SYNAD124

Embedded audio synchroniser

USER MANUAL

Crystal Vision

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1 Introduction

SYNAD124 is a video frame/line synchroniser with tracking audio delay built-in for up to two groups of embedded audio.

Two independent de-embedders can each accept four audio channels from a selected incoming audio group, which is then re-sampled, delayed and re-embedded into any selected output audio group.

There are up to four SDI outputs, an SDI loop-through, and up to four composite video outputs from an internal monitoring encoder.

The serial digital output has virtually no output jitter both when used as a synchroniser with a stable analogue reference and when used as a delay line without a reference.

In synchroniser mode, the SDI output contains video that has been synchronised by the frame synchroniser function, plus a total of up to 8 embedded signals, which have been de-embedded, re-sampled to 48 kHz and locked to the output SDI signal's video content.

This provides delayed audio that tracks the video delay, with selectable additional audio delay, as a fully synchronous embedded signal to SMPTE 272M.

When using 625-line video, picture disturbances on untimed input cuts are avoided by waiting until line 23 to re-lock. Interruptions to the embedded audio, or unusual methods of packing are automatically corrected.

The unit has a short minimum delay and a choice of black, blue or freeze on input failure.

SYNAD124 is particularly suitable for placing after a routing switcher where the sources are several lines apart, or in installations using devices such as the Sony IMX VTRs which record up to two groups of embedded audio.

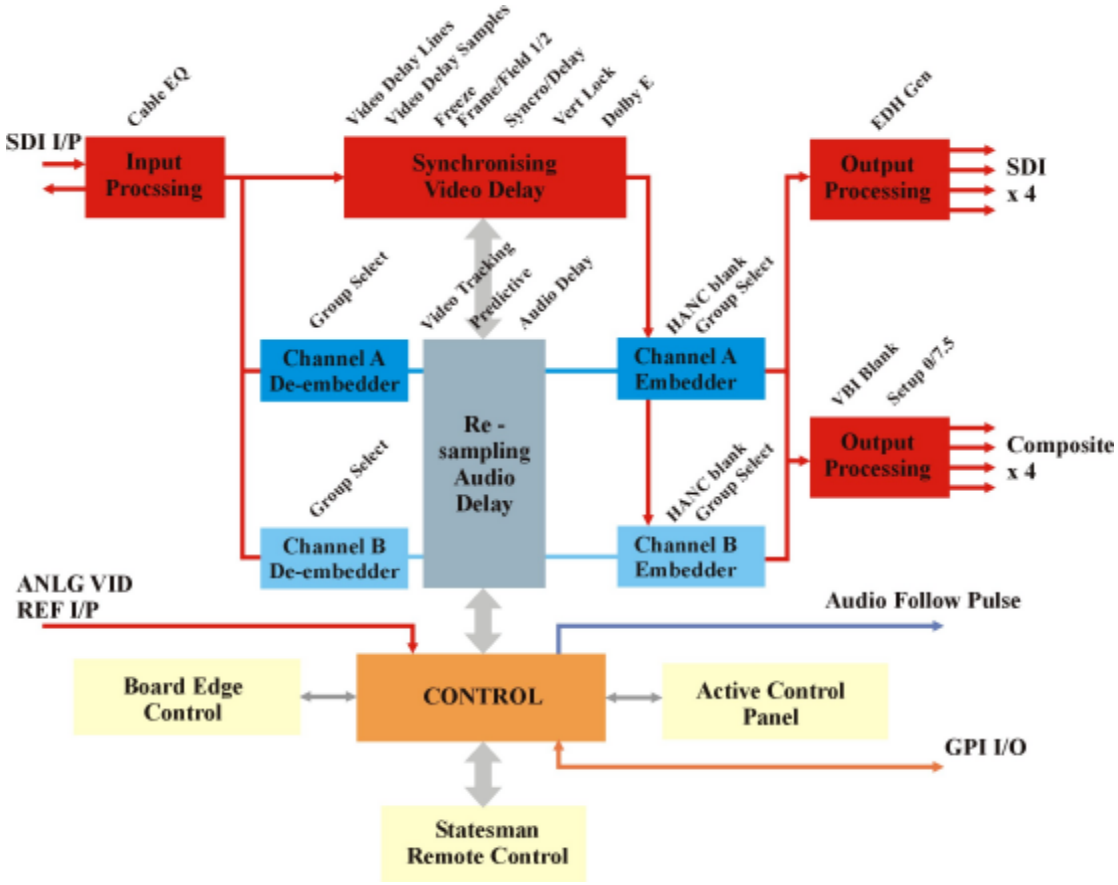
The main features are as follows:

- Frame or line synchroniser or use as a fixed delay line
- Transparent audio follow video tracking built-in
- Full vertical and horizontal adjustment from 0 to 2 fields in any mode
- Audio delay adjustment from 3 milliseconds to 88 milliseconds.
- Fast lock after up-stream switch
- Corrects and/or masks audio corruption
- 24 bit input and output stages and dither enhanced 20 bit processing ensure high quality operation
- Selectable black, blue or freeze on input failure
- EDH generation
- Option to pass or block non-linear data (Dolby E)
- Audio follow control output
- Composite monitor output
- Flexible control

SYNAD124 is a 100mm x 266mm module, which fits in the three standard frames and can be integrated with any boards from the company’s full product range. 12 modules fit in 2U, 6 in 1U or 2 in desktop box. It uses the RM01, RM02 and RM18 rear connectors.

The embedded audio is handled as 2 sets of 4 audio channels [2 stereo signals] from each of 2 audio groups. Each selected audio group is handled by an independent processing path.

The first de-embed/re-sample/delay/embed processing path is known as the ‘A Channel’ and the second processing path is known as the ‘B Channel’. The ‘A and B Channels’ should not of course be confused with the audio channels within each audio group.



SYNAD124 video and embedded audio synchroniser

Notes: Audio cannot be routed between the ‘A’ and ‘B’ SYNAD124 de-embed/embed paths and specific audio channels within an audio group cannot be individually selected. Only re-embedded audio will be present in the SDI output stream, since the entire HANC space is always blanked prior to the embedding process.

Synchroniser and delay modes

The SYNAD124 has two modes of operation, synchroniser and delay.

In Syncro (synchroniser) mode the unit takes its timing from the analogue external reference and will automatically synchronise sources with or without embedded audio between 0 and 2 fields. Synchroniser mode is ideal for external sources that are not timed to station references such as satellite or remote contribution feeds.

In Delay mode, timing is derived only from the SDI input. Typical applications are where a source passes through a processor such as a DVE, chroma keyer or standards converter where the delay can be a few microseconds, multiple lines or up to two fields.

In either mode the video delay remains fully adjustable over two complete fields. This allows the output of the SYNAD124 to be timed into any edit suite irrespective of the timing of the black and burst reference used in synchroniser mode.

Also in either mode the audio delay can be configured to track the video delay and provide an additional or offset delay to the video delay or to be configured for a fixed delay. There is also an external Audio Follow Video pulse output, the duration of which reflects the current video delay. The AFV output can be used with external audio delay processors if required.

Video tracking

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. Although video tracking (AFV) can be used in both Syncro and Delay modes, it operates dynamically in Syncro mode as input/output timing changes.

When video tracking is on in Syncro 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 40 ms change in video timing only takes 5 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 secs	40 secs	20 secs	10 secs	5 secs
20ms	40 secs	20 secs	10 secs	5 secs	2.5 secs
10 ms	20 secs	10 secs	5 secs	2.5 secs	1.25 secs
5 ms	10 secs	5 secs	2.5 secs	1.25 secs	0.6 secs
1ms	5 secs	2.5 secs	1.25 secs	0.6 secs	0.3 secs

Predictive tracking

In Syncro mode, there are two situations when the video delay changes abruptly between zero and two fields. When the video delay increases to the point where the video delay is about to jump from one full frame delay to zero, or when it decreases to the point where it is about to reach zero and then jump to one full frame delay.

To avoid the need for large changes in audio delay or noticeable lip sync problems it is may be better to change the audio delay in anticipation of the imminent jump in video delay.

If there is no predictive tracking (i.e. set to OFF) then only after the jump in video delay does the audio delay start changing. As a result, there is a short period of time just after the jump in video delay where the audio is offset from video by 40 milliseconds (625 line systems - 33 mS for 525L).

When predictive tracking is ON, then as the video delay jump approaches, the audio delay starts to change so that significant audio delay change has already been effected prior to the jump in video delay.

With predictive tracking on the relative audio timing will always be within the recommended window (less than 16ms ahead or 24ms behind).

When the video delay or rate of change is small the audio delay will track and remain very close to the value of video delay, until the point where predictive tracking function (if ON) will compute that predictive offset is required.

To ensure that lip sync errors are minimised during the necessary jumps in video timing with asynchronous inputs in Syncro mode, make sure that the predictive tracking is on and that an appropriate TAD value for the programme material has been selected.

Predictive tracking is not available in Delay mode.

Adjusting the audio delay

The audio delay can be controlled independently of the video delay from 0 to 88 milliseconds.

If video tracking is off the actual audio delay is set manually. If video tracking is on the audio delay is automatically controlled to match the video delay. However the offset timing between audio and video remains adjustable in any mode.

Audio delay	Description
Video tracking on	Audio delay controlled automatically to follow video delay. Relative timing available.
Video tracking off	Actual audio delay controlled manually

Note: Audio delay dynamically follows video delay in Syncro mode and when video delay is manually changed when video tracking is on in either Syncro or Delay mode.

Selecting the embed pattern

The SYNAD124 supports two different embedding formats ‘SONY’ or ‘SMPTE’. The ‘SONY’ format embeds on every line of the SDI output, whereas the ‘SMPTE’ format omits embedding from one line before the vertical interval switch point as defined in SMPTE RP168, through to three lines after - a total of a four line gap in each and every TV field.

The input format does not require setup as it is automatically detected.

The format chosen should match the most common format in use, or set to SMPTE if in any doubt.

Note: It is not possible to turn the Channel A embedder on or off if the Channel B embedder is on.

Freezing the picture

The type of picture freeze used when the freeze command is given may be selected from frame, field 1 and field 2. If there is movement between both fields a frame freeze may show movement judder. A field freeze works by repeating the same field to produce a synthetic frame of video, without movement judder. However a field freeze is more likely to show jagged edges on near horizontal lines.

The audio output is always muted when the video is frozen. The embedded packet structure is maintained but the packets contain silence.

SDI loss behaviour

The SYNAD124 behaviour when the SDI input is lost may be selected to cut to black, cut to blue, freeze; or hold a freeze for approximately one second before outputting a blue or black screen. The picture freeze type selected will determine the freeze displayed.

Vertical lock mode

With 525 line sources the re-lock is timed from the field flag to accommodate different lengths of vertical blanking. Normally when operating with 625 line sources SYNAD re-locks on the input at the start of active video. This means that if switch occurs between untimed sources there will be no disturbance in the active video if both the sources are in vertical blanking when the switch occurs. To allow operation with 625 line sources that have non-compliant vertical blanking lengths, it is possible to select a re-lock timed from the field flag.

Handling non-linear audio

Embedded data that is not linear audio, such as Dolby E, can be blocked or passed transparently through the video store with the SDI video.

Using the analogue video monitor output

Data in the VBI (Vertical Blanking Interval) of the analogue composite monitor output can be blanked or passed. 7.5% IRE setup may be applied to active video when a 525 standard SDI signal is used (composite monitor output will be NTSC).

