TAD202

Tracking audio delay

USER MANUAL

Crystal Vision

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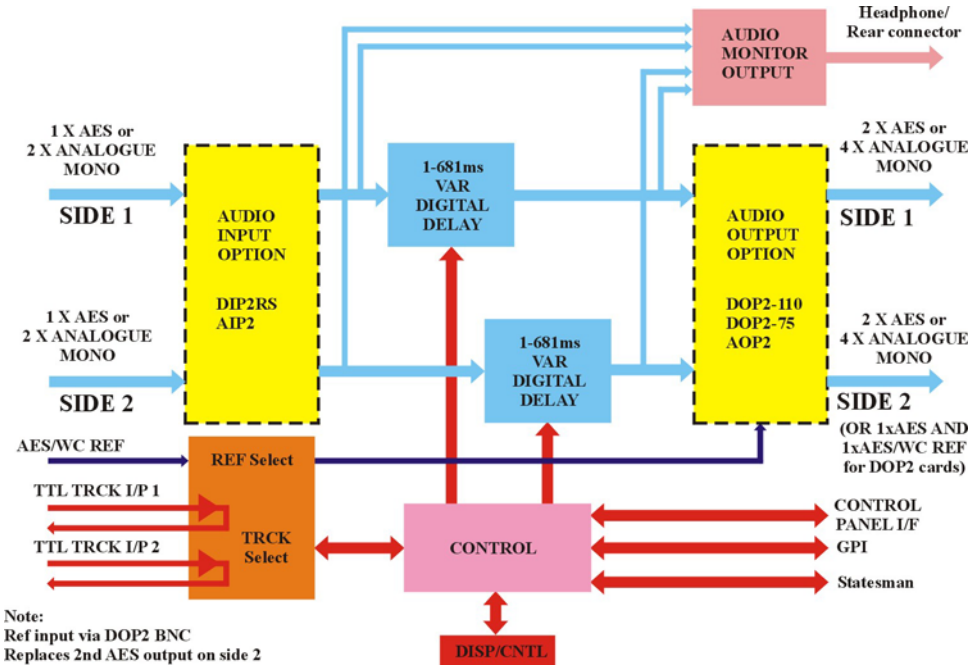
Revision 7.	Pages 6-7 RM07 information corrected.	06/11/07
Revision 8.	GPI5 and GPI6 change to be TTL pulse outputs. GPI frame connection tables added.	29/02/12

1 Introduction

The TAD202 (Tracking Audio Delay) is a dual digital audio variable delay. It incorporates both tracking and user-set system delay to synchronise audio to video for two separate stereo audio channels.

The tracking source for each channel can be selected from two TTL inputs, allowing each TAD202 to provide tracking audio delay for up to two video devices, such as Crystal Vision's SYN102.



The TAD202 Dual Tracking Audio Delay

Note: If a TAD202 is used to support two video synchronisers, the TTL tracking inputs must have the same line-frame standard. It will not support a mixture of 525/60 and 625/50 at the same time.

The main features are as follows:

- Dual independent stereo channels sharing either analogue or digital I/O
- Dual TTL tracking inputs with positive or negative polarity and buffered loop-through outputs
- Fall back reference safeguard
- Audio source preview monitoring
- Audio error masking
- Manual delay for 1 to 681 ms
- Tracking and fixed delay modes
- Control and status monitoring via Statesman, board edge or active control panel
- AES or wordclock reference input for digital output modules
- Buffered audio outputs
- GPI status outputs

The TAD202 has two option card positions, one for an input option card and one for an output card. The cards fitted are shared between each signal path or side. Both input and output positions must be fitted with an option card to complete the signal path.

The piggyback option cards provide any combination of either analogue or 75 or 110Ohm digital inputs or outputs as follows:

- DIP2RS – 2 AES/EBU inputs, 75Ohm, 110Ohm, HiZ
- DOP2-110 – 2 AES/EBU outputs, 110Ohm balanced, AES reference input
- DOP2-75 – 2 AES/EBU outputs, 75Ohm unbalanced, AES reference input
- AIP2B – Analogue dual stereo channel audio input
- AOP2 – Analogue dual stereo channel audio output

There are two different types of rear module to provide a wide range of I/O options.

The TAD202 can be used with two frame rear modules. The single slot RM04, which allows 24 tracking audio delays in 4U and should be used for analogue or 110Ohm AES and the two slot RM07 should be used for 75Ohm AES.

Further details of the rear modules can be found in the installation chapter.

System overview

For each channel used as a tracking delay the user-set system delay is generally set first. Each channel can then be made to intelligently track a video synchroniser as determined by its TTL tracking output. The two channels may use separate unrelated tracking pulses from different synchronisers provided they are of the same video standard.

The tracking delay added to any user-set delay varies between 2.5 and 37.5ms to compensate for a video delay of 0-40ms - figures are adjusted accordingly for NTSC.

Tracking is performed in a predictive manner based on the video synchroniser's current performance, pre-compensating for the addition or drop of a video frame to minimise lip-sync errors that would otherwise result.

The difference in output frequency relative to input frequency when tracking is adjustable in steps from 3.2% to 0.05%, with a 0.05% change resulting in minor audio distortion and therefore allowing live adjustment.

The user-set delay is used for the manual addition of large amounts of delay, and can be set between 1 and 680ms for each channel. It may be used as a simple dual variable delay when tracking inputs are disabled.

On rapidly changing video sources threatening degradation in audio, the tracking will disable itself and revert to system delay until the video becomes stable again, so as to always maintain the audio quality.

An AES or Wordclock reference can be used for each side with a digital output card. The supplied reference replaces the second digital audio output since there are not sufficient connectors for all outputs and digital references to be accommodated. The selection is accomplished with jumper links on the digital output option cards.

Any supplied TTL tracking delay pulse may be used as a replacement for the digital reference. This will ensure that framing errors do not occur if the normal reference is lost.

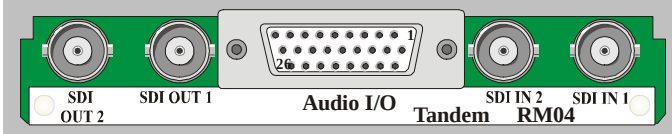
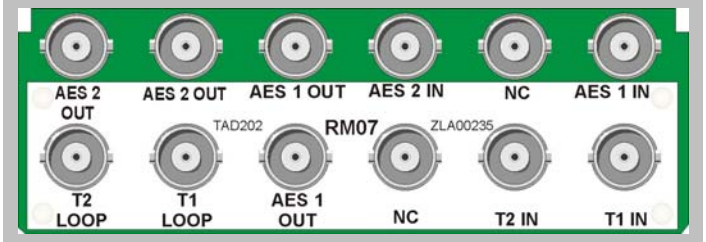
It has sophisticated audio error masking with the ability to repair corrupted audio packets, and can accept a wide range of digital audio frequencies, including 44.1kHz sources.

2 Installation

2.1 Rear modules and connector I/O

Up to 24 single height modules may be fitted in a 4U Indigo frame, 12 in 2U, six in 1U and two in a desk top box, depending on the choice of rear connector. The two types of rear connector available provide system flexibility by allowing a mix between access to all connections and maximum module packing density. All modules can be plugged in and removed while the frame is powered without damage.

The available rear connectors are as follows:

RM04 and RM07 rear connectors	Description
	**RM04** • Balanced analogue or digital audio • 24 TADs per 4U frame • 2 TTL tracking I/Ps (SDI IN) with buffered ops (SDI OUT) • Audio monitoring on Audio I/O connector • GPI lines available at frame remote connectors All frame slots can be used
	**RM07** • Unbalanced digital audio • 12 TADs per 4U frame • Only signal I/O available • 2 TTL tracking I/Ps (SDI IN) with buffered ops (SDI OUT) • Audio monitoring and GPI lines available at the frame remote connectors Slots 1,3,5,7,9 and 11 used

Note: SDI BNCs are only for TTL tracking signals.
Use the RM04 for analogue or 110Ω digital audio and the RM07 for unbalanced 75Ω digital audio.
The TAD card fits in the upper of the two slot positions for the RM07 and no card is fitted in the lower slot.

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

RM04 balanced analogue/digital audio

The RM04 rear module provides access to all GPIs and audio monitoring signals. However, the signal pin assignments on the D-Type connector on the RM04 are dependent on the sub PCBs fitted. Common pinout is used for audio monitoring.

Pinout		RM04 hi-density 26 way 'D' female socket			
Channel inputs	**Channel outputs**	AIP2/AOP2	DIP2RS	DOP2-110	DOP2-75
1	**9**	GND	GND	GND	GND
Side 1 (Channel 1)					
2	**14**	1L+	AES1+	AES1a	AES1a
3	**15**	1L-	AES1-	AES1a	GND
4	**10**	1R+	AES1scrn	AES1b+	AES1b
5	**11**	1R-	NC	AES1b-	GND
Side 2 (Channel 2)					
6	**16**	2L+	AES2+	AES2a+ OR EXT ref+	AES2a+ or EXT ref+
7	**17**	2L-	AES2-	AES2a- OR EXT ref-	GND or EXT ref-
8	**12**	2R+	AES2scrn	AES2b+	AES2b
18	**13**	2R-	NC	AES2b-	GND
Common Monitoring connections					
19		GND			
20		GND			
21		Mon L+			
22		Mon L-			
23		GND			
24		GND			
25		Mon R+			
26		Mon R-			

The RMO4 rear module allows cards to be placed in all of the frame slots.

Note: When DOP2-75 or DOP2-110 is used and unbalanced AES reference or World Clock is used for EXT ref+ ensure that EXT ref- (pin 17 on 26 way D-type) is connected to GND.

