Up-Down 3G

3G/HD/SD up/down/cross converters

Crystal Vision

Crystal Vision Ltd., Lion Technology Park, Station Road East, Whittlesford, Cambridge, CB22 4WL, England.
Tel: +44(0) 1223 497049 sales@crystalvision.tv www.crystalvision.tv

Contents

Revision 1	General update.	21-06-12
Revision 2	Table on page 8 corrected, Statesman control tab updated.	19-03-13
Revision 3	Moved Statesman info to Appendix, added VisionWeb info. Combined all nine models into one manual. (R3.0)	13-03-15
Revision 4	Added timecode information to page 80.	12-04-16
Revision 5	Clarified pulse mode GPI info and HD to HD ARC feature. Added new GPO alarm options for Dolby E detection.	28-06-16
Revision 6	Added note about removal of card edge control in 2019.	12-01-21

1 Introduction

The **Up-Down 3G** is a range of nine up-down converters that allow flexible up, down and cross conversions between 3Gb/s, HD and SD sources, provide an output picture of exceptional quality and include special features to allow studios to easily operate in HD and SD at the same time.

The Up-Down 3G range consists of the following models: ***Up-Down 3G***, ***Up-Down-A 3G***, ***Up-Down-AS 3G***, ***Up-Down-AFD 3G***, ***Up-Down-AFDS 3G***, ***Up-Down-AT 3G***, ***Up-Down-ATS 3G***, ***Up-Down-ATX 3G*** and ***Up-Down-ATXS 3G.***

The up conversions are SD to 720p, 1080i or 1080p. The cross conversions are 720p to 1080i or 1080p, 1080i to 720p or 1080p, and 1080p to 1080i or 720p. The down conversions are 1080p, 1080i or 720p to SD. Up-Down 3G's excellent picture quality is a result of motion adaptive video de-interlacing, which maximises the picture's vertical resolution while choosing the best processing method based on the video content.

Up-Down 3G can perform two conversions at the same time, with two separate converters on the board: one is used for the up and cross conversion, with the other used for the down conversion, which makes it the perfect up/down/cross converter for installations that work in multiple definitions, allowing simultaneously HD and SD copies of a feed from one board.

Up-Down 3G provides two feeds of the main output and three feeds of the secondary output. The most common application is to have HD (720p, 1080i or 1080p) on one output and SD on the other, and the input as either SD or the same HD as the output. Up-Down 3G is useful for installations that work in both HD and SD because it allows them to easily create HD and SD copies of a feed and so fulfil their requirement to offer HD and SD programming simultaneously.

One of Up-Down 3G's particularly powerful features is that it will always put out HD and SD in the same place on the same pins, regardless of the input – meaning you always know which output is going to be which and therefore don't need to change your wiring. Each output will either be converted from the input or be given a matching delay as required, with the matching delay allowing all the signals to have the same timing and enabling the use of common audio. Should you need an additional six input loop-throughs, a DA6 top board can be added. Up-Down 3G can easily include integrated fibre connectivity by fitting the appropriate fibre input or output option.

Noise reduction with detail and edge enhancement can be applied when up converting, cross converting or down converting from 3G to 1.5G. Separate RGB and YUV proc-amps give lift and gain controls to look after your picture colour fidelity and faulty video signal problems provide warnings using SNMP traps. Status indications available (depending on model) are video not present, video frozen, video black and both audio not present and audio silent on all four groups.

Up-Down 3G will look after any aspect ratio conversion requirements when up or down converting. All versions can be used as an SD to SD aspect ratio converter if required. Up-Down 3G models *AT / ATX / ATS / ATXS* can be used as an HD to HD aspect ratio converter for when the HD input and output formats are identical. This can be useful to correct the aspect ratio of signals that were up converted using the wrong aspect ratio, resulting in an HD image that is too squashed, stretched or cropped.

Up-Down 3G models *AFD / AT / ATX / AFDS / ATS / ATXS* additionally offer AFD code activated aspect ratio conversion.

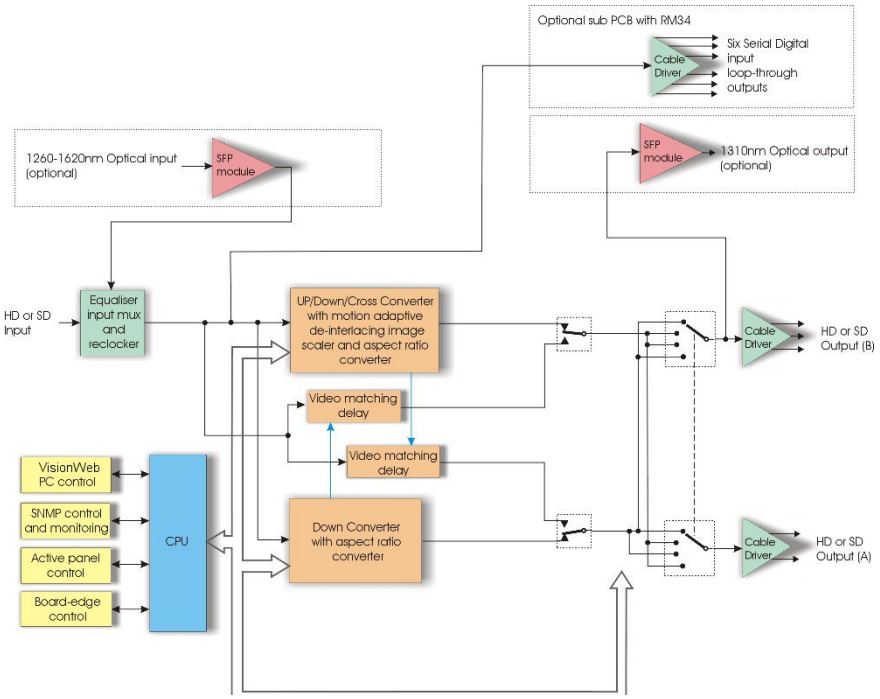
Up-Down 3G is a space-saving 100mm x 266mm module which fits in the standard Crystal Vision frames, with the inputs and outputs accessed by using either the RM41 or RM57 frame rear modules. Control options include an active front panel on the frame, a remote control panel, SNMP and the VisionWeb PC software. Board edge control was also available prior to 2019.

Each model in the Up-Down 3G range offers the following features:

Features	Up-Down 3G	Up-Down-A 3G	Up-Down-AFD 3G	Up-Down-AT 3G	Up-Down-ATX 3G	Up-Down-AS 3G	Up-Down-AFDS 3G	Up-Down-ATS 3G	Up-Down-ATXS 3G
Up converts (SD to 720p, SD to 1080i, SD to 1080p)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cross converts (720p to 1080i, 720p to 1080p, 1080i to 720p, 1080i to 1080p, 1080p to 1080i, 1080p to 720p)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Down converts (720p to SD, 1080i to SD, 1080p to SD)	✓	✓	✓	✓	✓	✓	✓	✓	✓
Input and output formats (50Hz and 59.94Hz)	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i	1080p, 720p, 1080i, 625i, 525i
Maximum video outputs (depends on rear module)	2 feeds of output A and 3 feeds of output B	2 feeds of output A and 3 feeds of output B	2 feeds of output A and 3 feeds of output B	2 feeds of output A and 3 feeds of output B	2 feeds of output A and 3 feeds of output B	2 feeds of output A and 2 feeds of output B	2 feeds of output A and 2 feeds of output B	2 feeds of output A and 2 feeds of output B	2 feeds of output A and 2 feeds of output B
Optional 6 reclocked input loop-throughs (with DA6) fitted	✓	✓	✓	✓	✓	✓	✓	✓	✓
Perform 2 different conversions at same time	✓	✓	✓	✓	✓	✓	✓	✓	✓
Two framestore synchronisers						✓	✓	✓	✓
Analogue reference (SD black-burst or HD tri-level syncs)						✓	✓	✓	✓
Automatic freeze						✓	✓	✓	✓
Video delays	1 frame plus 16 lines additional user delay	1 frame plus 16 lines additional user delay	1 frame plus 16 lines additional user delay	1 frame plus 16 lines additional user delay	1 frame plus 16 lines additional user delay	1, 2 or 3 frames additional delay	1, 2 or 3 frames additional delay	1, 2 or 3 frames additional delay	1, 2 or 3 frames additional delay
Handles 4 audio groups		✓	✓	✓	✓	✓	✓	✓	✓
Linear AES tracking delay (with user control of tracking speed to trade off frequency change and settling time)						✓	✓	✓	✓
Dolby E alignment delay						✓	✓	✓	✓
Audio delays (in addition to tracking delays)						Linear AES: 0-120mS; Dolby E: 1, 2 or 3	Linear AES: 0-120mS; Dolby E: 1, 2 or 3	Linear AES: 0-120mS; Dolby E: 1, 2 or 3	Linear AES: 0-120mS; Dolby E: 1, 2 or 3

						frames fixed delay	frames fixed delay	frames fixed delay	frames fixed delay
Audio routing in stereo pairs				✔	✔			✔	✔
Audio muting in stereo pairs				✔	✔			✔	✔
Audio resampling of linear AES						✔	✔	✔	✔
Aspect Ratio Conversion when up or down converting	✔	✔	✔	✔	✔	✔	✔	✔	✔
HD to HD aspect ratio conversion when input/output format identical				✔	✔			✔	✔
SD to SD aspect ratio conversion	✔	✔	✔	✔	✔	✔	✔	✔	✔
Flexible aspect ratio adjustment (size, position and crop controls)	✔	✔	✔	✔	✔	✔	✔	✔	✔
AFD reading (uses SMPTE 2016 AFD, WSS or Video Index to automatically select the output aspect ratio)			✔	✔	✔		✔	✔	✔
AFD insertion of SMPTE 2016 AFD, WSS or Video Index for use by downstream equipment			✔	✔	✔		✔	✔	✔
Video Proc-amp (RGB and YUV lift and gain controls)	✔	✔	✔	✔	✔	✔	✔	✔	✔
Video proc-amp when HD input/output format identical				✔	✔			✔	✔
Signal status reporting	✔	✔	✔	✔	✔	✔	✔	✔	✔
Timecode handling	Passes	Passes	Passes	Passes and converts between ATC and DVITC	Passes and converts between ATC and DVITC	Passes	Passes	Passes and converts between ATC and DVITC	Passes and converts between ATC and DVITC
Teletext transport (OP-47, SMPTE 2031)					✔				✔
Closed caption transport (CEA-608, CEA 708)					✔				✔
Fibre I/O	✔	✔	✔	✔	✔	✔	✔	✔	✔
Frame slots used	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)	1 (2 if DA6 fitted)

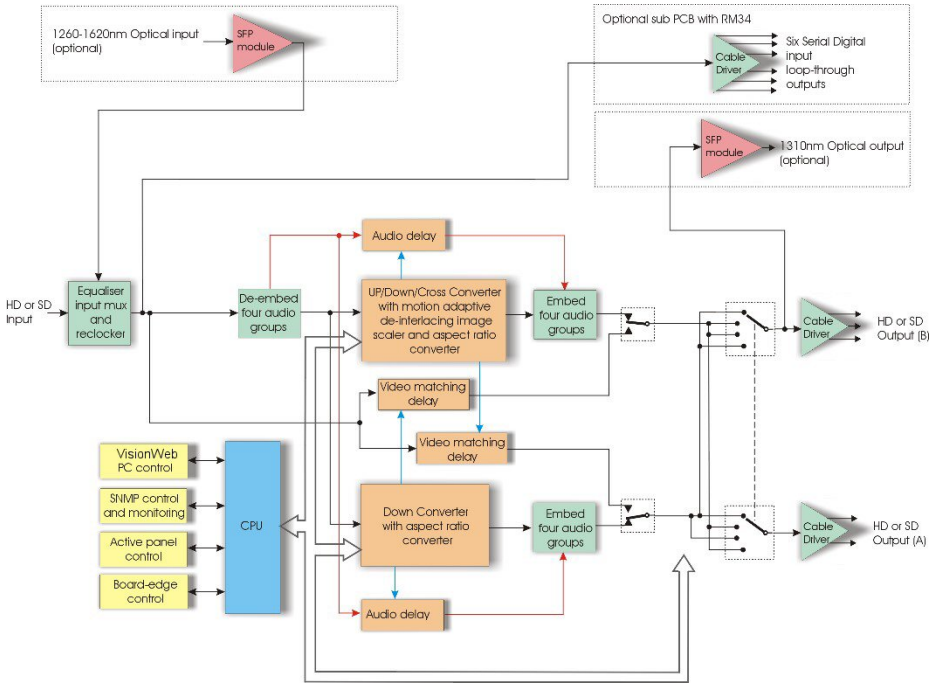
Up-Down 3G



The *Up-Down 3G* is the base model of the range and has the following features that are common to all models across the range:

- Simultaneous multiple high quality conversions with matched video delays.
- Six input loop-throughs with an additional sub-PCB.
- Noise reduction with detail and edge enhancement.
- Signal probe function.
- Optical input or optical output option.
- Active front panel, remote control panel, SNMP and VisionWeb PC software control options. Card edge control was also available prior to 2019.

Up-Down-A 3G

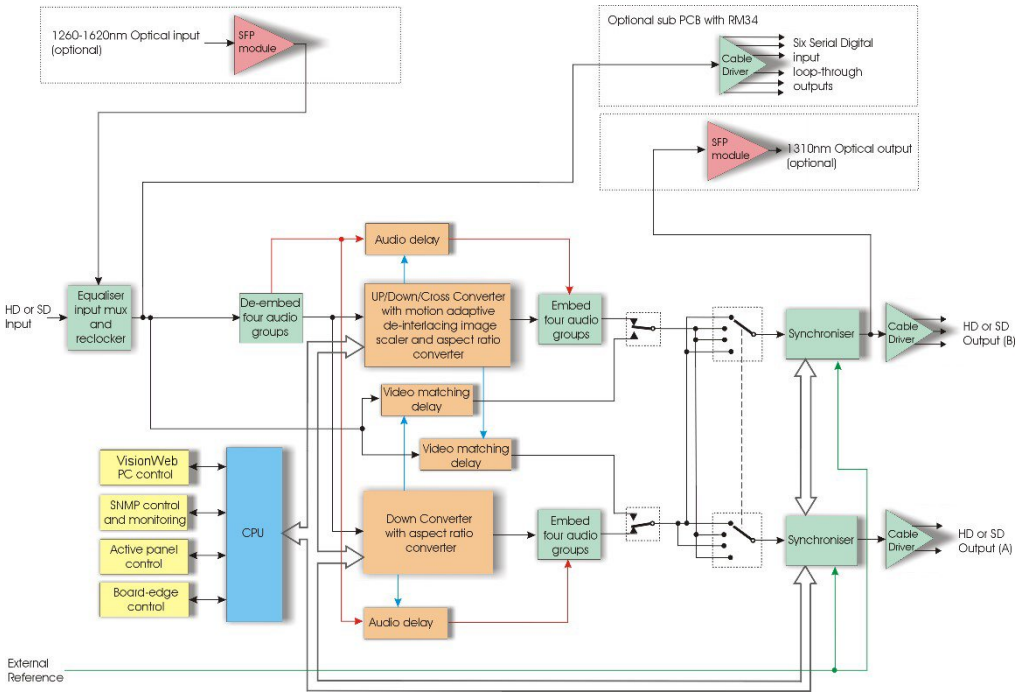


The main features of the *Up-Down-A 3G* are the same as the *Up-Down 3G* but with the following additional features:

- Passes four groups of embedded audio, including Dolby E, with delay matched to video.

Up-Down-A 3G is ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. Audio will be delayed automatically to match any video delay.

Up-Down-AS 3G

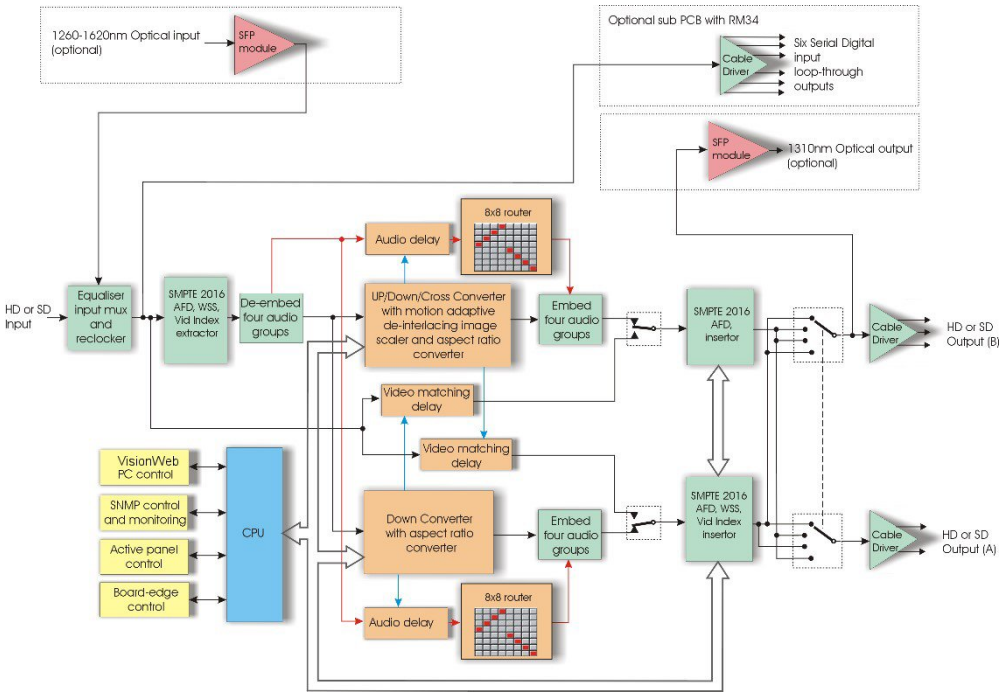


The main features of the *Up-Down-AS 3G* are the same as the *Up-Down 3G* but with the following additional features:

- Two on-board downstream synchronisers (one in each path) to retime for correct processing delays.
- Synchronise video that contains both normal embedded audio and embedded Dolby E.
- Passes four groups of embedded audio, including Dolby E, with delay matched to video.

Up-Down-AS 3G is ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. The audio resamplers ensure a smooth matching of the audio and video delay, and the guardband of any embedded Dolby E will also be correctly aligned.

Up-Down-AFD 3G



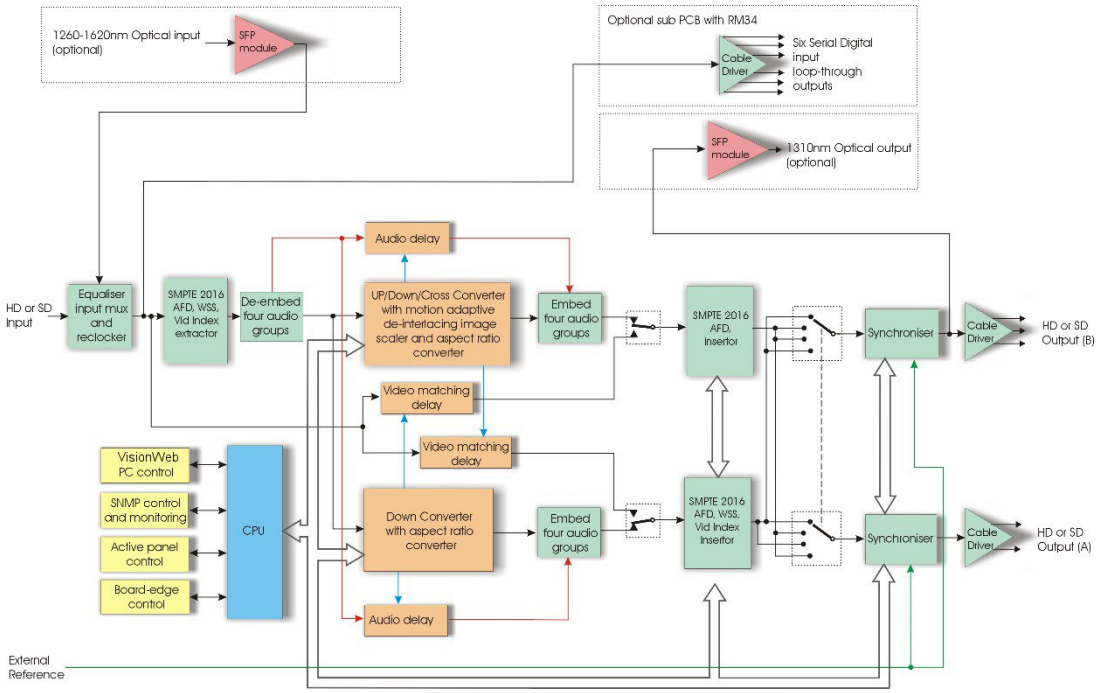
The main features of the *Up-Down-AFD 3G* are the same as the *Up-Down 3G* but with the following additional features:

- Passes four groups of embedded audio, including Dolby E, with delay matched to video.
- AFD and manual aspect ratio and picture position selection.
- Active Format Description (AFD) and widescreen signalling and video indexing insertion.

Up-Down-AFD 3G will look after any aspect ratio conversion requirements when up or down converting. *Up-Down-AFD 3G* can also be used to label a signal with SMPTE 2016 data by inserting one of 16 AFD codes to allow a following down converter to output the Standard Definition with an appropriate aspect ratio conversion.

Up-Down-AFD 3G is also ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. Audio will be delayed automatically to match any video delay.

Up-Down AFDS 3G



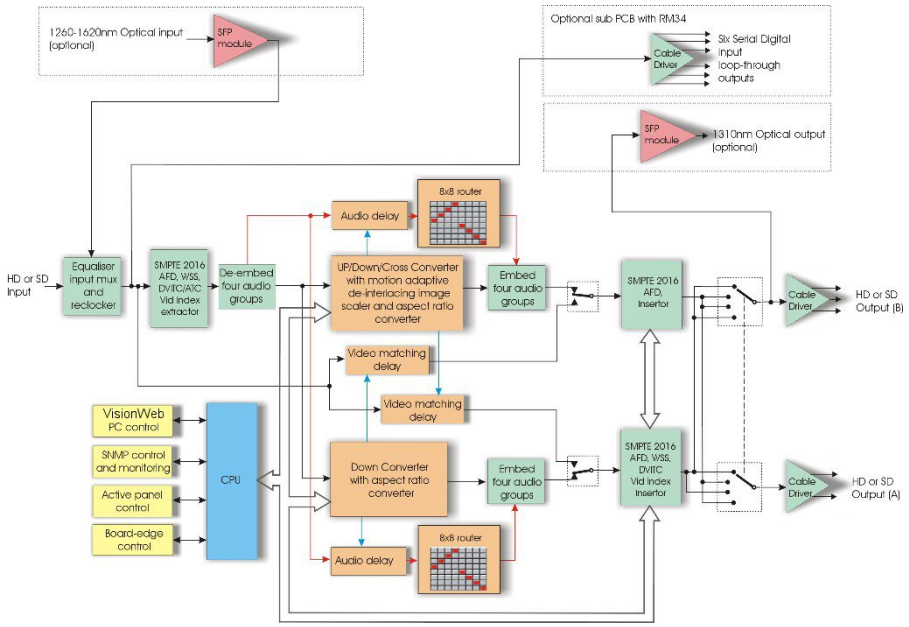
The main features of the *Up-Down-AFDS 3G* are the same as the *Up-Down 3G* but with the following additional features:

- Two on-board downstream synchronisers (one in each path) to retime for correct processing delays.
- Passes four groups of embedded audio, including Dolby E, with delay matched to video.
- AFD and manual aspect ratio and picture position selection.
- Active Format Description (AFD) and widescreen signalling and video indexing insertion.
- Synchronise video that contains both normal embedded audio and embedded Dolby E.

Up-Down-AFDS 3G will look after any aspect ratio conversion requirements when up or down converting. *Up-Down-AFDS 3G* can also be used to label a signal with SMPTE 2016 data by inserting one of 16 AFD codes to allow a following down converter to output the Standard Definition with an appropriate aspect ratio conversion.

Up-Down-AFDS 3G is also ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. The audio resamplers ensure a smooth matching of the audio and video delay, and the guardband of any embedded Dolby E will also be correctly aligned.

Up-Down-AT 3G



The main features of the *Up-Down-AT 3G* are the same as the *Up-Down 3G* but with the following additional features:

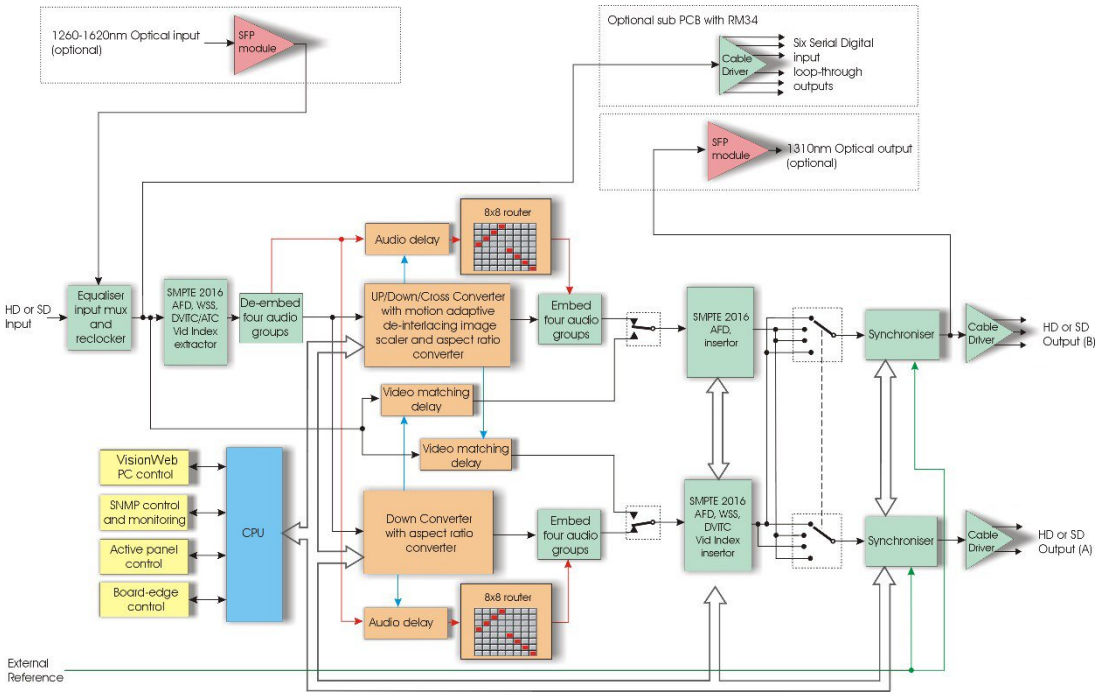
- AFD and manual aspect ratio and picture position selection.
- Active Format Description (AFD) and widescreen signalling and video indexing insertion.
- Timecode transport between input and output standards
- Passes four groups of embedded audio, including Dolby E, with delay matched to video.
- Audio shuffle of stereo pairs using the 8x8 stereo router.
- Simultaneous multiple high quality conversions with matched video delays.

Up-Down-AT 3G will look after any aspect ratio conversion requirements when up or down converting. *Up-Down-AT 3G* can also be used to label a signal with SMPTE 2016 data by inserting one of 16 AFD codes to allow a following down converter to output the Standard Definition with an appropriate aspect ratio conversion.

Up-Down-AT 3G is also ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. Audio will be delayed automatically to match any video delay.

A further feature is the inclusion of an 8x8 router in both the SD path and HD path to allow audio stereo pairs to be shuffled within and between the four embedded audio groups. It also includes audio signal probe functionality making it useful for flagging up faulty signals, especially in multi-channel applications.

Up-Down ATS 3G



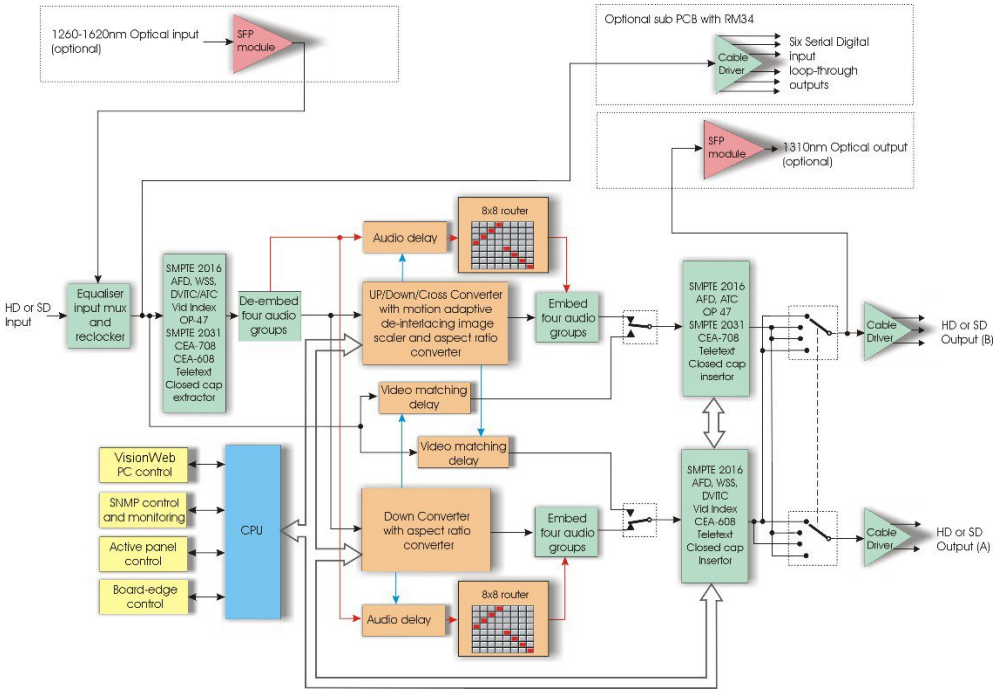
The main features of the *Up-Down-ATS 3G* are the same as the *Up-Down 3G* but with the following additional features:

- Two on-board downstream synchronisers (one in each path) to retime for correct processing delays.
- Passes four groups of embedded audio, including Dolby E, with delay matched to video.
- Audio shuffle of stereo pairs using the 8x8 stereo router.
- AFD and manual aspect ratio and picture position selection.
- User set aspect ratio controls plus an extensive selection of fixed aspect ratios.
- Active Format Description (AFD) and widescreen signalling and video indexing insertion.
- Timecode transport between input and output standards.
- Synchronise video that contains both normal embedded audio and embedded Dolby E.

Up-Down-ATS 3G is also ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. The audio resamplers ensure a smooth matching of the audio and video delay, and the guardband of any embedded Dolby E will also be correctly aligned.