Using the headphone monitor output

The card edge jack socket [3.5 mm, stereo] is used to monitor the four possible stereo audio signals that can be de-embedded from two Audio Groups by the ‘A & B Channel’ de-embedders in the incoming SDI input signal.

It can also be used to monitor the four possible stereo audio signals that can be embedded in two Audio Groups by the ‘A & B Channel’ embedders in the SDI output signal.

These analogue audio signals are only available through the headphone jack socket.

Note: There are no outputs to the rear connectors, as there are with Tandems, TAD202, & Demon.

Tip: The headphone output will not drive non-amplified speakers. Use with active loudspeakers, or a pair of headphones.

2 Statesman

The Crystal Vision Statesman PC control software is designed to control a range of Crystal Vision modules via serial control from a PC.

The main Statesman application communicates with each module in a frame through an active control panel with or without a LCD display. Statesman will not be able to detect modules used in a frame with only a passive front panel.

2.1 Installing Statesman

Minimum pre-requisites:

- A PC running either Windows 2000 or Windows XP is recommended
- A parallel port dongle for Statesman PCs with attached Crystal Vision frames
- An RS422 serial connection from the host PC to the Control/422 RJ45 or Remote/RMT 2 connector on Crystal Vision frames
- An active or Statesman enabled control panel MUST be fitted to the frame with version 1.63 or above firmware – if it is an Indigo frame the firmware must be V1.04 or above
- An optional RS422 to RS232 converter if the PC has no RS422 ports

Installing Statesman

- Refer to the readme and/or help file on the CD before proceeding
- To view all application windows, set graphics resolution to at least 1024 x 768
- Remove any previous version of the Statesman software using the Add/Remove Programs application in the Windows Control Panel
- Ensure that the Statesman dongle is fitted to the parallel port of the host PC
- Insert the Statesman CD and the installation should start immediately – if it does not, run the setup.exe file on the CD
- Obey any installation program prompts and restart the PC when prompted

Running Statesman for the first time

The Statesman PC Control System may be run from the Crystal Vision programs folder via the Start menu or by double-clicking on the Crystal Vision.exe file in the installed program directory.

When the program runs it will require licence information and an administrator name and password. It will also need to know which computer port is being used to connect to a Crystal Vision frame(s).

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

2.2 Statesman operation

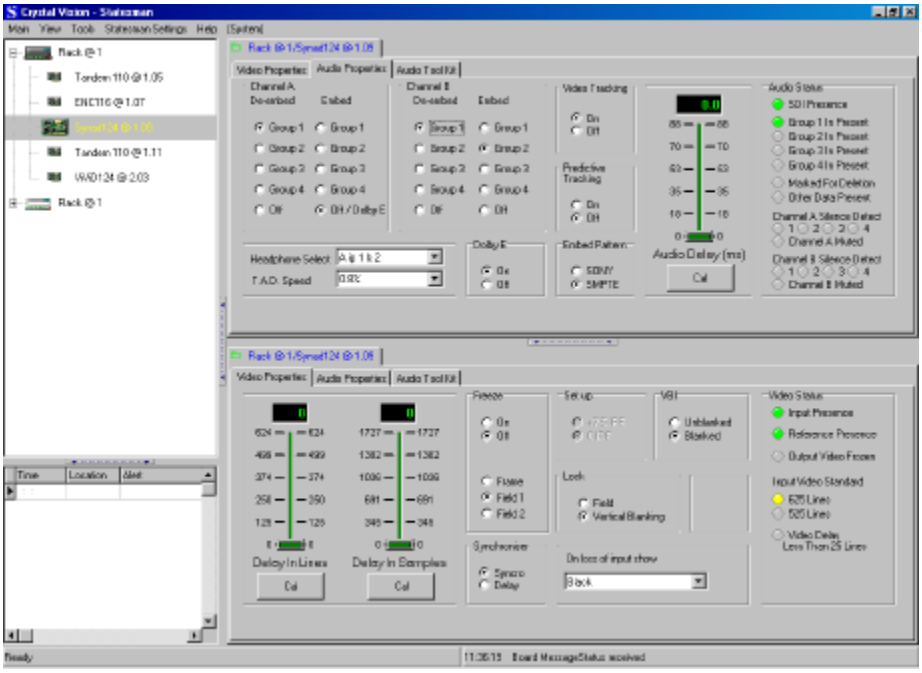
Once Statesman is configured it should automatically detect any statesman compatible modules in the connected frame or frames and display them in the main application left hand explorer-style window.

Open any frame by clicking on the '+' sign or by double clicking on a frame. Installed modules should be shown with module icons. Frame and module icons can be named as desired by right-clicking or using the edit menu and choosing rename.

To aid user recognition of module and frame status quickly, the following colour and size coding is used:

- A module is shown present by full colour and absent by greyed colour
- A module is shown open by large icon size and closed by small icon
- A module is the source of an active alarm if red and not alarmed if green

Double-clicking on a module will enable the display of the main application menus.



Statesman main application window

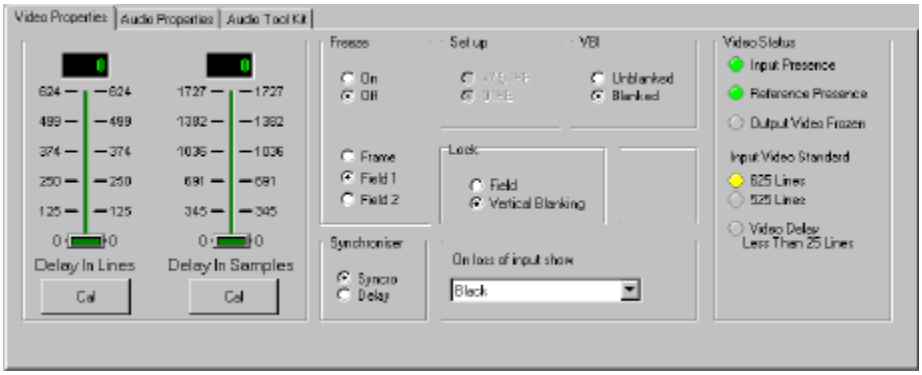
The two large control panes shown in the upper and lower halves of the window may display different menus for the same card, or controls for different cards. Click on the horizontal button-bar between the two panes to close the lower plane or drag the button to vary the size of the panes.

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

Selecting synchroniser or delay mode

The SYNAD124 may be used in either Syncro (synchroniser) or delay mode.

To select the desired mode check either the Syncro for synchroniser or Delay for delay mode.



SYNAD video properties

In synchroniser mode the unit takes its timing from the analogue external reference and will automatically synchronise sources with or without embedded audio between 0 and 2 fields.

In delay mode, timing is derived only from the SDI input.

In each case the audio delay can be made to track the video delay and the audio always remains locked to video.

Adjusting the video delay

The video delay may be adjusted from 0 to 2 fields for both 525 and 625 inputs in either Syncro or Delay mode. Use the Delay in Lines and Delay in Samples sliders to control the delay.

Delay control	625 range	525 range	Description
Delay in Lines	0 to 624	0 to 525	Number of lines of delay in Delay Mode or vertical timing offset with respect to reference in Syncro mode
Delay in Samples	0 to 1727	0 to 1715	Fine delay or horizontal offset in pixels in Delay Mode or fine vertical timing offset with respect to reference in Syncro mode

Freezing the video

The video signal may be frozen as a full fame (two fields) or single field. The field used may be field 1 or field 2. Make the selection by checking the Frame, Field 1 or Field 2 box, then check the Freeze On box to freeze the input.

The Audio Output is always muted when the video is frozen. The embedded packet structure is maintained but the packets contain silence.

Loss of input behaviour

The video display options when the video input is lost may be selected from the following:

Loss of video option	Video behaviour
Black	Output goes immediately to black
Blue	Output goes immediately to blue
Last good field	Last good field is repeated to produce a frame output
Last good frame	Last frame including video at point of failure
Delay then black	Output goes to black after a period of frozen video
Delay then blue	Output goes to blue after a period of frozen video

The Audio Output is always muted when the video is frozen. The embedded packet structure is maintained but the packets contain silence.

Vertical lock mode

With 525 line sources the re-lock is timed from the field flag to accommodate different lengths of vertical blanking. Normally when operating with 625 line sources SYNAD re-locks on the input at the start of active video. This means that if switch occurs between untimed sources there will be no disturbance in the active video if both the sources are in vertical blanking when the switch occurs. To allow operation with 625 line sources that have non-compliant vertical blanking lengths, it is possible to select a re-lock timed from the field flag.

Monitor output options

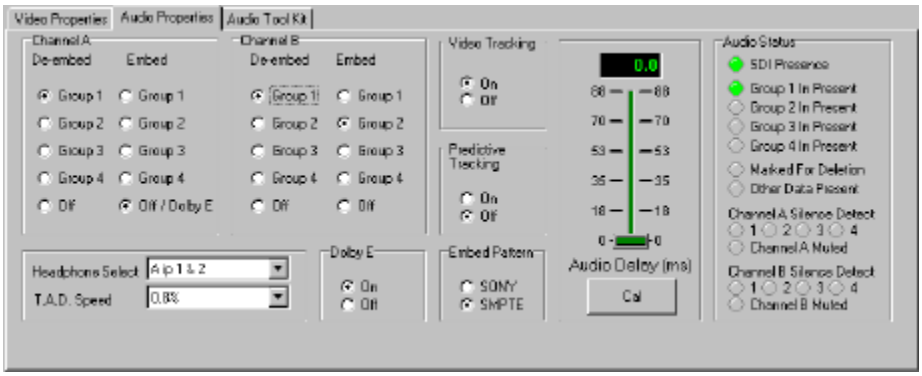
Data in the VBI (Vertical Blanking Interval) of the analogue composite monitor output can be blanked or passed. Check the VBI blanked or unblanked box as required.

7.5% IRE setup may be applied when a 525 standard SDI signal is used (composite monitor output will be NTSC). Check the 0% or +7.5% IRE box as required.

Selecting audio groups

The group de-embedded, re-sampled, delayed and then re-embedded can be selected for both the A and B de-embed/re-sample/delay/embed ‘Channels’.

The A and B ‘channels’ are independent audio de- embed > re-sample > delay > embed processors and should not be confused with AES/EBU audio channels within a group.



Audio properties

The group de-embedded, re-sampled, delayed and then re-embedded can be selected for both the SYNAD124 ‘A and B Channels’.

The ‘A and B Channels’ are independent de-embed/re-sample/delay/embed audio processors and should not be confused with AES/EBU audio channels within a group.

To select a group to de-embed from ‘channel A’, check Group 1, 2, 3, 4 or off.

To select a group to embed into ‘channel A’, check Group 1, 2, 3, 4 or off.

To select a group to de-embed from ‘channel B’, check Group 1, 2, 3, 4 or off.

To select a group to embed into ‘channel B’, check Group 1, 2, 3, 4 or off.

Note: It is not possible to turn the Channel A embedder on or off if the Channel B embedder is on.

Notes: Audio cannot be routed between the ‘A’ and ‘B’ SYNAD124 de-embed/embed paths and specific audio channels within an audio group cannot be individually selected. Only re-embedded audio will be present in the SDI output stream, since the entire HANC space is always blanked prior to the embedding process.

Adjusting the audio delay

The audio delay slider controls the actual delay if video tracking is off or the audio delay offset or additional delay if video tracking is on.

Use the audio delay sliders to control the delay from 0 to 88 milliseconds.