RM07 unbalanced digital audio

DIP2RS input sub PCB, DOP2 output sub PCB			
T1 IN	Side 1 audio tracking pulse input	**T2 IN**	Side 2 audio tracking pulse input
T1 IN LOOP	Side 1 audio tracking pulse input loop-through	**T2 IN LOOP**	Side 2 audio tracking pulse input loop-through
AES 1 IN	Side 1 AES input	**AES 1 OUT**	AES 2 output
AES 2 IN	Side 2 AES input	**AES 1 OUT**	AES 1 output
		AES 2 OUT	AES 2 output
		AES 2 OUT	AES 2 output or EXT Ref I/P (far left BNC)
NC	Not used		

Note: When DOP2 is used, the far left AES 2 OUT BNC can be used for the reference input for both channels. This replaces the 2nd buffered output for side 2.

RM07 monitoring assignments

The monitoring signals available at the Remote 1 and Remote 3 connectors at the rear of the 2U Indigo frame when the RM07 is used are dependent on the rear modules used as shown in the following table:

Active slot used with RM07	REMOTE 1 pins L+, L-, R+, R-	REMOTE 3 pins L+, L- R+, R-
1	7, 16, 17, 25	
3		7, 16, 17, 25
5	4, 14, 13, 23	
7		4, 14, 13, 23
9	10, 11, 19, 20	
11		10, 11, 12, 20
GND	2	2

The Remote 1 and 3 frame rear connectors cannot be used to access TAD202 audio monitoring connections when the RM04 rear connector is used.

2.2 General Purpose Interface (GPI)

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.

GPI			Low (<1V)	High (+5V)
1	**'a'**	**Recall preset bit 1**	See following table for user preset control	
2	**'b'**	**Recall preset bit 2**		
3	**'c'**	**Recall preset bit4**		
4	**'d'**	**Recall preset bit 8**		
5	**'e'**	**T1 pulse**		
6	**'f'**	**T2 pulse**		

Note: Input missing will assert the selected alarm immediately

Each General Purpose Input (GPI) is fitted with 220k Ω series resistor and a 6800Ω resistor connected to the internal +5V.

The 16 user preset configurations can be recalled using binary notation.

GPI Preset	Bit 8	Bit 4	Bit 2	Bit 1	GPI Preset	Bit 8	Bit 4	Bit 2	Bit 1
1	0	0	0	0	**9**	1	0	0	0
2	0	0	0	1	**10**	1	0	0	1
3	0	0	1	0	**11**	1	0	1	0
4	0	0	1	1	**12**	1	0	1	1
5	0	1	0	0	**13**	1	1	0	0
6	0	1	0	1	**14**	1	1	0	1
7	0	1	1	0	**15**	1	1	1	0
8	0	1	1	1	**16**	1	1	1	1

4U frame GPI connections

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

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

Table shows pin number (remote number)

Note: Remote 1, Remote 3, Remote 5 and Remote 7 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, Remote 4, Remote 6 and Remote 8 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 and Remote 6.

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. Remotes 5-8 are similarly protected.

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.

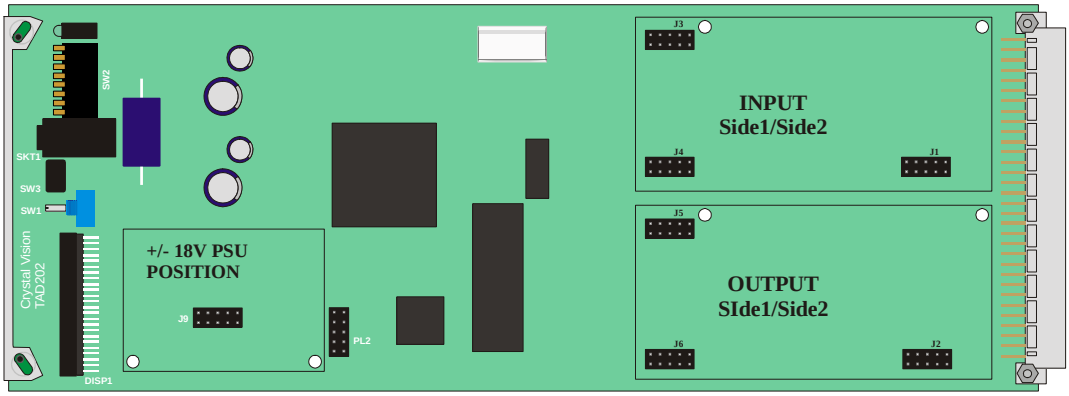
Remote 2: 26-way high-density D-Type male plugs and frame ground is pin 6 and +5V @500mA is pin 15.

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.

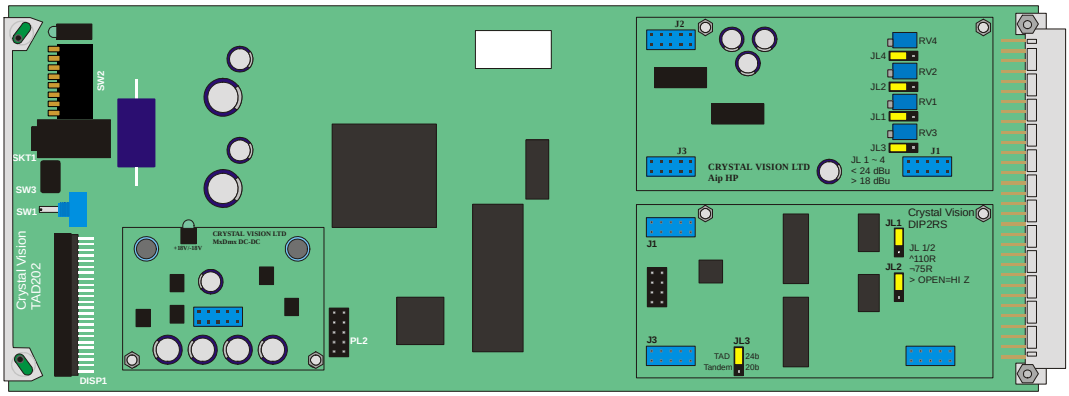
2.3 Fitting audio sub PCBs

The TAD202 has two option-card slots for audio I/O sub PCB. The upper I/O slot must have an input option-card and the lower I/O slot must have an output option-card fitted. Option-cards must be fitted to both I/O slots. If one or more analogue audio sub PCB are used an additional +/- 18V DC PSU sub-PCB is also fitted.

Each sub-PCB plugs via headers on the main card and is retained by screws and nuts.



TAD202 showing audio sub-PCB and PSU sub-PCB positions



TAD202 with an analogue input sub-PCB, a digital input sub-PCB and PSU sub-PCB

To fit a sub-PCB proceed as follows:

- ensure that all static electricity precautions have been taken
- fit two module retaining screws (3x10mm) from below the main PCB, and add a nylon spacer (3x3mm) on top of the TAD202 PCB to each screw for each sub-PCB location – hold screws firmly in place
- offer up the chosen sub-PCB to its intended position on the TAD202 main card

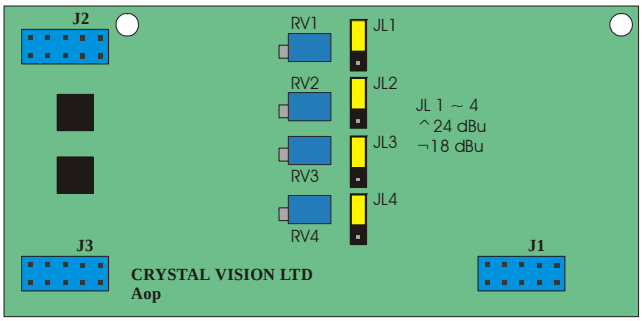
- check that the orientation is correct and that retaining holes and header sockets line up with the corresponding holes and header plugs on the main card
- push the sub-PCB in place firmly taking care not to bend any pins
- fit the retaining fibre washers, internal serrated washers and nuts to the two retaining screws

Removal is the reverse of the above procedure.

Note: All items are supplied with the TAD202 module.
All sub PCBs must be fitted with the component side uppermost and flat (track side) down, facing the TAD202 PCB. Fitting sub PCBs with the component face downwards may result in component damage.
To check which modules are fitted when a TAD202 is already in place in its frame, use the card-edge option status check (status menu 1 explained in section 5.1.) or active control panel menu 1.1 or Sub PCB status in the main Statesman control menu.

Sub-module link settings

AOP2

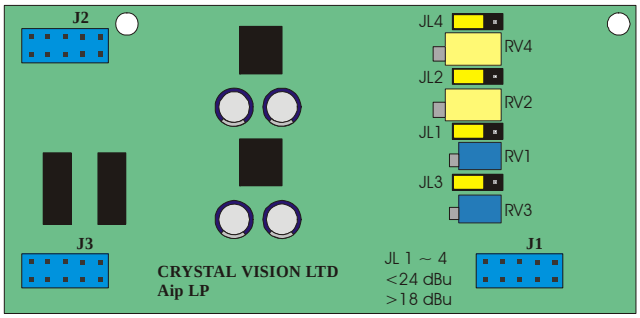


The analogue audio output module provides 2 stereo pairs or four mono outputs. Link jumpers are provided to allow 0dBFS to be set to +18dBu or +24 dBu. The variable adjustments on the card are set at the factory and should not require re-adjustment. Set channel 1 with JL1/RV1, channel 2 with JL2/RV2, channel 3 with JL3/RV3 and channel 4 with JL4/RV4.

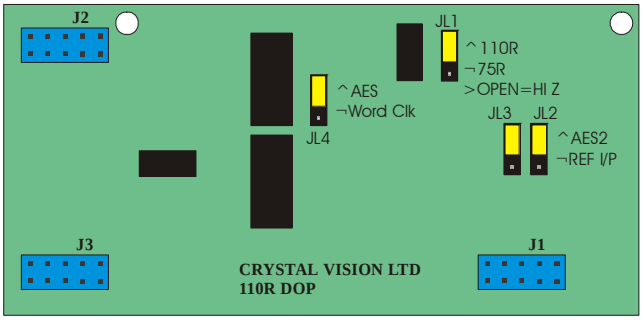
Selectable jumper links are provided to change input and reference terminations and pre-set levels, depending on sub-PCB features.