A further feature is the inclusion of an 8x8 router in both the SD path and HD path to allow audio stereo pairs to be shuffled within and between the four embedded audio groups. It also includes audio signal probe functionality making it useful for flagging up faulty signals, especially in multi-channel applications.

Up-Down-ATX 3G



The main features of the *Up-Down-ATX* 3G are the same as the *Up-Down 3G* but with the following additional features:

- AFD and manual aspect ratio and picture position selection.
- Active Format Description (AFD) and widescreen signalling and video indexing insertion.
- Timecode transport between input and output standards.
- Passes four groups of embedded audio, including Dolby E, with delay matched to video.
- Audio shuffle of stereo pairs using the 8x8 stereo router.
- Transport and convert CEA-608 and CEA-708 closed caption data between standards.
- Carry teletext and subtitle information across different definitions - both SMPTE 2031 and OP-47 supported.

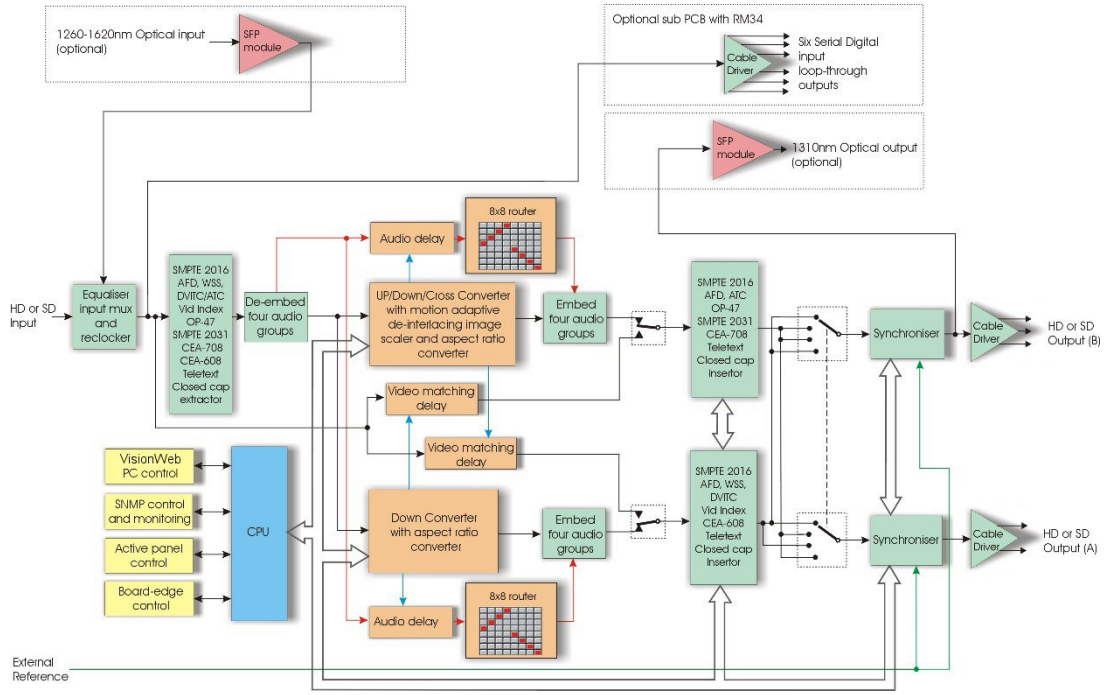
The *Up-Down-ATX 3G* supports SMPTE 2031 and OP-47 to carry teletext information across different definitions. When up converting teletext data can be taken out of the analogue coded signal and the same data put in the SMPTE 2031 or OP-47 data stream created; when down converting the teletext data can be taken out of SMPTE 2031 or OP-47 packets and be encoded as analogue waveforms on an SD output. Up-Down-ATX 3G can be used to convert between SMPTE 2031, OP-47 and teletext in any combination. It is also possible to specify which line in the VANC space is used to carry SMPTE 2031 or OP-47, an advantage given the increasingly crowded VANC space. Closed captions can also be transported across different definitions using its CEA-708 and CEA-608 extractors and inserters.

Up-Down-ATX 3G will look after any aspect ratio conversion requirements when up or down converting. *Up-Down-ATX 3G* can also be used to label a signal with SMPTE 2016 data by inserting one of 16 AFD codes to allow a following down converter to output the Standard Definition with an appropriate aspect ratio conversion.

Up-Down-ATX 3G is also ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. Audio will be delayed automatically to match any video delay.

A further feature is the inclusion of an 8x8 router in both the SD path and HD path to allow audio stereo pairs to be shuffled within and between the four embedded audio groups. It also includes audio signal probe functionality making it useful for flagging up faulty signals, especially in multi-channel applications.

Up-Down-ATXS 3G



The main features of the *Up-Down-ATXS 3G* are the same as the *Up-Down 3G* but with the following additional features:

- AFD and manual aspect ratio and picture position selection.
- User set aspect ratio controls plus an extensive selection of fixed aspect ratios.
- Active Format Description (AFD) and widescreen signalling and video indexing insertion.
- Timecode transport between input and output standards.
- Two on-board downstream synchronisers (one in each path) to retime for correct processing delays.
- Synchronise video that contains both normal embedded audio and embedded Dolby E.
- Passes four groups of embedded audio, including Dolby E, with delay matched to video.
- Audio shuffle of stereo pairs using the 8x8 stereo router.
- Transport and convert CEA-608 and CEA-708 closed caption data between standards.
- Carry teletext and subtitle information across different definitions - both SMPTE 2031 and OP-47 supported.

The *Up-Down-ATXS 3G* supports SMPTE 2031 (as well as OP-47) to carry teletext information across different definitions. When up converting teletext data can be taken out of the analogue coded signal and the same data put in the SMPTE 2031 or OP-47 data stream created; when down converting the teletext data can be taken out of SMPTE 2031 or OP-47 packets and be encoded as analogue waveforms on an SD output. Up-Down-ATXS 3G can be used to convert between SMPTE 2031, OP-47 and teletext in any combination. It is also possible to specify which line in the VANC space is used to carry SMPTE 2031 or OP-47, an advantage given the increasingly crowded VANC space. Closed captions can also be transported across different definitions using its CEA-708 and CEA-608 extractors and inserters.

Up-Down-ATXS 3G will look after any aspect ratio conversion requirements when up or down converting. The *Up-Down-ATXS 3G* can also be used to label a signal with SMPTE 2016 data by inserting one of 16 AFD codes to allow a following down converter to output the Standard Definition with an appropriate aspect ratio conversion.

Up-Down-ATXS 3G is also ideal for those working in embedded audio environments. It can pass four groups of audio, de-embedding the four groups and converting them to the appropriate format before re-embedding them. The audio resamplers ensure a smooth matching of the audio and video delay, and the guardband of any embedded Dolby E will also be correctly aligned.

A further feature is the inclusion of an 8x8 router in both the SD path and HD path to allow audio stereo pairs to be shuffled within and between the four embedded audio groups. It also includes audio signal probe functionality making it useful for flagging up faulty signals, especially in multi-channel applications

2 Up, Down and Cross Conversion

All models of Up-Down 3G are able to perform the following conversions:

Up Conversions	Down Conversions	Cross Conversions
SD to 720p	720p to SD	720p to 1080i
SD to 1080i	1080i to SD	720p to 1080p
SD to 1080p	1080p to SD	1080i to 720p
		1080i to 1080p
		1080p to 1080i
		1080p to 720p

Up-Down 3G can perform two conversions at the same time, with two separate converters on the board: one is used for the up or cross conversion, and the other used for down conversion. This allows simultaneous creation of HD and SD copies from a single feed from this one board.

Up-Down 3G gives dual outputs, with two output groups – A and B. Each output group can be individually selected as either SD or HD (*see Output Formats and Timing),* making it possible to configure both outputs as SD, both outputs as HD (720p, 1080i or 1080p), or one output as HD with the other as SD.

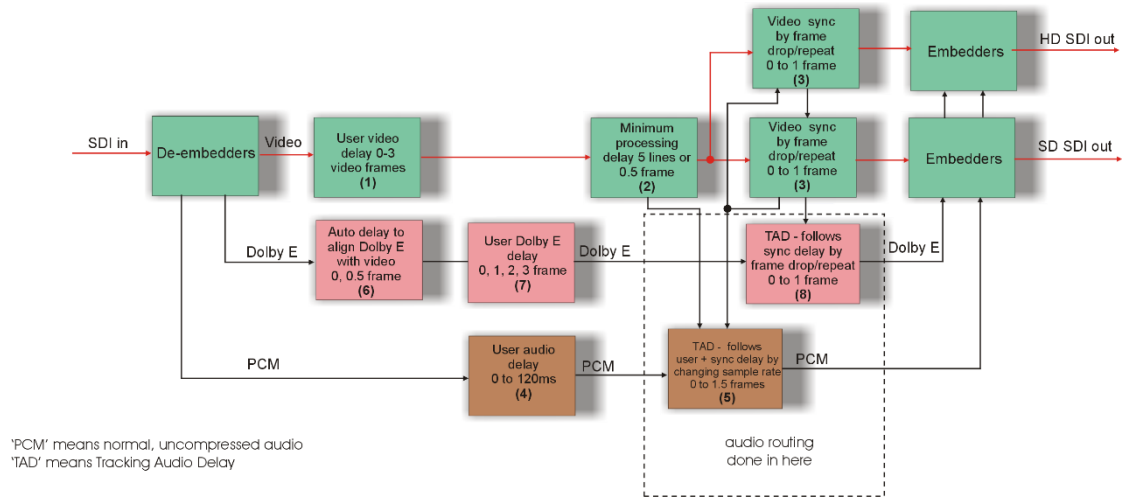
One of Up-Down 3G's most powerful features is that it will constantly put out HD and SD on the same pins regardless of the input, thanks to its smart routing. Once set, the output selection will remain true irrespective of any change in the input format – which means wiring can remain unchanged.

Up-Down 3G will automatically select the correct conversion algorithm depending on the input format and selected output formats.

3 Delays

The following section is only relevant to the *Up-Down-AS 3G, Up-Down-AFDS 3G, Up-Down-ATS 3G,* and *Up-Down-ATXS 3G* models which include two on-board synchronisers. These models provide the user with a full set of controls to set and/or bypass the delays – especially the various audio delays – as required. This has benefits in at least two areas:

- Maximum flexibility
- It simplifies the interaction between the different delays



Delays with Up-Down 3G 'S' models *(second output channel not shown)*

Video Delays

The video delay can be considered as being in three parts although the action of these delays will depend on whether the Up-Down 3G is set to synchronise, or if the external reference is not present.

(1) Fixed video delays of several frame lengths: 0, 1, 2 or 3. This is 'bulk' video delay for (i) matching other big video delays in the system and (ii) allowing the audio to be advanced relative to the video, to compensate for slippage elsewhere.

(2) A fixed video delay of 5-lines or 0.5 frames. This interacts differently with delays on different types of audio. PCM audio is delayed by the same amount as the video, maintaining lip-sync. Dolby E is not directly affected by this delay, so the Dolby E can be made earlier, relative to the video, prior to the alignment process. Without this delay, the alignment process will always delay the Dolby E relative to the video, by between 0 and 1 frame. With the 0.5 frame delay in the video path, the alignment process can change the Dolby E timing by +/- 0.5 frames relative to the video. This allows repeated embed/de-embed cycles with less risk of the Dolby E getting progressively later relative to the video.

(3) A synchroniser delay. This automatically adjusts over a range 0 to 1 frame to provide the desired output timing.

***Note**: The 'frames' used for describing delays are Dolby E frames. For interlaced video, a Dolby E frame is the same length as a video frame. For the relevant progressive video standards, a Dolby E frame is the same length as two video frames.*

The fundamental difference in "delay" mode is that the "video synchroniser" delay is set directly by user controls rather than automatically, by the relative timing of the input and the reference.

The change also affects the values available on one other video delay. In "synchroniser" mode delay (2) can have the values 0 or 0.5 frames. In "delay" mode, it can have the values 0, "matched", and 1 frame – where "matched" means that the video will be delayed by the minimum needed for lip-sync to remain absolutely unchanged through the de-embed/embed process - this is roughly 3ms.

The audio controls have the same effect in delay mode as in synchroniser mode.

Audio Delays

Two types of audio are considered – PCM and Dolby E. The Up-Down 3G will automatically detect Dolby E. There is a control to disable resampling of non-Dolby E data on per-stereo basis.

The audio delay can be considered in six parts, although not all delays are available for all types of audio.

(4) A continuously adjustable 0 to 120ms delay. This delay can also change either by resampling or by audio sample drop/repeat on a per-channel basis.

(5) A **T**racking **A**udio **D**elay (TAD) of between 0 and 1.5 frames that has the same value as the video synchroniser delay plus the 0.5 frame video delay i.e. this delay tracks the total delay through (2)+(3). This delay can change either by resampling or by audio sample drop/repeat, selected on a per-channel basis, using the same control as delay (5).

(6) A delay of 0 to 0.5 video frames to align the guardband of a Dolby E signal correctly with the video.

(7) A 0, 1, 2 or 3 frame Dolby E adjustable delay in the Dolby E path. As the user control for this can also select negative values, these will be provided by reducing delays elsewhere in the signal path where possible.

(8) A TAD of between 0 and 1 frame that has the same value as the video synchroniser delay. This is for Dolby E only and drops/repeats frames at the same time as the video synchroniser.

Tracking audio delay

When enabled, the built-in video tracking (strictly speaking Audio Follow Video tracking) helps to ensure that the audio delay matches the video delay to maintain lip-sync, by operating dynamically in Synchronisation mode as input/output timing changes.

When video tracking is on in Synchronisation mode, the rate at which the audio delay tracks fast or abrupt changes in video delay is controlled by the tracking audio delay (TAD) rate.

The faster the TAD speed, the faster the audio delay will match the video delay, but at the expense of musical pitch.

Since the TAD speed can be audible as a pitch change, the response time needs to be chosen with care. A sports event may well benefit from a fast TAD speed but classical music with piano and violins would require the slowest speed.

For example, a TAD speed of 0.1% can cause a pitch change of the same value to be heard as the audio delay catches up with the video.

To put this in perspective, imagine a piano recital is in progress and a concert pitch A above middle C is heard. This has a fundamental frequency of 440Hz. A 0.1% change would produce 440.44Hz. A sharp or B flat is 466.16Hz so in this case the audio delay slew rate only causes a pitch change of the order of one sixtieth of a semitone.

The TAD speeds are 0.8%, 0.4%, 0.2%, 0.1% and 0.05%.

TAD versus slew rate

A 40ms change in video timing only takes five seconds at the 0.8% TAD speed. Each decreasing response step takes double the time to catch up, so a 0.05% rate means that the audio would take 80 seconds to catch up with the video.

The following table relates audio tracking response time to video changes for a range of TAD values:

Video timing change	T.A.D. 0.05%	T.A.D. 0.1%	T.A.D. 0.2%	T.A.D. 0.4%	T.A.D. 0.8%
40ms	80 seconds	40 seconds	20 seconds	10 seconds	5 seconds
20ms	40 seconds	20 seconds	10 seconds	5 seconds	2.5 seconds
10ms	20 seconds	10 seconds	5 seconds	2.5 seconds	1.25 seconds
5ms	10 seconds	5 seconds	2.5 seconds	1.25 seconds	0.6 seconds
1ms	5 seconds	2.5 seconds	1.25 seconds	0.6 seconds	0.3 seconds

User Controls

Each stereo audio channel has the same set of controls, which determine whether it bypasses various delays or processes.

The TAD selection determines whether a stereo channel passes through the appropriate TAD (5) or (8), or bypasses it with minimum delay. This also affects the operation of the Dolby E alignment delay (6). If Dolby E goes through the TAD, then the output of (6) is aligned with the input video, ready to be synchronised. If Dolby E bypasses the TAD, the output of (6) is aligned with the output video, ready to be embedded.

The frame delays selection determines whether a stereo channel passes through the 0, 1, 2 or 3 frame audio delay (4), or bypasses it with minimum delay.

The user delay determines whether a stereo channel passes through the "user" audio delay, or bypasses it with minimum delay. The "user" delay for Dolby E is (7), for other audio it is (4).

The Resample Enable control affects how the audio data is manipulated to change the PCM delays. On resampled channels (resample enabled) the audio will be continuously resampled allowing seamless changes in audio delay. On non-resampled channels (resample not enabled) samples will be passed unchanged through the signal path: if the delay has to change, single audio samples will be dropped or repeated as required. This control has no effect on channels containing Dolby E.

The Dolby E align control allows the user to send Dolby E through delay (6) to produce the correct relationship with the video timing, or to bypass delay (6), passing the Dolby E to the next stage with minimum delay.

The global control adjusts both the PCM Audio Delay and Dolby E Delay. The Audio Delay control has a range of 0 to 120ms and will increase the tracking delay by the required amount.

The Dolby E delay has a range of 0 to 3 frames. This delay affects timing after the alignment process and allows for Dolby E to be embedded at a fixed offset from the default guardband position. Because this delay sits between the alignment block and the synchroniser, the delay range was chosen so that the user cannot move the Dolby E so far that it gets corrupted if the synchroniser drops or repeats a frame.

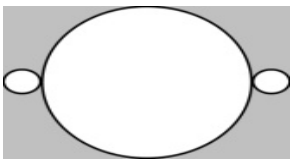
4 Aspect Ratio Correction

All Up-Down 3G models offer Aspect Ratio Correction (ARC) for the following input –output configurations: SD-SD, SD-HD, HD-SD. Up-Down 3G models *AT / ATS / ATX / ATXS* models also offer HD-HD aspect ratio correction when the input and output format are the same.

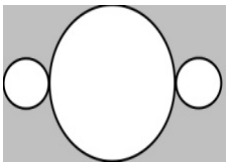
Why Aspect Ratio Correct?

There are two broadcast aspect ratios 4:3 and 16:9. An image correctly shaped for 4:3 will appear horizontally stretched on a 16:9 display. Similarly, a 16:9 image will appear vertically stretched on a 4:3 display. To correct these distortions requires either a part of the image or part of the display area to be lost.

For instance, a 4:3 image will be displayed on a 16:9 monitor would look like this:



And a 16:9 image would look like this on a 4:3 monitor:



Up-Down 3G's aspect ratio correction manipulates the size and shape of the picture to offer the best trade-off between image distortion and loss of image at edges.

525 line SD sources should always have an aspect ratio of 4:3 whereas 625 line SD sources can be 4:3 or 16:9. All HD signals should have an aspect ratio of 16:9 although they may not have originated in that format, they may have been up-converted from a 4:3 SD source. Up-Down 3G enables the aspect ratio of SD and HD sources to be corrected to the up or down converted output format.

Aspect ratio correction is independently controlled for all four modes of operation and is automatically applied to the active input-output configuration – as indicated by the 'Output Aspect Ratio' display in the Video Status menu. The active configuration is the one that is up or down converting i.e. an SD input converted to SD and HD will only be aspect ratio corrected on the up-converted HD output. Similarly, an HD input converted to HD and SD will only be aspect ratio converted at the down-converted SD output. If both outputs are set to either SD or HD then both outputs will be identically aspect ratio corrected.

Fixed Aspect Ratios

There are four selectable fixed aspect ratio types which are: Anamorphic, Letterbox (14:9, 16:9) Pillarbox (4:3, 14:9) and Stretch. Anamorphic correction will map the input picture directly to the native aspect ratio of the viewing display along with the resulting distortion associated with this. Should it be necessary to view the output on a 4:3 display, setting the aspect ratio selection to Letterbox will give the correct picture dimensions by adding black bars to the top and bottom of the picture. 14:9 Letterbox will crop the picture to 87.5%, and depending on the aspect ratio of the display will either add black bars to the top and bottom or

to both sides of the picture. There will be some loss of picture. Pillarbox will compress the picture to the centre part of the screen and add black bars to both sides. There may be a minimal picture loss depending on the selected video format. 'Stretch' is a specialist ratio requested by a major broadcaster to correct an input image that has been previously incorrectly aspect ratio corrected resulting in a vertically 'stretched' picture. Similarly, the aspect ratio corrections listed below for HD 4:3 inputs are specialist in nature, and unlikely to be encountered.

The table below lists all available fixed ARC ratios:

SD to HD	HD to SD	SD to SD	HD to HD
Anamorphic	Anamorphic	Anamorphic	Anamorphic
4:3 to 16:9 with Full Screen 16:9	4:3 to 16:9 with Full Screen 16:9	4:3 to 16:9 with Full Screen 16:9	4:3 to 16:9 with Full Screen 16:9
4:3 to 16:9 with 14:9 Pillarbox	4:3 to 16:9 with 14:9 Pillarbox	4:3 to 16:9 with 14:9 Pillarbox	4:3 to 16:9 with 14:9 Pillarbox
4:3 to 16:9 with 4:3 Pillarbox	4:3 to 16:9 with 4:3 Pillarbox	4:3 to 16:9 with 4:3 Pillarbox	4:3 to 16:9 with 4:3 Pillarbox
16:9 Stretch to Full Screen 16:9	16:9 to 4:3 with Full Screen 4:3	16:9 to 4:3 with Full Screen 4:3	16:9 Stretch to Full Screen 16:9
16:9 Stretch to 14:9 Letterbox	16:9 to 4:3 with 14:9 Letterbox	16:9 to 4:3 with14:9 Letterbox	16:9 Stretch to 14:9 Letterbox
16:9 Stretch to 16:9 Letterbox	16:9 to 4:3 with 16:9 Letterbox	16:9 to 4:3 with16:9 Letterbox	16:9 Stretch to 16:9 Letterbox

Note: The boxes shaded grey are the only fixed aspect ratio corrections offered by models Up-Down 3G and Up-Down-A 3G.

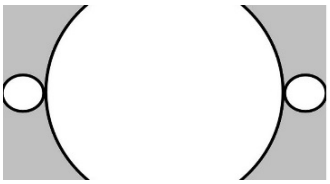
Anamorphic

All format conversions are capable of anamorphic aspect ratio correction which maps the image as though the ARC had been bypassed. Of course, the up/down conversion process may involve aspect ratio correction as the number and shape of pixels changes between formats (when converting from SD to 1080i, for example) but the image when viewed on the target display will appear distorted as if no aspect ratio correction was present.

SD to HD conversions

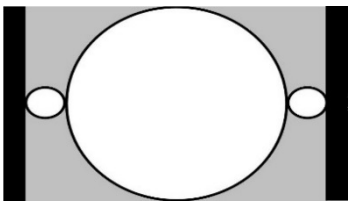
4:3 to 16:9 with Full Screen 16:9

With this correction, the 4:3 image is adjusted so that the image fills the 16:9 display. This results in picture detail at the top and bottom being lost:



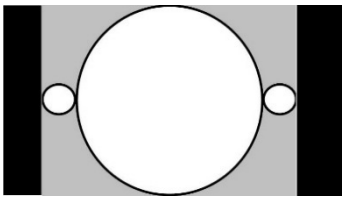
4:3 to 16:9 with 14:9 Pillarbox

This compromise correction, shrinks the picture horizontally to minimise the loss of detail at the top and bottom. The resultant picture is a trade-off between distortion, picture loss and image size.



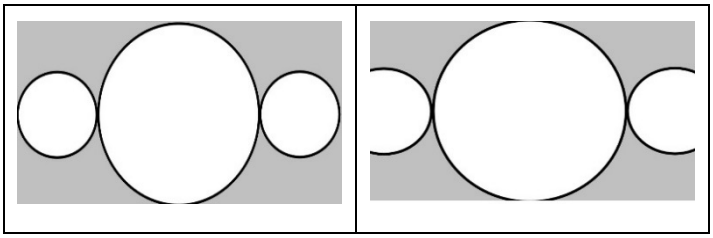
4:3 to 16:9 with 4:3 Pillarbox

This correction shrinks the image horizontally with black bands at the edges and will leave the resultant 16:9 image with an undistorted 4:3 picture:



16:9 Stretch to Full Screen 16:9

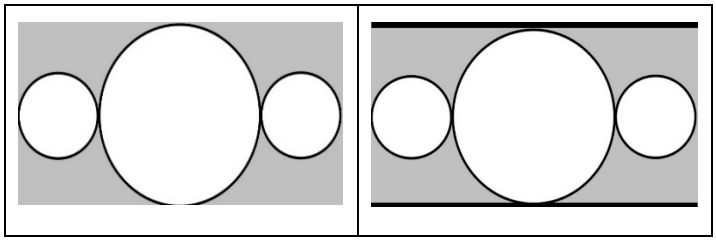
Correct a vertically ‘stretched’ 16:9 image to a correct 16:9 aspect ratio. Lose some detail from left and right edges of the picture.



16:9 ‘Stretched’ Input **16:9 Full Screen Output**

16:9 Stretch to 14:9 Letterbox

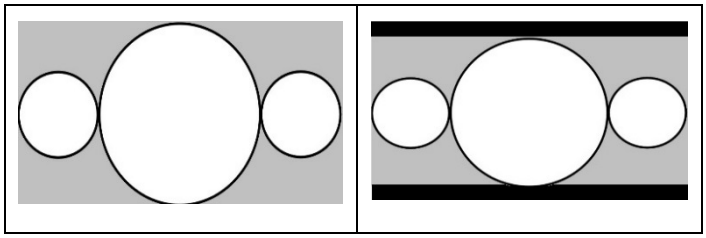
Correct a vertically ‘stretched’ image to 14:9 in a letterbox. This compromise correction shrinks the picture vertically to remove the loss of detail at the left and right hand edges. The resultant picture is a trade-off between distortion, picture loss and image size.



16:9 ‘Stretched’ Input **16:9 in 14:9 Letterbox output**

16:9 Stretch to 16:9 Letterbox

This corrects a vertically ‘stretched’ 16:9 image to a correct 16:9 aspect ratio. The image is shrunk vertically in a letterbox shape with black bands at the top and bottom.

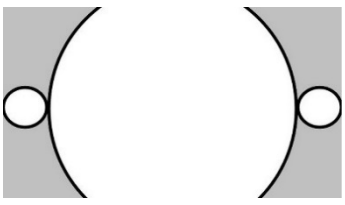


16:9 ‘Stretched’ Input **16:9 Letterbox output**

HD to SD conversions

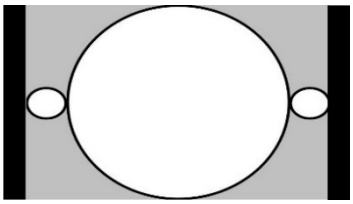
4:3 to 16:9 with Full Screen 16:9

This specialist ratio corrects a 4:3 HD image to produce a 16:9 picture with loss of detail at top and bottom.



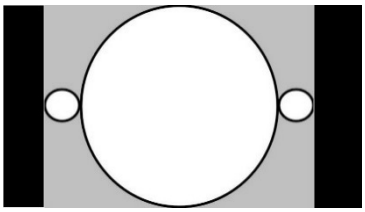
4:3 to 16:9 with 14:9 Pillarbox

This specialist ratio corrects a 4:3 HD image to produce a 16:9 compromise picture in a 14:9 Pillarbox shape with some distortion.



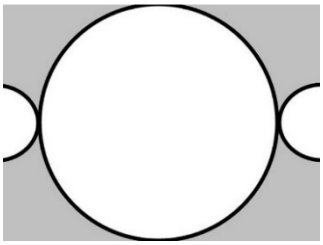
4:3 to 16:9 with 4:3 Pillarbox

This specialist ratio corrects a 4:3 HD image to produce a 16:9 picture with no distortions in a 4:3 Pillarbox shape.



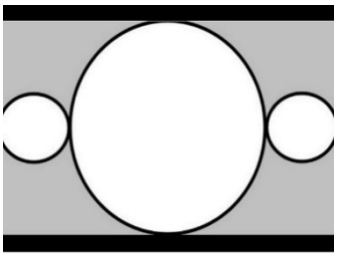
16:9 to 4:3 with Full Screen 4:3

This correction adjusts the image to fill the 4:3 screen with the result that picture detail at the left and right hand edges is lost.



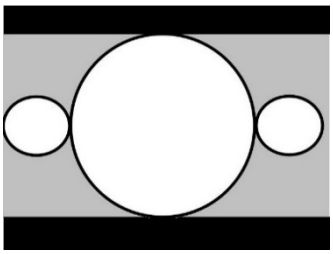
16:9 to 4:3 with 14:9 Letterbox

Use this ratio to produce a compromise 4:3 picture in a 14:9 Letterbox shape. The resultant picture is a trade-off between distortion, picture loss and image size.



16:9 to 4:3 with 4:3 Letterbox

This correction ratio shrinks the image vertically to produce a 4:3 picture in a letterbox shape with no loss of detail or distortion.



Auto modes & AFD

There are three auto modes available - Auto 16:9, Auto 4:3 and Auto Adaptive - and when any of these are selected the actual aspect ratio selected will depend on the input video Active Format Description (AFD). Up-Down 3G models *AT / ATS / AFD / AFDS / ATX / ATXS* all feature an AFD reader. AFD is a standard set of codes that can be sent in the SDI video signal that carries information about their aspect ratio and active picture characteristics. It is used by television broadcasters to enable both 4:3 and 16:9 television sets to optimally present pictures transmitted in either format. It has also been used by broadcasters to dynamically control how down-conversion equipment formats widescreen 16:9 pictures for 4:3 displays.

AFD codes provide information to the Up-Down 3G about where in the coded picture the active video is and also the "protected area" which is the area that needs to be shown. Outside of the protected area, edges at the sides or the top can be removed without the viewer missing anything significant.

For the *AT / ATS / AFD / AFDS / ATX / ATXS* models, the AFD reader will also automatically set the output WSS when Widescreen Signalling is set to auto.