Note: When video tracking is on, audio delay dynamically follows video delay in Syncro mode and when video delay is manually changed.

Video tracking

When enabled, the built-in video tracking helps to ensure that the audio delay matches the video delay to maintain lip sync.

To enable video tracking check the Video Tracking On box, to disable it check the Video Tracking Off box.

Tracking Audio Delay rate

The Tracking Audio Delay rate TAD speed determines the time taken for the audio delay to track fast or abrupt changes in video delay when Video Tracking is on. The faster the rate, the faster the audio delay will match the video delay, but at the expense of musical pitch.

To select the tracking audio delay maximum rate of change or speed click on the T.A.D. spin box and select from the available rates. The current rates are 0.8%, 0.4%, 0.2%, 0.1% and 0.05%.

Using predictive tracking

In Syncro mode, the video delay control processor has to add a frame of video when an asynchronous input video lags behind the reference timing by two fields or delete a frame of video when the input overtakes the reference. All video synchronisers have to work in a similar fashion, which means that when the video delay abruptly changes from zero delay to two fields delay.

The SYNAD124 does this with a predictive circuit that ‘knows’ when the timing jump is about to occur so that the audio delay can be slowly changed to maintain lip sync within close limits. The T.A.D. setting controls any change in audio pitch.

To ensure that lip sync errors are minimised during the necessary jumps in video timing with asynchronous inputs in Syncro mode, make sure that the Predictive Tracking On box is checked.

Remember to select a T.A.D. value appropriate for the programme material.

Selecting the embed pattern

The SYNAD124 supports two different embedding formats ‘Sony’ or ‘SMPTE’. The ‘Sony’ format embeds on every line of the SDI output, whereas the ‘SMPTE’ format omits embedding from one line before the vertical interval switch point as defined in SMPTE RP168, through to three lines after - a total of a four line gap in each and every TV field.

The input format does not require setup as it is automatically detected.

The output format chosen should match the most common format in use, or set to SMPTE if in any doubt.

To select the desired embedding format, check either the SONY or SMPTE box.

Using the headphone monitor

The card edge jack socket [3.5 mm, stereo] is used to monitor the four possible stereo audio signals that can be de-embedded from two Audio Groups by the A & B ‘channel’ de-embedders in the incoming SDI input signal.

It can also be used to monitor the four possible stereo audio signals that can be embedded in two Audio Groups by the A & B ‘channel’ embedders in the SDI output signal.

Select the desired audio pair to listen to from the Headphone Select drop-down box.

These analogue audio signals are only available through the headphone jack socket.

Note: There are no outputs to the rear connectors, as there are with Tandems, TAD202, & Demon.

Tip: The headphone output will not drive non-amplified speakers. Use with active loudspeakers, or a pair of headphones.

Handling non-linear audio

Embedded data that is not linear audio, such as Dolby E, can be blocked or passed transparently through the video store with the SDI video.

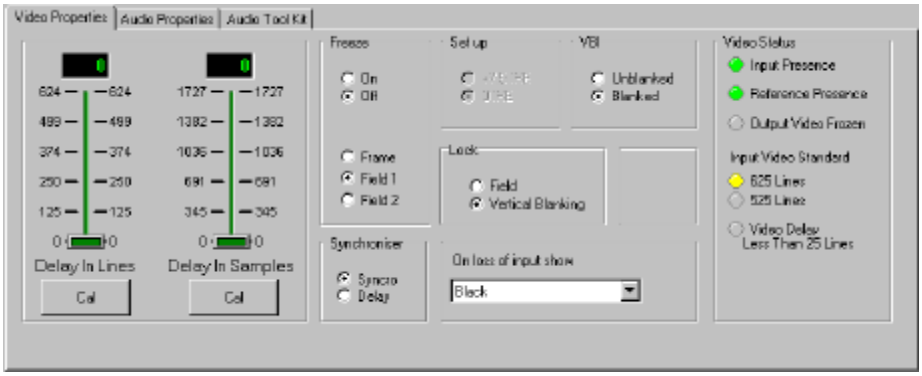
To pass non-linear audio data such as Dolby E ensure that the 'Dolby E On' box is checked. To block non-linear audio data check the 'Dolby E Off' box.

Using Statesman status displays

Video and audio status is provided by simulated LEDs in both the video and audio panels. In addition the third tab, Toolkit, provides a comprehensive status display.

Video status

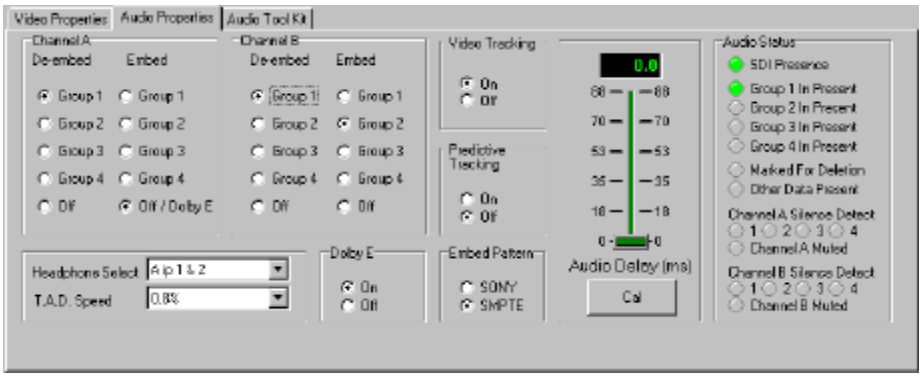
The Video status panel shows Input and reference presence and the detected input standard. In addition warning is given when the video delay is less than 25 lines and when the output is frozen.



Video properties with Video Status panel on the right hand side

Audio status

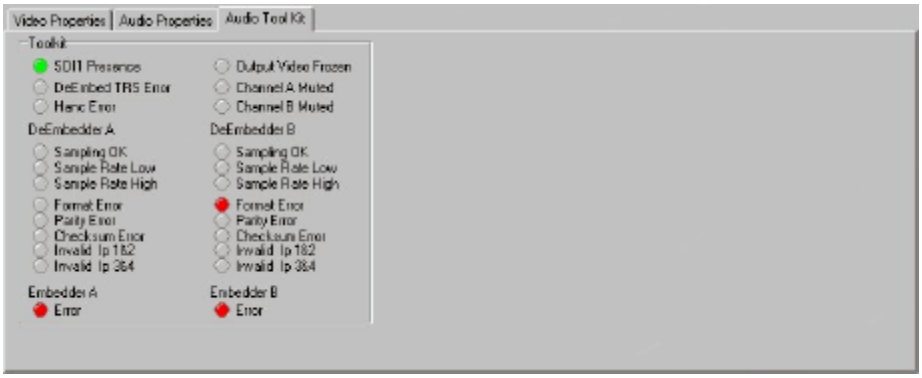
The Audio status panel shows SDI and audio group presence. In addition warning is given when any incoming audio channel is silent and if non-audio data has been detected or if any data marked for deletion has been detected.



Audio properties with Audio Status panel on the right hand side

Using the toolkit

The Audio Toolkit status display repeats some of the general video and audio status information and then expands upon it with a more detailed analysis.



The Audio Toolkit

Toolkit provides details of the general status of the de-embedder, embedder, and HANC space data which includes the following:

- De-embed TRS error may occur when a Timing Reference Signal is missing or corrupted causing a failure of any ancillary data, including audio to be recovered. Occasional TRS errors in the video may not have been noticed, particularly if the TRS errors occur in vertical blanking.
- 'Hanc error' normally indicate insufficient spare space in HANC to insert further embedded audio, or HANC space is filled with unspecified signals, such as 'blank' space that is not true black (e.g. analogue blanking prior to A-to-D conversion without true digital blanking applied). The SYNAD124 however, always blanks the entire HANC space prior to re-embedding.
- 'Low / high sample rates' indicate incorrect number of incoming audio samples beyond manageable error rates (both high+low = wildly varying sample rate)
- 'Format' error refers to errors in the format or structure of the embedded audio data packets
- 'Invalid' digital audio signals are indicated by the ‘V’ bits set to logic 'high'. ‘V’ bit high is set by the AES standard as indicating 'invalid' audio data, or possibly non-linear audio data, such as compressed multichannel audio data which cannot be directly converted back to audible signals

Note: The HANC blanking is always on for both embedders. This means that any incoming ancillary data other than the audio groups selected for re-embedding are always lost and are not passed by the SYNAD124.
There is no input EDH checking but new EDH data is always generated.
Card–edge warnings do not appear within Statesman or the front control panel.

3 Using the active control panel

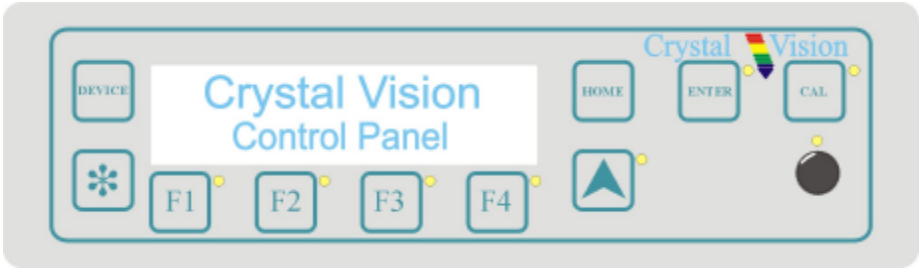
This operational guide assumes that the panel has been setup according to the Panel setup procedure described in the Crystal Vision Controls Panel manual.

Note: It is **ESSENTIAL** that the Panel setup procedure is followed and any old or unknown passwords cleared prior to using the panel for the first time.

At power up, the two line 20-character screen will display ‘Crystal Vision’ followed by the firmware version number for the control panel. All eight control panel key LEDs will illuminate.

The Crystal Vision control panel start up display

'Control Panel' then briefly replaces the version number display.



If the control panel firmware has been updated for Statesman control, Statesman Mode will be entered and the message, ‘Press CAL to Exit’ will be displayed and the CAL LED will light.

Statesman mode is entered by default

To continue with control panel operation or configuration, press the ‘CAL’ key once. A second press of the ‘CAL’ key will return to Statesman control.

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.

Selecting the SYNAD124

To select a particular card in a frame, press the DEVICE key to go to the Device menu. The top line of the display will show 'Available Cards X', where X is the number of cards that have responded so far to the polling request.

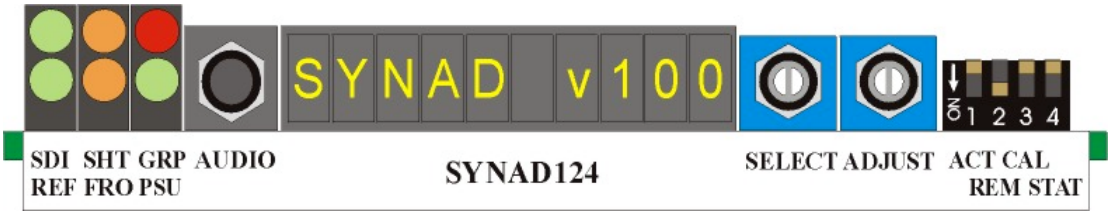
Control panel showing available cards

Rotate the shaft encoder and the bottom row will display the successfully polled cards by name and location or slot number.

In the example above, the card displayed is located in the first frame in slot number 2.