AIP2B

The AIP2B is identified on the silkscreen as the AIP2-LP to indicate its lower power consumption. The analogue audio input module provides 2 stereo pairs or four mono outputs. Link jumpers are provided to allow 0dBFS to be set to +18dBu (rearwards, towards J1) or +24 dBu (forwards, towards J2/3). The variable adjustments on the card are set at the factory and should not require re-adjustment. Set channel 1 with JL4/RV4, channel 2 with JL2/RV2, channel 3 with JL1/RV1 and channel 4 with JL3/RV3. *Take care to note the adjustment and channel numbering on this sub-board.*



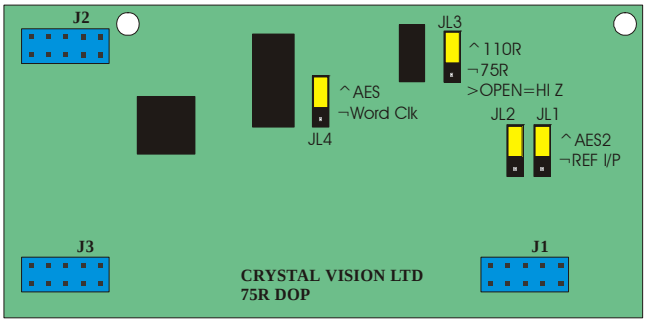
DOP2-110



This digital audio output module provides 2 110Ohm AES stereo pairs or four mono outputs.

In addition, jumper links are provided to configure an optional external reference when using the RM04 rear module, in place of a 2nd buffered output. The reference may be selected between AES reference or word clock with JL4. Use JL3 and JL4 together to select between AES2 (2nd buffered output – upper two pins) or REF I/P (external reference – lower 2 pins). Link jumper JL1 is provided to select the external reference input, which is always fed via a 'D' connector, between 110Ohm (upper 2 pins), HiZ (balanced – centre pin only) or 75Ohm (unbalanced – lower 2 pins).

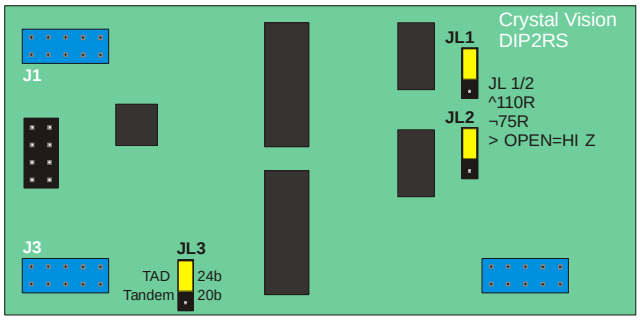
DOP2-75



This digital audio output module provides 2 75Ohm AES stereo pairs or four mono outputs.

In addition, jumper links are provided to configure an optional external reference when using the RM04, RM05 and RM06 rear modules, in place of a 2nd buffered output. The reference may be selected between AES reference or word clock with JL4. Use JL1 and JL2 together to select between AES2 (2nd buffered output – upper 2 pins) or REF I/P (external reference – lower 2 pins). Link jumper JL3 is provided to select the external reference input, which is always fed via a 'D' connector, between 110Ohm (upper 2 pins), HiZ (balanced – centre pin only) or 75Ohm (unbalanced – lower 2 pins).

DIP2RS



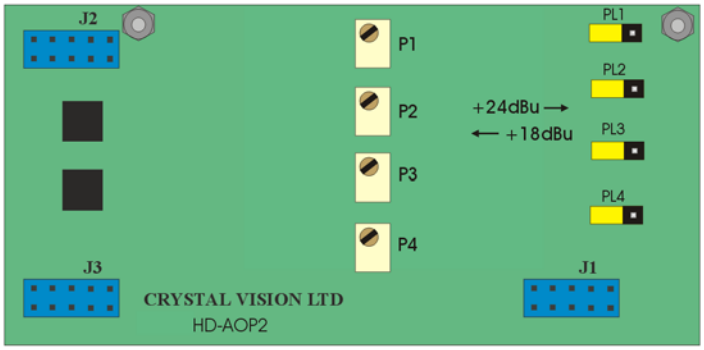
The digital audio input module provides 2 AES stereo pairs or four mono channels. This module provides re-sampling of the input data stream for the proper operation of the TAD202 variable delay feature. Link jumpers are provided to select between 110Ohm (upper 2 pins), HiZ (balanced – centre pins only) or 75Ohm (unbalanced – lower 2 pins).

Note: Balanced outputs require the use of rear modules with a D-Type connector and unbalanced outputs are for use with BNCs.
HiZ is achieved by removing termination jumpers – they can be parked for safe keeping by replacing them using only one pin.

HD-AOP2

Crystal Vision's range of HD sub PCB are also fully compatible with the TAD202 so may be used in place of the original sub PCBs.

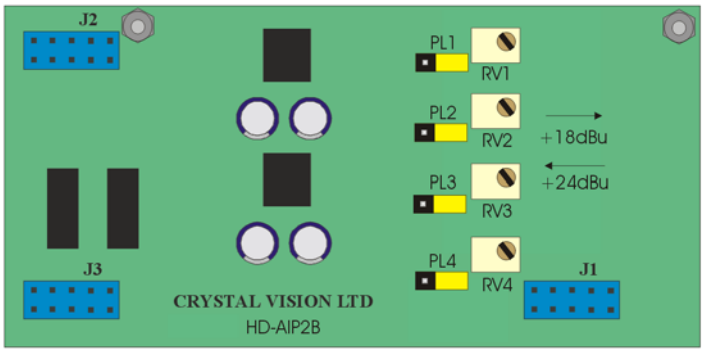
The analogue audio output module provides two stereo pairs or four mono outputs that may be used as destinations when routing de-embedded signals. Link jumpers are provided to allow 0dBFS to be set to +18dBu or +24 dBu. The variable adjustments on the card are set at the factory and should not require re-adjustment. Set channel 1 with PL1/P1, channel 2 with PL2/P2, channel 3 with PL3/P3 and channel 4 with PL4/P4.



Selectable jumper links are provided to change input and reference terminations and pre-set levels, depending on sub-module features.

HD-AIP2

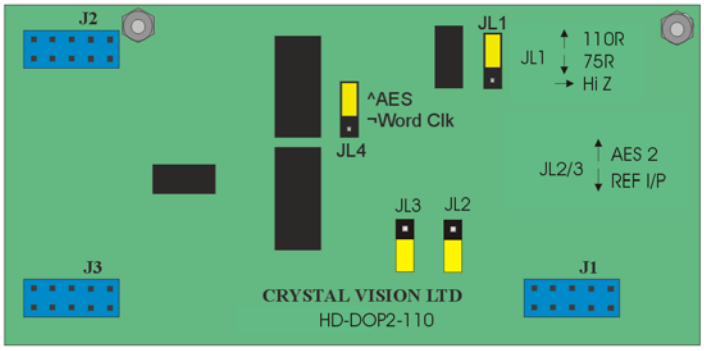
The analogue audio input module provides two stereo pairs or four mono signals that may be used as a source in subsequent embedding. Link jumpers are provided to allow 0dBFS to be set to +18dBu (rearwards, towards J1) or +24dBu (forwards, towards J2/3). The variable adjustments on the card are set at the factory and should not require re-adjustment. Set channel 1 with PL2/RV2, channel 2 with PL1/RV1, channel 3 with PL4/RV4 and channel 4 with PL3/RV3. *Take care to note the adjustment and channel numbering on this sub-board.*



HD-AIP2

HD-DOP2-110

This digital audio output module provides two 110 Ohm AES stereo pairs or four mono outputs that may be used as destinations when routing de-embedded signals.

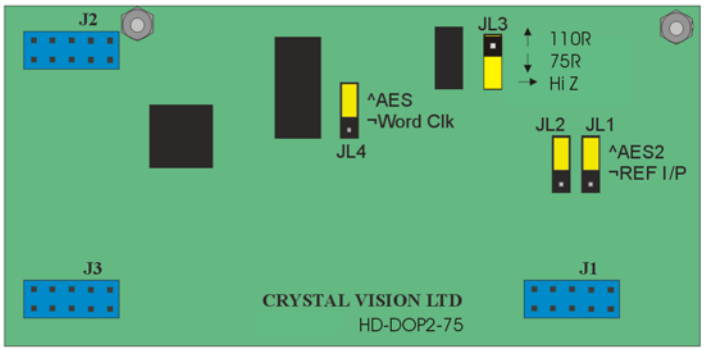


HD-DOP2-110

In addition, jumper links are provided to configure an optional external reference when using the RM04, RM05 and RM36 rear modules, in place of a 2nd buffered output. The reference may be selected between AES reference or word clock with JL4. Use JL2 and JL3 together to select between AES2 (2nd buffered output – upper two pins) or REF I/P (external reference – lower 2 pins). Link jumper JL1 is provided to select the external reference input, which is always fed via a 'D' connector, between 110 Ohm (upper 2 pins), HiZ (balanced – centre pin only) or 75 Ohm (unbalanced – lower 2 pins).

HD-DOP2-75

This digital audio output module provides two 75 Ohm AES stereo pairs or four mono outputs that may be used as destinations when routing de-embedded signals.