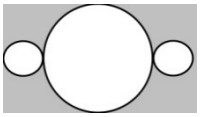
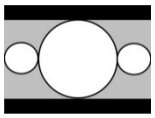
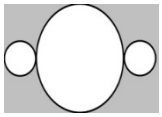
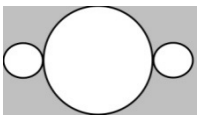
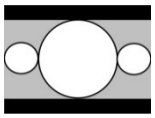
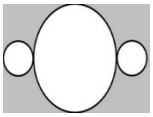
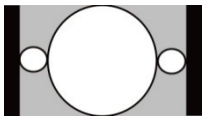
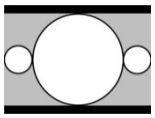
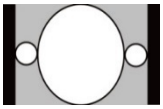
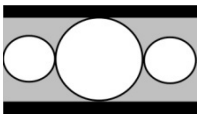
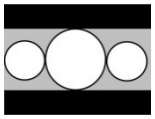
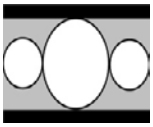
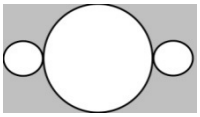
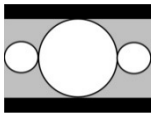
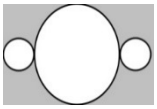
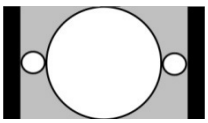
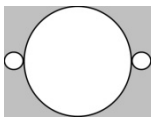
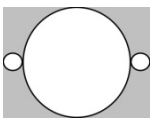
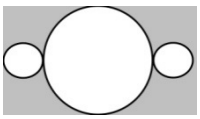
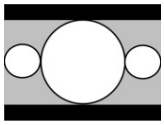
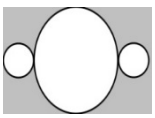
Widescreen signalling (WSS) is a digital stream embedded in the TV signal describing qualities of the broadcast, in particular the intended aspect ratio of the image. This can be used by a widescreen TV or other device to switch to the correct display mode.

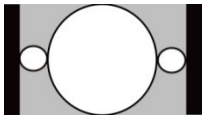
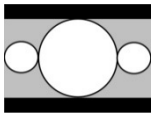
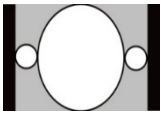
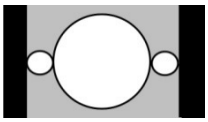
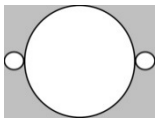
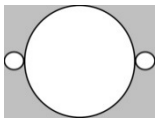
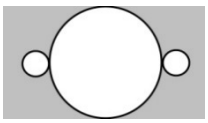
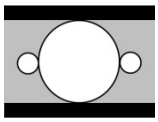
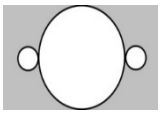
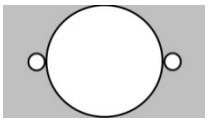
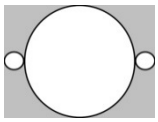
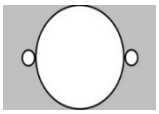
The effect of AFD varies depending on the conversion being done, with three auto modes. In these modes the conversion applied (and output AFD data) will depend on the input coded frame and AFD code, which may be presented as WSS, Video Index or SMPTE 2016.

Auto 16:9: The output coded frame is fixed at 16:9. If the input coded frame is 16:9, there will be an anamorphic correction and the output AFD will follow the input AFD. If the input coded frame is 4:3 then AFD codes for undefined/reserved, 14:9 and full frame inputs will produce a Pillarbox output. AFD codes for 16:9 Letterbox inputs will produce a conversion to a full frame output. **Auto 4:3:** The output coded frame is fixed at 4:3. If the input coded frame is 4:3, there will be an anamorphic correction and the output AFD will follow the input AFD. If the input coded frame is 16:9 then AFD codes for full frame and 14:9 inputs will produce a Letterbox output. AFD codes for a Pillarbox input will produce a correction to a full screen output. **Auto Adaptive:** If the input coded frame is 16:9, a 4:3 Pillarbox AFD will produce a 4:3 full frame output, with appropriate Video Index and/or WSS.

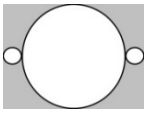
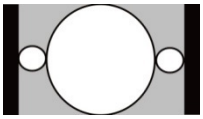
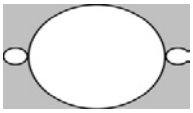
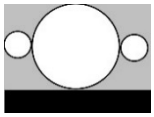
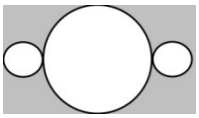
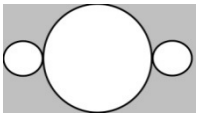
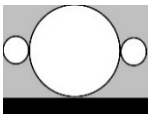
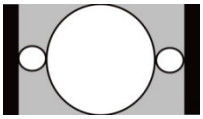
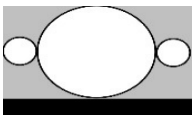
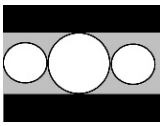
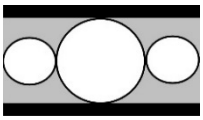
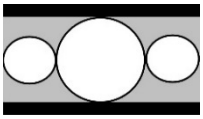
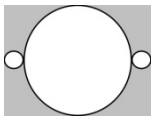
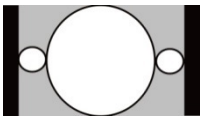
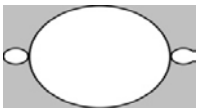
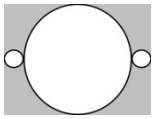
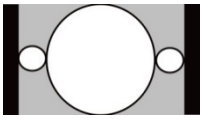
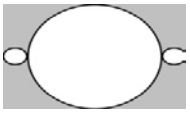
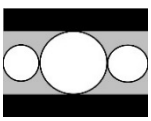
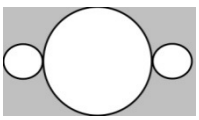
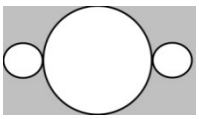
If the input coded frame is 4:3, a 16:9 Letterbox AFD will produce a 16:9 full frame output, with appropriate Video Index and/or WSS. All other AFD values will cause an anamorphic correction and the output AFD will follow the input value.

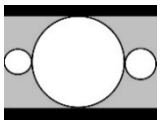
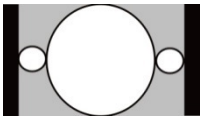
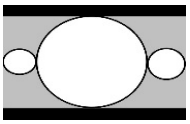
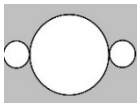
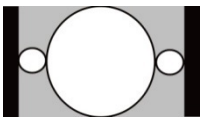
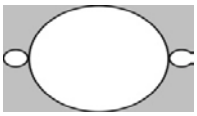
The following two tables illustrate auto aspect ratio correction from 16:9 sources and 4:3 sources with images showing input and output examples:

SMPTE 2016 AFD Code	Explanation and 16:9 input image example	Auto 4:3 correction (output WSS)	Auto adaptive correction (output WSS)
0, 1, 5, 6, 7, 12	 Undefined/reserved	 Letterbox 16:9 into 4:3	 Anamorphic
2	 Full frame 16:9	 Letterbox 16:9 into 4:3	 Anamorphic
3	 14:9 Pillarbox	 Letterbox 14:9 area into 4:3	 Anamorphic
4	 Letterbox image with aspect ratio > 16:9.	 Letterbox 16:9 into 4:3	 Anamorphic
8	 Full Frame 16:9 image	 Letterbox 16:9 into 4:3	 Anamorphic
9	 4:3 Pillarbox in 16:9 frame.	 Centre cut-area	 Centre cut-out 4:3 area
10	 Full frame 16:9 image (all areas protected)	 Letterbox 16:9 area into 4:3	 Anamorphic

11	 Pillarbox 14:9	 Letterbox 14:9 active area into 4:3	 Anamorphic
13	 4:3 with ‘shoot and protect’ 14:9 centre	 Centre cut-out 4:3 area	 Centre cut-out 4:3 area
14	 16:9 with ‘shoot and protect’ 14:9 centre.	 Letterbox 16:9 into 4:3	 Anamorphic
15	 16:9 with ‘shoot and protect’ 4:3 centre.	 Centre cut-out 4:3 from 16:9	 Anamorphic

Examples of Auto aspect ratio correction for 16:9 SD and HD signals

SMPTE 2016 AFD Code	Explanation and 4:3 input image example	Auto 16:9 correction	Auto adaptive correction (output WSS)
0, 1, 5, 6, 7, 12	 Undefined/reserved	 Pillarbox 4:3 into 16:9	 Anamorphic
2	 16:9 active picture (top aligned)	 Full frame conversion	 16:9 Full frame conversion
3	 14:9 active picture (top aligned)	 Pillarbox 14:9 into 16:9	 Anamorphic
4	 Letterbox image with aspect ratio >16:9	 Full frame conversion	 Full frame conversion
8	 Full Frame 4:3 image.	 Pillarbox 4:3 into 16:9	 Anamorphic
9	 4:3 Centred	 Pillarbox 4:3 into 16:9	 Anamorphic
10	 16:9 Letterbox in 4:3 frame	 Full frame conversion	 Full frame conversion

11	 14:9 Centred	 Pillarbox 14:9 into 16:9	 Anamorphic
13	 4:3 with 'shoot and protect' 14:9 centre	 Pillarbox 14:9 centre into 16:9	 Anamorphic

Examples of Auto aspect ratio correction for 4:3 SD signals

Aspect ratio size and position controls

Depending on the input format and selected output format there are up to seven fixed aspect ratios available. Each of these seven aspect ratios can be adjusted independently for picture size and position; the picture may also be cropped on all four edges. Once the controls are set they are automatically recalled whenever the particular aspect ratio is active.

HD to HD Aspect Ratio Correction

HD sources are normally always 16:9 but may not have been created in that aspect ratio and HD to HD aspect ratio correction allows for some adjustment of previous corrections. There are some limitations with HD to HD aspect ratio correction that the user should be aware of, namely:

- The conversions are only available on the AT, ATS, ATX and ATXS versions.
- The conversions are only enabled when the input and outputs have the same format.
- The conversions are fixed, with the size, position and crop sliders having no effect.
- "4x3 to 14x9 Pillarbox" (4:3 to 16:9 in a 14:9 Pillarbox) is under-sized by about 4%.
- "4x3 to 14x9 Pillarbox" is only possible for the 720p50, 720p59.94 and 1080i50 formats. For other formats, a 4x3 Pillarbox is used.
- "16x9 to 16x9 Letterbox" (16:9 stretch to 16:9 Letterbox) is only possible for the 720p50, 720p59.94 and 1080i50 and 1080p50 formats. For other formats a 14x9 Letterbox is used.

5 Noise reduction

All Up-Down 3G models are able to detect and remove mosquito noise, a common compression artefact caused by MPEG decoders which is often exhibited as a cloud around the edges of text and computer generated graphics. Algorithms within Up-Down 3G detect areas where mosquito noise would be the most likely and then work to diminish the mosquito noise without blurring the edge of the text or graphics.

Fine Detail and Edge Enhancement is a video processing technology that increases the sharpness or detail of images. It is especially useful when Standard Definition video is scaled to fit high resolution displays. The controls allow the image to be either sharpened or softened as required.

Noise reduction

Noise reduction uses a combination of edge mapping and proximity mapping to produce a composite blend map to ensure noise reduction is only applied to the areas where noise is present without causing blurring of the edges. The different levels of noise reduction applied are achieved by varying the amount of clip and gain applied to the various mapping.

Edge detail and detail enhancement

Up-Down 3G's fine detail and edge enhancement uses a technique known as 'unsharp mask'. This is a superior method of enhancing images that does not introduce ringing. Up-Down 3G enhances images both horizontally and vertically.

Two types of enhancement are provided, one for fine detail and one for object edges. Fine detail enhancement applies sharpening to the entire image. Edge enhancement applies sharpening only to object edges.

Both detail enhancement and edge enhancement produce similar results, but there are subtle differences. Fine detail enhancement works best when the source is 'clean' and free from noise. Edge enhancement works well for less pristine sources. It produces a sharpening effect without making noise more visible.

To allow simultaneous dual conversions with Up-Down 3G, its internal architecture contains two independent aspect ratio converters with an invisible switching matrix. The main converter is able to up convert, cross convert or down convert. The secondary converter is used for down converting only. Noise reduction, detail enhancement and edge enhancement can only be applied to the main converter; this imposes certain restrictions to the use of the noise reduction and enhancements controls.

Input video standard	A-B Output formats	Conversion	Controls
SD	HD	Up	Active
	SD	Bypass	Not active
SD	SD	ARC conversion	Active
	SD	ARC conversion	Active
SD	HD	Up	Active
	HD	Up	Active
HD	HD	Up/Down/Cross	Active
	SD	Down	Not active
HD	HD	Up/Down/Cross	Active
	HD	Up/Down/Cross	Active
HD	SD	Down	Not active
	SD	Down	Not active

Noise reduction, detail enhancement and edge enhancement controls

Vertical bandwidth filter

When down converting to Standard Definition the vertical bandwidth can be optimised for a given application by selecting the most appropriate vertical bandwidth filtering. There are four filters to select from, ranging from the highest (sharpest) to the lowest (softest).

6 Output AFD, WSS and VI

All models except Up-Down 3G, Up-Down-A 3G and Up-Down-AS 3G are able to offer AFD insertion of SMPTE 2016 AFD, WSS or Video Index for use by downstream equipment.

AFD

There are three sets of controls associated with Active Format Description (AFD). These are: the inserter mode control, entire image aspect ratio selector (coded frame) and the group of 16 AFD codes. These controls are repeated for both SD and HD.

The HD output will have the ANC data packets containing the AFD information inserted within the active line portion on the appropriate line.

The 16 available codes defined in SMPTE 2016 are described in the following table:

AFD code	Description	AFD code	Description
0	Undefined	8	Full Frame (as coded frame)
1	Reserved	9	4:3 Centre
2	16:9 Centre	10	16:9 Centre
3	14:9 Centre	11	14:9 Centre
4	16:9+	12	Reserved
5	Reserved	13	4:3 with shoot and protect 14:9 centre
6	Reserved	14	16:9 with shoot and protect 14:9 centre
7	Reserved	15	16:9 with shoot and protect 4:3 centre

Note: When inserting SMPTE 2016 data the inserter will blank any incoming SMPTE 2016 data.

Widescreen Signalling

Output widescreen signalling can be set to automatically follow the input AFD data or be manually selected. If WSS data should be present on the input video this can either be passed to the output unchanged or substituted for a user selected code. WSS data can also be set to be blanked. It is only possible to insert WSS information into a PAL output.

Outgoing WSS codes	Explanation	Conversion
0001	Full format 4:3	Centre cut
1000	Box 14:9 centre	Letterbox
1101	Box 16:9 centre	Letterbox
1110	Full format 16:9	Anamorphic

Video Indexing

SMPTE RP186 describes Video Index information coding for 525 and 625 line television systems. Video indexing, although not commonly used today, is still in use by some major broadcasters.

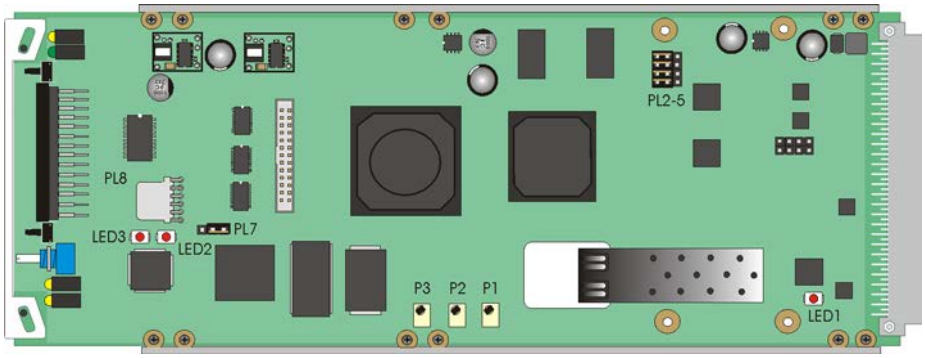
Video indexing can also be inserted into the output video for use by downstream equipment. Output video indexing is enabled by selecting the required output aspect ratio. Although in most applications the output selection will mirror the conversion setting the output video index control remains independent from the conversion setting, so that a user specified aspect ratio can have assigned the most appropriate ratio information. It is also possible to either insert blank video index data or pass the input data to the output unchanged.

The 4-bit AFD codes are identical to those for SMPTE 2016.

7 Hardware installation

Module configuration

There are five user settable links on the Up-Down 3G. These are PL2, PL3, PL4, PL5 and PL7. Links PL2, PL3, PL4 and PL5 are used to select between RS422 and GPI control. Other links have been factory set and should not need to be altered. PL7 sets the Up-Down 3G IP address to default (10.0.0.201) or to a user selected IP address.



Up-Down 3G top side

The surface-mounted LEDs on the top side of the PCB are not visible from the front of the frame and are included for diagnostic purposes only.

Engineering link and LEDs

PL7 sets the Up-Down 3G IP address to default (10.0.0.201) or to a user selected IP address. The LEDs LED1, LED2 and LED3 are included for diagnostic purposes and are not visible from the front of the frame.

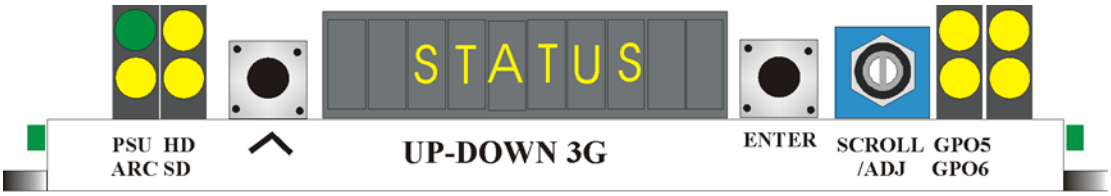
Link	Towards front of board or Up	Towards the rear of board or Down
PL7	Debug mode – forces board's IP address to be 10.0.0.201	Normal mode (factory set, do not alter)
PL2	GPI 1 Input = RS422 Rx+	GPI 1 Input = GPI 1
PL3	GPI 2 Input = RS422 Rx-	GPI 2 Input = GPI 2
PL4	GPI 3 Input = RS422 Tx+	GPI 3 Input = GPI 3
PL5	GPI 4 Input = RS422 Tx-	GPI 4 Input = GPI 4

Note: PL2-5 GPI/Controller select is only available on issue 3 and above Up-Down 3G

Potentiometers

These potentiometers have been factory set and should not require further adjustment

Potentiometer	Function
P1	Standard Definition free-running frequency
P2	High Definition 50Hz free-running frequency
P3	High Definition 59.94Hz free-running frequency



Front edge LED's					
PSU	**ARC**	**HD**	**SD**	**GPO5**	**GPO6**
On if power supply OK	On if Aspect Ratio Correction is other than anamorphic.	On if input video is HD	On if input video is SD	On if GPO5 alarm active.	On if GPO6 alarm active.

8 Rear modules and signal I/O

The 2U Indigo 2 frame will house up to 12 single height modules and dual power supplies. The 1U Indigo 1 frame will house six single height modules and a single or dual power supply. The Indigo DT desk top boxes have a built-in power supply and will house up to two single height modules. All modules can be plugged in and removed while the frame is powered without damage.

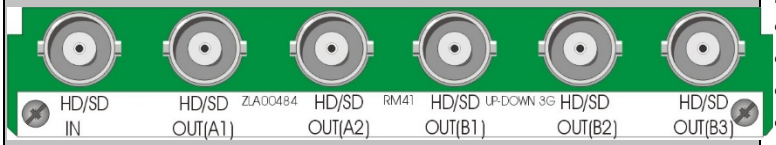
Note: For details of fitting rear connectors please refer to the appropriate frame manual.

Up-Down 3G models 3G/ A / AFD / AT / ATX

The following rear module I/O assignments are for Up-Down 3G models that are not fitted with a synchroniser and therefore do not require a sync input:

Rear module connections with RM41

The RM41 being a single height module will allow maximum packing density with the maximum number of outputs available.

RM41 rear module connector	Description
	**RM41** • 12 per Indigo 2 frame • Six per Indigo 1 frame • Two per Indigo DT • All frame slots can be used

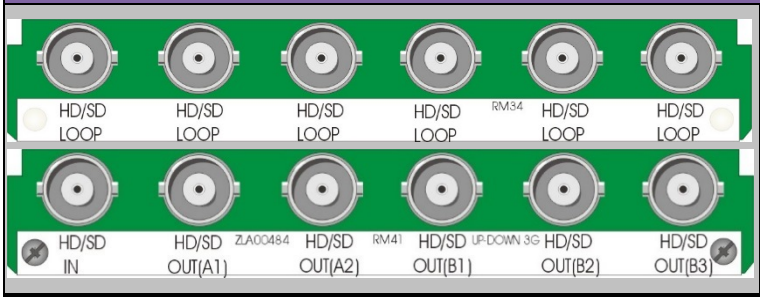
BNC	I/O assignment
HD/SD OUT(B3)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(B2)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(B1)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(A2)	High Definition/Standard Definition serial digital output (Group A)
HD/SD OUT(A1)	High Definition/Standard Definition serial digital output (Group A)
HD/SD IN	High Definition/Standard Definition serial digital input

Note: In HD applications it is also possible to use the RM34 which has the same connections. It is possible to also use the RM34 for 3G applications but the return-loss may be compromised.

Rear module connections with RM41 + RM34

Two single slot frame rear modules used together for when DA6 top board is fitted. RM34 must be fitted in top position. Allows six Up-Down 3G in 2U, three in 1U and one in desk top box. Gives access to one 3Gb/s, HD or SD input, six reclocked input loop-throughs and two

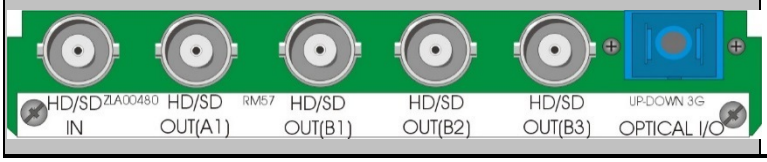
co-timed outputs (configurable as 3G/HD or SD), with two feeds of Output A and three feeds of Output B.

RM41 + RM34 rear module connector	Description
	**RM41+RM34** • Six per Indigo 2 frame • Three per Indigo 1 frame • One per Indigo DT • All frame slots can be used

BNC	I/O assignment
HD/SD LOOP	Loop-through of HD/SD input
HD/SD OUT(B3)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(B2)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(B1)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(A2)	High Definition/Standard Definition serial digital output (Group A)
HD/SD OUT(A1)	High Definition/Standard Definition serial digital output (Group A)
HD/SD IN	High Definition/Standard Definition serial digital input

Rear module connections with RM57

Single slot frame rear module. Allows maximum number of Up-Down 3G in frame (12 in 2U, six in 1U, and two in desk top box). Designed for applications using fibre inputs or outputs. When using fibre input, allows you to select between one fibre and one electrical 3Gb/s, HD or SD input, and gives access to two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and three feeds of Output B. When using fibre output, gives access to one 3Gb/s, HD or SD input and two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and three feeds of Output B along with one copy of Output B on fibre.

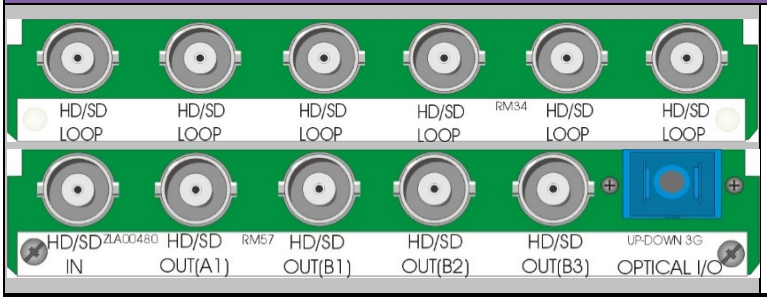
RM57 rear module connector	Description
	**RM57** • 12 per Indigo 2 frame • Six per Indigo 1 frame • Two per Indigo DT • All frame slots can be used

BNC	I/O assignment
OPTICAL I/O	SC optical connector. Input or output depending on optical module fitted (Group B)
HD/SD OUT(B3)	HD/SD SDI output (Group B)
HD/SD OUT(B2)	HD/SD SDI output (Group B)
HD/SD OUT(B1)	HD/SD SDI output (Group B)
HD/SD OUT(A1)	HD/SD SDI output (Group A)
HD/SD IN	High Definition/Standard Definition serial digital input

Note: Ensure the internal dust-cap has been removed before mounting the RM57 into the frame.

Rear module connections with RM57 + RM34

Two single slot frame rear modules used together for when DA6 top board is fitted. RM34 must be fitted in top position Designed for applications using fibre inputs or outputs. When using fibre input, allows you to select between one fibre and one electrical 3Gb/s, HD or SD input, and gives access to six reclocked input loop-throughs and two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and three feeds of Output B. When using fibre output, gives access to one 3Gb/s, HD or SD input, six reclocked input loop throughs and two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and three feeds of Output B along with one copy of Output B on fibre.

RM57 + RM34 rear module connector	Description
	**RM57+RM34** • Six per Indigo 2 frame • Three per Indigo 1 frame • One per Indigo DT • All frame slots can be used

BNC	I/O assignment
OPTICAL I/O	SC optical connector. Input or output depending on optical module fitted (Group B)
SDI OUT(B3)	HD/SD SDI output (Group B)
SDI OUT(B2)	HD/SD SDI output (Group B)
SDI OUT(B1)	HD/SD SDI output (Group B)
SDI OUT(A1)	HD/SD SDI output (Group A)
SDI IN	High Definition/Standard Definition serial digital input

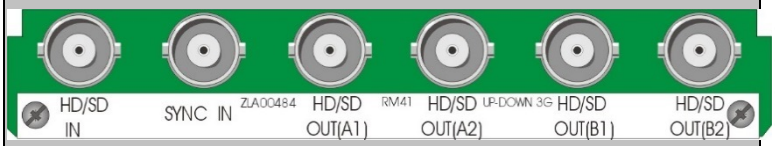
Note: Ensure the internal dust-cap has been removed before mounting the RM57 into the frame.

Up-Down 3G models AS / AFDS / ATS / ATXS

The following rear module I/O assignments are for Up-Down 3G models that are fitted with a synchroniser and require a sync input:

Rear module connections with RM41

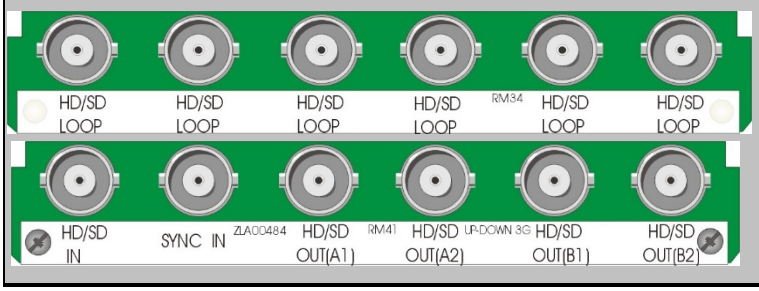
The RM41 being a single height module will allow maximum packing density with a sync input and the maximum number of outputs available.

RM41 rear module connector	Description
	**RM41** • 12 per Indigo 2 frame • Six per Indigo 1 frame • Two per Indigo DT • All frame slots can be used

BNC	I/O assignment
HD/SD OUT(B2)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(B1)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(A2)	High Definition/Standard Definition serial digital output (Group A)
HD/SD OUT(A1)	High Definition/Standard Definition serial digital output (Group A)
SYNC IN	Analogue black-burst or tri-level sync input
HD/SD IN	High Definition/Standard Definition serial digital input

Rear module connections with RM41 + RM34

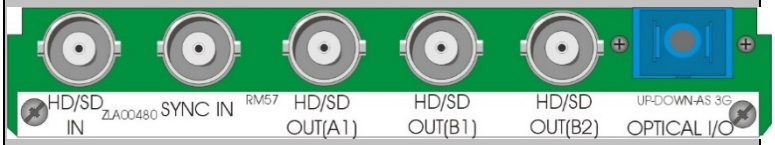
Two single slot frame rear modules used together for when DA6 top board is fitted. RM34 must be fitted in top position. Allows six Up-Down 3G in 2U, three in 1U and one in desk top box. Gives access to one 3Gb/s, HD or SD input, six reclocked input loop-throughs and two co-timed outputs (configurable as 3G/HD or SD), with two feeds of Output A and two feeds of Output B.

RM41 + RM34 rear module connector	Description
	**RM41 + RM34** • Six per Indigo 2 frame • Three per Indigo 1 frame • One per Indigo DT • All frame slots can be used

BNC	I/O assignment
HD/SD LOOP	Loop-through of HD/SD input
HD/SD OUT(B2)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(B1)	High Definition/Standard Definition serial digital output (Group B)
HD/SD OUT(A2)	High Definition/Standard Definition serial digital output (Group A)
HD/SD OUT(A1)	High Definition/Standard Definition serial digital output (Group A)
SYNC IN	Analogue black-burst or tri-level sync input
HD/SD IN	High Definition/Standard Definition serial digital input

Rear module connections with RM57

Single slot frame rear module. Allows maximum number of Up-Down 3G in frame (12 in 2U, six in 1U, and two in desk top box). Designed for applications using fibre inputs or outputs. When using fibre input, allows you to select between one fibre and one electrical 3Gb/s, HD or SD input, and gives access to two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and two feeds of Output B. When using fibre output, gives access to one 3Gb/s, HD or SD input and two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and two feeds of Output B along with one copy of Output B on fibre.

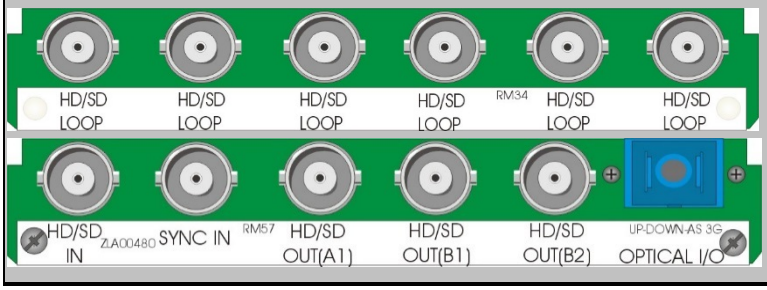
RM57 rear module connector	Description
	**RM57** • 12 per Indigo 2 frame • Six per Indigo 1 frame • Two per Indigo DT • All frame slots can be used

BNC	I/O assignment
OPTICAL I/O	SC optical connector. Input or output depending on optical module fitted (Group B)
HD/SD OUT(B2)	HD/SD SDI output (Group B)
HD/SD OUT(B1)	HD/SD SDI output (Group B)
HD/SD OUT(A1)	HD/SD SDI output (Group A)
SYNC IN	Analogue black-burst or tri-level sync input.
HD/SD IN	High Definition/Standard Definition serial digital input

Note: Ensure the internal dust-cap has been removed before mounting the RM57 into the frame.

Rear module connections with RM57 + RM34

Two single slot frame rear modules used together for when DA6 top board is fitted. RM34 must be fitted in top position Designed for applications using fibre inputs or outputs. When using fibre input, allows you to select between one fibre and one electrical 3Gb/s, HD or SD input, and gives access to six reclocked input loop-throughs and two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and two feeds of Output B. When using fibre output, gives access to one 3Gb/s, HD or SD input, six reclocked input loop throughs and two co-timed outputs (configurable as 3G/HD or SD), with one feed of Output A and two feeds of Output B, along with one copy of Output B on fibre.