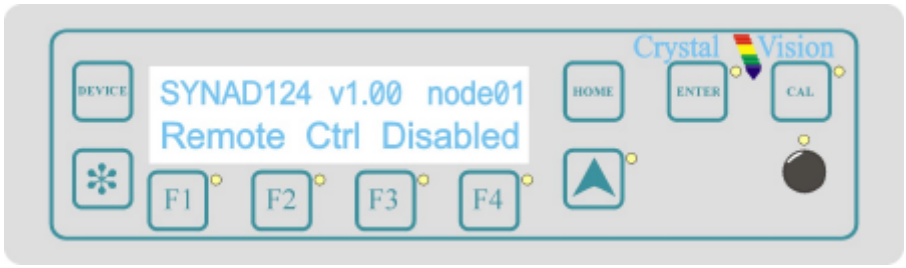
When the desired card is selected press the ENTER key to access that card's HOME menu.

The card edge DIL switch lever labelled REM must be in the down position to enable the active control panel.



SYNAD124 front edge view

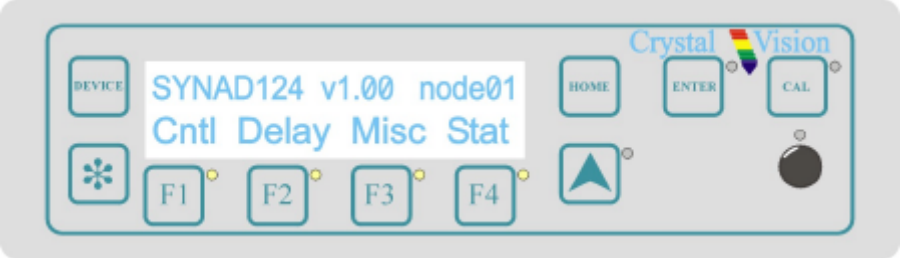
If the REM switch is in the wrong position the following message will be displayed:



SYNAD124 home menu disabled

To enable the active control panel, ensure that the REM lever of the card edge DIL switch is in the DOWN position as shown above and select it again with the ENTER key.

If remote control has been enabled, the control panel will then enter card mode and communicate with the selected module.



SYNAD124 home menu

Note: In all current Crystal Vision frames the node address is coded into the backplane giving a unique node address for each slot. The node address is typically one less than the location number. Refer to the Frame Manual for further information on using node addresses.

3.1 Navigating the display

The functions assigned to control panel keys are dependent on the card selected for control, and the panel mode. The following list illustrates the functions when controlling the SYNAD124:

- DEVICE – enters Device menu to select a card or card to control / enter Panel setup when held down during power up / shows frame status when pressed from Statesman mode
- CAL – Enter or leave Statesman mode / enter panel diagnostics mode when held down during power up
- Asterisk – enters board rename menu from the Device menu
- F1 to F4 – soft keys, function assigned within each menu
- HOME – moves the display to the home menu
- ENTER – press to enable or disable data entry mode or accept device selection
- Upward arrow – used to move up the menu structure / enter lock panel menu from the Device menu
- Rotary control – shaft encoder used to select options or variable data

Note: Please refer to the Crystal Vision Control Panel manual for details of the Panel Setup, Lock Panel and Diagnostic menus.

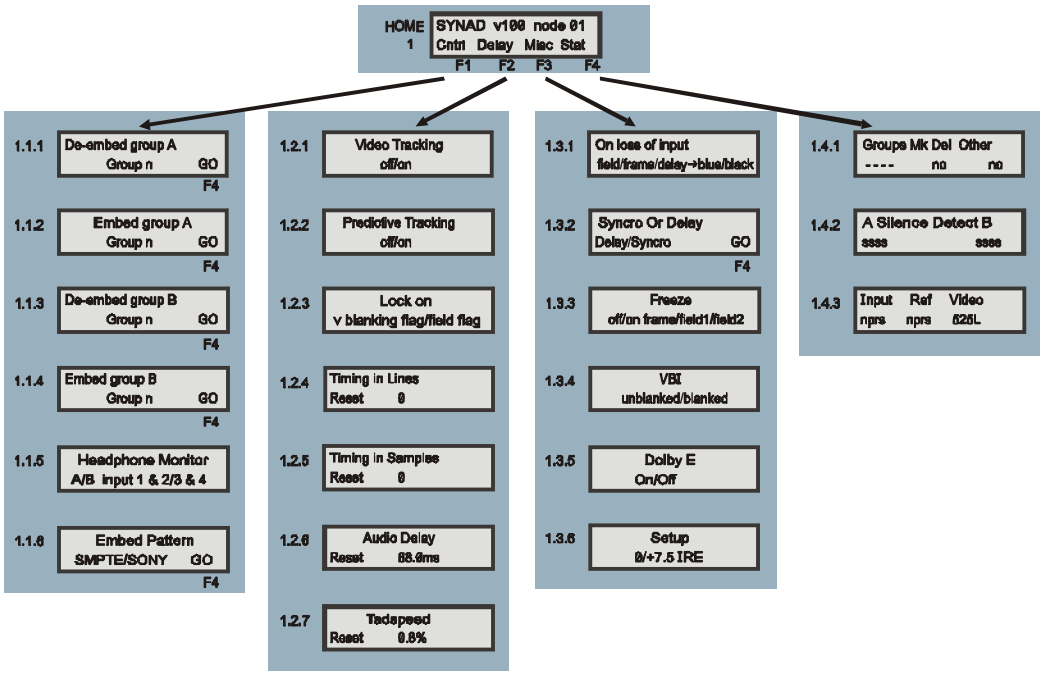
Updating the display

The display updates automatically within a second or two of changes occurring.

3.2 The SYNAD124 active panel menu structure

The main top-level menus for the SYNAD124 module are obtained by pressing the F1 to F4 keys from the HOME menu. Menu keys are illuminated when active and when further menus are available.

The following chart shows the available menus.



The SYNAD124 control panel menu tree

Menu numbering scheme

This manual uses a simple menu numbering convention based on the sequence of keys required to reach each menu from the top level home menu. For example, menu 1.1.2 is reached from the home menu by pressing F1, then rotating the shaft encoder clockwise until the next menu is displayed. Menu 1.2.3 is reached by pressing F2 and then rotating the shaft encoder clockwise until the third menu is displayed.

Sub-menus and data entry:

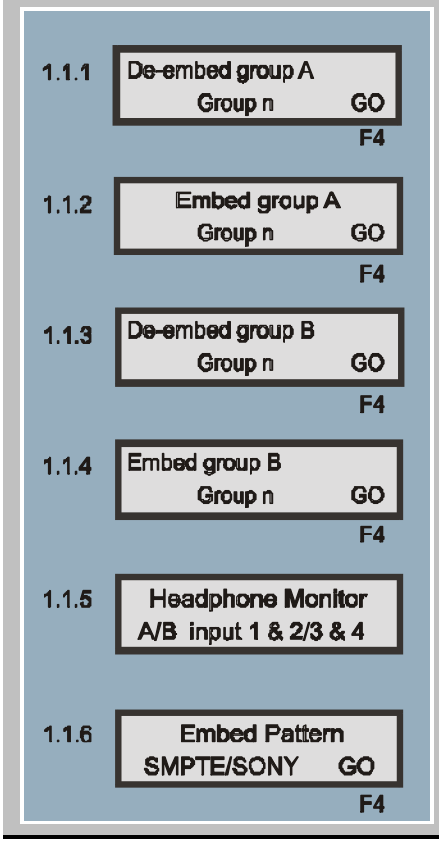
The shaft encoder is used to scroll through available sub-menus and the ENTER key acts as a guard key. Press the ENTER key to enter data-entry mode, press it again to leave data-entry mode and continue navigating through the menu system.

Notes: Square brackets appear round menu parameters in data-entry mode.
Function keys and shaft encoder LEDs are illuminated when active.

3.3 Using the control menu

Pressing F1 from the home menu will bring up the top Cntrl (control) menu. The control menu provides access to de-embed and embed group selection for each SYNAD124 'channel', the headphone monitor output selector and embed pattern.

Press the ENTER key when the chosen menu is displayed. Square brackets will appear around the available parameters to indicate data-entry mode. Press ENTER again to leave the data-entry mode and continue navigating the available menus.

SYNAD124 Cntrl menu	Description
	Press ENTER to activate menu Shaft encoder selects de-embed group channel A or off F4: GO (send value). Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects embed group channel A or off (see note) F4: GO (send value). Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects de-embed group channel B or off F4: GO (send value). Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects embed group channel B or off F4: GO (send value). Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects channel A or B and audio pair 1&2 or 3&4 Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects SMPTE or SONY embedding pattern F4: GO (send value). Press ENTER again to leave menu

The group de-embedded, re-sampled, delayed and then re-embedded can be selected for both SYNAD124 'A and B Channels'.

The 'A and B Channels' are independent de-embed/re-sample/delay/embed audio processors and should not be confused with AES/EBU audio channels within a group.

Note: It is not possible to turn the Channel A embedder on or off if the Channel B embedder is on. (Menu 1.1.2 will show BOn if A embedder is on).
Audio cannot be routed between the 'A' and 'B' paths and specific audio channels within an audio group cannot be individually selected.
Only re-embedded audio will be present in the SDI output stream, since the entire HANC space is always blanked prior to the embedding process.

Monitoring embedded audio

The 3.5 mm, stereo jack socket is used to monitor the four possible stereo audio signals that can be de-embedded from two Audio Groups by the A and B de-embedders in the incoming SDI input signal.

It can also be used to monitor the four possible stereo audio signals that can be embedded in two Audio Groups by the A and B channel embedders in the SDI output signal.

Notes:
Analogue monitoring audio is only available through the headphone jack socket.
Specific audio channels may only be selected for monitoring, there is no facility to route or select individual channels for embedding.
Use one of the TANDEM series of modules for more extensive control of external and embedded audio.

Choosing the embedding format

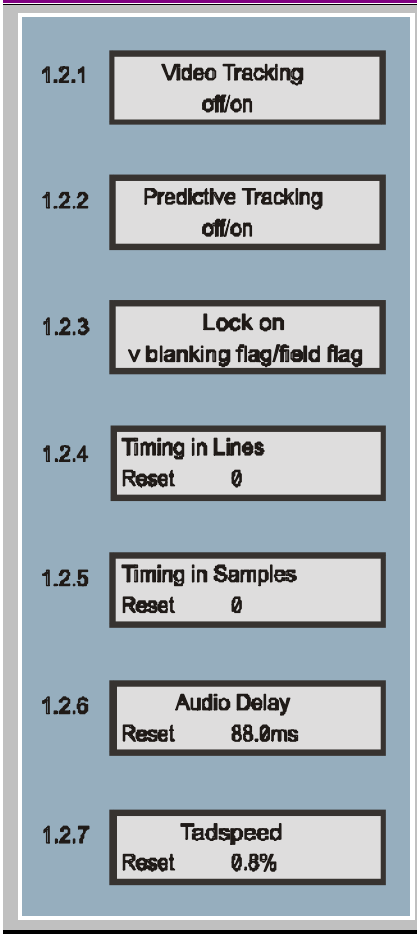
The SYNAD124 supports two different embedding formats ‘Sony’ or ‘SMPTE’. The ‘Sony’ format embeds on every line of the SDI output, whereas the ‘SMPTE’ format omits embedding from one line before the vertical interval switch point as defined in SMPTE RP168, through to three lines after - a total of a four line gap in each and every TV field.