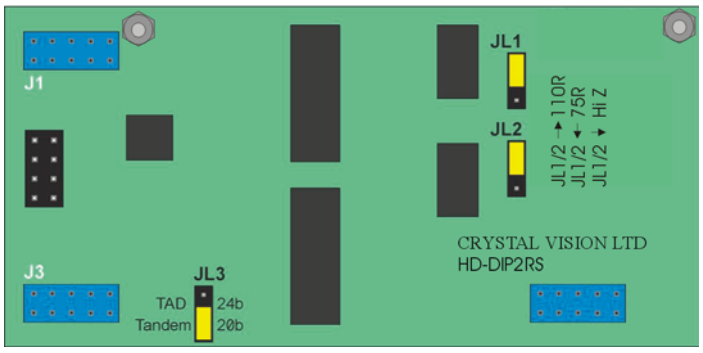


HD-DOP2-75

In addition, jumper links are provided to configure an optional external reference when using the RM04, RM05 and RM36 rear modules, in place of a 2nd buffered output. The reference may be selected between AES reference or word clock with JL4. Use JL1 and JL2 together to select between AES2 (2nd buffered output – upper 2 pins) or REF I/P (external reference – lower 2 pins). Link jumper JL3 is provided to select the external reference input, which is always fed via a 'D' connector, between 110 Ohm (upper 2 pins), HiZ (balanced – centre pin only) or 75 Ohm (unbalanced – lower 2 pins).

HD-DIP2RS

This digital audio input module provides two AES stereo pairs or four mono channels with an integral re-sampler for use when the AES input is either asynchronous, or at a sample rate other than 48 kHz.



HD-DIP2RS

The sample rate inputs can work with signals from less than 30 kHz to 108 kHz. It is particularly useful for asynchronous 48 kHz inputs, and other sample rate inputs such as 44.1 kHz and 96 kHz.

The signal output from the DIP2-RS to the TANDEM HD-20 is at 48 kHz derived from the video content of the SDI signal into which it is to be embedded.

Because of the processing of the audio waveform, error words indicated by V-bit set high are ignored. Occasional errors marked by V-bit high such as would be the case with a noisy or too long AES input path, are masked out by the processing.

If the V-bit is consistently high, to indicate continuous error states, or to indicate non-audio data, then the processor will give a silent output. All other cards, except RS4, pass audio data unaltered even when V bit is set or held high.

Link jumpers are provided to select between 110 Ohm (upper two pins), HiZ (balanced – centre pins only) or 75 Ohm (unbalanced – lower two pins).

Notes: In general, balanced outputs require the use of rear modules with a D-type connector and unbalanced outputs are for use with BNCs.
HiZ is achieved by removing termination jumpers – they can be parked for safe keeping by replacing them using only one pin.

3 Card edge operation

Card edge controls

The front edge of the card provides power rail monitoring, menu selection, an analogue audio monitoring output, rotary set-up controls and a ten-digit visual status display.

The TAD202 front view

In general the Menu DIL switch is used to select one of five main menus, whilst the SEL rotary hex switch selects sub-menus or internal variables. The ADJ shaft encoder is used to assign values to variables (such as GPI options or synchronisation reference).

Parameters are generally saved to non-volatile RAM when piano switch 1 is toggled down and then up again. The display will normally flash alternately between bright and dim to indicate that the displayed value may no longer be current when the ADJ shaft encoder is turned. The only exception is the delay parameter, which must be saved to a preset to ensure that all system values can be retained after power is lost and restored.

The TAD202 always powers up with the last settings of the most recently saved preset.

If a setting is adjusted by mistake, changing the menu (piano MENU or SEL switches) will discard the unwanted setting.

The auto-configuration process, performed when a TAD202 is first powered up, normally returns the card to the state it was when powered down. If the audio option piggyback cards have been changed, the following default settings are selected:

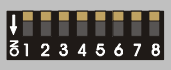
- Delay: 20ms
- T.A.D. Speed (rate of delay change): 3.2%

Once this 10-second initialisation procedure is complete, the TAD202 card can be controlled or configured both from the card edge and from the frame's local or remote control panel.

Setting control mode options

The piano switch to the left of the card edge is used to view or configure the following options:

- TAD202 parameter status
- Preset save/recall
- Setup menu

Menu switch	Menu
	• Status/Config menus – all levers OFF (UP). This should be the default setting if card edge controls are not in use
	• Preset menu – lever 2 ON (DOWN) all others OFF (UP) – disable GPIs to use
	• Setup menu – lever 5 ON (DOWN) all others OFF (UP)
	• No user function
	• Status menu – lever 7 ON (DOWN) all others OFF (UP)

Note: Menu switches 3, 4 and 8 are not used.

The card edge display codes

A condensed code is used to maximise the information that can be shown on the ten bit status display. Codes used for sources and destinations are as follows:

Code	Meaning	Comments
Ch1	Input stereo channel 1	
Ch2	Input stereo channel 2	
T1	Tracking synchronisation pulse input 1	May be assigned to input channel 1 or 2
T2	Tracking synchronisation pulse input 2	May be assigned to input channel 1 or 2
AES	AES reference input	Option card must be DOP2 75 or 110
TTL	T1 / T2 pulse (AES replacement)	Option card must be DOP2 75 or 110
Channel	Signal path or ‘side’	Do not confuse TAD202 channel with AES channel
1.	GPI output 5	No used function. T1 presented on GPI5
2.	GPI output 6	No used function. T2 presented on GPI6

3.1 Card edge status menus

Status Only Menus

The SEL hex switch provides access to a range of status displays when the MENU DIP levers are all OFF (UP). The available status-only displays (SEL positions 1-5) are summarised in the following table:

SEL No.	Description	Examples and comments	ADJ funct
0	Video input	Displays video input line standard 625 / 525 Use this setting when card edge controls are not in use	N/A
1	Option cards fitted	Aip : AIP2 analogue input option fitted Aop : AOP2 analogue output option fitted DRS : DIP2RS resampling digital input option dop7: DOP2-75 digital output option card dop1: DOP2-110 digital output option card	N/A
2	AES & Ref I/P status	If DOP fitted AESOK = AES reference present TTLOK = selected T1/T2 reference present NoAES if no reference input NoTTL if no T1/T2 reference selected and present	N/A
3	T1 and T2 status	Status of T1 and T2 sync inputs No T1: T1 sync input not present T1 ok: T1 sync input detected	N/A

Warning: For the first four (0 to 3) SEL status positions the shaft encoder is not active and settings cannot be changed.

Ancillary data status

The ancillary data status display is obtained with Menu DIL, lever 7 ON (DOWN), all other levers UP (OFF**)** and the SEL switch in position 1, 2, 3 and 4.

SEL	Display	Comments
0	TAD202 2.3	Board and software revision
1	TD1= 25.1	Audio channel 1 tracking delay = total delay of channel 1
2	TD2= 35.2	Audio channel 2 tracking delay = total delay of channel 2
3	1L R 2L R	Silence detect on channels -indicates silent

Status/config menus

For SEL positions 4 to F, the shaft encoder will alter (but not save) the assigned values as indicated in the remainder of the table. Do **NOT** touch the ADJ shaft encoder when using these SEL positions for status information.

SEL No.	Description	Examples and comments	ADJ funct
4	Speed 1	Set rate of change of channel 1 delay 0.05%-3.2% A # replacing % indicates tracking off	ADJ = speed (%)
5	Speed 2	Set rate of change of channel 2 delay 0.05%-3.2% A # replacing % indicates tracking off	ADJ = speed (%)
6	Audio delay CH 1 Coarse	Set using ADJ shaft encoder in 2.6ms steps from 1 – 681ms	ADJ = delay
7	Audio delay CH 1 Fine	Set using ADJ shaft encoder in 0.1ms steps from 1 – 681ms	ADJ = delay
8	Audio delay CH 2 Coarse	Set using ADJ shaft encoder in 2.6ms steps from 1 – 681ms	ADJ = delay
9	Audio delay CH 2 Fine	Set using ADJ shaft encoder in 0.1ms steps from 1 – 681ms	ADJ = delay
A	AES reference backup	Select TTL tracking pulse edge to use (T1+, T1-, T1+ or T2-) if AES reference is lost	ADJ = T1/2
B	Tracking source polarity	Select polarity of tracking sync input T1Hi/Low T2Hi/Low	ADJ = T source polarity
C	Tracking source	Select source for audio tracking video sync Ch1T1/Ch2T2 (T1, T2, --) -- indicates no tracking source, giving a constant audio delay	ADJ = T source select / enable
D	headphone monitor source	Selects stereo source for headphone socket and rear audio monitoring bus if enabled Phone ip1 (ip1, ip2, op1, op2)	ADJ = stereo pair select
E	Audio monitor format	Selects analogue or digital for rear audio bus (source as D) eg. MON=AESip1 or ANAip1	ADJ = ANA/AES
F	GPI Enable/Disable	Disables GPI inputs (preset recall). GPI outputs are not disabled	ADJ = disable /enable

3.2 Configuration

The tracking function of the TAD202 is driven by a TTL level pulse. The tracking delay added to any user-set delay varies to compensate for the video delay. The tracking source and the rate at which tracking occurs may be selected for each channel. If tracking is off, delay may be set manually for each channel.

Adjusting auto-tracking

The auto-tracking speed is the rate at which the delay changes from the current to the required delay as set by Speed 1 for channel 1 and Speed 2 for channel 2.

The tracking speed (or T.A.D speed) can be set from 0.05% to 3.2% using sub-menus 4 and 5 of the Status/Config menu - MENU DIL switch all levers UP (or OFF). Switch 1 of the MENU dip switch must be toggled between ON and OFF to save the new value in the TAD202 database.

SEL No.	Description	Examples and comments	ADJ funct
4	Speed 1	Set rate of change of channel 1 delay 0.05%-3.2% A # replacing % indicates tracking off	ADJ = speed (%)
5	Speed 2	Set rate of change of channel 2 delay 0.05%-3.2% A # replacing % indicates tracking off	ADJ = speed (%)

A rate of 0.05% corresponds to a maximum pitch change of 0.5Hz on a 1kHz input. A rate of 3.2% corresponds to a maximum pitch change of 32Hz on a 1kHz input.