RM57 + RM34 rear module connector	Description
	**RM57 + RM34** • Six per Indigo 2 frame • Three per Indigo 1 frame • One per Indigo DT • All frame slots can be used

BNC	I/O assignment
OPTICAL I/O	SC optical connector. Input or output depending on optical module fitted (Group B)
SDI OUT(B2)	HD/SD SDI output (Group B)
SDI OUT(B1)	HD/SD SDI output (Group B)
SDI OUT(A1)	HD/SD SDI output (Group A)
SYNC IN	Analogue black-burst or tri-level sync input
SDI IN	High Definition/Standard Definition serial digital input

Note: Ensure the internal dust-cap has been removed before mounting the RM57 into the frame.

9 General Purpose Interface

Introduction

Each frame slot has up to six connections ‘a-f’ for GPI control and monitoring. These connections are available at the rear of the frame on the 26-way D-Type remote connectors.

Up-Down 3G has four GPI inputs and two GPI outputs.

Each General Purpose Interface (GPI) input is fitted with a 10kΩ resistor connected to the internal +5V and in the following table, this equates to logic ‘H’. With the GPI preset recall lines set to ‘level’ mode and no connections (logic ‘HHHH’), preset 1 will be selected. With the GPI preset recall lines set to ‘pulse’ mode, the GPI will be activated whenever a bit is pulled low but no change to the preset selection will occur when all bits return to logic ‘HHHH’. Note that preset 16 is not accessible in pulse mode.

***Note**: Because the GPI inputs are sampled in the vertical interval it is recommended that in ‘pulse’ mode, the GPI should be asserted at least 2mS before the start of vertical sync to ensure stability and held active for at least 40mS.*

Each General Purpose Interface (GPI) output has a 270Ω resistor in series with its output. This allows for an external LED to be driven, connected to a DC voltage of +5V.

The GPI inputs can be programmed to automatically recall a previously saved preset configuration. The 16 user preset configurations are selected using binary notation. The two outputs can be programmed to assert themselves for a number of different alarm conditions.

<table>
<tr><th colspan="3">GPI</th><th colspan="2">Low (<1V)</th><th>High (+5V)</th></tr>
<tr><td>1</td><td>‘a’</td><td>Recall preset bit 1</td><td colspan="2" rowspan="4">See following table for user preset control</td></tr>
<tr><td>2</td><td>‘b’</td><td>Recall preset bit 2</td></tr>
<tr><td>3</td><td>‘c’</td><td>Recall preset bit 4</td></tr>
<tr><td>4</td><td>‘d’</td><td>Recall preset bit 8</td></tr>
<tr><td>5</td><td>‘e’</td><td>Input missing, Reference missing, Video frozen / Black, Audio silence / missing</td><td>Selected Alarms asserted after set delay</td><td>No alarm</td></tr>
<tr><td>6</td><td>‘f’</td><td>Input missing, Reference missing, Video frozen / Black, Audio silence / missing</td><td>Selected Alarms asserted after set delay</td><td>No alarm</td></tr>
</table>

Note: Input missing will assert the selected alarm immediately.

Note: Reference missing alarm only available for AS / ATS / AFDS / ATXS models only.

Card software version V1.80 onwards, with Indigo frame software version V5.4 onwards includes GPO alarms for embedded input Dolby E detection (AS / ATS / AFDS / ATXS models only).

GPI	Bit 8	Bit 4	Bit 2	Bit 1
Preset				
1	H	H	H	H
2	H	H	H	L
3	H	H	L	H
4	H	H	L	L
5	H	L	H	H
6	H	L	H	L
7	H	L	L	H
8	H	L	L	L
9	L	H	H	H
10	L	H	H	L
11	L	H	L	H
12	L	H	L	L
13	L	L	H	H
14	L	L	H	L
15	L	L	L	H
16	L	L	L	L

Binary coding of GPI inputs to recall preset configurations in level mode

GPI	Bit 8	Bit 4	Bit 2	Bit 1
Preset				
No change				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16	Not accessible in pulse mode.			

Binary coding of GPI inputs to recall preset configurations in pulse mode

2U frame GPI connections

GPI lines ‘a’ to ‘f’ of each card connect to two of four rear remote connectors as follows:

Slot no.	‘a’ pin	‘b’ pin	‘c’ pin	‘d’ pin	‘e’ pin	‘f’ pin
1	8 (1)	9 (1)	18 (1)	26 (1)	19 (2)	20 (2)
2	7 (1)	16 (1)	17 (1)	25 (1)	10 (2)	11 (2)
3	8 (3)	9 (3)	18 (3)	26 (3)	19 (4)	20 (4)
4	7 (3)	16 (3)	17 (3)	25 (3)	10 (4)	11 (4)
5	5 (1)	6 (1)	15 (1)	24 (1)	1 (2)	2 (2)
6	4 (1)	14 (1)	13 (1)	23 (1)	3 (2)	4 (2)
7	5 (3)	6 (3)	15 (3)	24 (3)	1 (4)	2 (4)
8	4 (3)	14 (3)	13 (3)	23 (3)	3 (4)	4 (4)
9	3 (1)	12 (1)	22 (1)	21 (1)	12 (2)	13 (2)
10	10 (1)	11 (1)	19 (1)	20 (1)	21 (2)	22 (2)
11	3 (3)	12 (3)	22 (3)	21 (3)	12 (4)	13 (4)
12	10 (3)	11 (3)	19 (3)	20 (3)	21 (4)	22 (4)

Table shows pin number (remote number)

Note: Remote 1 and Remote 3 are 26-way high-density D-Type female sockets. Frame ground is pin 2 and +5V @500mA is pin 1 in each case.

Remote 2 and Remote 4 are 26-way high-density D-Type male plugs and frame ground is pin 6 in each case and +5V @500mA is pin 15 on Remote 2.

Note: The +5V output is protected by self-resetting thermal fuses, which limit the total output current available from Remotes 1-4 to approximately 1A.

1U frame GPI connections

GPI lines ‘a’ to ‘f’ of each card connect to two rear remote connectors as follows:

Slot no.	‘a’ pin	‘b’ pin	‘c’ pin	‘d’ pin	‘e’ pin	‘f’ pin
1	8 (1)	9 (1)	18 (1)	26 (1)	19 (2)	20 (2)
2	7 (1)	16 (1)	17 (1)	25 (1)	10 (2)	11 (2)
3	5 (1)	6 (1)	15 (1)	24 (1)	1 (2)	2 (2)
4	4 (1)	14 (1)	13 (1)	23 (1)	3 (2)	4 (2)
5	3 (1)	12 (1)	22 (1)	21 (1)	12 (2)	13 (2)
6	10 (1)	11 (1)	19 (1)	20 (1)	21 (2)	22 (2)

Table shows pin number (remote number)

Note: Remote 1: 26-way high-density D-Type female socket. Frame ground is pin 2 and +5V @500mA is pin 1.

Remote 2: 26-way high-density D-Type male plugs and frame ground is pin 6 and +5V @500mA is pin 15.

Note: The +5V output is protected by self-resetting thermal fuses, which limit the total output current available from Remotes 1-2 to approximately 1A.

Indigo DT desk top box GPI connections

GPI lines ‘a’ to ‘f’ of each card connect to two rear remote connectors as follows:

Slot no.	‘a’ pin	‘b’ pin	‘c’ pin	‘d’ pin	‘e’ pin	‘f’ pin
1	8 (1)	9 (1)	18 (1)	26 (1)	19 (2)	20 (2)
2	7 (1)	16 (1)	17 (1)	25 (1)	10 (2)	11 (2)

Table shows pin number (remote number)

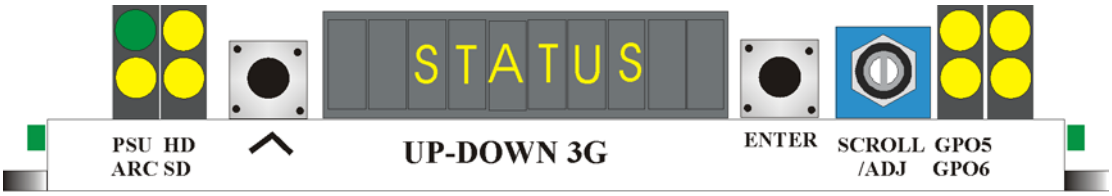
Note: Remote 1: 26-way high-density D-Type female socket. Frame ground is pin 2 and +5V @500mA is pin 1.

Remote 2: 26-way high-density D-Type male plugs and frame ground is pin 6 and +5V @500mA is pin 15.

The +5V output is protected by self-resetting thermal fuses, which limit the total output current available from Remotes 1-2 to approximately 1A.

10 Card edge operation

Card edge controls



Up-Down 3G board edge

Board edge control was removed from the Up-Down 3G range in 2019. Therefore the card edge control information detailed here is only relevant for older versions of the product.

Card edge buttons

The two tactile push button switches allow the operator to navigate within the menu structure.

Button	Function	Normal state Up, Action Down
^	Up Menu	Push to jump up a menu level or cancel a selection
ENTER	Select/Action	Push to select a menu and to action and confirm a change

Card edge rotary control

The board edge rotary encoder is used to navigate through the menu categories and adjust parameter values.

Control	Function
SCROLL /ADJUST	Rotate SCROLL to identify a menu category. In combination with the ENTER button select and ADJUST to change the current level or select a further option.

Note: The rotary control can access menus and parameter values by clockwise or anti-clockwise rotation.

Reading card edge LEDs

Card edge LEDs may be used in conjunction with status information from any connected remote status panel display or from VisionWeb if available.

Refer also to the trouble shooting chapter for more help with solving problems and monitoring status information.

The following table summarises the card edge LED functions and colours:

Name	LED Colour	Function when ON	Function when Off
PSU	Green	Good power supply (PSU) rails	One or more of the monitor supplies is out of specification
ARC	Yellow	Aspect ratio conversion selected	Full screen (anamorphic) selected
HD	Yellow	Video input standard is HD (High Definition)	Input not present
SD	Yellow	Video input standard is SD (Standard Definition)	
GPO5	Yellow	GPO5 active / low	GPO5 inactive / high
GPO6	Yellow	GPO6 active / low	GPO6 inactive / high
	Yellow	No function	
	Yellow	No function	

Navigating card edge menus

To access the card edge menu system proceed as follows:

- Press the up-arrow [⌃] until a top menu category is reached
- Rotate the SCROLL control until the desired menu category is found
- Push ENTER to enter the sub-menus of that category
- Rotate SCROLL to select a sub-menu
- Push ENTER to select the desired function. Selection will be indicated by the text being displayed in ***italic*** text
- Rotate ADJUST to make the desired change to the selected parameter. The display brightness flashes slowly to indicate that a change has been made and requires confirmation
- When required push ENTER to action the change. The display will cease flashing
- Use the up-arrow [⌃] and SCROLL control to navigate to further menus

Note: The displayed menu brightness will flash slowly if confirmation of a change is required.

11 Using the front control panel

Module selection

At power up, the LEDs of all eight control panel keys will illuminate briefly. Once the panel has completed its power up and configuration sequence the panel will enter its status mode and display the current software version and frame IP address.

Active control panel Home screen

To continue with control panel operation or configuration, press the 'Device' key once. The control panel will display the name of the card that first responds to the polling request together with its location number. The location number consists of the frame number plus the card position in the frame. Rotate the Shaft control to poll through the available cards. Use the F2 soft key to toggle between the card's serial number and issue number with modification level.

The available cards menu

In the example above, the card displayed is located in the first frame in slot number 1.

When the desired card is selected press the ENTER key to access that card's HOME menu.

The Up-Down-A 3G Home menu

Rotate the shaft control to scroll through the menu structure and press ENTER to select the sub-menus. Press HOME at any time to return to the home menu.

Up-Down-A 3G Video Status sub-menu

Press ENTER to select the Reference Status menu or SCROLL to display other sub-menus. See description of menu structure below for list of sub-menus.

Control Panel keys overview

The functions assigned to the control panel keys are:

- DEVICE – enters 'device' menu to select a card or show available cards.
- ASTERISK (*) – selects 'network configuration' menu.
- F1 to F4 – soft keys not currently used by Up-Down 3G.
- HOME – returns to top of Up-Down 3G's menu structure.
- ENTER – accept current selection.
- Up arrow – used to move up through the menu structure.
- Rotary control – shaft encoder used to select sub-menus or variable data.

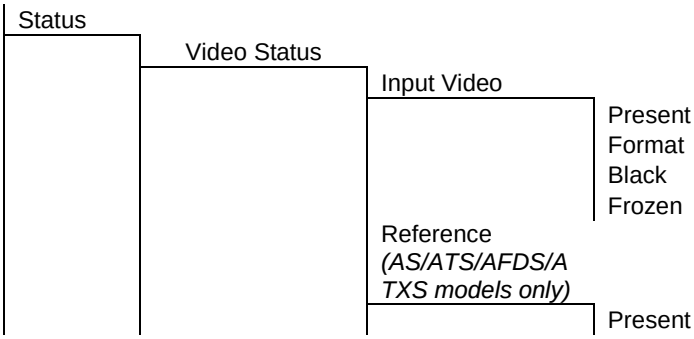
Updating the display

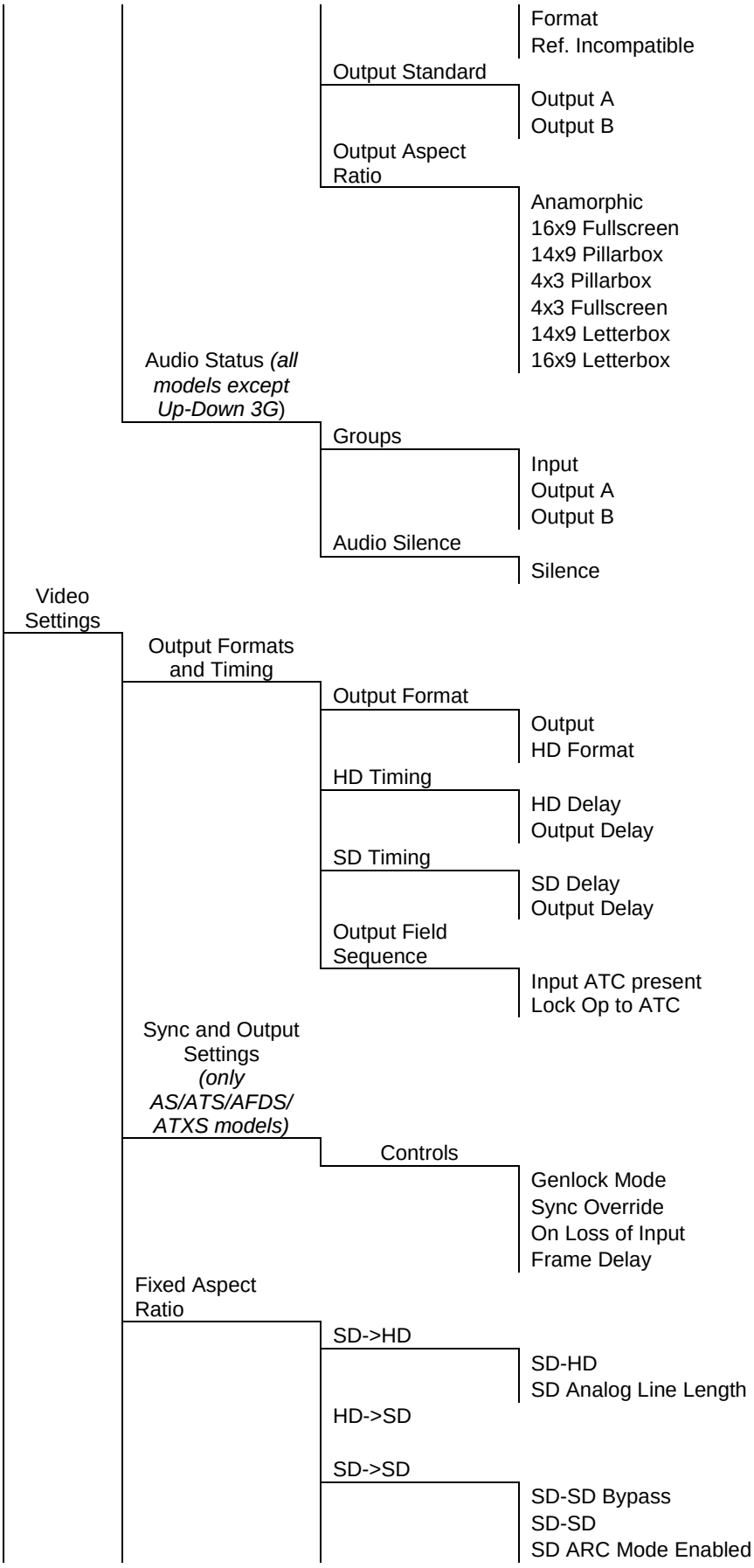
The values displayed on an active front panel are only updated when an adjustment is made and when changing menu level. If changes occur through the use of card edge controls or other remote control, the text displayed on the active front panel will not be updated immediately. If necessary, use the upward arrow to leave and then re-enter a menu to update the display.

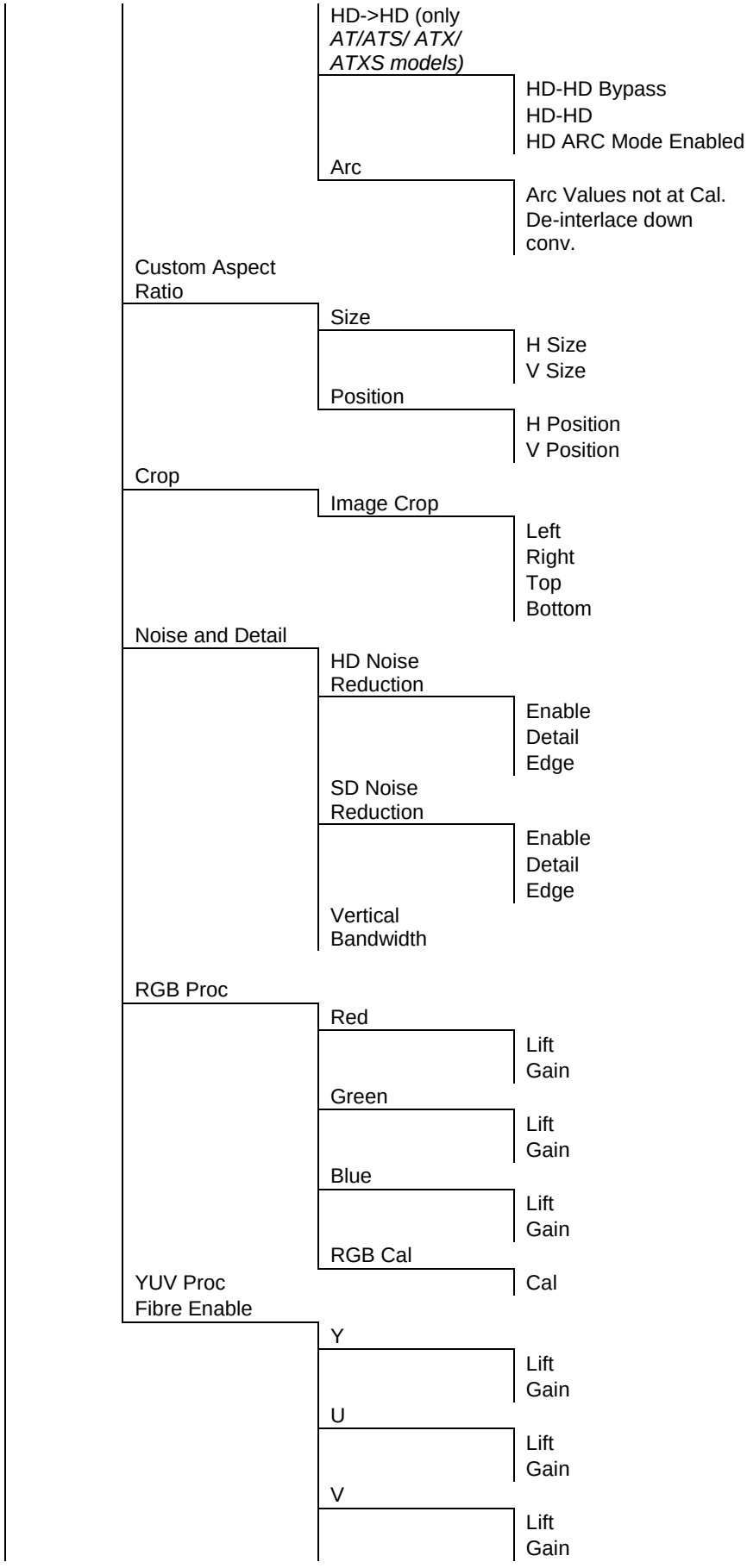
The following chart shows the available Up-Down 3G menus. The actual menus available may vary according to model and as software is updated.

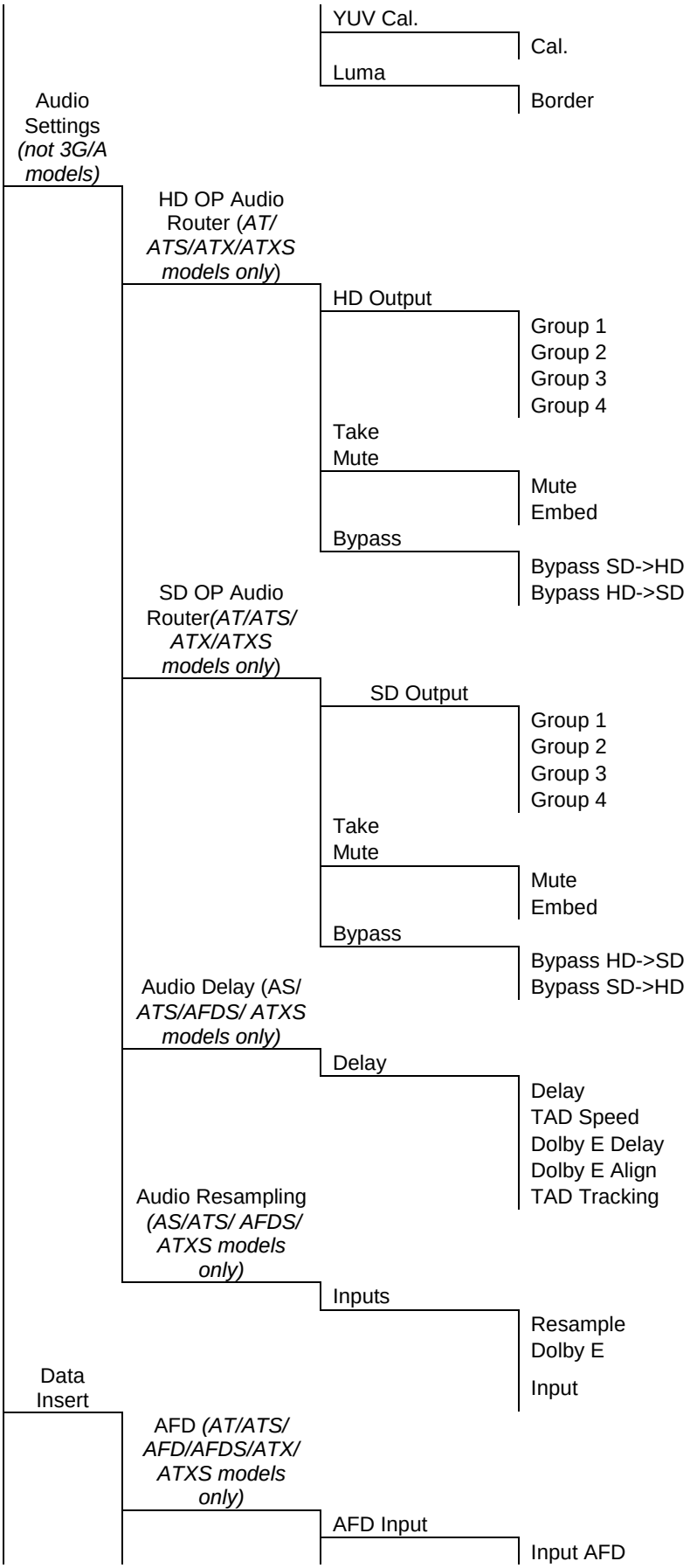
Menu Tree

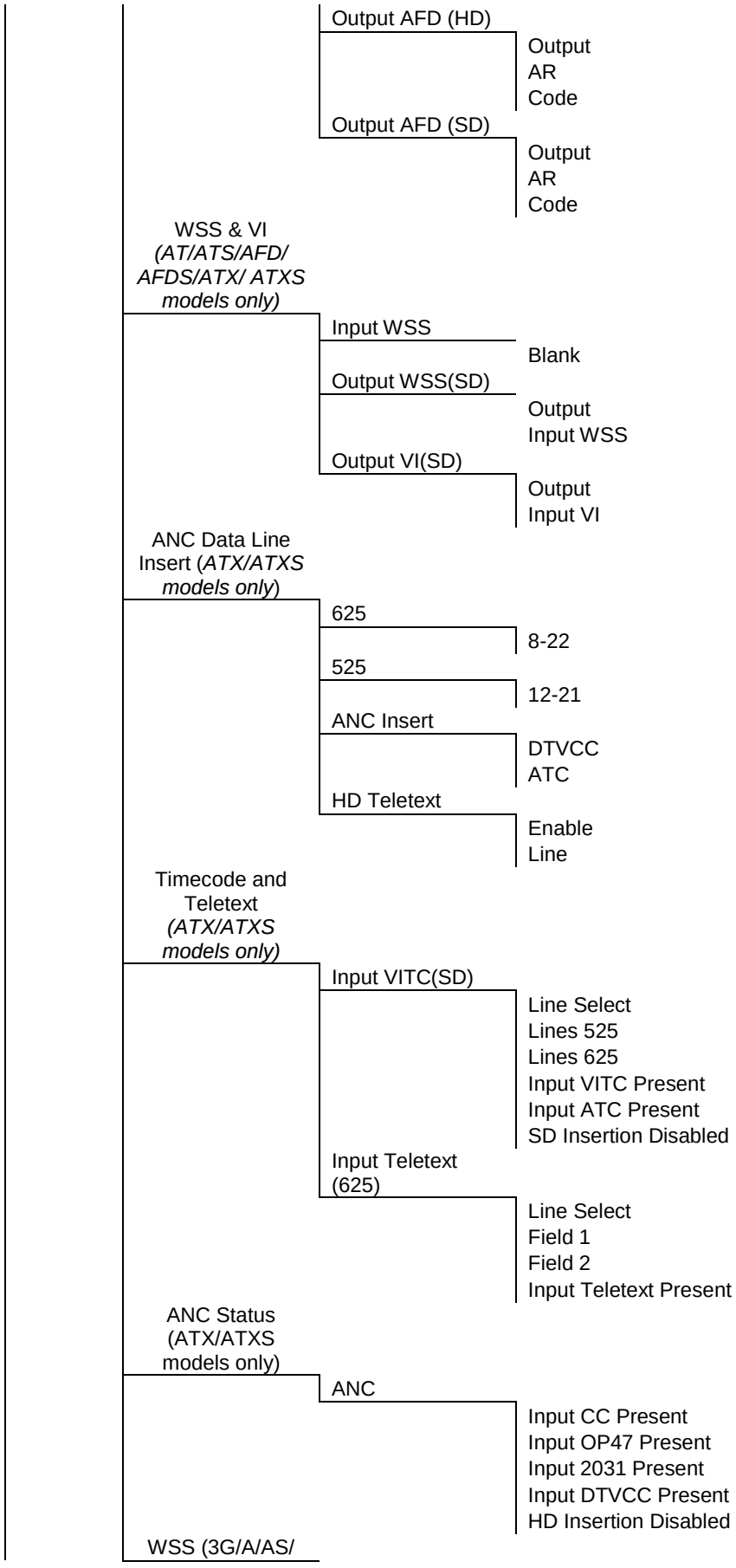
The basic menu structure for VisionWeb, card edge and front panel access is identical and consists of the following menus and sub-menus. Where the menu structure varies with model type, this is indicated in the chart below:

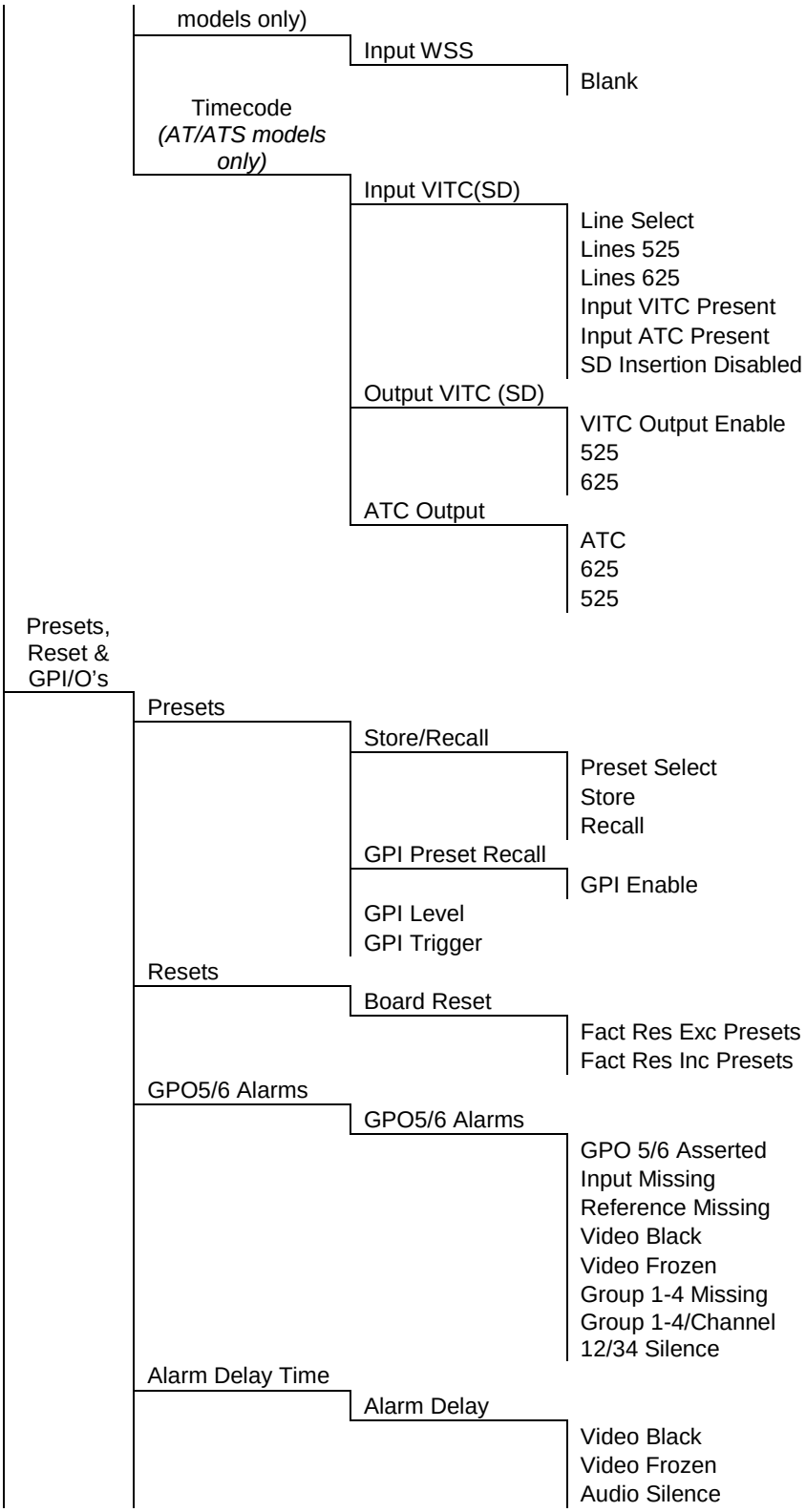



Format
Ref. Incompatible
Output Standard
Output A
Output B
Output Aspect Ratio
Anamorphic
16x9 Fullscreen
14x9 Pillarbox
4x3 Pillarbox
4x3 Fullscreen
14x9 Letterbox
16x9 Letterbox
Audio Status (all models except Up-Down 3G)
Groups
Input
Output A
Output B
Audio Silence
Silence
Video Settings
Output Formats and Timing
Output Format
Output
HD Format
HD Timing
HD Delay
Output Delay
SD Timing
SD Delay
Output Delay
Output Field Sequence
Input ATC present
Lock Op to ATC
Sync and Output Settings (only AS/ATS/AFDS/ ATXS models)
Controls
Genlock Mode
Sync Override
On Loss of Input
Frame Delay
Fixed Aspect Ratio
SD->HD
SD-HD
SD Analog Line Length
HD->SD
SD->SD
SD-SD Bypass
SD-SD
SD ARC Mode Enabled