Notes:
The input format does not require setup as it is automatically detected.
The output format chosen should match the most common format in use, or set to SMPTE if in any doubt.

Configuring audio and video delay

Press F2 from main menu 1.1 and then rotate the shaft encoder to access the available menus.

Press the ENTER key when the chosen menu is displayed. Square brackets will appear around the available parameters to indicate data-entry mode. Press ENTER again to leave the data-entry mode and continue navigating the available menus.

SYNAD124 delay menu	Description
	Press ENTER to activate menu Shaft encoder or F2 key selects video tracking off or on Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder or F2 key selects predictive tracking off or on Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects v blanking or field vertical lock mode Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects video timing in lines Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects video timing in pixels Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects audio delay in milliseconds Press ENTER again to leave menu Press ENTER to activate menu Shaft encoder selects Tracking Audio Delay Speed in percentage Press ENTER again to leave menu

Enabling video tracking

When video tracking is enabled the audio delay can be made to match the video delay and so maintain lip sync.

Selecting predictive tracking

Predictive tracking is designed to be used Syncro mode with video tracking on, so that as the video delay changes, the rate of change of the audio delay is controlled.

Note: Predictive tracking cannot be turned on if video tracking is off.

Selecting the vertical lock mode

With 525 line sources the re-lock is timed from the field flag to accommodate different lengths of vertical blanking. Normally when operating with 625 line sources SYNAD re-locks on the input at the start of active video. This means that if switch occurs between untimed sources there will be no disturbance in the active video if both the sources are in vertical blanking when the switch occurs. To allow operation with 625 line sources that have non-compliant vertical blanking lengths, it is possible to select a re-lock timed from the field flag.

Selecting the output video timing or offset

This sets the number of lines or pixels the video is to be delayed in Delay Mode, or the vertical timing offset with respect to the reference input in Syncro Mode.

Selecting the audio delay

This sets the time the audio is to be delayed by in Delay mode, or the additional or offset delay added to the tracking audio delay in Syncro mode. If tracking delay is OFF in Syncro mode this selects the actual audio delay.

Selecting the Tracking Audio Delay rate

Tadspeed or the Tracking Audio Delay rate 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.

Selecting system options

Press F3 from main menu 1.3 and then rotate the shaft encoder to access the 'Misc' menu. Press the ENTER key when the chosen menu is displayed. Square brackets will appear around the available parameters to indicate data-entry mode. Press ENTER again to leave the data-entry mode and continue navigating the available menus.

SYNAD124 Miscellaneous menu		Description
1.3.1	On loss of input field/frame/delay→blue/black	Press ENTER to activate menu Shaft encoder selects loss of input behaviour option Press ENTER again to leave menu
1.3.2	Syncro Or Delay Delay/Syncro GO F4	Press ENTER to activate menu Shaft encoder selects Delay or Syncro mode Pressing F4 activates the command Press ENTER again to leave menu
1.3.3	Freeze off/on frame/field1/field2	Press ENTER to activate menu Shaft encoder selects Freeze type F2 selects frozen or live video Press ENTER again to leave menu
1.3.4	VBI unblanked/blanked	Press ENTER to activate menu Shaft encoder selects Freeze type F2 selects frozen or live video Press ENTER again to leave menu
1.3.5	Dolby E On/Off	Press ENTER to activate menu Shaft encoder or pressing F2 selects Dolby E On/Off Press ENTER again to leave menu
1.3.6	Setup 0/+7.5 IRE	Press ENTER to activate menu Shaft encoder or pressing F2 selects composite NTSC IRE setup option Press ENTER again to leave menu

Note: Note VBI blanking and setup controls only affect the composite output.

Selecting SDI loss behaviour

The SYNAD124 behaviour when the SDI input is lost may be selected to cut to black, cut to blue, freeze or hold a freeze for a about a second while before outputting a blue or black screen.

Selecting the operating mode

The SYNAD124 has two modes of operation, synchroniser and delay line.

In synchroniser mode the unit takes its timing from the analogue external reference and will automatically synchronise sources with or without embedded audio between 0 and 2 fields. In delay mode, timing is derived only from the SDI input.

Selecting the freeze mode

The type of freeze used when the freeze command is given may be selected from frame, field 1 and field 2. If there is movement between two consecutive fields a frame freeze may show movement judder.

A field freeze works by repeating the same field to produce a synthetic frame of video, without movement judder. However a field freeze is more likely to show jagged edges on near horizontal lines.

Note: When freeze is ON, audio output is MUTED. Freeze may be set to ON by manual control from edge of PCB, remote control panel, Statesman control, or by asserting a GPI "Assert Freeze" input low.

Handling non-linear audio

Embedded data that is not linear audio, such as Dolby E, can be blocked or passed transparently through the video store with the SDI video.

To pass non-linear audio data such as Dolby E ensure that the 'Dolby E' is set to On. To block non-linear audio set 'Dolby E' to Off.

Composite output options

Data in the VBI (Vertical Blanking Interval) of the analogue composite monitor output can be blanked or passed and 7.5% IRE setup may be applied when a 525 standard SDI signal is used (composite monitor output will be NTSC).

Using the status menu

Press F4 from main menu 1.4 and then rotate the shaft encoder to access the available menus.

SYNAD124 Status menu	Description
1.4.1 Groups Mk Del Other ---- no no	Shows the status of the ancillary data in the incoming SDI stream
1.4.2 A Silence Detect B ssss ssss	Shows the status of selected audio groups in the 'A and B Channels'
1.4.3 Input Ref Video nprs nprs 525L	Input and reference video input status shown

Menu 1.4.1 shows the status of the incoming SDI ancillary data. The first four character positions of the bottom line indicate the presence of incoming embedded audio groups with numbers 1, 2, 3 and 4 and absent groups with '-'. The next position indicates if any characters are marked for deletion and the final position indicates if any non-audio data is present.

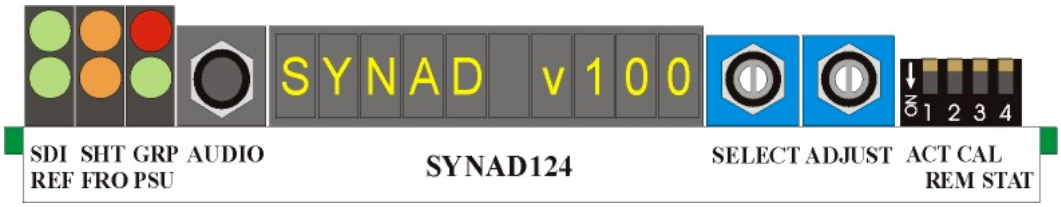
Menu 1.4.2 shows silent audio channels in the selected groups in the SYNAD124 'A and B Channels' with 's' and active channels with numbers 1, 2, 3 and 4.

Menu 1.4.3 shows Input or Ref presence with 'pres' and not present with 'nprs', input standard is either 525L or 625L.

Note: Take care not to confuse SYNAD124 'A and B Channels' with audio channels within a group.
The status display is automatically updated approximately once a second.

4 Card edge operation

The hinged front panel of the case reveals user control of the card, LED indication of card status and the monitor headphone socket.



The SYNAD124 front edge view

Card edge switch settings

The 4-way piano switch allows the operating modes and status options to be selected.

Lever	Function	Up	Down
1 ACT	ACTion	Normally UP, Set DOWN & back UP to action certain operational control 'ON/OFF' functions.	
2 REM	REMote	Local card edge control	Active panel remote control
3 CAL	CALibrate	Normally UP, Set DOWN & back UP to preset some variable controls back to zero. Hold down during power up to recall factory defaults.	
4 STAT	STATus	Normally UP for local 'edge of PCB' control functions, Set DOWN for monitoring only of SYNAD124 operational status.	

4-Way DIL switch functions

Notes: Statesman has continuous access independent of the REM switch setting.

Card edge rotary controls

Control	Function
SELECT	Rotary menu control. Rotate to selects the various menus available and initially show the current status of that parameter or setting.
ADJUST	Used in conjunction with the SELECT control. When the SELECT control has selected the required menu, the ADJUST control is rotated to change the current setting to other options.

Rotary control functions

Notes: Rotary controls 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 Statesman 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
SDI	Green	Good SDI input present. (Top LED)
REF	Green	Good REFerence analogue sync input present. (Bottom LED)
SHT	Yellow	SHorT Video Delay - less than 25 H Lines. (Top LED)
FRO	Yellow	SDI output contains a FROzen picture. (Bottom LED).
GRP	Red	Illuminates if EITHER de-embedder 'A' or 'B' is set to de-embed an Audio Group that is missing from the incoming SDI signal. (Top LED)
PSU	Green	Good power supply (PSU) rails. (Bottom LED)

Navigating card edge menus

Card edge control is enabled when the REM switch is in the UP position and active panel control is enabled when the REM switch is DOWN.

To access the card edge menu system proceed as follows:

- Start with all of the DIL switch levers in the UP position
- Scroll through and select desired menu by rotating the SELECT control
- The current value assigned will be displayed
- To change the assigned value, rotate the ADJUST control
- Assign new value with DIL switch lever 1 if required (operational changes only)

The action required to save the new assignment depends on the data type as shown in the following table:

Data Type	Down
Numeric value	Automatically updated as value is changed
Audio monitor source	New selection is active immediately
Operational mode change	DIL lever 1 'ACT' must be set DOWN and then UP

If the value to be changed is a numeric variable, it is automatically applied as soon as it is changed. Similarly, Audio Monitor source selection responds instantly to new selections.

Operational mode changes, such as selection of Audio Groups to be de-embedded or embedded, are not applied until the DIL switch lever 1 'ACTion' is set to DOWN & UP.

The displayed menu brightness will flash slowly if confirmation with the ACT lever is required.

Card edge configuration

Menu order assumes clockwise rotation from the initial 'SYNAD v100' display.

Selecting embed/de-embed audio groups

The following steps are required to select up to two audio groups from the incoming audio to be embedded into the same or different groups in the SDI output stream.

Selecting an audio group from the 'A' de-embedder

Turn the SELECT control to display **[Au GrpAip 'n']**, turn the ADJUST control to select the desired option and then confirm the new value.

[Au GrpAip 'n']		**Rotate ADJUST to select audio group from 'A' de-embedder**
Option:	**'n'**	Audio Group number: 1 / 2 / 3 / 4, or - for OFF
Confirmation:		DIL lever 1 'ACT' must be set DOWN and then UP

Selecting an audio group for the 'A' embedder

Turn the SELECT control to display **[Au GrpAop 'n']**, turn the ADJUST control to select the desired option and then confirm the new value.

[Au GrpAop 'n']		**Rotate ADJUST to select audio group for 'A' embedder**
Option:	**'n'**	Audio Group number: 1 / 2 / 3 / 4, or - for OFF or BOn if B embedder on
Confirmation:		DIL lever 1 'ACT' must be set DOWN and then UP

Note: It is not possible to turn the Channel A embedder on or off if the Channel B embedder is on. (Display will show GrpAop BOn if A embedder is on).

Selecting an audio group from the 'B' de-embedder

Turn the SELECT control to display **[Bu GrpAip 'n']**, turn the ADJUST control to select the desired option and then confirm the new value.

[Bu GrpAip 'n']		**Rotate ADJUST to select audio group from 'B' de-embedder**
Option:	**'n'**	Audio Group number: 1 / 2 / 3 / 4, or - for OFF
Confirmation:		DIL lever 1 'ACT' must be set DOWN and then UP

Selecting an audio group for the 'B' embedder

Turn the SELECT control to display **[Bu GrpAop 'n']**, turn the ADJUST control to select the desired option and then confirm the new value.