The audio delay may be adjusted imperceptibly on-air by first setting the speed to 0.05%. Higher speed settings may be used, but as the speed is increased, a noticeable pitch change may occur in music or tone as the delay is changed.

The tracking delay added to any user-set delay varies between 2.5 and 37.5ms to compensate for a video delay of 0-40ms - figures are adjusted accordingly for NTSC. The tracking delay is predictive, pre-compensating for the addition or drop of a video frame by the synchroniser so as to minimise lip-sync errors that would otherwise result.

If the frame drop/add rate increases, the operational window and speed of the tracking delay adjustment is varied automatically to allow the system to track correctly. This may result in some noticeable pitch change in extreme circumstances.

If the frame drop/add rate is extremely high, tracking is disabled and the tracking delay is fixed at 15ms.

In tracking mode, the fixed delay should be set to the minimum audio delay that the system requires. For example, if a video synchroniser is used in a particular signal path, the compensating TAD202 audio delay should be set to the delay of that signal path when the synchroniser is introducing its minimum delay.

To add a constant delay, set the tracking input for the channel to '-- ' rather than T1 or T2. The T.A.D. Speed will shift from the existing delay to a new user-set one at the rate set by the tracking speed control. (In addition, the board edge speed display will change from % to # to indicate no tracking.)

Manual delay control

The amount of delay can be set independently for each channel in 2.6 or 0.1ms steps from 1 to 681ms using sub-menus 6, 7, 8 and 9 of the Status/Config menu - MENU DIL switch all levers UP (or OFF).

The values for audio delay for channel 1 and channel 2 are entered into the TAD202 database the moment the ADJ shaft encoder is turned. This is the sole exception to the use of switch 1 of the MENU dip switch to save shaft encoder values. This has been provided to allow delay values to be updated as soon as the shaft encoder is altered to ease the task of setting audio delay empirically. To save delay settings and protect them against loss during power failure create a preset as explained in section 5.6.

For all other menus where the shaft encoder changes assigned values, switch 1 of the MENU dip switch must be toggled between ON and OFF to save the new value in the TAD202 database.

SEL No.	Description	Examples and comments	ADJ funct
6	Audio delay CH 1 Coarse	Set using ADJ shaft encoder in 2.6ms steps from 1 – 681ms	ADJ = delay
7	Audio delay CH 1 Fine	Set using ADJ shaft encoder in 0.1ms steps from 1 – 681ms	ADJ = delay
8	Audio delay CH 2 Coarse	Set using ADJ shaft encoder in 2.6ms steps from 1 – 681ms	ADJ = delay
9	Audio delay CH 2 Fine	Set using ADJ shaft encoder in 0.1ms steps from 1 – 681ms	ADJ = delay

The audio delay may be adjusted imperceptibly on-air by first setting the speed to 0.05%. Higher speed settings may be used, but as the speed is increased, a noticeable pitch change may occur in music or tone as the delay is changed.

To add a constant delay, set the tracking input for the channel to null '- -' rather than T1 or T2. The TAD will shift from the existing delay to a new user-set one at the rate set by the tracking speed control. In addition, the board edge speed display will change from % to # to indicate no tracking.

Process delay

The input/output delay is summarised in the following table:

Example mode combination	Digital delay DIP2>DOP2	Analogue delay AIP2>AOP2
All delay set to zero, tracking OFF	310µs	1,540µs
All delay set to zero, tracking ON	2.5ms	3.7ms
Delay at maximum	680ms	681ms

Note: Changing DPI2+DOP2 to AIP2+AOP2 adds approximately 1,240µs.

AES reference backup

The main AES reference can be replaced automatically if it fails or is removed for any reason by one of the TTL tracking references. Either a positive or negative going tracking pulse edge may be selected as the backup reference.

Access the AES reference backup menu using sub-menus A of the Status/Config menu - MENU DIL switch all levers UP (or OFF). Switch 1 of the MENU dip switch must be toggled between ON and OFF to save the new value in the TAD202 database.

SEL No.	Description	Examples and comments	ADJ funct
A	AES reference backup	Select TTL tracking pulse edge to use (T1+, T1-, T1+ or T2-) if AES reference is lost	ADJ = T1/2

Selecting the tracking source and polarity

The Tracking source may be selected between the T1 and T2 TTL tracking inputs or tracking off '- -'.

If either T1 or T2 tracking references are selected for any side, that side will vary in delay automatically by tracking the supplied reference so as to minimise input synchronisation errors.

The TTL tracking control inputs should be compatible with the SYN102 Crystal Vision video synchroniser tracking sync output with a period of 1 video frame.

The pulse length (the time between the rising and falling edges) should be the same as the video delay being tracked, but not less than 5µs.

For T1 and T2, the Tracking Sync Polarity may be set for either HIGH (timing set by duration of pulse when high) or LOW (timing set by duration of TTL pulse when low).

Access the Tracking source and polarity menus using sub-menus B and C of the Status/Config menu - MENU DIL switch all levers UP (or OFF). Switch 1 of the MENU dip switch must be toggled between ON and OFF to save the new value in the TAD202 database.

SEL No.	Description	Examples and comments	ADJ funct
B	Tracking source polarity	Select polarity of tracking sync input T1Hi/Low T2Hi/Low	ADJ = T source polarity
C	Tracking source	Select source for audio tracking video sync Ch1T1/Ch2T2 (T1, T2, --) -- indicates no tracking source, giving a constant audio delay	ADJ = T source select / enable

Adjusting AES audio output phase

The phase of the digital audio output may be adjusted with respect to both the AES reference and to the TTL reference used when the AES reference is lost.

The appropriate jumper link must be set on the DOP2-75 or DOP2-110 sub-board

To enter these menus, ensure that only MENU dip switch 5 is down.

The AES output phase may be varied over a range of just over 360 degrees. The display shows a reading of 0 to 255 for indication purposes only. To action a phase change, DIP switch 1 must be cycled down then up. The phase should be adjusted in increments of 32 steps or less to avoid losing lock. If REF-AES lock or TTL-AES lock is lost, it will often take over 2 minutes to recover.

SEL No.	Display	Description	ADJ funct
0	AES-Tph xxx	Use shaft encoder to select 0-255	ADJ =xxx
1	AES-REF xxx	Use shaft encoder to select 0-255	ADJ =xxx

Audio monitoring

Select a stereo source for headphone socket and rear audio monitoring bus from those available ip1, ip2, op1 or op2. Select the rear monitoring bus to be in digital (AES) or analogue format.

Audio monitoring is provided at the card edge with a miniature stereo jack socket. The same signal may also be routed to the rear connector. The stereo source monitored can be selected from any valid audio input or output using the shaft encoder in Status/Config sub-menus D and E (MENU DIL switch all levers UP or OFF). Switch 1 of the MENU dip switch must be toggled between ON and OFF to save the new value in the TAD202 database.

The available audio monitoring settings are summarised in the following table:

SEL No.	Description	Examples and comments	ADJ funct
D	headphone monitor source	Selects stereo source for headphone socket and rear audio monitoring bus if enabled Phone ip1 (ip1, ip2, op1, op2)	ADJ = stereo pair select
E	Audio monitor format	Selects analogue or digital for rear audio bus (source as D) e.g. MON=AESip1 or ANAip1	ADJ = ANA/AES

Using presets and GPIs

Preset setups may be saved and recalled from the card edge and by GPIs. There are four GPIs for external recall of preset setups and two to provide alarm monitoring. GPI configuration is only available from the card edge or from an active control panel.

Enabling/disabling GPIs

The GPI inputs can be used to recall TAD202 setups that have been stored previously. This recall function can be disabled from the card edge.

Ensure that all MENU DIL switch all levers UP or OFF and the SEL switch is in position F. Use the shaft encoder to select Disable or Enable. Switch 1 of the MENU dip switch must be toggled between ON and OFF to save the new value in the TAD202 database.

SEL No.	Description	Examples and comments	ADJ funct
F	GPI Enable/disable	Disables GPI inputs (preset recall). GPI outputs are not disabled. Shows ‘n’, where ‘n’ is current GPI input status – see section 5.8	ADJ = DISABL/ EN = ‘n’

Using presets

Up to 16 setups may be stored for the board and recalled either from the board control or through the use of external GPIs. Presets cannot be saved or recalled from the card edge unless GPIs are disabled. This avoids the possibility of GPI inputs causing preset memory data to re-configure the TAD202 at the same time as presets are being updated.

Presets store board setup data, operating mode and option card status. It is not possible to recall a preset if the operating mode or option card configuration is different to those established when the preset was created. Presets are currently numbered 0-15.

To store or recall a preset proceed as follows:

- Disable GPIs – see previous section
- Enter the preset menu Menu DIL switch 2 ON (DOWN)
- Select appropriate preset with the rotary SEL switch
- To store a preset put the Menu DIL lever-1 down and then up again
- To recall a preset put the Menu DIL lever-8 down and then up again

The ancillary status display will indicate the status of each preset as it is selected:

Preset status	Meaning
Valid	A preset has been stored at this location with the same option cards and mode as now. It can be recalled or over written.
Invalid	The preset cannot be recalled since the mode or option card configuration has changed. It can be over written with a fresh preset.
Empty	No setup data is stored at this location.

Using GPI inputs to select presets

GPI inputs 1-4 can be used to select setup presets as follows:

GPI 1-4 state	Setup number
0 0 0 0	Preset 0
0 0 0 1	Preset 1
0 0 1 0	Preset 2
0 0 1 1	Preset 3
0 1 0 0	Preset 4
0 1 0 1	Preset 5
0 1 1 0	Preset 6
0 1 1 1	Preset 7
1 0 0 0	Preset 8
1 0 0 1	Preset 9
1 0 1 0	Preset 10
1 0 1 1	Preset 11
1 1 0 0	Preset 12
1 1 0 1	Preset 13
1 1 1 0	Preset 14
1 1 1 1	Preset 15

Note: All GPIs are active low.