HD->HD (only AT/ATS/ ATX/ ATXS models)
HD-HD Bypass
HD-HD
HD ARC Mode Enabled
Arc
Arc Values not at Cal.
De-interlace down conv.
Custom Aspect Ratio
Size
H Size
V Size
Position
H Position
V Position
Crop
Image Crop
Left
Right
Top
Bottom
Noise and Detail
HD Noise Reduction
Enable
Detail
Edge
SD Noise Reduction
Enable
Detail
Edge
Vertical Bandwidth
RGB Proc
Red
Lift
Gain
Green
Lift
Gain
Blue
Lift
Gain
RGB Cal
Cal
YUV Proc
Fibre Enable
Y
Lift
Gain
U
Lift
Gain
V
Lift
Gain


YUV Cal.
Cal.
Luma
Border
Audio Settings (not 3G/A models)
HD OP Audio Router (AT/ ATS/ATX/ATXS models only)
HD Output
Group 1
Group 2
Group 3
Group 4
Take
Mute
Mute
Embed
Bypass
Bypass SD->HD
Bypass HD->SD
SD OP Audio Router(AT/ATS/ ATX/ATXS models only)
SD Output
Group 1
Group 2
Group 3
Group 4
Take
Mute
Mute
Embed
Bypass
Bypass HD->SD
Bypass SD->HD
Audio Delay (AS/ ATS/AFDS/ ATXS models only)
Delay
Delay
TAD Speed
Dolby E Delay
Dolby E Align
TAD Tracking
Audio Resampling (AS/ATS/ AFDS/ ATXS models only)
Inputs
Resample
Dolby E
Input
Data Insert
AFD (AT/ATS/ AFD/AFDS/ATX/ ATXS models only)
AFD Input
Input AFD


Output AFD (HD)
Output AR Code
Output AFD (SD)
Output AR Code
WSS & VI (AT/ATS/AFD/ AFDS/ATX/ ATXS models only)
Input WSS
Blank
Output WSS(SD)
Output Input WSS
Output VI(SD)
Output Input VI
ANC Data Line Insert (ATX/ATXS models only)
625
8-22
525
12-21
ANC Insert
DTVCC ATC
HD Teletext
Enable Line
Timecode and Teletext (ATX/ATXS models only)
Input VITC(SD)
Line Select
Lines 525
Lines 625
Input VITC Present
Input ATC Present
SD Insertion Disabled
Input Teletext (625)
Line Select
Field 1
Field 2
Input Teletext Present
ANC Status (ATX/ATXS models only)
ANC
Input CC Present
Input OP47 Present
Input 2031 Present
Input DTVCC Present
HD Insertion Disabled
WSS (3G/A/AS/


models only)
Input WSS
Blank
Timecode
(AT/ATS models only)
Input VITC(SD)
Line Select
Lines 525
Lines 625
Input VITC Present
Input ATC Present
SD Insertion Disabled
Output VITC (SD)
VITC Output Enable
525
625
ATC Output
ATC
625
525
Presets, Reset & GPI/O's
Presets
Store/Recall
Preset Select
Store
Recall
GPI Preset Recall
GPI Enable
GPI Level
GPI Trigger
Resets
Board Reset
Fact Res Exc Presets
Fact Res Inc Presets
GPO5/6 Alarms
GPO5/6 Alarms
GPO 5/6 Asserted
Input Missing
Reference Missing
Video Black
Video Frozen
Group 1-4 Missing
Group 1-4/Channel 12/34 Silence
Alarm Delay Time
Alarm Delay
Video Black
Video Frozen
Audio Silence

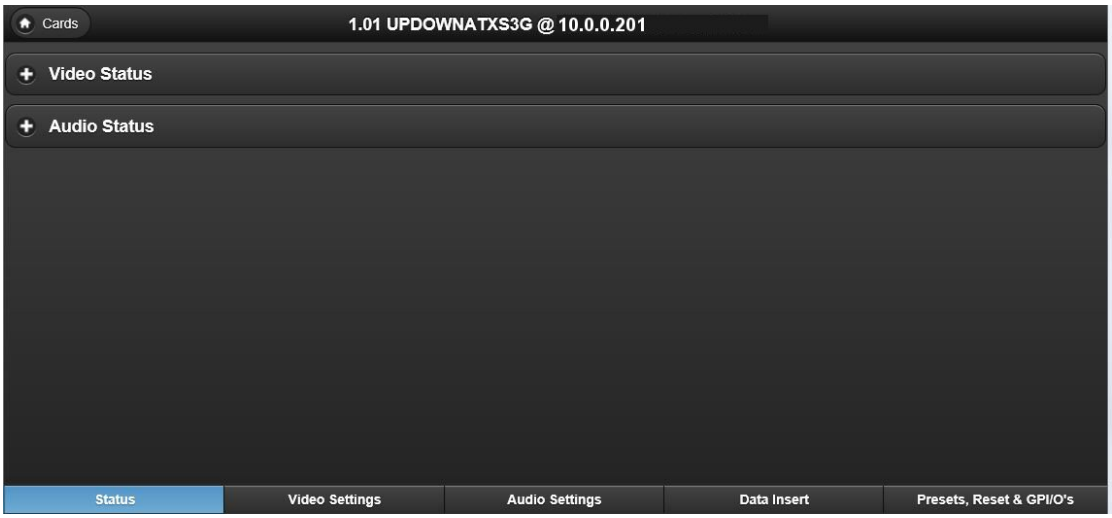
Controlling cards via VisionWeb

Crystal Vision cards use an XML file to create a control database that is used by the card's front-edge controller, the Indigo frame front panel controller and VisionWeb software. VisionWeb software offers a full range of controls with slider controls etc. similar to that available with the older Statesman PC software.

Accessing the Indigo Home page with a PC browser via the Ethernet connector of an Ethernet-enabled frame will display a list of the cards fitted (see Frame Manual for more details).

Indigo home page

The example above shows an Up-Down 3G card fitted in slot one and the frame's power supply and status monitor in slots 13 and 14. Clicking on the Up-Down 3G card will bring up the card's home page, for example:



Up-Down-ATXS 3G Status Page

12 Control Descriptions

The controls of Up-Down 3G are accessible from the front panel, the board edge or from Crystal Vision's 'VisionWeb' software. The description of controls used in this manual is based on VisionWeb GUI screen grabs but the path to locate controls via the front panel or board edge follows the same logic. For instance, in the VisionWeb GUI the input video 'Frozen' indicator is located in the '**Video Status/Input Video'** sub-menus of the '**Status'** menu. To find the same control using the card edge or front panel follow the path **Status->Video Status->Input Video** to the **Frozen** control.

VisionWeb GUI controls are accessed by menus at the bottom of the page which, when selected, offer sub-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 Up-Down 3G settings.

The description of the menus are in the order shown in the GUI i.e.

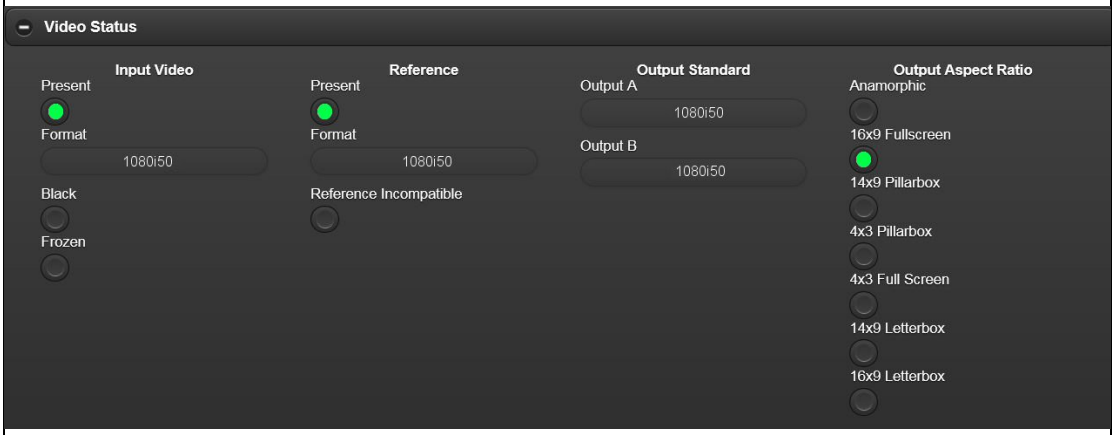
VIDEO STATUS, AUDIO STATUS, OUTPUT FORMATS AND TIMING, SYNC AND OUTPUT SETTINGS, FIXED ASPECT RATIO, CUSTOM ASPECT RATIO, CROP, NOISE AND DETAIL, RGB PROC, YUV PROC, FIBRE ENABLE, HD OP ROUTER, SD OP ROUTER, AUDIO DELAY, AUDIO RESAMPLING, AFD, WSS & VI, ANC DATA LINE INSERT, TIMECODE AND TELETEXT, ANC STATUS, WSS, PRESETS, RESETS, GPO ALARMS, ALARM DELAY TIME.

Each menu is shown with a screen grab and description of each control's function. Some menus and some controls are applicable to specific models only, in this case the model number(s) are indicated.

Status Menu

Video Status

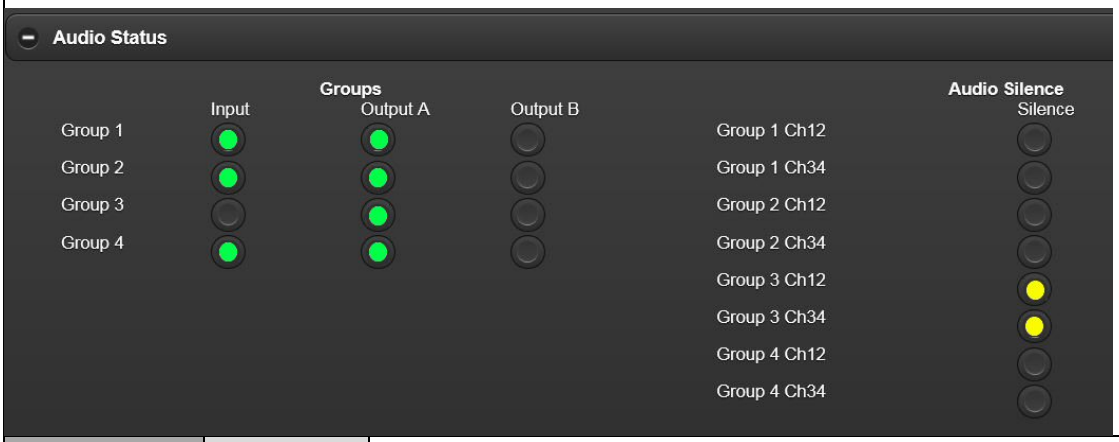
Display presence, standard and status of reference video signal.



Input Video	**Present**	**On if input video present.**
	Format	**The Input video standard is shown i.e. *IP 525, IP 625, IP 720p 50/59, IP 1080i50/59, IP 1080p50/59, IP Missing, IP Unknown.***
	Black	**On if input video at constant black level.**
	Frozen	**On if input video frozen (still frame).**
Reference *(AS / ATS / AFDS / ATXS models only)*	**Present**	**On when valid Black and Burst or tri-level video input present.**
	Format	**The external reference input standard is shown i.e. *1080p50/59.94, 1080i50/59.94, 720p50/59.94, 525, 625, Reference Missing, Unknown.***
	Incompatible	**On if reference signal incompatible with output video standard.**
Output Standard	**Output A**	**Displays selected standard of Output A video i.e. *OPA 525, OPA 625, OPA 720p 50/59, OPA 1080i50/59, OPA 1080p50/59, Missing.***
	Output B	**Displays selected standard of Output B video i.e. *OPB 525, OPB 625, OPB 720p 50/59, OPB 1080i50/59, OPB 1080p50/59, Missing.***
Output Aspect Ratio	**Displays selected output aspect ratio i.e. *Anamorphic, 16x9 Full Screen, 14x9 Pillarbox, 4x3 Pillarbox, 4x3 Full Screen, 14x9 Letterbox, 16x9 Letterbox.* This display indicates which aspect ratio correction is active and adjustable with the Custom Aspect Ratio controls.**	

Audio Status

Display presence of embedded audio signals and indicate if silent *(all models <u>except</u> Up-Down 3G).*

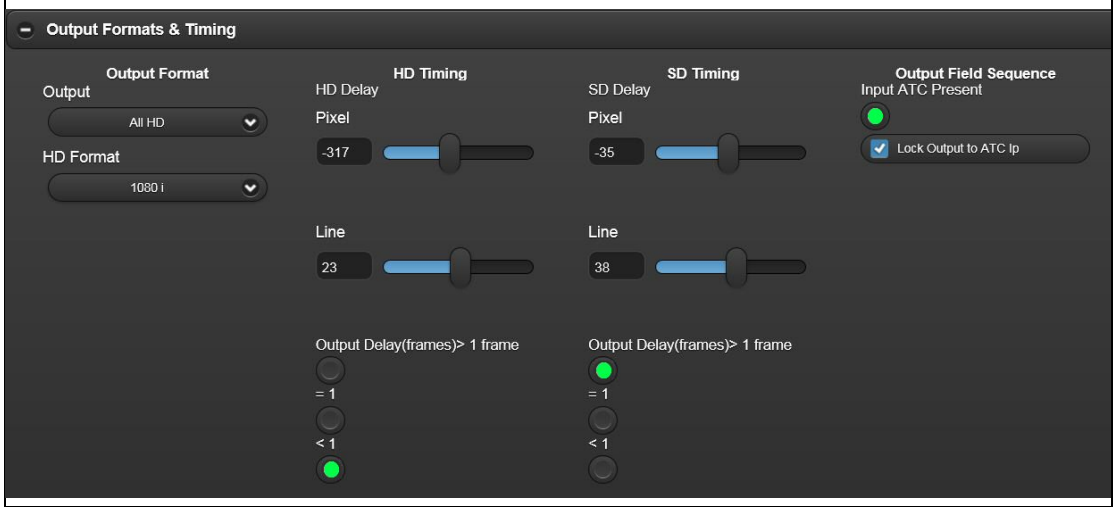


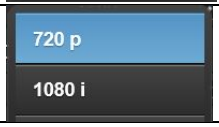
Group 1-4	**Input**	**On when the audio group is embedded into the video input.**
	Output A	**On when the audio group is embedded into video output A.**
	Output B	**On when the audio group is embedded into video output B.**
Audio Silence	**Group 1-4 Channels 1/2 & 3/4**	**On if the channel pairs are silent (<-63dbfs) for each of the four embedded audio groups.**

Video Settings Menu

Output Formats and Timing

Select output formats, delay video and lock progressive field sequence to ATC.

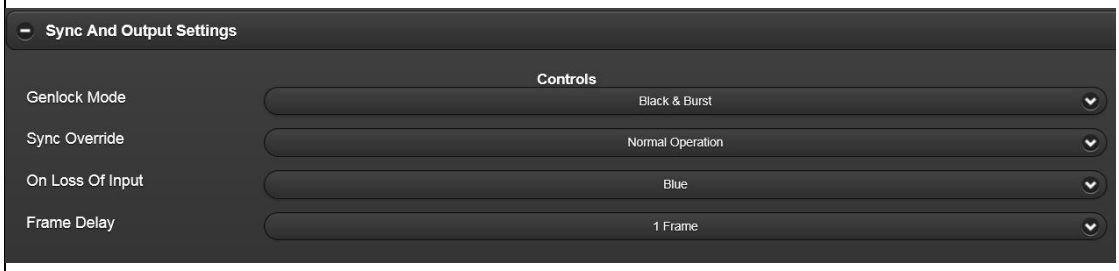


Output Format	**Output**		**Select which combination of output formats will be used for outputs A and B. Once configured, the output format will remain true for all input formats.**
	HD Format		**Select which format to use for HD outputs.**
HD/SD Timing	**Pixel/ Line**	**HD and SD both have separate controls giving output phase adjustment in both lines and pixels. If the timing reference is Black and Burst or tri-level syncs, with the controls set to zero the output will aligned with the timing reference. If the timing reference is the input, the delay at zero settings will be exactly one frame. This delay can be increased by up to two frames. The minimum delay through the board is one frame less 16 lines, any further negative delay will cause the delay to jump to two lines less the desired delay number.**	
	Output Delay	**Three LEDs give a visual indication of the status of the delay: Greater than one video frame; Equal to one frame; Less than one frame.**	

Output Field Sequence	**Input ATC Present**	**On if ancillary audio timecode is detected.**
	Lock Output to ATC Ip	**Select to use incoming ancillary data timecode to determine the field sequence when converting a High Definition progressive video input to an interlaced video output. This control is only active when a progressive video input is present. When disabled the field sequence of the interlaced output will free-wheel.**

Sync and Output Settings

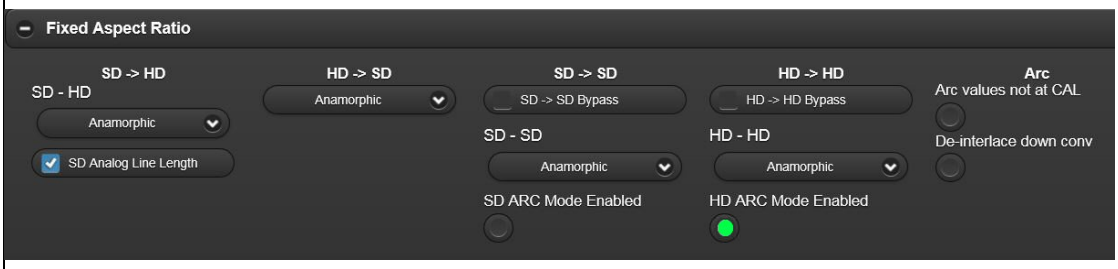
Select genlock source, operation in the event of loss of input or syncs, and video delay (*AS / ATS / AFDS / ATXS models only).*

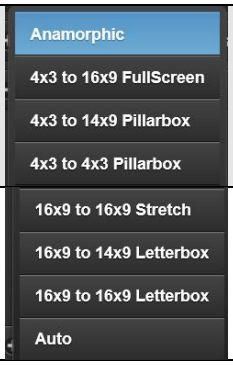


Genlock Mode	Video Input Tri-Level Syncs Black & Burst	**Select source of video reference to be the video input video or reference input using either tri-level syncs or black and burst.**
Sync Override	Normal Operation Override Sync	**In 'override sync' mode, should the input frame rate change to something other than that of the external reference, the Up-Down 3G will lock to the input. Once the reference conflict is resolved the output will relock to the external reference.**
On Loss of Input	Blue Black Freeze then Blue Freeze then Black Freeze	**Select video output in the event of lost input.**
Frame Delay	0 Frames 1 Frame 2 Frames 3 Frames	**Select video delay from 0 – 3 frames. (See Section *Delays*.)**

Fixed Aspect Ratio

Set Aspect Ratio Conversion ratios for all modes of operation.



SD-HD		**Select one of the aspect ratios for SD to HD conversion. See section** *Aspect Ratio Correction* **for details of each aspect ratio mode.** *Note*: Only first four options 'Anamorphic…4x3 to 4x3 Pillarbox' are available to *Up-Down 3G* and *Up-Down-A 3G* models.
SD Analog Line Length	**Select to set the SD output line length to be equal to analogue video.**	
HD-SD		**Select one of the aspect ratios for HD to SD conversion. See section** *Aspect Ratio Correction* **for details of each aspect ratio mode.** *Note*: Only first four options 'Anamorphic…16x9 to 16x9 Letterbox are available to *Up-Down 3G* and *Up-Down-A 3G* models.
SD-SD Bypass	**Select to bypass ARC in SD to SD mode whenever the input and the selected output format are both the same. In bypass mode the proc-amps will be disabled. AFD and WSS insertion will remain active.**	
SD-SD		**Select one of the aspect ratios for SD to SD conversion. See section** *Aspect Ratio Correction* **for details of each aspect ratio mode.** *Note*: Only first seven options 'Anamorphic…16x9 to 16x9 Letterbox available to *Up-Down 3G* and *Up-Down-A 3G* models.

		
SD ARC Mode Enabled	**On if the ARC is enabled in SD to SD mode i.e. active and not bypassed.**	
HD-HD Bypass	**Select to bypass ARC in HD to HD mode whenever the input and the selected output format are both the same. In bypass mode the proc-amps will be disabled. AFD and WSS insertion will remain active.** *Note:* This option only available for *AT / ATS / ATX / ATXS* models.	
HD-HD		**Select one of the aspect ratios for HD to HD conversion. See section** *Aspect Ratio Correction* **for details of each aspect ratio mode.** *Note:* These options are only available for *Up-Down AT / ATS / ATX / ATXS* models and are functional when all output formats are the same as the input format.
HD ARC Mode Enabled	**On if the ARC is enabled in HD to HD mode i.e. active and not bypassed.** *Note:* This option only available for *Up-Down AT / ATS / ATX / ATXS* models and is functional when all output formats are the same as the input format.	
ARC Values not at Cal.	**On if the active ARC size or position has been adjusted and is no longer at its default values.**	
De-interlace down conversion	**On when output video has been de-interlaced following down conversion.**	

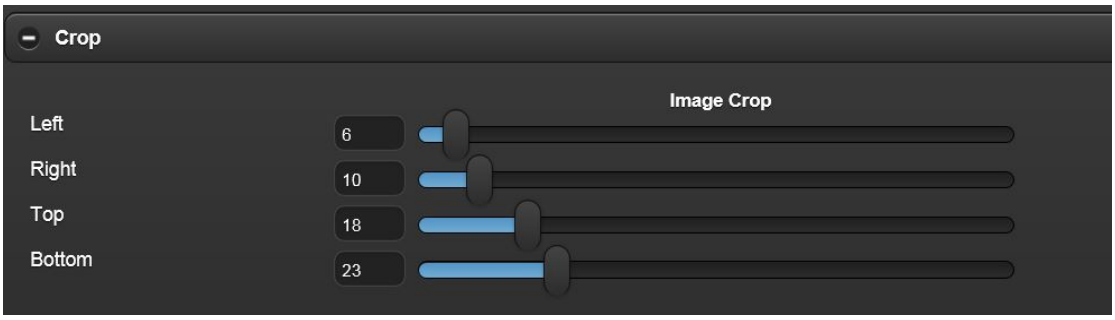
Custom Aspect Ratio

Adjust size and position of the currently active aspect ratio.

H/V Size	**These controls alter the output image size. These adjustments will be recalled whenever the currently active aspect ratio is re-selected. The active aspect ratio is shown by the 'Output Aspect Ratio' indicator in the Video Status menu.**
X/Y Position	**Adjust position of output image. These adjustments will be recalled whenever the currently active aspect ratio is re-selected.**

Crop

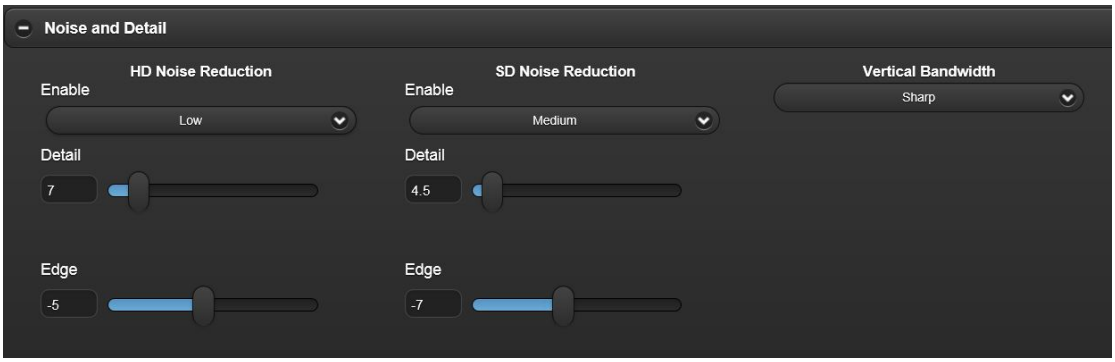
Adjust the size of the output image.



Left/ Right / Top / Bottom	**Adjust the size of the output image.**

Noise and Detail

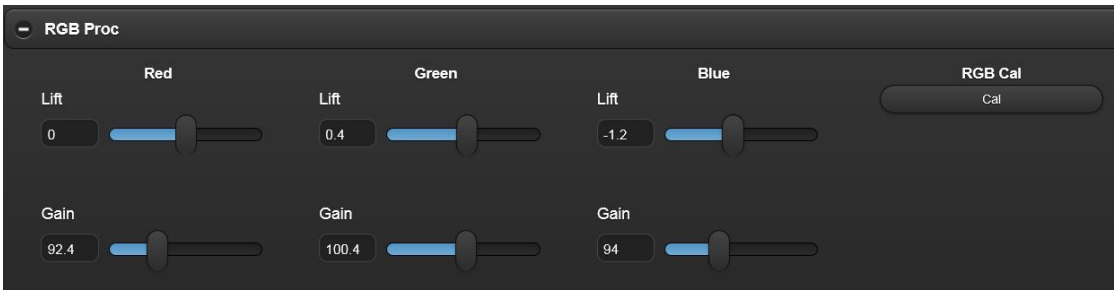
Select noise reduction and image enhancement options.



Enable		**Select amount of noise reduction for HD and SD outputs. *Note*: *Noise reduction, detail enhancement and edge enhancement can only be applied to the main converter; this imposes certain restrictions to the use of the noise reduction and enhancements controls. See section 'Noise Reduction' for details of when these controls are operational.***
Detail		**Set amount of detail enhancement for HD and SD outputs. This control will sharpen the entire image. See note above for restrictions.**
Edge		**Set amount of edge enhancement for HD and SD outputs. This control applies sharpening to the object edges only and produces a sharpening effect without making noise more visible. See note above for restrictions.**
Vertical Bandwidth		**When down converting to Standard Definition the vertical bandwidth can be optimised for a given application by selecting the most appropriate vertical bandwidth filtering. There are four filters to select from, ranging from the highest (sharpest) to the lowest (softest).**

RGB Proc

Control the lift and gain of the Red, Green and Blue components.



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

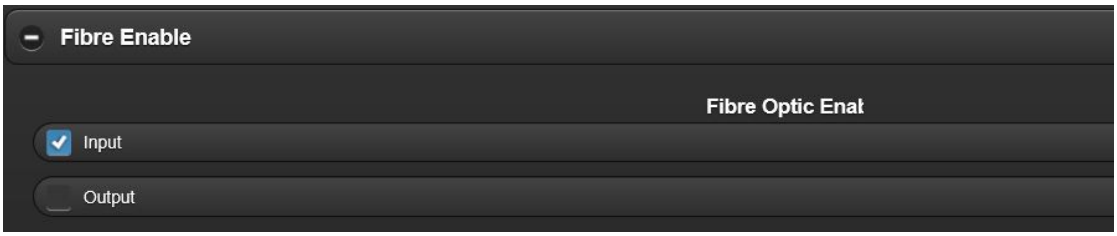
YUV Proc

Control the lift and gain of the YUV components.

Lift	**Apply a positive or negative DC offset to the black level of the Y, U and V components of the video path.**
Gain	**Apply 0 to 200% gain to the Y, U and V components of the video path.**
Cal.	**Return Lift and Gain for all components to their calibrated values of 0 lift and 100% gain.**
Border	**Adjust the luminance of the border around aspect ratio corrected pictures between black and peak white.**

Fibre Enable

Select fibre-optic I/O options.