[Bu GrpAop 'n']		**Rotate ADJUST to select audio group for 'B' embedder**
Option:	**'n'**	Audio Group number: 1 / 2 / 3 / 4, or - for OFF
Confirmation:		DIL lever 1 'ACT' must be set DOWN and then UP

Monitoring embedded audio

The 3.5 mm, stereo jack socket is used to monitor the four possible stereo audio signals that can be de-embedded from two Audio Groups by the A and B de-embedders in the incoming SDI input signal.

It also can be used to monitor the four possible stereo audio signals that can be embedded in two Audio Groups by the A and B channel embedders in the SDI output signal.

To select audio source for the headphone monitor jack socket turn the SELECT control to display **[mon 'src' 'ch']** then turn the ADJUST control to select the desired option.

[mon 'src' 'ch']		**Rotate ADJUST for monitor source**
Option:	**src**	Source may be Aip, Aop, Bip or Bop; where A or B is the SYNAD124 de-embed/embed/delay path, op is embedder and ip is de-embedder
	ch	Channel may be: 12 for audio channels 1 and 2 or 34 for audio channels 3 and 4
Confirmation:		The new value is active the moment it is displayed

Notes: Analogue monitoring audio is only available through the headphone jack socket.
Specific audio channels may only be selected for monitoring, there is no facility to route or select individual channels for embedding.
Use one of the TANDEM series of modules for more extensive control of external and embedded audio.

Choosing the embedding format

The SYNAD124 supports two different embedding formats 'Sony' or 'SMPTE'. The 'Sony' format embeds on every line of the SDI output, whereas the 'SMPTE' format omits embedding from one line before the vertical interval switch point as defined in SMPTE RP168, through to three lines after - a total of a four line gap in each and every TV field.

To select audio embedding format for the SDI output turn the SELECT control to display **[embd 'format']**, turn the ADJUST control to select the desired option and then confirm the new value.

[embd 'format']		**Rotate ADJUST for embedding format**
Option:	**SONY**	Embed all lines
	SMPTE	Leave four line gap in vertical blanking
Confirmation:		DIL lever 1 'ACT' must be set DOWN and then UP

Notes: The input format does not require setup as it is automatically detected.
The output format chosen should match the most common format in use, or set to SMPTE if in any doubt.

Selecting the vertical lock mode

To optimise the handling of upstream switching of SDI sources that may not be correctly co-timed, the normal field lock of the framestore input can be replaced by vertical blanking lock.

The 'vblnk' mode may help avoid picture position disturbances when switching between SDI sources which are not exactly co-timed, and may be offset by a few lines.

To select the video frame synchroniser vertical lock mode for the SDI input turn the SELECT control to display **[lock 'source']**, turn the ADJUST control to select the desired option.

[lock 'source']		**Rotate ADJUST for vertical lock options**
Option:	**field**	Lock to field flag
	vblnk	Lock to vertical blanking flag
Confirmation:		The new value is active the moment it is displayed

Notes: This adjustment is only available in 625 line operation. 525 line operation automatically defaults to locking on the field flag.
V blanking should be terminated in accordance with EBU 601 specifications for vblnk mode. Some USA originated equipment may not comply, in which case 'field' lock mode should be selected.

Selecting the video delay or offset

This sets the number of lines or pixels to be delayed in Delay Mode, or the vertical timing offset with respect to the reference input in Syncro Mode.

Setting the video delay in lines

To select the video frame synchroniser video delay or vertical offset in lines turn the SELECT control to display **[lines 'n']**, and then turn the ADJUST control to select the desired option.

[lines 'n']		**Rotate ADJUST for video delay or offset in lines**
Option:	**'n'**	Required vertical timing or offset (video delay) in lines: where 'n' is 0 to 624 for 625 line systems, or 0 to 524 for 525 line systems
Confirmation:		The new value is active the moment it is displayed

Note: Setting DIL lever 3 'CAL' DOWN & UP during this function will set the displayed value & selection to '0'.

Setting the fine video delay

This sets the number of pixels to be delayed by in the Delay Mode, or the horizontal timing offset with respect to the reference input in Syncro Mode.

To select the video frame synchroniser video fine delay or horizontal offset turn the SELECT control to display **[sample 'n']**, and then turn the ADJUST control to select the desired option.

[sample 'n']		**Rotate ADJUST control for fine video delay value**
Option:	**'n'**	Fine video delay in pixels or picture samples: where 'n' is 0~1727 for 625 line systems, or 0~1715 for 525 line systems
Confirmation:		The new value is active the moment it is displayed

Note: Setting DIL lever 3 'CAL' DOWN & UP during this function will set the displayed value & selection to '0'.

Selecting the additional audio delay

This sets the time the audio is to be delayed in the Delay Mode, or in Syncro Mode, added to the tracking audio delay when that mode is switched on. When tracking delay is OFF, then this selects the actual audio delay.

To select the additional audio delay turn the SELECT control to display **[ADel 'n']**, and then turn the ADJUST control to select the desired option.

[ADel 'n']		**Rotate ADJUST for additional audio delay**
Option:	**'n'**	Additional delay in milliseconds: where 'n' = 0.0 to 88.0 in 1/10th millisecond steps
Confirmation:		The new value is active the moment it is displayed

Note: Setting DIL lever 3 'CAL' DOWN & UP during this function will set the displayed value & selection to '0'.

Selecting the 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.

Note: Video Tracking is turned on or off with the **[VidTrk on/off]** menu.

Refer to the Introduction chapter for more help with TAD speed settings for different applications.

To select the tracking audio delay maximum rate of change (speed) turn the SELECT control to display **[spd 'n%']**, then turn the ADJUST control to select the desired option.

[spd 'n%']		**Rotate ADJUST for TAD speed**
Option:	**'n%'**	Maximum permitted rate of change in binary steps: where 'n%' = 0.8%, 0.4%, 0.2%, 0.1%, 0.05%
Confirmation:		The new value is active the moment it is displayed

Enabling video tracking

As explained in the previous section, when video tracking is enabled the audio delay can be made to match the video delay and so maintain lip sync.

To enable or disable video tracking turn the SELECT control to display **[VidTrk 'off/on']**, then turn the ADJUST control to select the desired option.

[VidTrk 'on/off']		**Rotate ADJUST for video tracking options**
Option:	**off**	Turns video tracking off
	on	Turns video tracking on
Confirmation:		The new value is active the moment it is displayed

Selecting predictive tracking

Predictive tracking is designed to be used in Syncro Mode with video tracking on, so that as the video delay changes, the rate of change of the audio delay is controlled.

To select the predictive tracking audio delay mode turn the SELECT control to display **[PreTrk 'on/off']**, turn the ADJUST control to select the desired option.

[PreTrk 'on/off']		**Rotate ADJUST for predictive tracking options**
Option:	**off**	Turns predictive tracking off
	on	Turns predictive tracking on
Confirmation:		The new value is active the moment it is displayed

Note: Predictive tracking cannot be turned on if video tracking is off.

Selecting SDI loss behaviour

The SYNAD124 behaviour when the SDI input is lost may be selected to cut to black, cut to blue, freeze or hold a freeze for approximately one second before outputting a blue or black screen.

To select the video frame synchroniser operation on lost SDI input turn the SELECT control to display **[no ip 'option']**, turn the ADJUST control to select the desired option.

[no ip 'option']		**Rotate ADJUST for SDI loss options**
Option:	**blk**	set SDI output video content to black picture on loss of SDI input
	fld	set SDI output video content to frozen last good field picture on loss of SDI input. (Repeat last good field twice as a frame output.)
	frm	set SDI output video content to frozen last frame picture on loss of SDI input. (Used for diagnostics, as it includes last field where input was lost.)
	del blck	set SDI output video content to frozen last good field picture for a brief time delay, and then switches to black picture, on loss of SDI input.
	del blue	set SDI output video content to frozen last good field picture for a brief time delay, and then switches to blue picture, on loss of SDI input.
Confirmation:		The new value is active the moment it is displayed

Selecting the operating mode

The SYNAD124 has two modes of operation, synchroniser and delay line.

In synchroniser mode the unit takes its timing from the analogue external reference and will automatically synchronise sources with or without embedded audio between 0 and 2 fields. In delay mode, timing is derived only from the SDI input.

To select the SYNAD124 to video frame synchroniser operation or variable SDI delay mode turn the SELECT control to display **[S/D 'option']**, turn the ADJUST control to select the desired option and then confirm the new value.

[S/D 'option']		**Rotate ADJUST for operating mode**
Option:	**syncro**	sets SYNAD124 into frame synchroniser mode
	delay	sets SYNAD124 into variable SDI delay mode
Confirmation:		DIL lever 1 'ACT' must be set DOWN and then UP

Selecting the freeze mode

The type of freeze used when the freeze command is given may be selected from frame, field 1 and field 2. If there is movement between both fields a frame freeze may show movement judder. A field freeze works by repeating the same field to produce a synthetic frame of video, without movement judder. However a field freeze is more likely to show jagged edges on near horizontal lines.

To select the SYNAD124 to video picture freeze mode turn the SELECT control to display **[frze 'option']**, turn the ADJUST control to select the desired option.

[frze 'option']		**Rotate ADJUST for freeze mode**
Option:	**frame**	sets SYNAD124 into frame freeze mode, whenever freeze is ON
	fld1	sets SYNAD124 into field 1 freeze mode, whenever freeze is ON
	fld2	sets SYNAD124 into field 2 freeze mode, whenever freeze is ON
Confirmation:		The new value is active the moment it is displayed

Note: When freeze is ON, audio output is MUTED. Freeze may be set to ON by manual control from edge of PCB (see below), remote control panel, Statesman control, or by asserting a GPI 'assert freeze' input low.

Forcing a picture freeze

To select the SYNAD124 forced video picture freeze mode ON turn the SELECT control to display **[freeze 'option']**, then turn the ADJUST control to select the desired option.

[freeze 'option']		**Rotate ADJUST for picture freeze on/off**
Option:	**off**	sets SYNAD124 into automatic frame freeze mode as selected above
	on	sets SYNAD124 into forced freeze mode
Confirmation:		The new value is active the moment it is displayed

Note: When freeze is ON, audio output is MUTED. Freeze may be set to ON by manual control from edge of PCB (see above), remote control panel, Statesman control, or by asserting a GPI 'assert freeze' input low.
When freeze mode is ON, the FROzen video LED is illuminated.

Composite output options

Enabling Blanking of the Vertical Interval

The VBI of the SYNAD124 analogue video picture output may be blanked or passed, turn the SELECT control to display **[VBI 'option']**, then turn the ADJUST control to select the desired option.

[VBI 'option']		**Rotate ADJUST for VBI on/off**
Option:	**off**	sets analogue video picture output VBI content to be blanked.
	on	sets analogue video picture output VBI content to be passed
Confirmation:		The new value is active the moment it is displayed

Enabling NTSC setup (pedestal)

When a 525 SDI signal is used, pedestal may be applied to the SYNAD124 analogue NTSC video picture output. Turn the SELECT control to display **[IRE 'option']**, then turn the ADJUST control to select the desired option.