4 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 Control 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 all eight control panel keys LEDs will illuminate briefly. Once the panel has completed its power up and configuration sequence the panel will enter Statesman mode and the message 'Press Cal to Exit' will be displayed.

The Crystal Vision control panel start up display

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.

Navigating the display

The functions assigned to control panel keys are:

DEVICE – enters Device menu to select a card or show cards available/enters panel set up when held down during power up/shows frame status when pressed from Statesman mode

CAL – enters or leaves Statesman mode/enters panel diagnostics mode when held down during power up/updates the display

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 – accept current 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.

Selecting the TAD202

To select a particular card in a frame, press the DEVICE key to go to the Device menu.

Note: There may be a delay whilst the frame is interrogated during which time the 'No cards Found' could be displayed.

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 1.

When the desired card is selected press the ENTER key to access that card's HOME menu. The message shows that a TAD202 has been selected.

TAD202 home menu

Updating the display

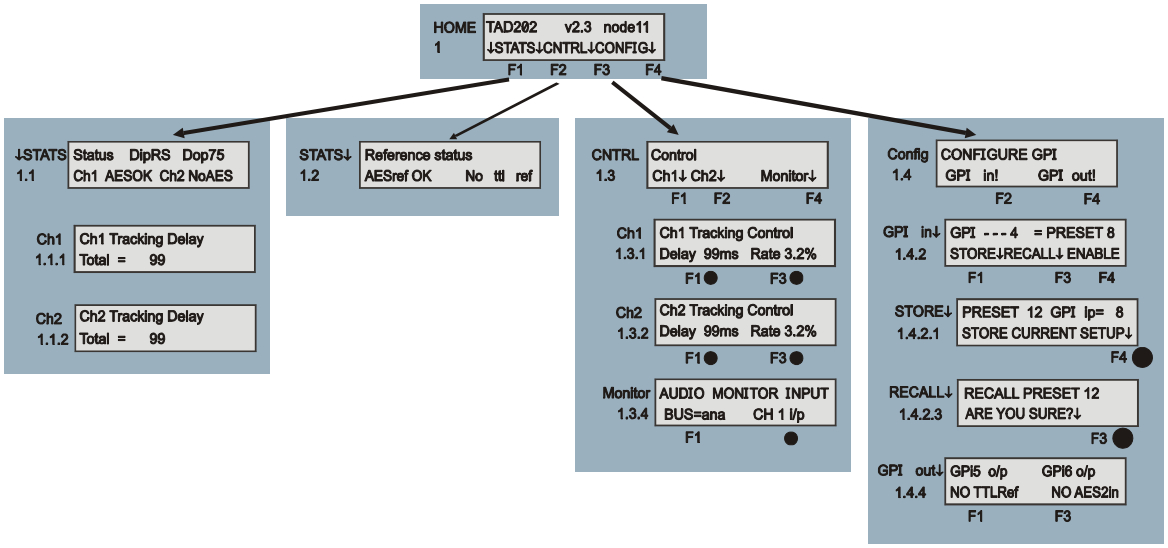
The values displayed on an active front panel are only updated when an adjustment is made and when changing menu level. If mode changes occur through the use of card edge controls or through automatic response to GPI signals, the text displayed on the active front panel will not be updated immediately.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

4.1 The TAD202 menu structure

The main top-level menus for a module are obtained by pressing the F1, F2, F3 and F4 keys from that module's HOME menu. Menu keys are illuminated when active and when further menus are available. The three top-level menus are:

- ¬STATS (Input Status) – press F1
- STATS¬ (Reference status) – press F2
- CNTRL (Control) – press F3
- CONFIG (Configure) – press F4

The following chart shows the available menus.



The TAD202 menu tree

Note: Function keys and shaft encoder LEDs are illuminated when active.
Menus or function keys associated with the shaft encoder for changing assigned values are shown with a black circle.
Please refer to the card edge control chapter for details of reference selection, digital output phase and TTL tracking pulse source assign/polarity.

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 F2. Menu 1.2.3 is reached by pressing F2 and then F3.

Module codes

The following module and function codes are used in all TAD202 control panel menus:

Menu code	Module code	Function code	Function description
Aip	AIP2	Ana IP	Analogue input option card
Aop	AOP2	Ana OP	Analogue output option card
DRS	DIP2RS	Dig IP RS	Digital input option card
Dop75	DOP2-75	DigDMUX	Unbalanced Digital output option card
Dop11	DOP2-110	DigDMUX	Digital output option card

Shorthand codes

The following shorthand codes are used in all TAD202 control panel menus:

Menu code	Function description
G	GPI
s	Audio signal silent (below –50dBs FS)
-	Signal not present

4.2 Input status

Pressing F1 from the home menu will bring up the 1st STATS menu, Input Status. The following information is shown:

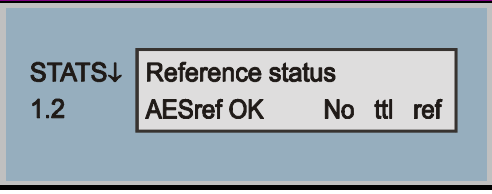
- Installed sub PCBs
- Input status
- Tracking delay

Input status menu	Description
↓STATS 1.1 Status DipRS Dop75 Ch1 AESOK Ch2 NoAES	Top line shows installed cards Ch1 and Ch2 status may be AESOK, NOAES, NOana, anaOK depending on input option fitted
Ch1 1.1.1 Ch1 Tracking Delay Total = 99	Ch1 Tracking Delay Shows current delay for Ch1 in milliseconds
Ch2 1.1.2 Ch2 Tracking Delay Total = 99	Ch2 Tracking Delay Shows current delay for Ch2 in milliseconds

4.3 Reference status

Pressing F2 from the home menu will bring up the 2nd STATS menu, reference status. External reference is applicable to digital output sub PCBs only. The following information is shown:

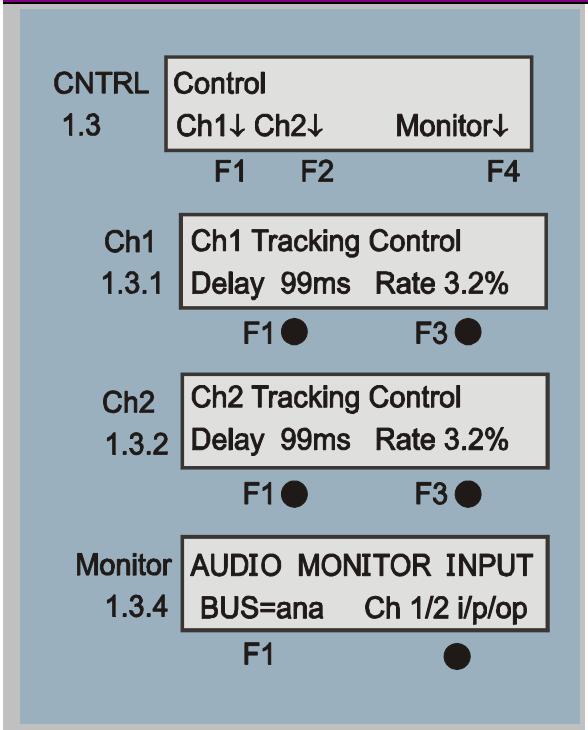
- External reference status
- TTL tracking reference status

Phase menu structure	Description
	If a digital output card is fitted status may be AESrefOK or No AESref TTL status may be ttl ref OK or No ttl ref

4.4 Control and monitoring

Pressing F3 from the home menu will bring up the Control menu. Use this menu to select monitoring and delay configuration, select tracking source or turn tracking off for fixed delay. The Control menu provides the following functions:

- Each channel's audio delay
- Each channel's T.A.D Speed or Rate (rate of change of audio delay)
- Monitor output set-up

Gain menu structure	Description
	Use the F keys to select the required Control sub-menu Channel 1 Tracking Control F1 allows the shaft encoder to vary delay from 1ms to a maximum of 681ms. F3 allows the shaft encoder to vary the adjustment rate from 0.05% to 3.2%. Channel 2 Tracking Control F1 allows the shaft encoder to vary delay from 1ms to a maximum of 681ms. F3 allows the shaft encoder to vary the adjustment rate from 0.05% to 3.2%. Monitor source F1 toggles rear audio monitor bus output between analogue and digital. Shaft encoder selects either input or output from either channel (side) 1 or channel (side) 2

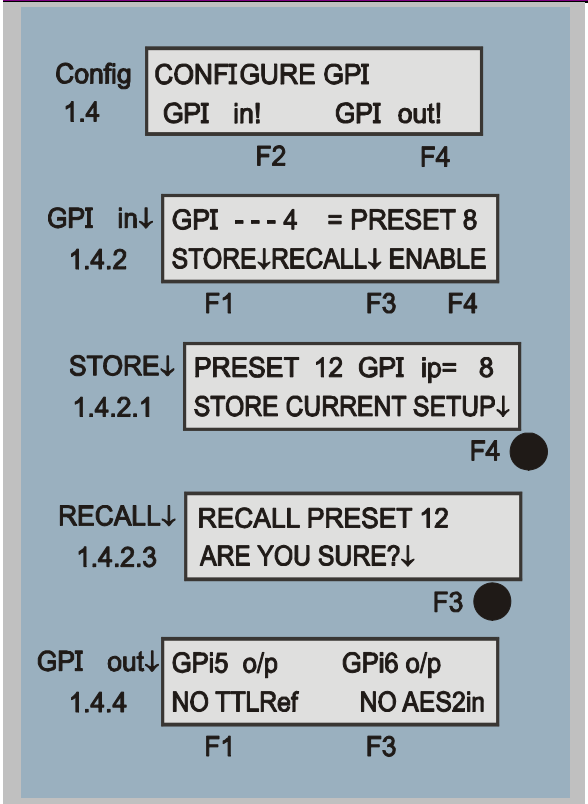
Note: 'Rate' is the speed at which the delay changes from the current to the required delay as set by the user or tracking input. A rate of 0.05% corresponds to a maximum pitch change of 0.5Hz on a 1kHz input. A rate of 3.2% corresponds to a maximum pitch change of 32Hz on a 1kHz input.