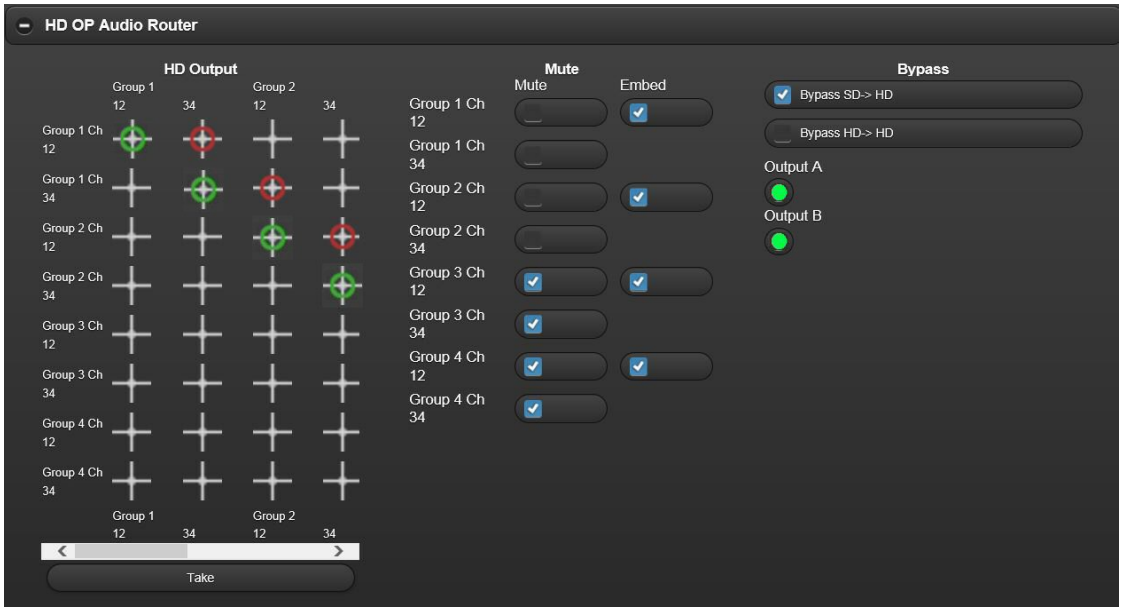


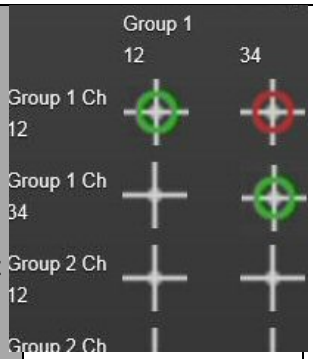
Input	**Select optical as the video input. The optional SPF module and correct rear module must be fitted for optical input.**
Output	**Select optical as the video output. The optional SPF module and correct rear module must be fitted for optical output.**

Audio Settings Menu

HD OP Audio Router

Select audio embedding options for HD outputs (*AT / ATS / ATX / ATXS models only*).

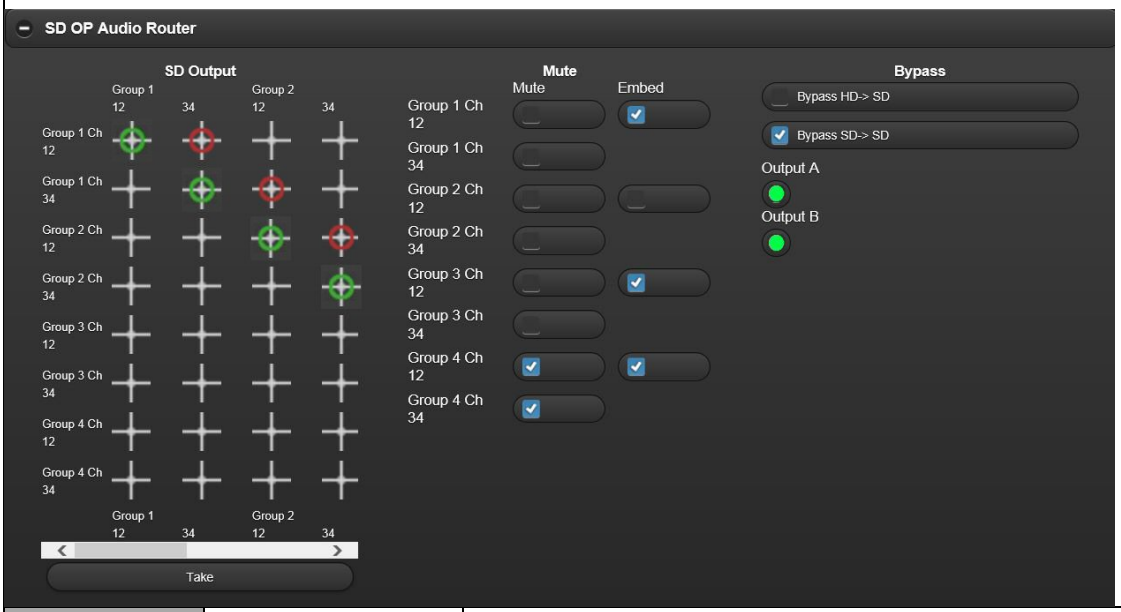


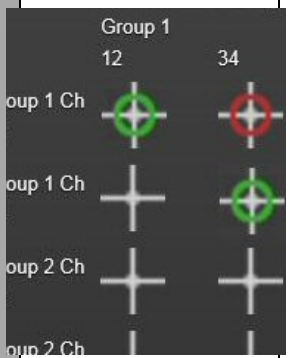
HD Output 	**Select which embedded audio inputs are to be re-embedded at the output. Current selections are shown as green circles, pre-selected selections (red circles) are the crosspoints to be routed when the 'Take' button is pressed. The inputs shown along the top of the matrix are, or will be, routed to the embedded output channels shown on the left hand side (use the scroll bar at the bottom of the matrix to view all 16 inputs). Clicking on the intersection of the input and output will show a red circle which will change to green when the 'Take' control is selected. All crosspoints can be pre-selected. The screen grab above shows de-embedded inputs Group 1 C3,4 and Group 2 C1-4 preselected to embedded channels Group 1 C1-4 and Group 2 C1,2. Embedded inputs can be routed to several outputs if required.**
Take	**Switch all pre-selected crosspoints in one go.**
Mute	**Mute the selected audio pairs.**
Embed	**Select to embed the audio group.**

Bypass SD->HD/ Bypass HD->HD	**The audio sent to an output can be set to bypass the routers under certain selected circumstances. These conditions can be set individually according to the output format so that if these conditions are met, the input embedded audio will appear on the output in the same positions as the input. If these conditions are not met, the audio will be placed according to the router. There are separate controls for both High Definition and Standard Definition.**
Output A	**On if Output A is HD.**
Output B	**On if Output B is HD.**

SD OP Audio Router

Select audio embedding options for SD outputs *(AT / ATS / ATX / ATXS models only)*.



SD Output 	**Select which embedded audio inputs are to be re-embedded at the output. Current selections are shown as green circles, pre-selected selections (red circles) are the crosspoints to be routed when the 'Take' button is pressed. The inputs shown along the top of the matrix are, or will be, routed to the embedded output channels shown on the left hand side (use the scroll bar at the bottom of the matrix to view all 16 inputs). Clicking on the intersection of the input and output will show a red circle which will change to green when the 'Take' control is selected. All crosspoints can be pre-selected. The screen grab above shows de-embedded inputs Group 1 C3,4 and Group 2 C1-4 preselected to embedded channels Group 1 C1-4 and Group 2 C1,2. Embedded inputs can be routed to several outputs if required.**
Take	**Switch all pre-selected crosspoints in one go.**
Mute	**Mute the selected audio pairs.**

Embed	**Select to embed the audio group.**
Bypass HD->SD/ Bypass SD->SD	**The audio sent to an output can be set to bypass the routers under certain selected circumstances. These conditions can be set individually according to the output format so that if these conditions are met, the input embedded audio will appear on the output in the same positions as the input. If these conditions are not met, the audio will be placed according to the router. There are separate controls for both High Definition and Standard Definition.**
Output A	**On if Output A is SD.**
Output B	**On if Output B is SD.**

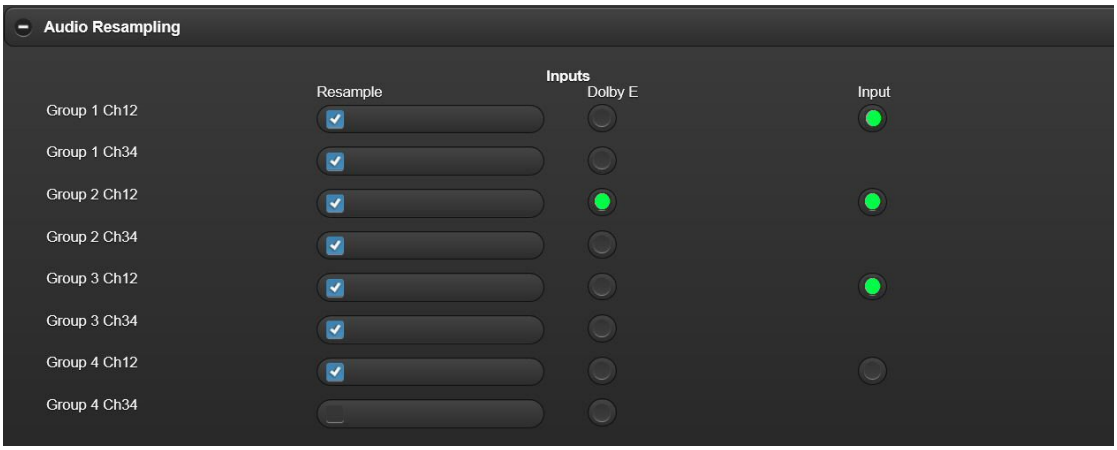
Audio Delay

Select audio delay options *(AS / ATS / AFDS / ATXS models only).*

Delay	**This control is used to delay the audio between 0 and 120mS with respect to the video and compensate for any small delay between the incoming video and audio signals.**	
TAD Speed	0.05 % 0.10 % 0.20 % 0.40 % 0.80 %	**This sets the time the audio delay takes to track fast or abrupt changes in video delay, when TAD tracking is on. The faster the rate of change, the quicker the audio delay will match changes in video delay so minimising lip-sync errors, but at the expense of a matching change of musical pitch. Refer to the section 'Delays' for more help with TAD speed settings for different applications.**
Dolby E Delay	0 Frames 1 Frame 2 Frames 3 Frames	**Delay Dolby E encoded signals by up to three frames in one frame increments.**
Dolby E Align	**Enable Dolby E alignment to ensure correct positioning of the guardband. Dolby E Align mode will limit the minimum video delay to 0.5 frames.**	
TAD Tracking	**On if TAD tracking is enabled.**	

Audio Resampling

Select audio embedding options for HD outputs *(AS / ATS/ AFDS / ATXS models only).*

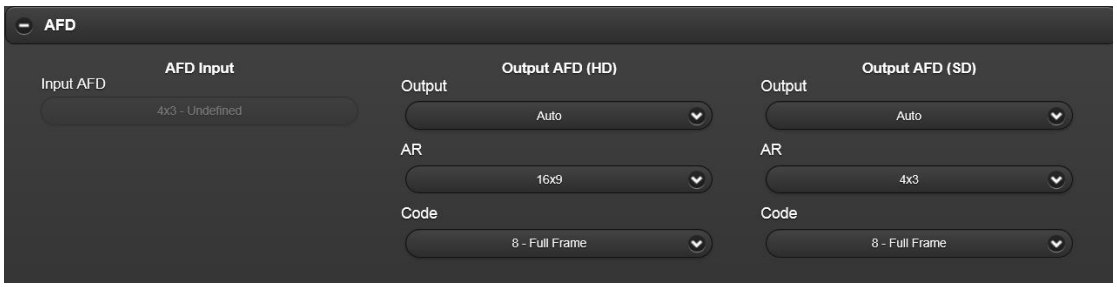


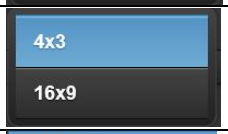
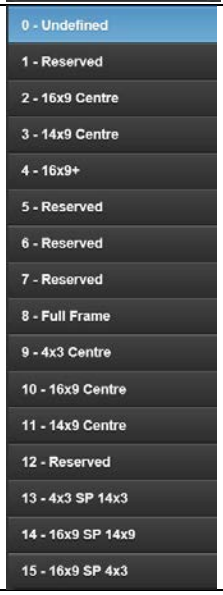
Resample	**The Resample control affects how the audio data is manipulated to change the PCM delays. On resampled channels (resample enabled) the audio will be continuously resampled allowing seamless changes in audio delay. On non-resampled channels (resample not enabled) samples will be passed unchanged through the signal path: if the delay has to change, single audio samples will be dropped or repeated as required. This control has no effect on channels containing Dolby E which is automatically detected and bypasses the resamplers.**
Dolby E	**On when an audio input pair is Dolby E encoded.**
Input	**On when an audio input group is detected.**

Data Insert Menu

AFD

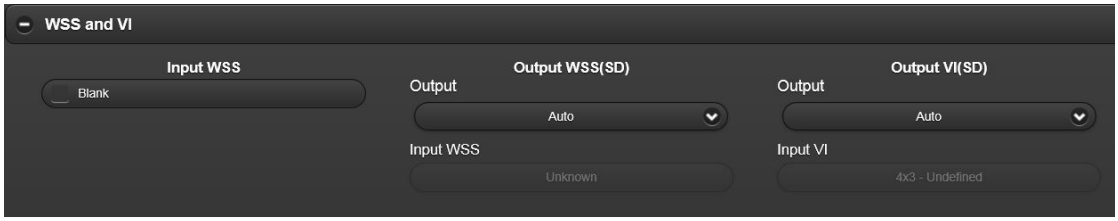
Select AFD output options for HD and SD outputs (AT / ATS / AFD / AFDS / ATX / ATXS models only).



Input AFD	**Displays incoming AFD descriptor i.e. 'undefined, full frame,16:9 centre' etc. (See *Output AFD, WSS and VI* for more information.)**	
Output		**Select mode control 'Auto' to automatically set the AFD output codes based on the output aspect ratio and incoming AFD codes. Select 'Pass' to use the incoming AFD code.**
AR		**Select aspect ratio of entire image. For instance if the output is a 16:9 letterbox image within a 4:3 frame, select 4:3 for AR and Code '10'.**
Code		**Code for active image area. See *Output AFD, WSS and VI* for more information.**

WSS and VI

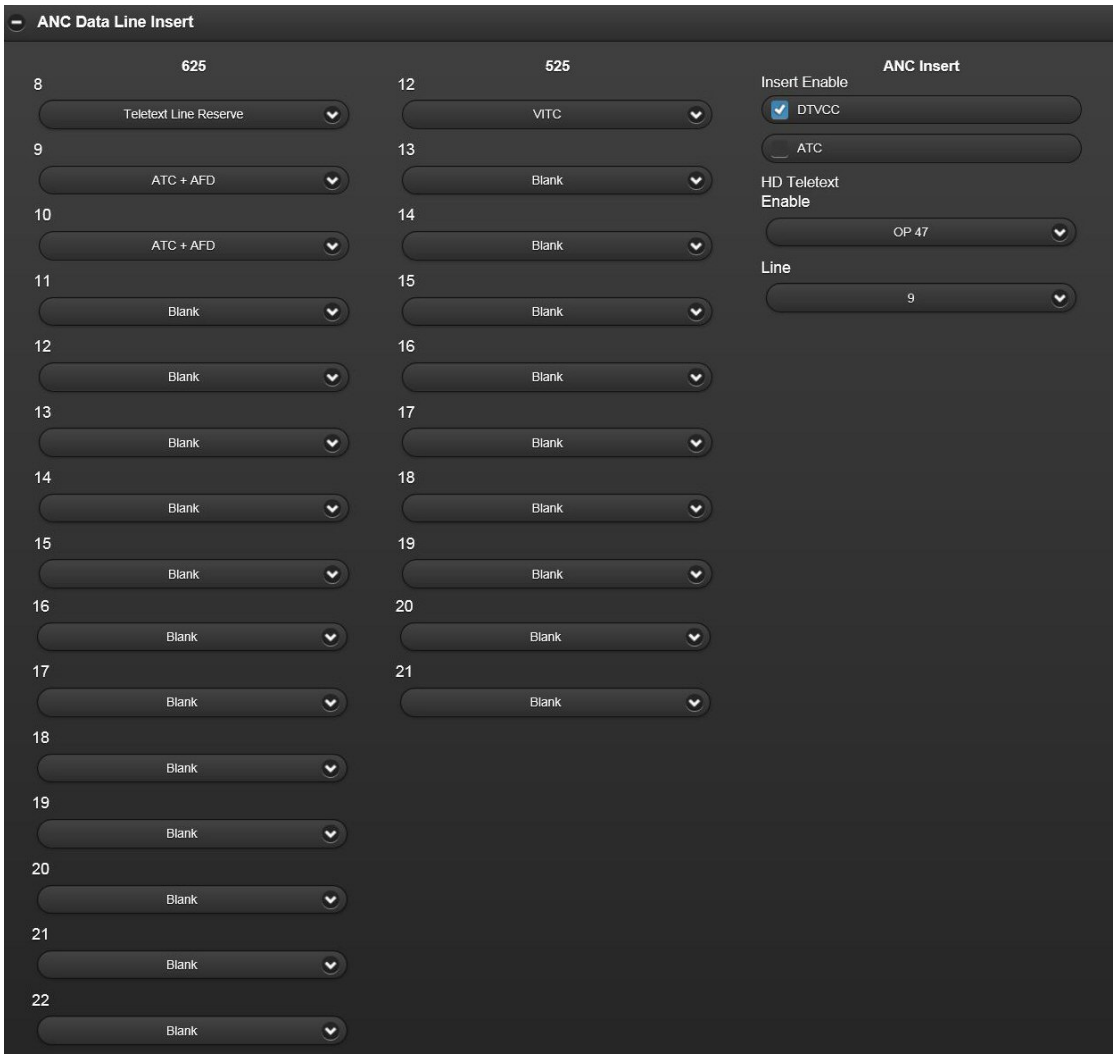
Select widescreen signalling options for PAL SD outputs *(AT / ATS / AFD / AFDS / ATX / ATXS models only).*



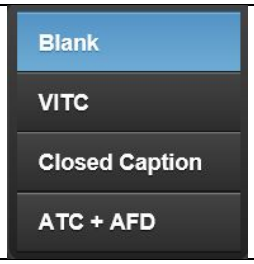
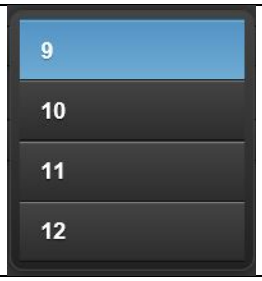
Blank	**Blank incoming WSS data.**
Output WSS	 **Output widescreen signalling can be set to automatically follow the input AFD data or be manually selected. If WSS data should be present on the input video, this can either be passed to the output unchanged or substituted for a user selectable code. WSS data can also be set to be blanked. It is only possible to insert WSS information into a PAL output.**
Input WSS	**Display incoming WSS codes i.e. '4:3 Full, 14:9 Letterbox Centre' etc. See *Output AFD, WSS and VI* for more information.**
Output VI	 **Video indexing can also be inserted into the output video for use by downstream equipment. Select 'Auto' to mirror the conversion setting; select 'Manual' to follow the output WSS settings above; select 'Disable' to insert blank VI data; or select 'Pass' to route the input data to the output unchanged.**
Input VI	**Display incoming VI codes i.e. 'Reserved, Box 16:9 Top' etc. See *Output AFD, WSS and VI* for more information.**

ANC Data Line Insert

Select line number and other options for ANC insertion (*ATX / ATXS models only*).

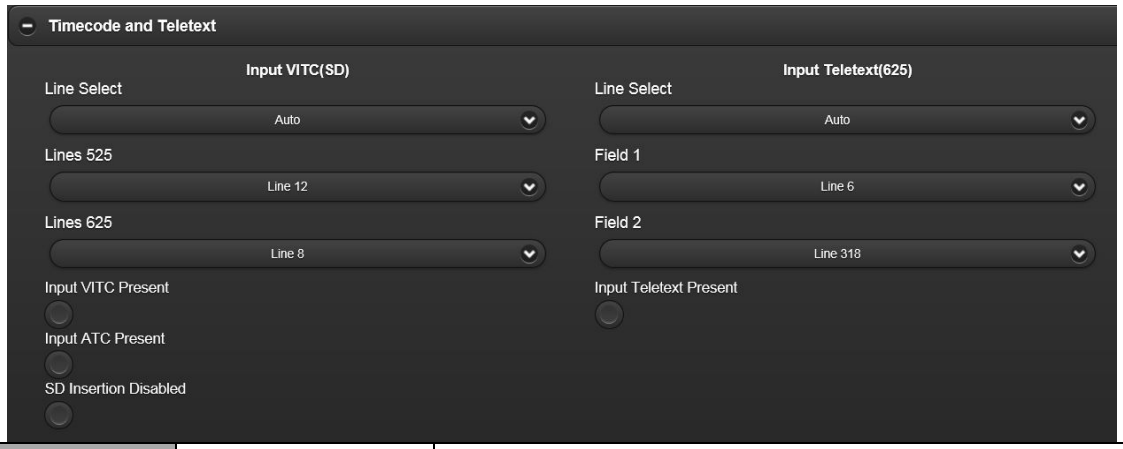


625 lines 8-22		**For each of the television lines 8-22, select the data to be inserted into 625-line SD. VITC code is always repeated on two adjacent video lines, one in each field. Select 'Teletext Line Reserve' to insert teletext or subtitle data when down-converting from a HD source. Select 'ATC+AFD' to insert ancillary timecode and AFD.** **If the ATC output is disabled, the AFD+ATC line number will still select the line number, on which AFD will appear for down-converted SD outputs.**

525 lines 12-21		**For each of the television lines 12-21, select the data to be inserted into 525-line SD. Note: For 525 outputs, having both AFD and VI on line 14 is not possible. To get AFD on line 14, VI needs to be disabled. ATC, AFD and VITC are output on both fields.**
DTVCC	**Enabling the DTVCC function will transport closed captions across definitions: when down converting CEA-708 closed caption data will be output as the corresponding CEA-608 closed caption data. When up converting the CEA-608 data will be inserted into the appropriate section of CEA-708. The 525-line line number can be selected using the 525 ANC line control for the reinsertion of the closed caption data in the output video waveform.**	
ATC	**The Output ATC control, when enabled, will allow the translation of HD ancillary timecode and SD VITC depending on whether up converting or down converting. The ANC line selection controls will allow the line or lines to be selected for reinsertion.**	
HD Teletext Enable		**When up converting from SD to HD, incoming teletext information can be inserted into the HD signal as OP-47 or SMPTE 2031 packets. Using the HD Teletext Line selection control (below) will set the line or lines in the HD output signal to carry this data.**
HD Teletext Line		**Select the HD line number to insert decoded OP-47 or SMPTE 2031 teletext or subtitle data when up converting.**

Timecode and Teletext

Select line numbers to read VITC and Teletext *(ATX / ATXS models only).*



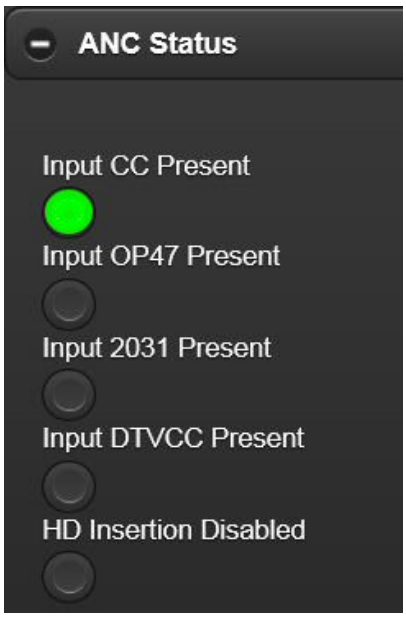
Input VITC Line Select		**The Line Select control allows the SD input timecode (VITC) to be either automatically detected, the individual line to be manually selected or timecode extraction disabled. When manual mode is selected the line containing the VITC data can be selected using the 525 or 625 line selection control.**
Lines 525		**In 525 line SD, VITC would normally be inserted into the vertical interval of a single TV line between line 12 and line 21 and then repeated two lines later. Timecode is inserted into the second field using the corresponding interlaced line number. Select the first line of the Field 1 pair containing VITC. The corresponding lines from F2 will be automatically selected. So by selecting Line 12, for instance, the timecode reader will look for VITC on F1 lines 12 and 14 (repeated) and F2 lines 275 and 277.**

Lines 625		**In 625 line SD, VITC would normally be inserted into the vertical interval of a single TV line between line 8 and line 22 and then repeated two lines later. Timecode is inserted into the second field using the corresponding interlaced line number. Select the first line of the Field 1 pair containing VITC. The corresponding lines from F2 will be automatically selected. So by selecting Line 8, for instance, the timecode reader will look for VITC on F1 lines 8 and 10 (repeated) and F2 lines 321 and 323.**
Input VITC Present	**On if VITC is detected in the selected lines.**	
Input ATC Present	**On if Ancillary timecode is detected.**	
SD Insertion Disabled	**On if timecode insertion into SD outputs is disabled.**	
Input Teletext Line Select		**In order to allow the maximum flexibility, control of the line selection for both field 1 and field 2 of the incoming Standard Definition video signal is given. This selection is under the control of the line mode selector. Selecting Field 1 or Field 2 will take any teletext data from whichever line has been selected and present it ready for reinsertion as digital data in the High Definition output. Selecting Field 1 and Field 2 will make a combination of the information from both lines of both fields. If Auto mode is selected all data on all lines of both fields will be combined and inserted into the High Definition output.**
Field 1		**Select lines 6-22 as the Teletext source in Field 1.**

Field 2		**Select lines 318-335 as the Teletext source in Field 2.**
Input Teletext Present	**On if Teletext is detected on the selected lines.**	

ANC Status

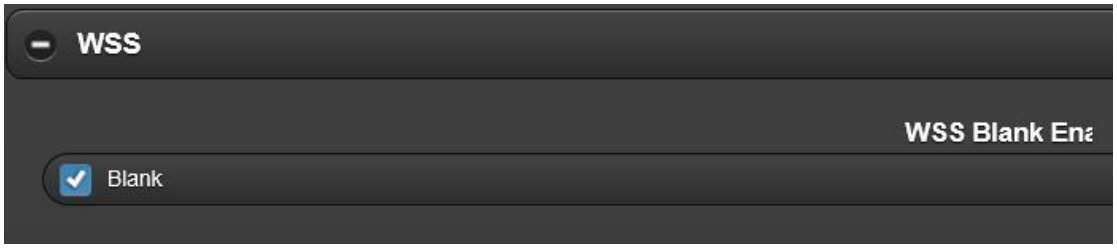
Display status of ANC data space in HD inputs *(ATX / ATXS models only).*



Input CC / OP47 / 2031 / DTVCC Present	**On when Closed Caption, HD Teletext or DVTCC is detected in the VANC area.**
HD Insertion Disabled	**On when ANC insertion into HD video is disabled. See menu *ANC Data Line Insert*'.**

WSS

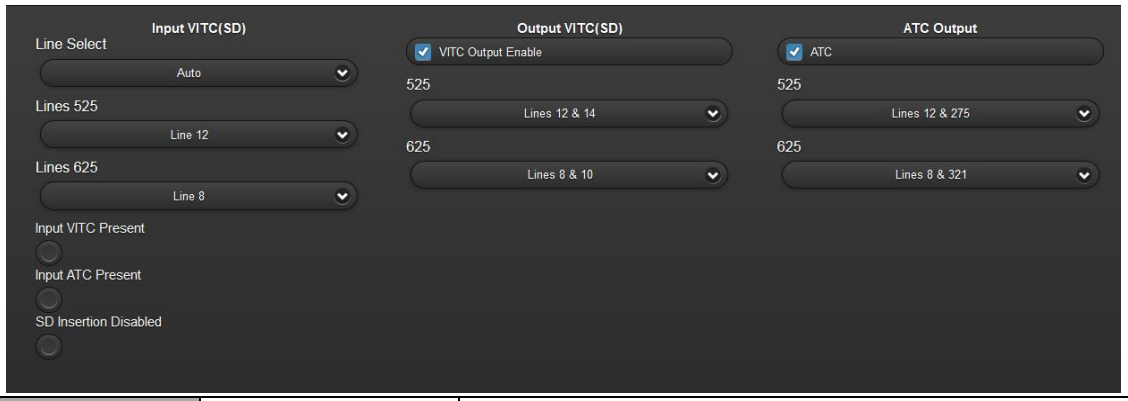
Blank Widescreen Signalling input *(3G / A / AS models only).*



Blank	**Select to blank incoming WSS data.**

Timecode

Select line numbers to read and output VITC *(AT/ ATS models only).*



Input VITC Line Select		**The Line Select control allows the SD input timecode (VITC) to be either automatically detected, the individual line to be manually selected or timecode extraction disabled. When manual mode is selected, the line containing the VITC data can be selected using the 525 or 625 line selection control.**
Lines 525		**In 525 line SD, VITC would normally be inserted into the vertical interval of a single TV line between line 12 and line 21 and then repeated two lines later. Timecode is inserted into the second field using the corresponding interlaced line number. Select the first line of the Field 1 pair containing VITC. The corresponding lines from F2 will be automatically selected. So by selecting Line 12, for instance, the timecode reader will look for VITC on F1 lines 12 and 14 (repeated) and F2 lines 275 and 277.**

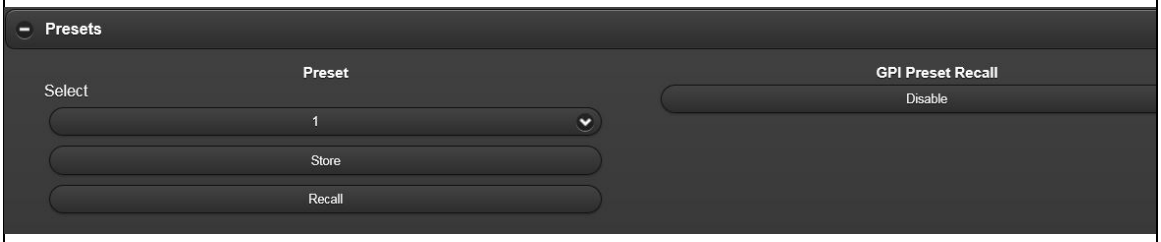
Lines 625		**In 625 line SD, VITC would normally be inserted into the vertical interval of a single TV line between line 8 and line 22 and then repeated two lines later. Timecode is inserted into the second field using the corresponding interlaced line number. Select the first line of the Field 1 pair containing VITC. The corresponding lines from F2 will be automatically selected. So by selecting Line 8, for instance, the timecode reader will look for VITC on F1 lines 8 and 10 (repeated) and F2 lines 321 and 323.**
Input VITC Present	**On if VITC is detected in the selected lines.**	
Input ATC Present	**On if Ancillary Timecode is detected.**	
SD Insertion Disabled	**On if timecode insertion into SD outputs is disabled.**	
VITC Output Enable	**Select to enable SD VITC insertion into the selected lines.**	
Output VITC 525		**In 525 line SD, VITC would normally be inserted into the vertical interval of a single TV line between line 12 and line 21 and then repeated two lines later. Timecode is inserted into the second field using the corresponding interlaced line number. Select the first line of the Field 1 pair containing VITC. The corresponding lines from F2 will be automatically selected. So by selecting Line 12, for instance, timecode will be generated on F1 lines 12 and 14 (repeated) and F2 lines 275 and 277.**

Output VITC 625		**In 625 line SD, VITC would normally be inserted into the vertical interval of a single TV line between line 8 and line 22 and then repeated two lines later. Timecode is inserted into the second field using the corresponding interlaced line number. Select the first line of the Field 1 pair containing VITC. The corresponding lines from F2 will be automatically selected. So by selecting Line 8, for instance, timecode will be generated on F1 lines 8 and 10 (repeated) and F2 lines 321 and 323.**
ATC Output ATC	**The Output ATC control, when enabled, will allow the translation of HD Ancillary Timecode and SD VITC depending on whether up converting or down converting. The ANC line selection controls will allow the line or lines to be selected for reinsertion.**	
ATC Output 525		**Select the lines that ATC timecode will be inserted when up converting to HD in 525.**
ATC Output 625		**Select the lines that ATC timecode will be inserted when up converting to HD in 625.**

Presets, Resets & GPI/Os

Presets

Up to 16 user-defined configurations may be stored and recalled either from VisionWeb or through the use of external GPIs. Presets store the board setup data including operating mode card status. The presets are numbered 1-16.