[IRE 'option']		**Rotate ADJUST for NTSC pedestal on/off**
Option:	**0**	sets SYNAD124 analogue video picture output for zero NTSC setup
	+7.5 IRE	sets SYNAD124 analogue video picture output for +7.5% IRE setup
Confirmation:		The new value is active the moment it is displayed

Handling non-linear audio (Dolby E)

Pass/Block non-linear audio (Dolby E) in SDI video output

Non-linear data embedded in the SDI video output may be blanked or passed. Turn the SELECT control to display **[DolbyE 'option']**, then turn the ADJUST control to select the desired option.

[DolbyE 'option']		**Rotate ADJUST for Dolby E on/off**
Option:	**off**	framestore does not pass non-linear data (Dolby E)
	on	framestore passes non-linear data (Dolby E)
Confirmation:		The new value is active the moment it is displayed

Card edge status operation

To enter the card edge status mode set all 4 DIL switch levers UP, except lever 4, which should be DOWN.

Turn the SELECT control to show either the audio or video status display.

Selected audio group status

Shows the status of the audio channels in the selected groups in the SYNAD124 A and B 'Channels'.

[A1234B1234]	**Rotate SELECT to show 'A and B Channel' status**
Option: Axxxx	Where 'A' is SYNAD124 Channel and 'x' is group 1, 2, 3, 4 or s for silent

Example: [A12ssBss34]

Incoming SDI status

Shows the presence and data status of incoming embedded audio groups.

[SDin1 2 3 4 d O]	**Rotate SELECT for incoming audio group status**
Option: 1234dO	Where the first four positions show the status of any incoming audio groups. The fifth character 'd' shows if packet data marked for deletion was present and sixth character 'O' shows if other (non-audio) data was present. If no data appropriate to the character position was detected a dash is shown.

Example: [SDin1 2 - 4 d O]

Note: Take care not to confuse SYNAD124 'A and B Channels' with audio channels within a group.
The status display shows the current status of each function as selected. It is not live, and not updated by changing conditions. To update the status display, select a different parameter, and then return to the desired displayed item.

Recalling factory defaults

To recall factory defaults hold the CAL lever (card-edge switch, lever 3) down whilst powering the module.

The following table shows the default values for each parameter affected:

Parameter	Default value
Deembedder A	Group 1
Deembedder B	Group 1
Embedder C	Group 1
Embedder D	Off
Embed Pattern	SMPTE
Audio Delay	4ms - minimum measured delay through board
Dolby E	Off
Headphone select	De-embedder A Input Channels 1 and 2
Fail Mode	Freeze then blue
Syncro Mode	Syncro
Freeze	Off
Freeze Mode	Field 1
TadSpeed	0.2
Video Tracking	On
Predictive Tracking	Off
Video Standard	PAL
Delay In Lines	0
Delay in Samples	2 - minimum through board

Warning: On no account should the CAL lever be left in the DOWN position during normal operation.

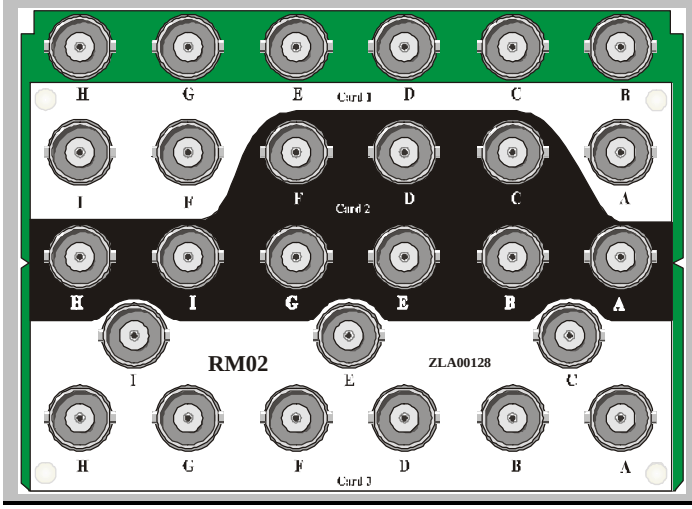
5 Installation

The SYNAD124 video frame/line synchroniser with tracking audio delay is a single height module, which fits into all Crystal Vision rack frames. All modules can be plugged in and removed while the frame is powered without damage.

5.1 Rear modules and signal I/O

The 2U frame takes up to 12 single height Crystal Vision modules, 6 single height modules fit in the 1U frame and 2 single height modules fit in the 1U desk-top box.

RM02

RM02 fits in a 2U frame	Description
	**RM02 (ZLA00128 artwork)** • 9 modules per 2U frame • 3 modules per rear connector • 9 connections available • Card 1 fits in slots 1, 5 and 9 • Card 2 fits in slots 2, 6 and 10 • Card 3 fits in slots 4, 8 and 12 • No card fits in 3, 7 or 11

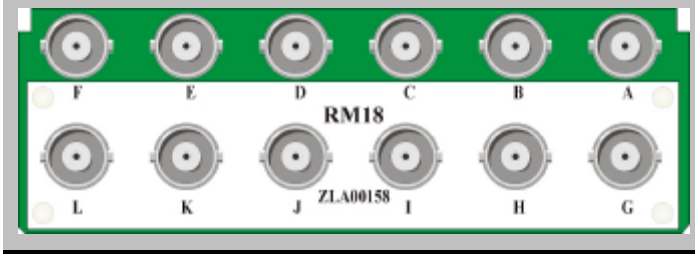
BNC – ZLA00110	BNC – ZLA00128	Signal
IN	A	SDI In
1	B	SDI loop through output
2	C	SDI output 1
3	D	SDI output 2
4	E	SDI output 3
5	F	Composite monitor out
6	G	SDI output 4
7	H	Reference loop through output
8/IN2	I	Reference sync input

RM01

RM01 fits in all current frames	Description
	**RM01 (ZLA00085 artwork)** • 12 modules per 2U frame, 6 per 1U frame & 2 per 1U desk top box • All frame slots can be used

BNC – ZLA00073	BNC – ZLA00085	Signal
V/R/OPC	**A**	Composite monitor out
SDI /1	**B**	SDI In
SDI 2	**C**	SDI loop through output
Y/G/OPA	**D**	SDI output 1
U/B/OPB	**E**	SDI output 2
SYNC/OPD	**F**	Reference sync input

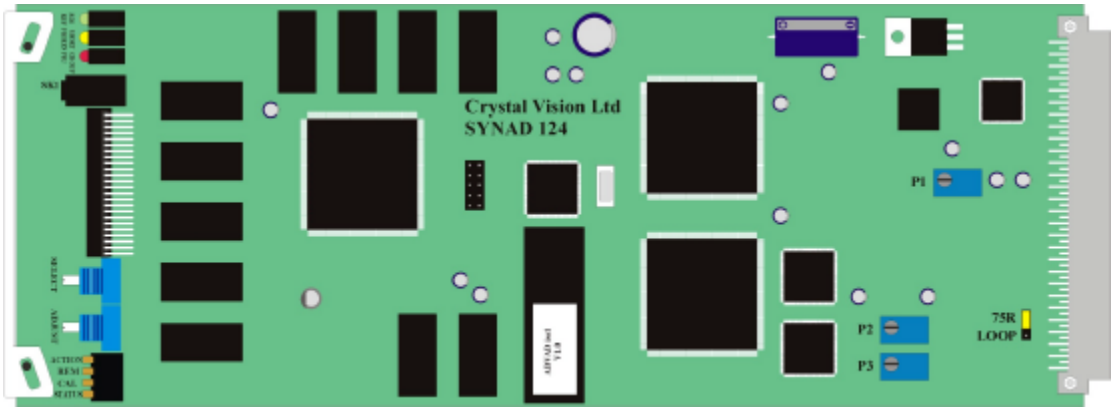
RM18

RM18 fits in all current frames	Description
	**RM18 (ZLA00158 artwork)** • 6 modules per 2U frame, 3 per 1U frame, 1 per 1U desk top box • 1 module per rear connector • 10 connections available • Card fits in upper slot • No card fits in lower slot

BNC – ZLA00158	Signal
A	Composite monitor out 1
B	SDI In
C	SDI loop through output
D	SDI output 1
E	Reference sync input
F	Reference loop through output
G	Composite monitor out 2
H	SDI output 2
I	SDI output 3
J	SDI output 4
K	Composite monitor out 3
L	Composite monitor out 4

5.2 SYNAD124 configuration

The P1, P2 and P3 controls on the board are set correctly when the unit is tested before despatch and should be left as set at the factory.



SYNAD124

Selecting the SDI input termination

PL1 Link positions - board viewed as above

PL1 position	Required position
75R	Upper position, SDI input terminated with 75 Ω. No loop though.
LOOP	Lower position, SDI unterminated and loop though output available.

5.3 GPI connections

Each slot has an associated set of GPI connections for remote control and external status outputs on the frame rear-panel remote connectors. For convenience, GPI lines are associated with reference codes ‘a’ to ‘f’ in the connector pin-out tables for each frame.

GPI	OPEN (+5V)	Ground	Notes
‘a’	live output	freeze output	input to SYNAD
‘b’	Delay > 25 lines	Delay < 25 lines	output from SYNAD
‘c’	audio follow pulse output		output from SYNAD
‘d’	Selected audio group(s) present	Selected audio group(s) absent	
‘e’	Ref present	Ref absent	output from SYNAD
‘f’	SDI present	SDI absent	output from SYNAD

GPI input connections have 10k Ω pull-up resistors to +5V. Closed-contact switches or +5V to +24V logic levels can be used

GPI outputs are provided by open collector transistors with 330 Ω current limit resistors pulled up to +5V through 10K Ω resistors. The Audio Follow output is pulled up to +5V through 100Ω with a zero Ω current limit resistor.

2U Indigo and FR2AV GPI Connections

GPI lines 1 to 6 of each SYNAD card are brought to one of the four remote connectors at the rear of the FR2AV frame as follows:

Slot no.	GPI 'a'		GPI 'b'		GPI 'c'		GPI 'd'		GPI 'e'		GPI 'f'	
	pin	rem	pin	rem	pin	rem	pin	rem	pin	rem	pin	rem
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

Note: Remote (rem) 1 and Remote (rem) 3 are 26 way high density ‘D’ type female sockets and frame ground is pin 2 in each case. Remote (rem) 2 and Remote (rem) 4 are 26 way high density ‘D’ type male plugs and frame ground is pin 6 in each case.

1U Indigo and FR1AV GPI connections

GPI lines ‘a’ to ‘f’ of each SYNAD card connect to one of 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 socket. Frame ground is pin 2 and +5V @500mA is pin 1.
Remote 2: 26 way high density D-type plug. Frame ground is pin 6 and +5V @500mA is pin 15.

Desktop box GPI connections

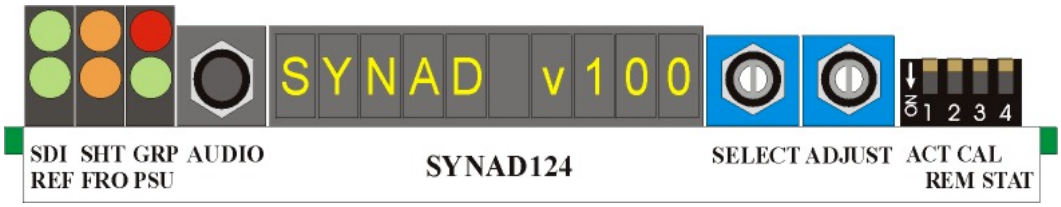
GPI lines ‘a’ to ‘f’ of each SYNAD card connect to the rear remote connector as follows:

Slot no.	‘a’ pin	‘b’ pin	‘c’ pin	‘d’ pin	‘e’ pin	‘f’ pin
1	1	2	3	4	5	6
2	9	10	11	12	13	14

Note: Remote connector is 15 way normal density D-type socket. Frame ground is pin 15.