Warning: The active control panel does not provide controls to select the TTL tracking source for each side or to select between non-tracking or manual delay mode.
Please refer to the card edge control or Statesman chapter for details of reference selection, digital output phase and TTL tracking pulse source assign/polarity.

4.5 Configuration (GPI) menus

Pressing F3 from the home menu will bring up the top Configuration menu. The configuration menus provide the following functions:

- Enable GPI preset recall
- Store and recall presets

Configure menu structure	Description
	Select GPI IN (F2) or GPI OUT (F4) Configure GPI Top line: GPI 1234 = Current Preset (0 to 15) Bottom line: Store, Recall, Enable/Disable selected by function keys, F1, F3 and F4 Store preset (DISABLE GPIs to use) Top line: preset no. GPI status Bottom line: Store Current Setup Shaft encoder changes preset, F4 saves setup Recall preset (DISABLE GPIs to use) Top line: preset no. Bottom line: ARE YOU SURE or EMPTY MEMORY LOCATN if nothing to recall Shaft encoder cycles active presets, F3 recalls setup This function is no longer available. GPI 5 and GPI 6 now present the TTL pulses.

Using presets

Up to sixteen setups may be stored and recalled from Statesman, the card edge control or by external GPIs. Presets store board setup data including configuration and option card status. It is not possible to recall a preset if the option card configuration is different to those established when the preset was created. The presets are currently numbered 0-15.

Preset recall is not available from the front control panel unless GPIs have been disabled. This avoids the possibility of GPI inputs causing preset memory data to re-configure TAD202 at the same time as presets are being updated.

To store a preset proceed as follows:

Ensure menu 1.4.2 is set to 'DISABLE'

Select appropriate preset with menu 1.4.2.1

Press F4 to save setup data into the selected preset

To recall a preset proceed as follows

Ensure menu 1.4.2 is set to 'DISABLE'

Select appropriate preset with menu 1.4.2.3

If EMPTY MEMORY LOCATION is displayed, rotate the shaft encoder to cycle through valid memory locations to recall

Press F3 to recall setup data from the selected preset

The contents of a chosen location will be overridden when store is selected. The TAD-202 mode will be reconfigured when an active preset location is recalled.

TIP: To check if a location is empty use menu 1.4.2.1 to select the location, BUT DO NOT STORE. Then move up the menu until RECALL can be selected. Press RECALL. The message 'EMPTY MEMORY LOCATION' will be displayed if it is empty. Otherwise 'ARE YOU SURE' will be displayed.

5 Statesman

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.

Most functions can be accessed from Statesman menus. Some advanced functions may only be available from the card edge. Refer to section 6.1, Control cross reference for further information.

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.

5.1 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.

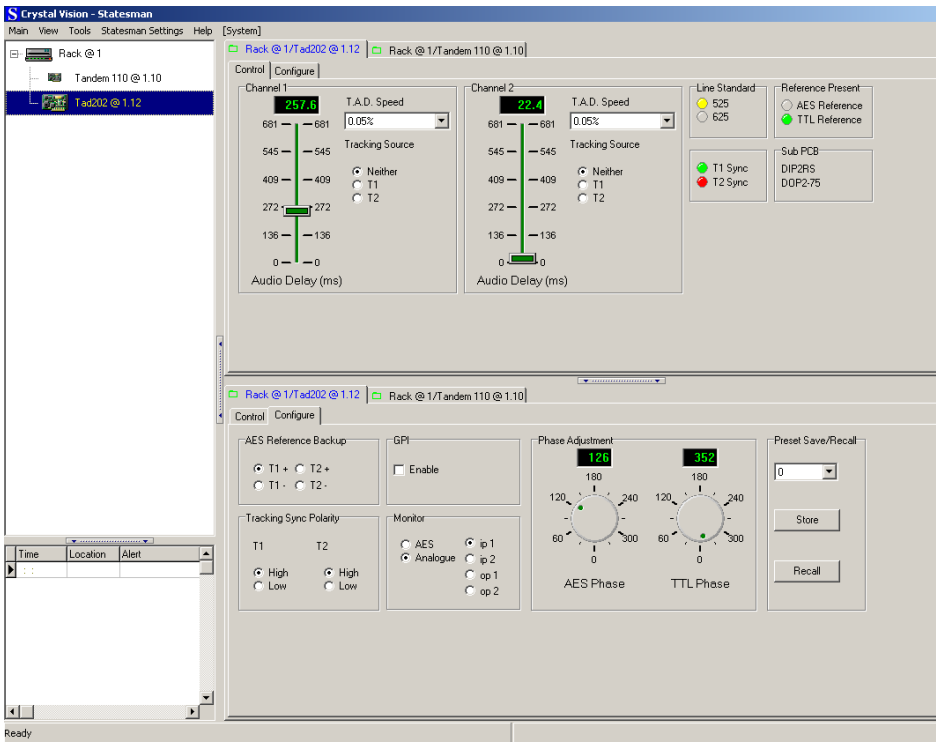
To aid user recognition of module and frame status quickly, the following colour and size coding is used:

A module is shown present by full colour and absent by greyed colour

A module is shown open by a large icon and closed by a 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 pane or drag the button to vary the size of the panes.

Warning: Always ensure that the active front panel (if fitted) is in STATESMAN mode. If the front panel is active, control via Statesman will be subject to high latency and the response to changes will be slow.

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

Power-up defaults

The auto-configuration process, performed when a TAD202 is first powered up, normally returns the card to the state it was when powered down. User delay settings must be stored as a preset in order to be restored. If the audio option piggyback cards have been changed, the following default settings are selected:

Delay: 20ms

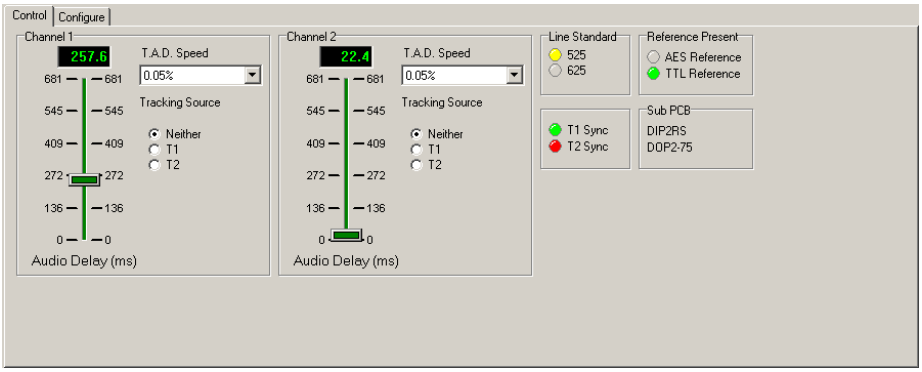
Rate of auto-tracking delay (T.A.D. Speed): 3.2%

Once this 10-second initialisation procedure is complete, the TAD202 card can be controlled or configured from Statesman, the card edge and from the frame's local or remote control panel.

Control

The control menu provides access to:

- Module status
- Manual audio delay
- T.A.D. Speed
- Tracking source



TAD-202 control menu

Selecting the tracking source

The Tracking source may be selected between the T1 and T2 TTL tracking inputs or Neither (Tracking Off).

If either T1 or T2 tracking references are selected for any side, that side will vary in delay automatically by tracking the supplied reference so as to minimise input synchronisation errors.

The TTL tracking control inputs should be compatible with the SYN102 Crystal Vision video synchroniser tracking sync output with a period of 1 video frame.

The pulse length (the time between the rising and falling edges) should be the same as the video delay being tracked, but not less than 5µs. See the configuration section for tracking pulse polarity.

Manual delay control

If tracking is off (Neither), the manual sliders set a range of 1 to 681 ms delay independently for each side. If tracking is on (T1or T2), the delay required by the tracking pulse is added to the user set delay. The read out at the top of the slider indicates the user selected delay.

Adjusting the auto-tracking rate

The T.A.D. Speed is the rate at which the delay changes from the current to the required delay as set by the T.A.D Speed spin box.

A rate of 0.05% corresponds to a maximum pitch change of 0.5Hz on a 1kHz input. A rate of 3.2% corresponds to a maximum pitch change of 32Hz on a 1kHz input.

The audio delay may be adjusted imperceptibly on-air by first setting the speed to 0.05%. Higher speed settings may be used, but as the speed is increased, a noticeable pitch change may occur in music or tone as the delay is changed.

To add a constant delay, set the tracking input for the channel to 'Neither' rather than T1 or T2. The T.A.D. Speed will shift from the existing delay to a new user-set one at the rate set by the tracking speed control.

The tracking delay added to any user set delay is between 2.5 and 37.5ms to compensate for a video delay of 0-40ms - figures are adjusted accordingly for NTSC.

Tracking is predictive, pre-compensating for the addition or drop of a video frame by the synchroniser so as to minimise lip-sync errors that would otherwise result.

If the frame drop/add rate increases, the operational window and speed of the tracking delay adjustment is varied automatically to allow the system to track correctly. This may result in some noticeable pitch change in extreme circumstances. If the frame drop/add rate is extremely high, tracking is disabled and the tracking delay is fixed at 15ms.

In tracking mode, the fixed delay should be set to the minimum audio delay that the system requires. For example, if a video synchroniser is used in particular signal path, the compensating TAD-202 audio delay should be set to the delay of that signal path when the synchroniser is introducing its minimum delay.