Preset select		**Store or recall Up-Down 3G's configuration to one of 16 memory locations.**
GPI Preset Recall		**Recall previously saved presets via the external GPI port. Select either a change in level or a pulse to trigger the GPI recall. See *General Purpose Interface* for more information on GPIs.**

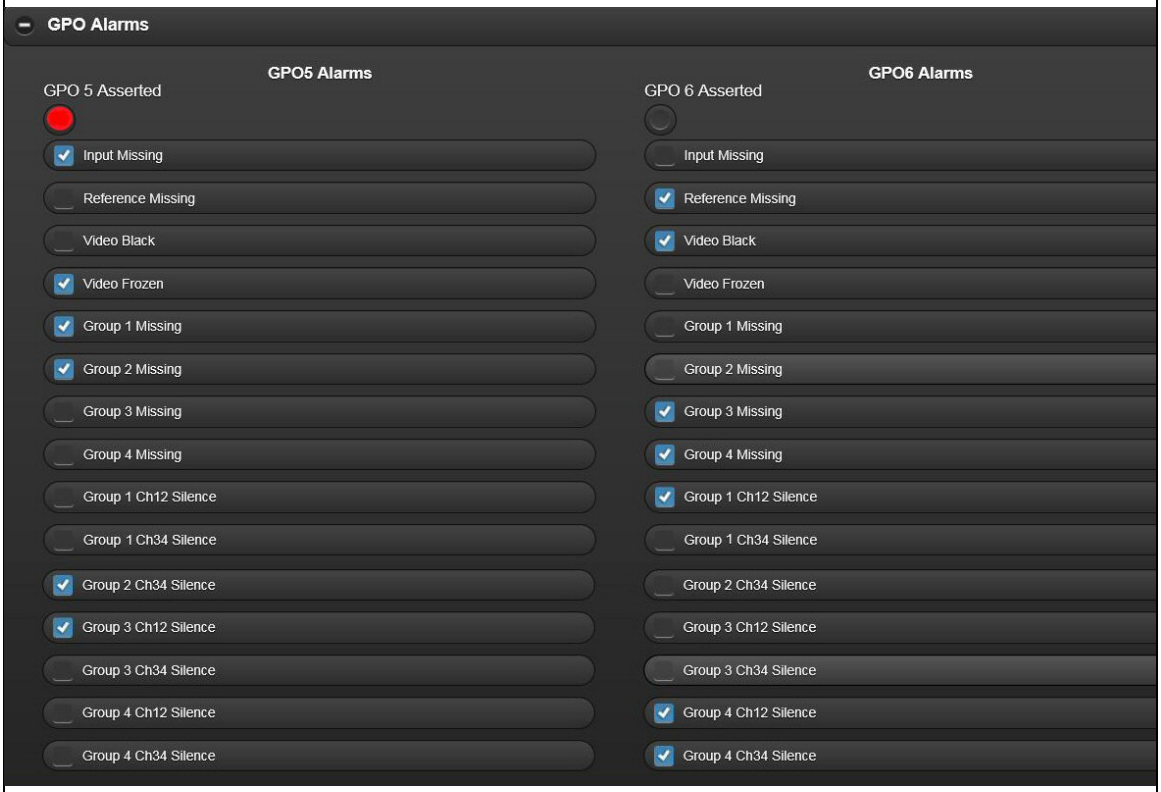
Resets

Reset the board to its default settings

Fact. Res Exc Preset	**Reset the board to default settings but leave preset memories unaffected (see section *Defaults*).**
Fact. Res Inc Preset	**Reset the board to default settings and erase preset memories.**

GPO Alarms

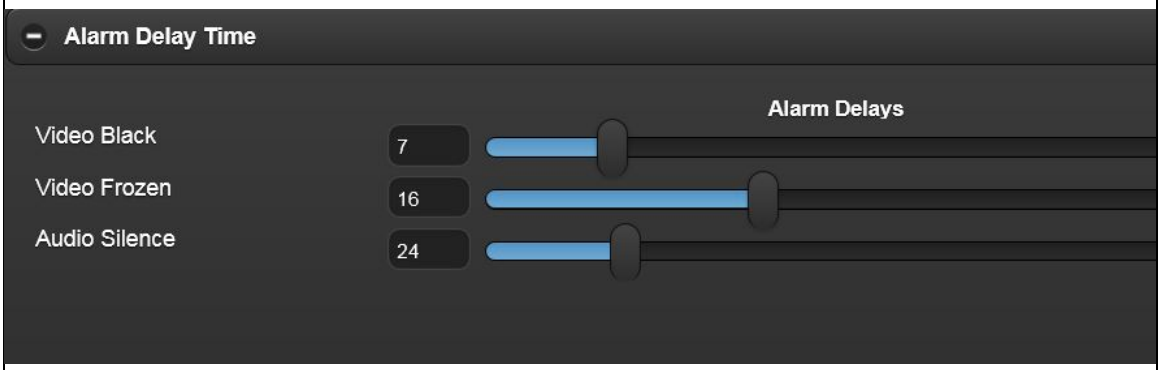
Set the conditions that trigger GPO alarms 5 and 6.



GPO 5/6 Asserted	**On when alarm conditions have been met.**
Input Missing	**Select to assert alarm if the video input is missing.**
Reference missing	**Select to assert alarm if synchroniser reference is missing (AS / ATS / AFDS / ATXS models only).**
Video Black/Frozen	**Select to assert alarm if incoming video is at black level or frozen for the period set by the Alarm Delay menu.**
Group 1-4 Missing	**Select to assert alarm if any of the embedded audio groups 1-4 are missing from the video input.**
Group 1-4 Ch12/34 Silence	**Select to assert alarm if any of the embedded audio channel pairs are silent for the period set by the Alarm Delay menu.**
Note	Card software version V1.80 onwards, with Indigo frame software version V5.4 onwards includes GPO alarms for embedded input Dolby E detection (AS / ATS / AFDS / ATXS models only).

Alarm Delay Time

Set time that an alarm condition must be active before triggering an alarm.



Video Black	**Set the period between 0 to 40 seconds that the incoming video must be permanently at black level before asserting GPO5 or GPO6 alarms.**
Video Frozen	**Set the period between 0 to 40 seconds that the incoming video must be permanently frozen (still frame) before asserting GPO5 or GPO6 alarms.**
Audio Silence	**Set the period between 0 to 120 seconds that any embedded audio channel pair must be permanently below -63dBFS before asserting GPO5 or GPO6 alarms.**

13 Defaults

The following table lists Up-Down 3G's default settings after reset. Note that not all settings are relevant for every model.

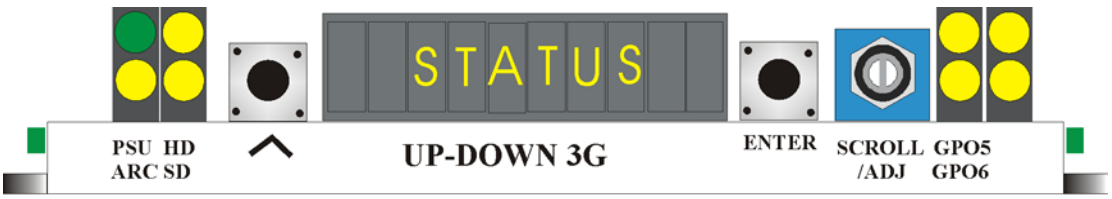
Parameter	Default value
HD Format	1080i
Output Format	All SD
Fibre Optic I/O	Unselected
Aspect ratio (all outputs)	Anamorphic
HD and SD ARC Bypass	Selected
Input WSS (625)	Unselected
Output AFD	Auto, 8-Full Frame 525 line 12 & 275, 625 line 8 & 321
Coded Frame	HD 16:9, SD 4:3
Widescreen Signalling	Auto
Video Indexing	Auto
Lock O/P to I/P ATC	Unlocked
H Size	100%
V Size	100%
Position and Crop	0
Border Luma	0 (Black)
Proc-amp lift (all)	0
Proc-amp gain (all)	100
GPO alarms	Unchecked
HD output timing	0 line, 0 pixels
SD output timing	0 line, 0 pixels
Noise and Detail enhance	Off & 0
Vertical Bandwidth	Soft
Alarm delay video black	1
Alarm delay video frozen	1
Alarm delay audio silence	10 seconds
Video delay	Frame delay, Pixels 0, Lines 0
Audio Bypass	All checked
Audio Mute	All unchecked
Output embedders	All checked
Input VITC (SD)	Auto, 525 line 14, 625 line 19
Output VITC (SD)	Disabled, 525 line 14&16, 625 line 19&21
Output ATC	Disabled, 525 line 12&275, 625 line 8&321

Teletext	Auto, Line 20, Line 333, Disabled
Presets	Set to Preset 1 and all contents erased
GPI Enable	Not enabled

14 Troubleshooting

Card edge monitoring

The front edge of the card provides useful power rail monitoring, input status and aspect ratio information.



Up-Down 3G front edge view

The following table summarises the card edge LED functions and colours:

Name	LED Colour	Function when ON	Function when Off
PSU	Green	Good power supply (PSU) rails	One or more of the monitor supplies is out of specification
ARC	Yellow	Aspect ratio conversion selected	Full screen (anamorphic) selected
HD	Yellow	Video input standard is HD (High Definition)	Input not present
SD	Yellow	Video input standard is SD (Standard Definition)	
GPO5	Yellow	GPO5 active / low	GPO5 inactive / high
GPO6	Yellow	GPO6 active / low	GPO6 inactive / high
	Yellow	No function	
	Yellow	No function	

The card edge LEDs and 10-digit display may be used in conjunction with status information from any connected remote status panel display or from VisionWeb if available.

Board edge control was removed from Up-Down 3G range in 2019. Therefore the card edge control information is only relevant for older versions of the product.

Basic fault finding guide

The Power OK LEDs are not illuminated

Check that the frame PSU is functioning – refer to the appropriate frame manual for detailed information

There is no video output

Check that a valid SDI input is present and that any cabling is intact

The video output exhibits jitter

Check that the input SDI stability is within normal limits

The card no longer responds to card edge or front panel control

Check that the card is seated correctly and that the Power OK LEDs are lit

Check any active control panel cabling

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, use a factory reset to erase any configurations stored in the card.

15 Specification

General

Dimensions	100mm x 266mm module with DIN 41612 connector.
Weight	180g.
Power consumption	Up-Down 3G - 11.9 Watts. DA6 - 3 Watts. FIP - 0.6 Watts. FOP - 0.6 Watts.

Inputs

Video	HD or SD SDI 270Mb/s to 2.970Gb/s serial digital compliant to EBU 3267-E, SMPTE 259M, SMPTE 292M and SMPTE 424M. Cable equalisation: 3G (2.970Gb/s) – 80 metres, Belden 1694 or equivalent. HD (1.485Gb/s) – 140 metres, Belden 1694 or equivalent. SD (270Mb/s) >250 metres, Belden 8281 or equivalent.
Sync	Analogue black-burst or tri-level sync. ‘S’ models only.
Video standards supported	1080p 50/59.94, 1080i 50/59.94, 720p 50/59.94, PAL, NTSC. Input format auto selected.
Return loss	50Mhz to 1.5GHz -15dB.

Outputs

RM41	The Up-Down 3G has five video outputs without a sync input or four video outputs and a sync input.
RM41 + RM34	The Up-Down 3G with DA6 has five video outputs plus six input loop-throughs or four video outputs and a sync input.
RM57	The Up-Down 3G with optical I/O has one optical input or optical output and four video outputs without a sync input or three with.
RM57 + RM34	The Up-Down 3G with DA6 has one optical input or optical output and four video outputs without a sync input or three video outputs with, plus six input loop-through outputs.
Serial digital	HD or SD SDI 270Mb/s to 2.970Gb/s serial digital compliant to EBU 3267-E, SMPTE 259M, SMPTE 292M and SMPTE 424M.
Delay through board	Adjustable up to 2 frames. Minimum delay: 1 frame less 16 lines.
Auxiliary data	Auxiliary data passed when I/P = O/P.

Status monitoring

LEDs	Front of card edge LED indicators to indicate:

PSU rails present
SDI input HD/SD
ARC selected
GPI Out 5 GPI Out 6 active

GPI inputs

Number and type: 4 x GPI inputs. Recall of presets. Pulse or level asserted.

GPI outputs

Number and type: 2 x GPI outputs, selectable from (depending on model) loss of input, video black, video frozen, audio missing, audio channel silence and input incompatible

Input fail output

Type: Last Frame, Show Black, Show Blue, Delay Then Black, Delay Then Blue.

16 Appendix 1

Statesman

In July 2014, Statesman control of Up-Down 3G was superseded by VisionWeb control. Statesman is no longer supported after this date, but information for existing users is included in this appendix. The following is an extract from the Up-Down-ATXS 3G manual:

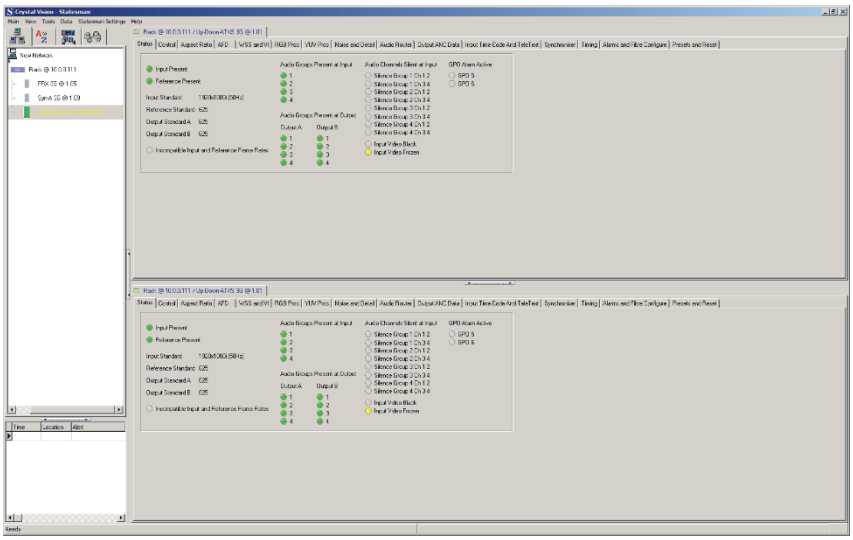
Statesman introduction

The Crystal Vision Statesman PC control software is designed to control a range of Crystal Vision modules via serial control from a PC. Statesman provides a user friendly means of configuring and operating Crystal Vision modules with the benefit of “see-at-a-glance” status monitoring.

The main Statesman application communicates with each module in a frame through a Statesman capable or active control panel. An active panel or REMIND remote control panel must be fitted to allow Statesman control.

Statesman operation

The initial view will show an Explorer style view of the connected frames and modules. Double clicking on a module will enable the display of the main application menus.



Statesman main application window

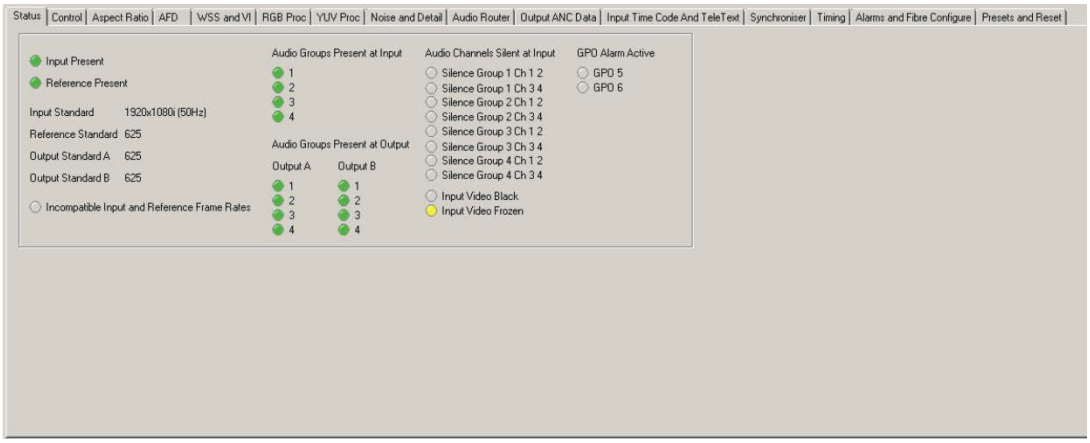
The two large control panes shown in the upper and lower halves of the window may display different menus for the same card, or controls for different cards. Click on the horizontal button-bar between the two panes to close the lower pane or drag the button to vary the size of the panes.

Note: For further details of Statesman configuration and operation please refer to the Statesman manual.

Status

The board status is shown using a mixture of simulated LEDs and text information. As a general rule a green LED shows a good condition such as input present or audio groups present. An amber LED will give a warning as with channel silence, video black or video frozen. If an LED turns red this is a fault condition so input present will turn red if the input should go away. The GPO alarms will also show red when active. A greyed LED will indicate an absence such as non-alarm or non-warning status.

Text is used where more information is required than can be inferred by a simple LED such as video standards.



Status monitoring

Input Video and audio status

Input present is indicated by a simulated LED. Green will indicate that the input is present, red for no input. The video standard of the incoming video is also given in text. Text is also used to show the video standard of both output groups. There are two further LEDs that indicate if the video is frozen or black. Both of these indications have an associated delay control which can be set to prevent unwanted triggering during short periods of black or no movement in the programme material.

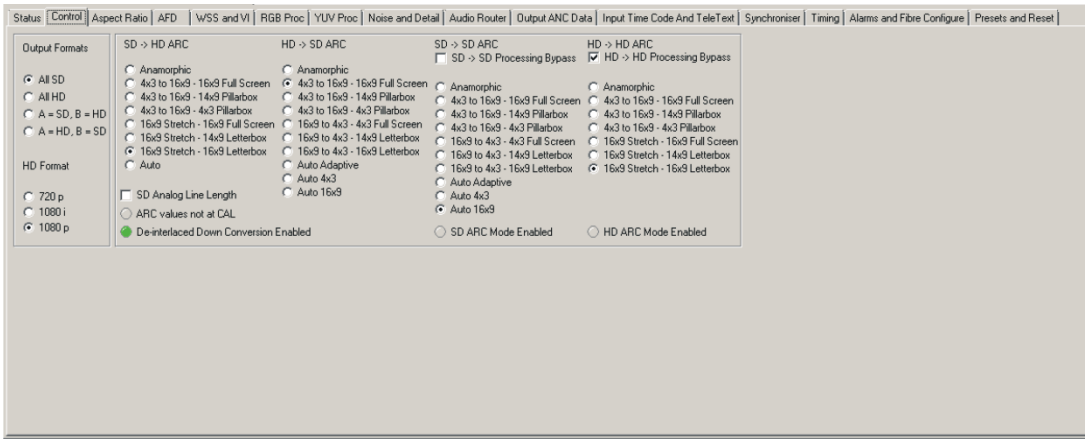
Audio status is also shown using simulated LEDs. Indication is given of groups present on both the input video and output video. Should any audio channel become silent for an extended period indication is given by the channel LED changing from greyed-out to yellow.

Note: The audio channels are grouped as pairs so further investigation will be required to identify which of the audio pair is causing the alarm to be asserted. Again a delay control is used to set the silence detect period to prevent false triggering during quiet passages.

All the various status indications can also be allotted to trigger either of the GPI outputs. Indication of the GPI state is also indicated for convenience.

Control

The control tab is where the output formats are configured and output aspect ratios selected.



Video output fixed aspect ratio selection

High Definition video output format and A-B matrix

The output format and configuration is controlled by the HD output format and A-B matrix controls. Up-Down-ATXS 3G has up to four video outputs – either one or two assigned to output A (depending on whether the optical option is fitted) and two assigned to output B. The A-B matrix control allows the user to select whether an output group will be either SD or HD; all combinations of HD-HD, HD-SD, SD-HD or SD-SD are available. The output format control is then used to select the output format for the HD selected outputs. Once configured the output selection will remain true for all input formats. The SD line length can also be selected between digital and analogue.

Note: The output line rate will always be determined by the line rate of the input.

Output aspect ratio

Aspect ratio conversion is independently controlled for all three modes of operation. Separate controls are given for SD-HD, HD-SD, HD-HD and SD-SD.

There are four fixed aspect ratio types which are: Anamorphic, Letterbox (14:9, 16:9), Pillarbox (4:3, 14:9) and centre cut. Anamorphic will map the input picture directly to the native aspect ratio of the viewing display along with the resulting distortion associated with this. Should it be necessary to view the output on a 4:3 display, setting the aspect ratio selection to Letterbox will give the correct picture dimensions by adding black bars to the top and bottom of the picture. 14:9 Letterbox will crop the picture to 87.5%, and depending on the aspect ratio of the display will either add black bars to the top and bottom or to both sides of the picture. There will be some loss of picture. Pillarbox will compress the picture to the centre part of the screen and add black bars to both sides. There may be a minimal picture loss depending on the selected video format. Centre cut will show the central 75% of a 16:9 widescreen picture mapped to the full monitor height or width with the corresponding loss of the left, right or bottom picture edges.

There are also three auto modes available. When any of these is selected the actual aspect ratio selected will depend on the input video AFD. The AFD reader will also automatically set the output WSS when Widescreen Signalling is set to auto.

The effect of AFD varies depending on the conversion being done, with three auto modes. In these modes the conversion applied (and output AFD data) will depend on the input coded frame and AFD code, which may be presented as WSS, Video index or SMPTE 2016.

Auto 16:9: The output coded frame is fixed at 16:9. If the input coded frame is 16:9, there will be an Anamorphic conversion and the output AFD will follow the input AFD. If the input coded frame is 4:3 then AFD codes for undefined/reserved, 14:9 and full frame inputs will produce a Pillarbox output. AFD codes for 16:9 Letterbox inputs will produce a conversion to a full frame output. **Auto 4:3:** The output coded frame is fixed at 4:3. If the input coded frame is 4:3, there will be an Anamorphic conversion and the output AFD will follow the input AFD. If the input coded frame is 16:9 then AFD codes for full frame and 14:9 inputs will produce a Letterbox output. AFD codes for a Pillarbox input will produce a conversion to a full screen output. **Auto Adaptive:** If the input coded frame is 16:9, a 4:3 Pillarbox AFD will produce a 4:3 full frame output, with appropriate Video index and/or WSS.

All other AFD values will cause an Anamorphic conversion and the output AFD will follow the input value. If the input coded frame is 4:3, a 16:9 Letterbox AFD will produce a 16:9 full frame output, with appropriate Video index and/or WSS. All other AFD values will cause an Anamorphic conversion and the output AFD will follow the input value.

Response to SMPTE 2016 AFD HD and SD codes

Incoming (HD) AFD value	Explanation	Auto 4:3 conversion (output WSS)	Auto adaptive Conversion (output WSS)	Incoming (SD) AFD value	Explanation
0, 1, 5, 6, 7, 12	Undefined/reserved	Letterbox (box 16:9 centre)	No change, as previous	**0, 8, 9, 13**	Pillarbox 4:3
2, 8, 10, 14, 15	Full frame	Letterbox (box 16:9 centre)	Anamorphic (full format 16:9)	**2, 4, 10, 14, 15**	Centre cut 16:9
9, 13	Pillarbox 4:3	Centre cut (full format 4:3)	Centre cut (full format 4:3)	**3, 11**	Pillarbox 14:9
3, 11	Pillarbox 14:9	Centre cut (full format 4:3)	No change, as previous	**Others**	Anamorphic
4	Letterbox>16:9	Centre cut (full format 4:3)	No change, as previous	**16:9**	Anamorphic

Note: Widescreen Signalling must be set to Auto for the output WSS to be automatically set by the incoming AFD data.

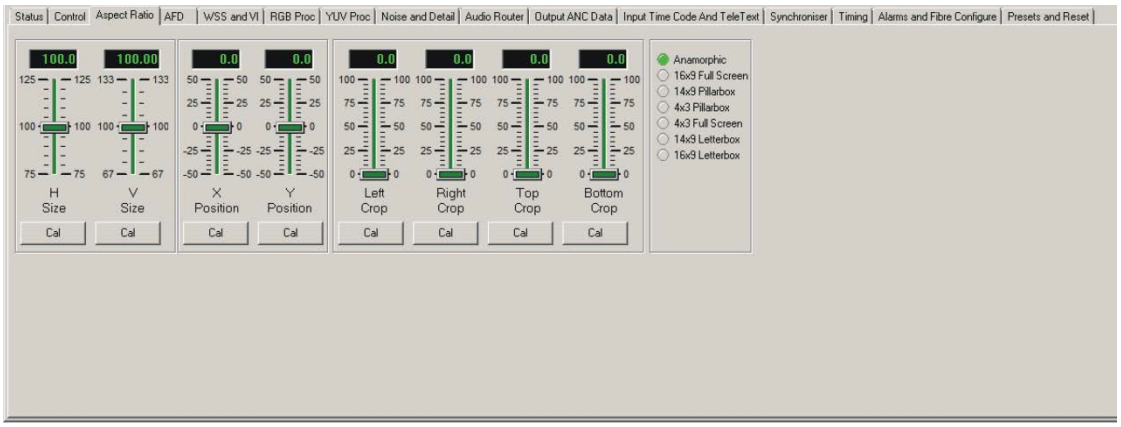
HD and SD ARC Bypass

Enabling the HD ARC and SD ARC disable controls will set the Up-Down-ATXS 3G into bypass mode whenever the input and the selected output format are both the same. In bypass mode the proc-amps will be disabled. AFD and WSS insertion will remain active.

Aspect ratio size and position controls

Depending on the input format and selected output format there are up to seven fixed aspect ratios available. Each of these seven aspect ratios can be adjusted independently for picture size and position; the picture may also be cropped on all four edges. Once the controls are set they are automatically recalled whenever the particular aspect ratio is active. The active aspect ratio conversion is indicated to the right of the size, position and crop sliders.

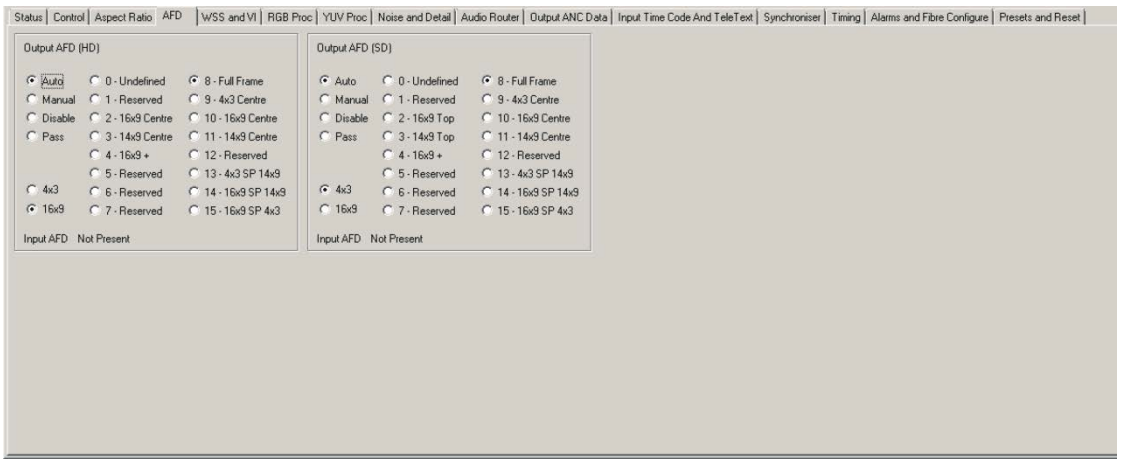
Pressing the Cal button will return all slider control to their default value.



Aspect ratio size, position and crop controls

Output AFD

There are three sets of controls associated with Active Format Descriptor (AFD). These are: the inserter mode control, entire image aspect ratio selector (coded frame) and the group of 16 AFD codes. These controls are repeated for both SD and HD.



Output AFD selection

The HD output will have the ANC data packets containing the AFD information inserted within the active line portion on the appropriate line. The SD output has further controls to select the line to be inserted. There are separate controls for both 525-line and 625-line.

The 16 available codes are described in the following table:

AFD code	Description	AFD code	Description
0	Undefined	8	Full Frame (as coded frame)
1	Reserved	9	4:3 centre
2	16:9 top	10	16:9 centre
3	14:9 top	11	16:9 centre
4	16:9+	12	Reserved for future use
5	Reserved	13	4:3 with shoot and protect 14:9 centre
6	Reserved	14	16:9 with shoot and protect 14:9 centre
7	Reserved	15	16:9 with shoot and protect 4:3 centre

Note: When inserting SMPTE 2016 data the inserter will blank any incoming SMPTE 2016 data.

Widescreen Signalling and Video Indexing

Output widescreen signalling can be set to automatically follow the input AFD data or be manually selected. If WSS data should be present on the input video this can either be passed to the output unchanged or substituted for a user-selected code. WSS data can also be set to be blanked. It is only possible to insert WSS information into a PAL output.