6 Problem solving

Trouble shooting may be performed by using the card edge, Statesman or the remote status panel display.



The SYNAD124 front edge view

Card edge LEDs

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

Name	Led Colour	Function when ON
SDI	Green	Good SDI input present. (Top LED).
REF	Green	Good REFerence analogue sync input present. (Bottom LED).
SHT	Yellow	SHorT Video Delay - less than 24 H Lines. (Top LED).
FRO	Yellow	SDI output contains a FROzen picture. (Bottom LED).
GRP	Red	SDI input does NOT include a selected Audio GRouP to be de-embedded. (Top LED). This is illuminated if EITHER de-embedder "A" or "B" is set to de-embed an Audio Group that is missing from the incoming SDI signal.
PSU	Green	Good power supply (PSU) input & output rails. (Bottom LED).

Card edge status operation

To enter the card edge status mode set all 4 DIL switch levers UP, except lever 4, which should be DOWN.

Turn the SELECT control to show either the audio or video status display.

Selected audio group status

Shows the status of the audio channels in the selected groups in the SYNAD124 A and B ‘Channels’.

[A1234B1234]	**Rotate SELECT to show ‘A and B Channel’ status**
Option: Axxxx	Were ‘A’ is SYNAD124 Channel and ‘x’ is group 1, 2, 3, 4 or s for silent

Example: [A12ssBss34]

Incoming SDI status

Shows the presence and data status of incoming embedded audio groups.

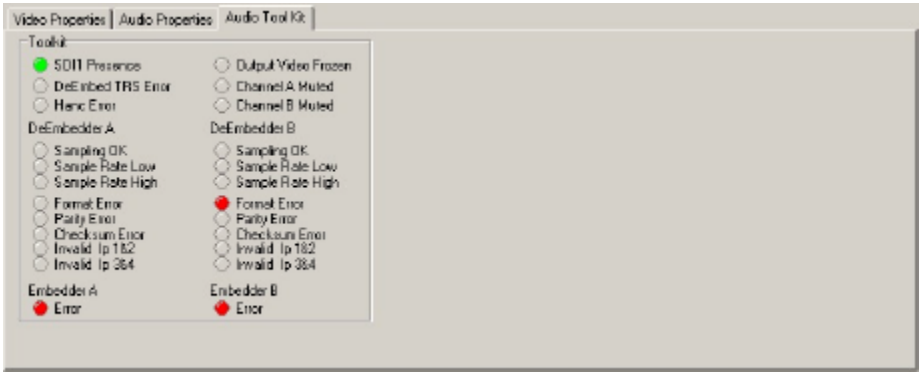
[SDin1 2 3 4 d O]	**Rotate SELECT for incoming audio group status**
Option: 1234dO	Where the first four positions show the status of any incoming audio groups. The fifth character 'd' shows if packet data marked for deletion was present and sixth character 'O' shows if other (non-audio) data was present. If no data appropriate to the character position was detected a dash is shown.

Example: **[SDin1 2 - 4 d O]**

Note: Take care not to confuse SYNAD124 'A and B Channels' with audio channels within a group.
The status display shows the current status of each function as selected. It is not live, and not updated by changing conditions. To update the status display, select a different parameter, and then return to the desired displayed item.

Using the Statesman toolkit

The Audio Toolkit status display repeats some of the general video and audio status information and then expands upon it with a more detailed analysis



The Audio Toolkit

Toolkit provides details of the general status of the de-embedder, embedder, and HANC space data which includes the following:

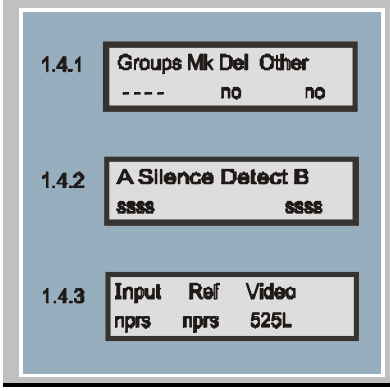
- De-embed TRS error may occur when a Timing Reference Signal is missing or corrupted causing a failure of any ancillary data, including audio to be recovered. Occasional TRS errors in the video may not have been noticed, particularly if the TRS errors occur in vertical blanking.
- 'hanc error' normally indicate insufficient spare space in HANC to insert further embedded audio, or HANC space is filled with unspecified signals, such as 'blank' space that is not true black [e.g. analogue blanking prior to A-to-D conversion without true digital blanking applied]. The SYNAD124 however, always blanks the entire HANC space prior to re-embedding.

- 'low / high sample rates' indicate incorrect number of incoming audio samples beyond manageable error rates [both high+low = wildly varying sample rate]
- 'format' error refers to errors in the format or structure of the embedded audio data packets
- 'invalid' digital audio signals are indicated by the "V" bits set to logic 'high' - "V" bit high is set by the AES standard as indicating 'invalid' audio data, or possibly non-linear audio data, such as compressed multichannel audio data which can not be directly converted back to audible signals

Note: The HANC blanking is always on for both embedders. This means that any incoming ancillary data other than the audio groups selected for re-embedding are always lost and are not passed by the SYNAD124.
There is no input EDH checking but new EDH data is always generated.
The Audio and Video Properties in Statesman also provide basic status information.

Using the active control panel status menu

Press F4 from main menu 1.4 and then rotate the shaft encoder to access the available menus.

SYNAD124 Status menu	Description
	Shows the status of the ancillary data in the incoming SDI stream Shows the status of selected audio groups in the 'A and B Channels' Input and reference video input status shown

Menu 1.4.1 shows the status of the incoming SDI ancillary data. The first four character positions of the bottom line indicate the presence of incoming embedded audio groups with numbers 1, 2, 3 and 4 and absent groups with '-'. The next position indicates if any characters are marked for deletion and the final position indicates if any non-audio data is present.

Menu 1.4.2 shows silent audio channels in the selected groups in the SYNAD124 'A and B Channels' with 's' and active channels with numbers 1, 2, 3 and 4.

Menu 1.4.3 shows Input or Ref presence with 'pres' and not present with 'nprs', input standard is either 525L or 625L.

Note: Take care not to confuse SYNAD124 'A and B Channels' with audio channels within a group.
The status display is automatically updated approximately once a second.

Basic fault finding guide

The Power OK LED is 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 is present and that any cabling is intact

The video output exhibits jitter

Check that the input SDI stability is within normal limits and that the maximum cable length has not been exceeded

There are no audio outputs

Check that valid audio data is embedded in the incoming SDI stream

Try connecting a pair of headphones to the 3.5mm jack socket on the card edge to verify that incoming audio is available and that it is being routed to the output embedders.

The video output is not synchronous with other station sources

If the input SDI stream is not synchronous with station sources ensure that SYNAD124 is in Syncro mode and that an appropriate analogue composite video signal such as station black and burst is used as a reference.

Check the video offset timing (delay) is correct for your application

The video output is not synchronised with the embedded audio output

Check that the incoming audio is not already out of sync with the incoming video

Check if Video Tracking is on or off

Check if Predictive Tracking is on or off

If the problem slowly corrects itself with Predictive Tracking on, try changing the TAD speed to a higher value

Changes in pitch can be heard with certain sections of music

Ensure that Video Tracking and Predictive Tracking are on

Try changing the TAD speed to a lower value

I need to synchronise video with more than eight channels of audio

Connect the AFV output to an external audio delay processor and use external de-embedders and embedders

Why are non-selected audio channels absent from the embedded output?

The SYNAD124 blanks the entire HANC space before embedding and so only passes the embedded audio groups selected for embedding

Why cant individual audio channels be selected or routed to the embedders?

More advanced ‘audio shuffling’ features are provided by then TANDEM series of modules

The card no longer responds to Statesman 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 re-set the card by simply removing the rack power and re-applying power after a few seconds or by removing the card from the rack and then re-inserting the card

It is safe to re-insert the card whilst the rack is powered

Re-setting the card

The card may be reset by simply removing the rack power and re-applying power after a few seconds or by removing the card from the rack re-inserting the card. It is usually safe to reinsert the card whilst the rack is powered.

If necessary, factory defaults may be recalled by holding the CAL lever (card-edge switch, lever 3) DOWN whilst powering the module. The factory default values are listed at the end of the Card-edge operation chapter.

Warning: On no account should the CAL lever be left in the DOWN position during normal operation.

7 Specification

General

Dimensions	100mm x 266 mm module with DIN 41612 connector
Weight	225g
Power consumption	12 W

Reference input

Video	Analogue Black and Burst, mixed syncs or video
	Amplitude of syncs 100mV to 4V
	PCB link selects 75 Ω termination or high impedance with loop-through

SDI input

Video	270Mb/s serial digital to EBU Tech 3267-E and SMPTE-259M
	with or without embedded audio
	Cable equalisation >200m Belden 8281 or equivalent
	Auto 525/625 selection
	< 600ps 1KHz jitter and < 800ps broadband jitter from stable 300mV Black and Burst reference
	< 600ps 1KHz jitter in delay mode (low frequency jitter follows SDI input in delay mode only

Outputs

SDI	Re-clocked SDI loop-through and Maximum of 4 reclocked SDI outputs to EBU Tech 3267-E and SMPTE-259M with embedded audio with up to selected audio groups
	Will drive >200m Belden 8281 or equivalent
Composite	Maximum of 4 PAL/NTSC (follows input) analogue monitor outputs

Processing

Vertical data	Incoming HANC and VANC always blanked
Delay	Video delay range from 2 µs to 2 fields
	Audio delay from 4 milliseconds to 88 milliseconds
Noise and distortion	Additional noise due to video tracking < 0.00017% THD + Noise

Control

Local/remote control panel	Multi-drop 19200 Baud, 8 bits, no parity – control from local frame active front panel / remote panel
Statesman	RS422 control via 9-way Remote 2 connector on 2U and 1U frames

GPI Inputs

Type	Freeze
Active	Connect to ground
Inactive	High impedance, or 5 volts
Details	Input current <50µA Inputs will tolerate 0V to 30V, pulled up to +5V through 10K Ω

GPI Outputs

Type	Large delay (> 24 lines), SDI input presence, analogue reference input, selected audio group missing from input, audio follow pulse
Details	Open collector transistors with 330 Ω current limit resistors. Pulled up to +5V through 10K Ω. Audio follow pulse pulled up +5V through 100 Ω with zero Ω current limit resistor.

Ordering information

SYNAD124	Video and embedded audio synchroniser
RM01	Single slot frame rear module
RM02	Triple slot frame rear module
RM18	Double slot frame rear module
Statesman	PC Control System
Indigo 2	2U frame without active control panel for up to 12 modules
Indigo 1	1U frame without active control panel for up to 6 modules
Indigo DT	1U Desk top box without active control panel for up to 2 modules
Indigo 2A	2U frame with active control panel for up to 12 modules
Indigo 1A	1U frame with active control panel for up to 6 modules
Indigo DTA	1U Desk top box with active control panel for up to 2 modules
Indigo 2S	Statesman enabled only 2U frame for up to 12 modules
Indigo 1S	Statesman enabled only 1U frame for up to 6 modules
Indigo DTS	Statesman enabled only 1U Desk top box for up to 2 modules