for all available Inputs) Rear C16
Present
Grp1 C1 (for all embedded inputs) Grp4 C16
Take
Discrete output router (only if piggyback fitted)
Output channels
Front C1 (for all available outputs) Rear C16
Grp1 C1 (for all embedded Inputs) Grp4 C16
Front C1 (for all available Inputs) Rear C16
Take
Mute & group enable
Mute
Group1 C1 (all embedded output channels) Group4 C16
Embed mute
Output mutes
C1 (all possible output channels)


C16
Output enable
Mute
Group1
Group2
Group3
Group4
Embedder mode
SMPTE
Sony


Presets Default, alarms
Presets
Store/Recall
Store
Recall
Preset select
1->16
Card defaults
Card defaults
Default exc preset
Default inc preset
Alarm delays
Alarm delays
Video black(secs)
2->60
Video frozen(secs)
2->60
Audio silence (secs)
2->120
Audio silence level
-90 -> -48dBFS