Out going WSS codes	Explanation	Conversion
0001	Full format 4:3	Centre cut
1000	Box 14:9 centre	Letterbox
1101	Box 16:9 centre	Letterbox
1110	Full format 16:9	Anamorphic

Widescreen Signalling and Video Indexing inserter controls

Video Indexing

Video indexing can also be inserted into the output video for use by downstream equipment. Output video indexing is enabled by selecting the required output aspect ratio. Although in

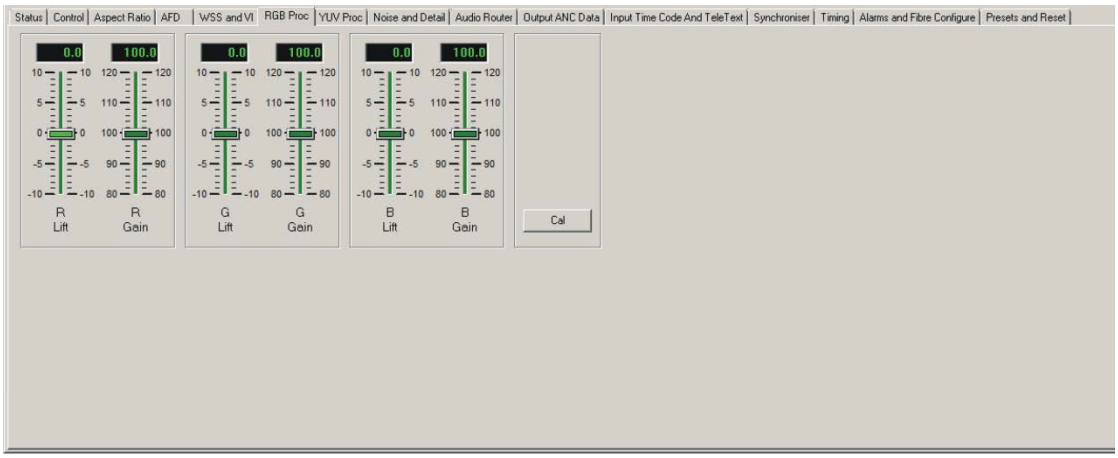
most applications the output selection will mirror the conversion setting, the output video index control remains independent from the conversion setting, so that a user-specified aspect ratio can have assigned the most appropriate ratio information. It is also possible to either insert blank video index data or pass the input data to the output unchanged.

Input WSS blanking

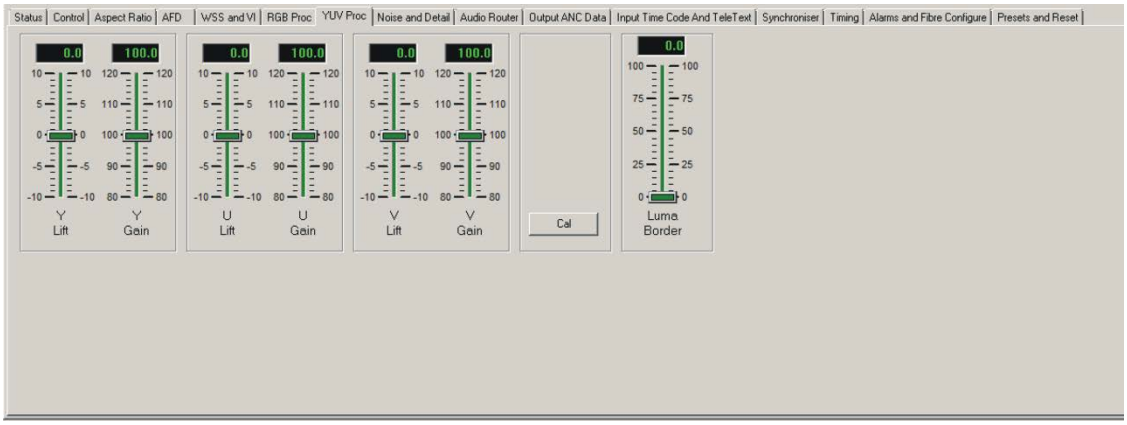
This control allows the widescreen signalling information on the input to be blanked.

RGB and YUV lift and gain controls

Up-Down-ATXS 3G's RGB and YUV lift and gain controls allow independent digital image adjustments in both the RGB and YUV domains, essential for maintaining colour fidelity.



RGB lift and gain controls



YUV lift and gain controls

Border Luma control

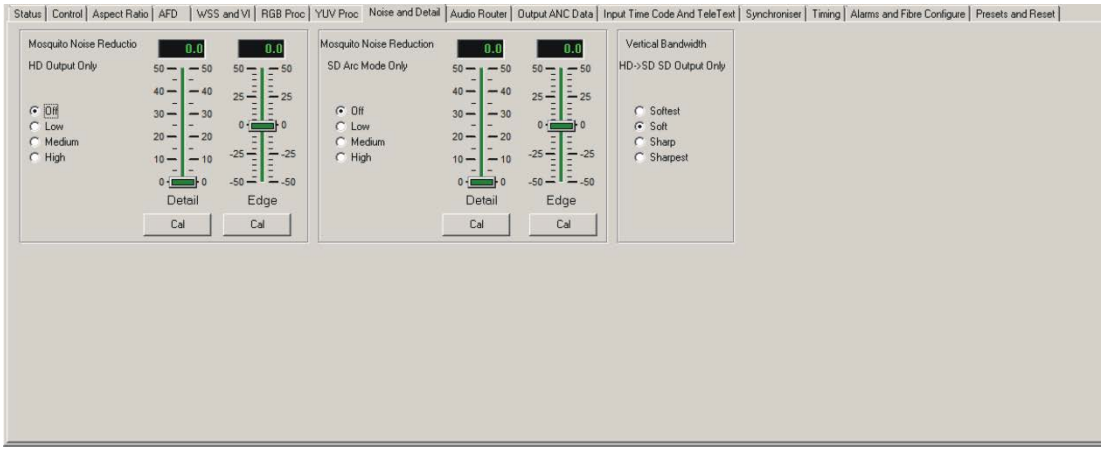
This control varies the Luma level of the picture border if present to be adjusted from zero giving a black border to 100% white.

Noise reduction and picture enhancement controls

Up-Down-ATXS 3G is able to detect and remove mosquito noise, a common compression artefact caused by MPEG decoders which is often exhibited as a cloud around the edges of text and computer generated graphics. Algorithms within the Up-Down-ATXS 3G detect areas

where mosquito noise would be the most likely and then work to diminish the mosquito noise without blurring the edge of the text or graphics.

Fine Detail and Edge Enhancement is a video processing technology that increases the sharpness or detail of images. It is especially useful when Standard Definition video is scaled to fit high resolution displays. The controls allow the image to be either sharpened or softened as required.



Noise reduction, edge and detail enhancements controls

Noise reduction

Noise reduction uses a combination of edge mapping and proximity mapping to produce a composite blend map to ensure noise reduction is only applied to the areas where noise is present without causing blurring of the edges. The different levels of noise reduction applied are achieved by varying the amount of clip and gain applied to the various mapping.

Edge detail and detail enhancement

Up-Down-ATXS 3G's fine detail and edge enhancement uses a technique known as 'unsharp mask'. This is a superior method of enhancing images that does not introduce ringing. Up-Down-ATXS 3G enhances images both horizontally and vertically.

Two types of enhancement are provided, one for fine detail and one for object edges. Fine detail enhancement applies sharpening to the entire image. Edge enhancement applies sharpening only to object edges.

Both detail enhancement and edge enhancement produce similar results, but there are subtle differences. Fine detail enhancement works best when the source is 'clean' and free from noise. Edge enhancement works well for less pristine sources. It produces a sharpening effect without making noise more visible.

To allow simultaneous dual conversions with Up-Down-ATXS 3G, its internal architecture contains two independent aspect ratio converters with an invisible switching matrix. The main converter is able to up convert, cross convert or down convert. The secondary converter is used for down converting only. Noise reduction, detail enhancement and edge enhancement can only be applied to the main converter; this imposes certain restrictions to the use of the noise reduction and enhancements controls.

The noise reduction, detail enhancement and edge enhancement controls are detailed in the following table:

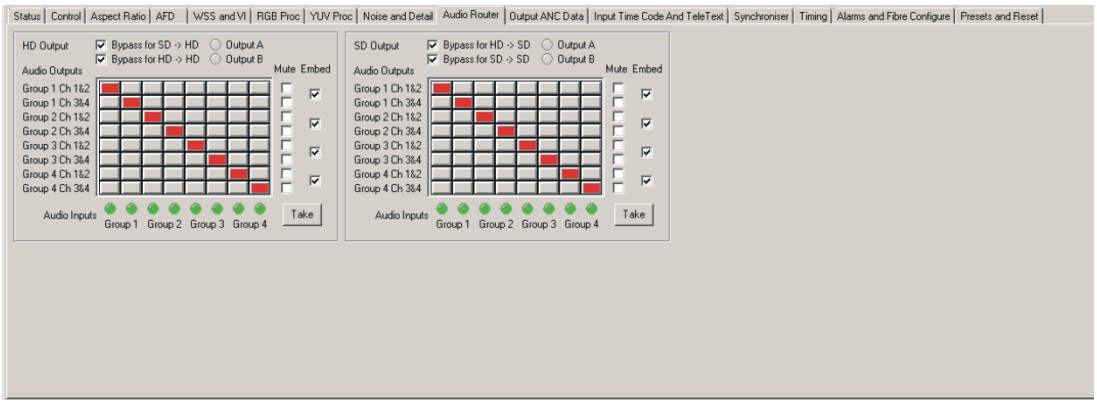
Input video standard	A-B Output formats	Conversion	Controls
Standard Definition	HD	Up	Active
	SD	Bypass	Not active
Standard Definition	SD	ARC conversion	Active
	SD	ARC conversion	Active
Standard Definition	HD	Up	Active
	HD	Up	Active
High Definition	HD	Up/Down/Cross	Active
	SD	Down	Not active
High Definition	HD	Up/Down/Cross	Active
	HD	Up/Down/Cross	Active
High Definition	SD	Down	Not active
	SD	Down	Not active

Vertical bandwidth filter

When down converting to Standard Definition the vertical bandwidth can be optimised for a given application by selecting the most appropriate vertical bandwidth filtering. There are four filters to select from, ranging from the highest (sharpest) to the lowest (softest).

Audio Router

Both Standard Definition and High Definition have their own individual routing matrix.



Audio router

Audio bypass

The audio sent to an output can be set to bypass the routers under certain selected circumstances. These conditions can be set individually according to the output format so that if these conditions are met, the input embedded audio will appear on the output in the same positions as the input. If these conditions are not met, the audio will be placed according to the router. There are separate controls for both High Definition and Standard Definition.

Routing

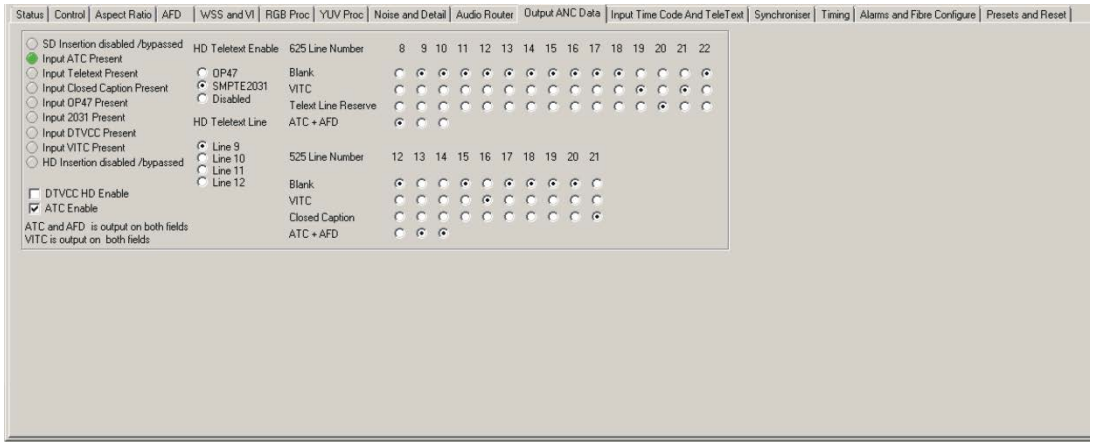
There are two 8x8 routers available, one available for if the output is Standard Definition and the second for if the output is High Definition. This allows the user to shuffle the audio according to the selected output standard. Once the desired routing has been configured it can be asserted by pressing the salvo button.

Note: The Up-Down-ATXS 3G can output both Standard Definition and High Definition simultaneously.

Mute and embedder controls

Output channel pairs can be muted if required by checking the mute control boxes. Individual output group embedders can also be disabled if required.

Output ANC data



Output ancillary data

The Up-Down-ATXS 3G can deal with both (ATC) ancillary data timecode (SMPTE 12M) and (D-VITC) vertical interval timecode (SMPTE 266M). ATC is particularly useful when down converting progressive High Definition video to an interlaced High Definition output. When outputting Standard Definition Up-Down-ATXS 3G will also convert the ancillary timecode to vertical interval timecode. VITC code is always repeated on two adjacent video lines, one in each field. The line pairs used are also selectable to allow extra data to be encoded. If the ATC output is disabled, the AFD/ATC line number will still select the line number, on which AFD will appear for down-converted SD outputs. When using the Up-Down-ATXS 3G to convert 1080p to 1080i output, the ATC and AFD are inserted in lines 9+571 and 11+547 respectively.

DTVCC transport

Enabling the DTVCC function will transport closed captions across definitions: when down converting CEA-708 closed caption data will be output as the corresponding CEA-608 closed caption data. When up converting the CEA-608 data will be inserted into the appropriate section of CEA-708. The 525-line line number can be selected using the 525 ANC line control for the reinsertion of the closed caption data in the output video waveform.

Teletext and subtitle handling (OP-47 and SMPTE 2031)

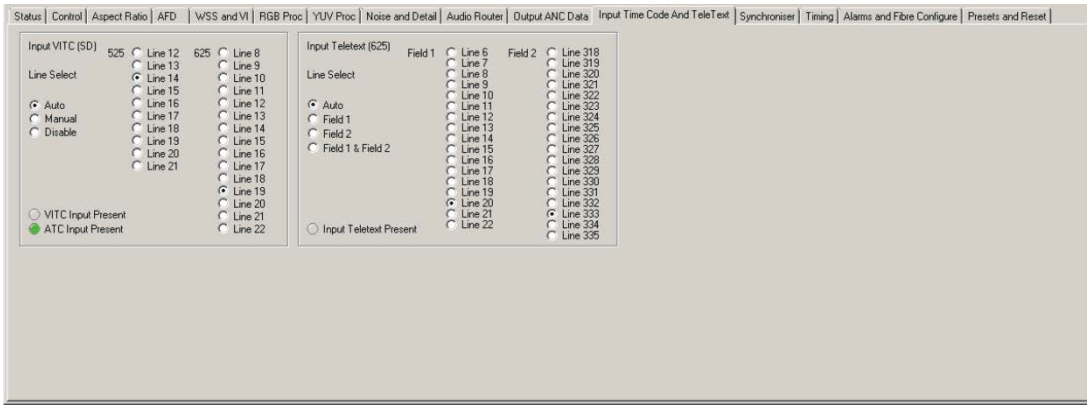
Teletext and subtitle information can also be carried across different definitions with OP-47 data stream creation when up converting and the extraction of teletext data from the OP-47 packets when down converting. Setting the HD Teletext control will enable this process and using the 625-line ANC line selection control will set the line or lines in the output waveform to carry this data. Similarly SMPTE 2031 can be selected as the transport medium.

ATC and VITC transport

The Output ATC control when enabled will allow the translation of HD ancillary timecode and SD VITC depending on whether up converting or down converting. The ANC line selection controls will allow the line or lines to be selected for reinsertion.

Note: For 525 outputs, having both AFD and VI on line 14 is not possible. To get AFD on line 14, VI needs to be disabled. ATC, AFD and VITC are output on both fields.

Timecode



Input timecode and teletext

The mode selection control allows the SD input timecode (VITC) to be either automatically detected, the individual line to be manually selected or timecode extraction disabled. When manual mode is selected the line containing the VITC data can be selected using the 525 or 625 line selection control.

525 VITC lines		
12+14 (275+277)	15+17 (278+280)	18+20 (281+283)
13+15 (276+278)	16+18 (279+281)	19+21 (282+284)
14+16 (277+279)	17+19 (280+282)	

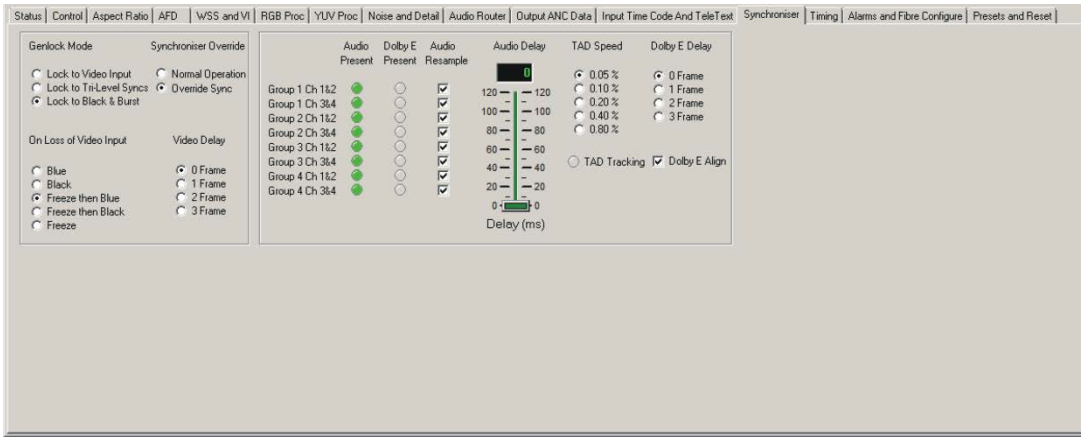
625 VITC lines		
8+10 (321+323)	13+15 (326+328)	18+20 (331+333)
9+11 (322+324)	14+16 (327+329)	19+21 (332+334)
10+12 (323+325)	15+17 (328+330)	20+22 (333+335)
11+13 (326+328)	16+18 (329+331)	
12+14 (325+328)	17+19 (330+332)	

Teletext

In order to allow the maximum flexibility, control of the line selection for both field 1 and field 2 of the incoming Standard Definition video signal is given. This selection is under the control of the line mode selector. Selecting Field 1 or Field 2 will take any teletext data from whichever line has been selected and present it ready for reinsertion as digital data in the High Definition output. Selecting Field 1 and Field 2 will make a combination of the information from both lines of both fields. If Auto mode is selected all data on all lines of both fields will be combined and inserted into the High Definition output.

Note: Disabling the HD Teletext control will prevent any transfer of teletext data.

Synchroniser controls



Synchroniser menu

Genlock mode

The Up-Down-ATXS 3G has two modes of operation, as a synchroniser or as a user set fixed delay. In synchroniser mode the external reference can be both Black and Burst or a tri-level/bi-level sync containing not burst. Delay mode is achieved by locking the Up-Down-ATXS 3G to the incoming video rather than the external reference.

A separate control allows the external sync to be overridden. When enabled, should the input frame rate change to something other than that of the external reference, the Up-Down-ATXS 3G will go to delay mode ignoring the reference standard and lock to the input. Once the reference conflict is resolved the output will relock to the external reference.

On loss of video input

Should the input video be lost due an up-line fault such as an equipment failure the Up-Down-ATXS 3G can be set to give a selection of responses. This response can be chosen from the following list: Blue, Black or Freeze last good frame. A three second delay can also be introduced where the picture will freeze for three seconds before reverting to the mode selected.

Video delay and output timing

The delay control gives a coarse setting of delay in whole frames up to three frames of delay.

Note: The final input to output delay will be reliant on several factors such as synchroniser delay, audio resampling and Dolby E alignment.

Resamplers

The Resample Enable control affects how the audio data is manipulated to change the PCM delays. On resampled channels (resample enabled) the audio will be continuously resampled allowing seamless changes in audio delay. On non-resampled channels (resample not enabled) samples will be passed unchanged through the signal path: if the delay has to change, single audio samples will be dropped or repeated as required. This control has no effect on channels containing Dolby E which is automatically detected and bypasses the resamplers.

Audio delay

This control can be used to delay the audio with respect to the video and compensate for any small delay between the incoming video and audio signals.

Tracking audio delay speed

This sets the time the audio delay takes to track fast or abrupt changes in video delay, when video tracking is on. The faster the rate of change, the quicker the audio delay will match changes in video delay so minimising lip-sync errors, but at the expense of a matching change of musical pitch. Refer to the Introduction chapter for more help with TAD speed settings for different applications.

Dolby E delay and alignment

Dolby E can be delayed up to three frames of delay in one frame increments, and to ensure the correct positioning of the guardband the Dolby E alignment control can be enabled.

Note: Dolby E Align mode will limit the minimum video delay to 0.5 frames.

Timing

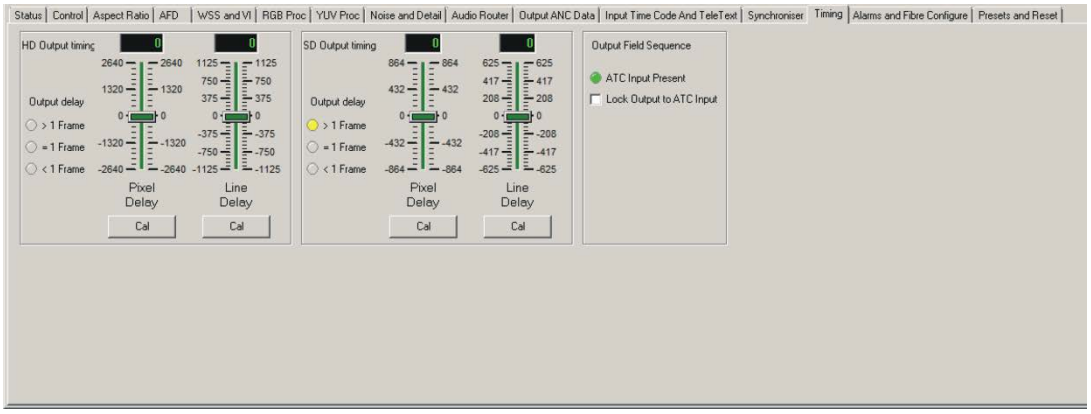
SD and HD delay

High Definition and Standard Definition both have separate controls giving output phase adjustment in both lines and pixels. If the timing reference is Black and Burst or tri-level syncs, with the controls set to zero the output will aligned with the timing reference. If the timing reference is the input, the delay at zero settings will be exactly one frame. This delay can be increased up to two frames. The minimum delay through the board is one frame less 16 lines, any further negative delay will cause the delay to jump to two lines less the desired delay number. Three LEDs give a visual indication of the status of the delay.

Locking to input timecode (ATC)

A useful feature of the Up-Down-ATXS 3G is its ability to take incoming ancillary data timecode and use it to determine the field sequence when converting a High Definition progressive video input to an interlaced video output. Checking the ‘Lock Output to ATC Input’ tick box will allow the Up-Down-ATXS 3G to determine the correct field sequence.

Note: The ATC lock control is only active when a progressive video input is present. When disabled the field sequence of the interlaced output will free-wheel.



Video Delay timing

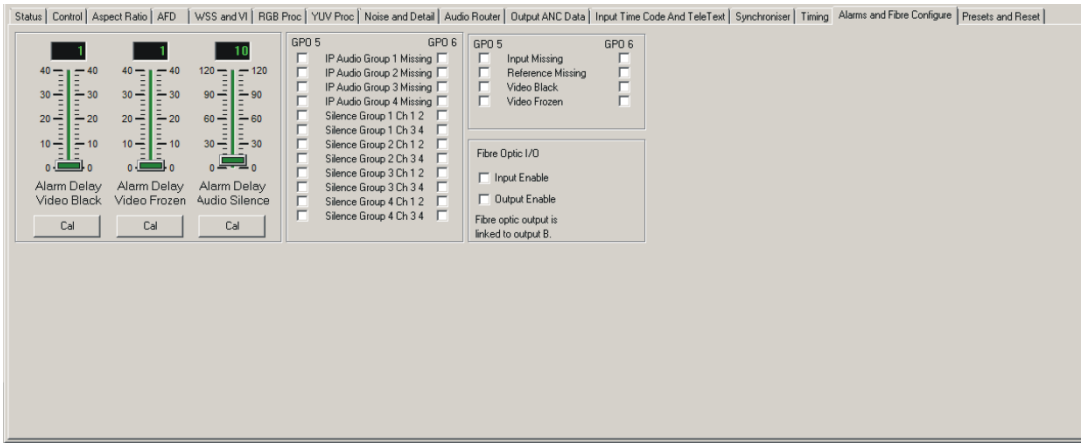
GPI alarm outputs

The Preset and Alarms tab contains the GPI output alarm configuration, alarm delay controls and Preset save/recall. The reset controls are also found here. There are two GPI outputs reserved for alarm indication – GPO5 and GPO6, which may have assigned to them any of the 16 video and audio alarms.

Any number of alarms may be assigned to each GPI output as the 16 alarm conditions have been assigned a level of priority. Input, reference and audio groups missing have the highest priority and will assert an alarm immediately. The ten subsequent conditions descend in order of priority with Group 4 channel 3 & 4 silent given the lowest. Black, frozen and silence can be assigned a delay timer to delay the time after which an alarm is asserted. This ability is especially useful to prevent false alarming during quiet periods in the audio or brief pauses in the video programme.

Where more than one alarm is flagged and an alarm condition is asserted, use the various status indicators to determine the exact cause. Visual indication of GPO5 and GPO6 status is provided on the board edge.

See Section 2.3 for further discussion of GPIs and pinout details.



Preset and GPI alarm configuration

Silence detect delay

The silence detect delay can be set from 0 to 120 seconds for the amount of time a signal is allowed to remain below -56dB, with respect to Full Scale, before a silence error is flagged. To prevent false alarms during quiet passages there is a minimum delay period of

approximately four seconds in which silence must be maintained before the delay timer is initiated.

Note: The minimum delay will become significant at short delay settings.

Video frozen and black delay

A picture is considered frozen when a frame is identical to the previous frame. If this condition is met consistently for the period of time set by the video frozen delay control, a video frozen error will be flagged.

Video black is defined as values in the range of 58 to 70 around digital black (approx +/- 5mV). If digital black is present for longer than the delay time set by the video black delay control, a video black error will be flagged.

Note: Press the cal button at anytime to reset the timer delays to their default values.

Optical I/O

The Up-Down-ATXS 3G has the option of either receiving an optical input or transmitting an optical output once the necessary optical equipment has been fitted. If the optical receiver module is fitted, the fibre optic I/O input enable will allow the video input to be selected between the input BNC and the optical input. The input loop-through will show whichever of the inputs are selected so with an optical input the input loop-through BNC will give a reclocked output of the optical input.

With the fibre transmitter module fitted, the optical output can also be enabled or disabled. The output BNCs remain active when the optical output is both enabled and disabled. When the optical output is fitted the number of A outputs will be reduced from two to one and the optical output will always show the video signal present on the B outputs.

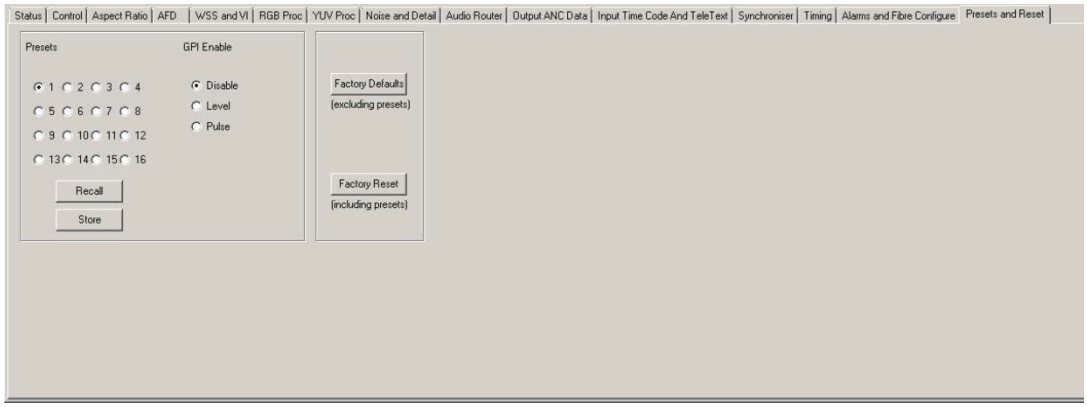
Preset menu and factory reset

Up to 16 user-defined configurations may be stored and recalled either from the board control, active front panel, Statesman or through the use of external GPIs. Presets store the board setup data including operating mode card status. The presets are numbered 1-16.

When enabled the GPI inputs can be selected to trigger from a level change or pulse.

Note: Care should be taken when storing presets that the configuration is not changed by any external input.

See Section 2.3 for further discussion of GPIs and pinout details.



Presets and factory reset menu

Note: Care should be taken when storing presets that the configuration is not changed by any external input.

Saving and recalling presets

The current board settings can be saved in one of 16 locations to be recalled as desired. This allows the user to store and recall up to 16 different configurations for later use. To save the current settings, select the preset location and press ENTER. This will write the current settings into this location. If a preset has previously been used any data will be overwritten.

Note: If the selected location contains previously saved setting information it will be overwritten by the new setting data.

To recall previously stored setting information, again choose the selected location and press ENTER to recall the stored configuration. The recalling of previously stored presets can also be implemented externally via the GPI port. To sanction this facility, enable the GPI controls preset recall box.

Factory reset

The user has the choice of performing a total factory reset or a partial reset. Factory Reset will return all parameters to their factory default values and erase all user stored configuration presets. Selecting the Defaults option will perform the same reset to factory default values but will leave any user stored configurations unaffected.

Note: Factory reset will erase all user stored presets.

Parameter	Default value
HD Format	1080i
Output Format	All SD
Fibre Optic I/O	Unselected
Aspect ratio (all outputs)	Anamorphic
HD and SD ARC Bypass	Selected
Input WSS (625)	Unselected

Output AFD	Auto, 8-Full Frame 525 line 12 & 275, 625 line 8 & 321
Coded Frame	HD 16:9, SD 4:3
Widescreen Signalling	Auto
Video Indexing	Auto
Lock O/P to I/P ATC	Unlocked
H Size	100%
V Size	100%
Position and Crop	0
Border Luma	0 (Black)
Proc-amp lift (all)	0
Proc-amp gain (all)	100
GPO alarms	Unchecked
HD output timing	0 line, 0 pixels
SD output timing	0 line, 0 pixels
Noise and Detail enhance	Off & 0
Vertical Bandwidth	Soft
Alarm delay video black	1
Alarm delay video frozen	1
Alarm delay audio silence	10 seconds
Video delay	Frame delay, Pixels 0, Lines 0
Audio Bypass	All checked
Audio Mute	All unchecked
Output embedders	All checked
Input VITC (SD)	Auto, 525 line 14, 625 line 19
Output VITC (SD)	Disabled, 525 line 14&16, 625 line 19&21
Output ATC	Disabled, 525 line 12&275, 625 line 8&321
Teletext	Auto, Line 20, Line 333, Disabled
Presets	Set to Preset 1 and all contents erased
GPI Enable	Not enabled