Process delay

The input/output delay is summarised in the following table:

Example mode combination	Digital delay DIP2>DOP2	Analogue delay AIP2>AOP2
All delay set to zero, tracking OFF (Neither)	310µs	1,540µs
All delay set to zero, tracking ON (T1 or T2)	2.5ms	3.7ms
Delay at maximum	680ms	681ms

Note: Changing DPI2+DOP2 to AIP2+AOP2 adds approximately 1,240µs.

Module status

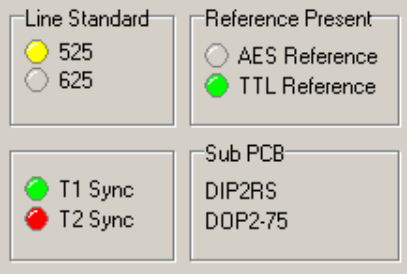
The TAD-202 status is shown on the top right hand side of the Control menu:

Line standard – 525 or 625

Reference presence AES/TTL (green OK)

Tracking sync T1 and T2 (green = present, red = absent)

Sub PCB fitted AOP, AIP2B, DIP2RS, DOP2-75/110



TAD-202 status

Configuration

The Configure menu tab provides access to the following functions:

AES reference backup - select T1 or T2 high or low

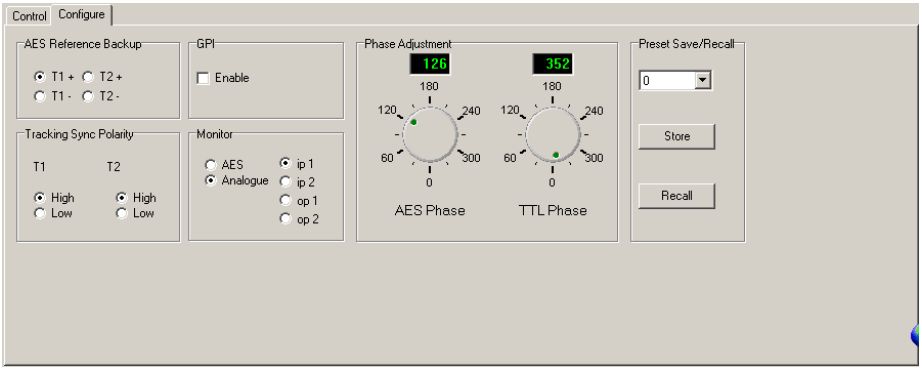
Tracking sync polarity - select high or low for both T1 and T2

GPI – enable/disable

Audio monitor – AES/Analogue Input 1/2 or Output 1/2

AES/TTL phase adjustment

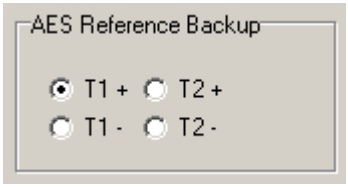
Preset recall and store



TAD-202 configuration menu

AES reference backup

The main AES reference (chosen in the Control menu) can be replaced automatically if it fails or is removed for any reason by one of the TTL tracking references. Either a positive or negative going tracking pulse edge may be selected as the backup reference.

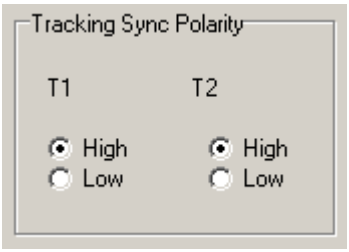


AES-reference backup

Check one of the 'AES Reference Backup' options as required to select a suitable backup reference.

Tracking sync polarity

For T1 and T2, the Tracking Sync Polarity may be set for either HIGH (timing set by duration of pulse when high) or LOW (timing set by duration of TTL pulse when low).



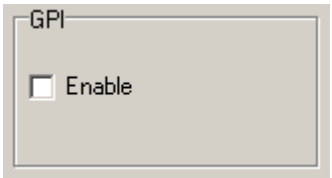
Tracking sync polarity

See the control section to set the tracking source.

Enabling GPIs

There are four GPIs for external recall of setups and two to provide alarm monitoring.

External GPI control can be enabled or disabled by clicking or clearing the 'Enable GPI' box. Presets cannot be manually stored or recalled whilst enable GPI is selected.

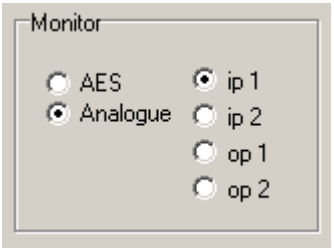


GPI recall disabled

Audio Monitoring

Audio monitoring is provided by a miniature stereo jack socket at the card edge. The same signal may also be routed to the rear connector in either AES or analogue format.

The stereo source monitored can be selected from any valid audio input or output.



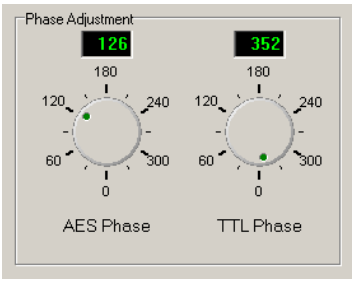
Audio monitoring

Select a stereo source for headphone socket and rear audio monitoring bus from those available ip1, ip2, op1 or op2. Select the rear monitoring bus to be in digital (AES) or analogue format.

Adjusting TTL and AES phase

The phase of the digital audio output may be adjusted with respect to both the AES reference and to the TTL reference used when the AES reference is lost.

The appropriate jumper link must be set on the DOP2-75 or DOP2-110 sub-board.



AES/TTL phase adjustment

In each case, the output phase may be varied using the rotary control provided over a range of 360 degrees.

Using presets

The Preset Controls menu provides access to setup presets, monitoring assignments and SDI crystal PLL embed reference selection.

Preset controls

Up to 16 setups may be stored and recalled from Statesman, the card edge control or by external GPIs. Presets store board setup data including configuration and option card status. It is not possible to recall a preset if the option card configuration is different to those established when the preset was created. The presets are currently numbered 0-15.

To store a preset proceed as follows:

Ensure ‘GPI enable’ is unchecked

Select appropriate preset with the Preset Number drop-down menu

Click on ‘Store’ to save setup data into the selected preset

To recall a preset proceed as follows

Ensure ‘GPI enable’ is unchecked

Select appropriate preset with the Preset Number drop-down menu

Click on ‘Recall’ to recall setup data from the selected preset

The Presets Save/Recall menu area will indicate if a location is empty. If it has already been used, the display will show ‘invalid’. If OK is clicked on the contents of the chosen location will be overridden.

If an attempt is made to recall an empty location, the recall operation will fail.

‘GPI enable’ should not be checked whilst presets are being created or recalled by this menu to prevent inadvertent GPI operation. Enable ‘GPI controls preset recall’ when finished if required.

6 Trouble shooting

Trouble-shooting may be performed by using the card edge or remote status panel displays. In addition, audio monitoring of input and output busses is provided from both the card edge headphone socket and the multi-way socket on the RM04 rear connector.

Card edge status LEDs

Board edge LEDs provide status reporting and may be useful when fault finding.

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

Power rail	LED Colour	Description
+3V	Green	+3 volt power supply rail OK
+5V	Green	+3 volt power supply rail OK

Card edge error messages

If option cards are fitted incorrectly, the following error messages will appear

Code	Meaning
wrong ip L	Left sub-PCB (input type) is incorrect
wrong op R	Right sub-PCB (output type) is incorrect
no ip PCB	No input sub-PCB fitted
no op PCB	No output sub-PCB fitted
PCBs swap!	Input and output PCBs have been swapped L<->R
AIP not B	AIP2 card is the wrong format
No DC-DC	No DC-DC converter fitted (when analogue i/o)

Note: These error messages are not displayed at the remote or local panel displays (if fitted). The remote or local panel may not be able to locate the TAD202 if one or more of the above errors are present.

Checking inputs, references and configuration parameters

Status displays are provided at the card edge and remote panel to monitor the analogue and/or digital inputs and outputs, the digital audio references, the TTL tracking inputs and configuration parameters. Some problems can be traced to configuration errors or missing or inappropriate reference or input signals. Please refer to the control panel and card edge chapters for details of the supplied status displays and configuration controls.

Audio monitoring

The audio monitor output is accessible from the card edge headphone socket and the multi-way socket at the rear of the RM04. The audio monitor output can be used to 'listen' to input and output buses of either 'side' or TAD202 channel.

6.1 Control cross reference

The following table is provided to cross-reference the card edge and active front panel commands. The card edge controls allow access to the all TAD202 parameters, whilst the Active Control Panel provides access to a selected sub-set.

Piano switch	Hex switch	Description	Statesman	Card-edge section	Front panel menu
all up	0 – 3	display status	Control tab	4.1	1.1 /1.2
	4 – 5	adjust audio delay speed	Control tab	4.2	1.3.1/2
	6 – 9	adjust audio delay	Control tab	4.2	1.3.1/2
	A	select reference	Configure tab	4.2	N/A
	B	select tracking pulse polarity	Configure tab	4.2	N/A
	C	select tracking pulse input	Control tab	4.2	N/A
	D/E	Aud Bus anlg/Dig, Mon source	Configure tab	4.2	1.3.4
	F	GPI inputs enable / disable	Configure tab	4.2	1.4.2.2
2 only down	0 - 15	preset 0-15 save / recall	Configure tab	4.2	1.4.2.2
3 only down	0 - 15	unused			
4 only down	0 - F	unused			
5 only down	0	adjust AES output phase	Configure tab	4.2	N/A
6 only down	0-E	No user controls			
7 only down	0	TAD firmware status	Board info	4.1	1./Device
	1	tracking delay 1 status	N/A	4.1	1.1.1
	2	tracking delay 2 status	N/A	4.1	1.1.2
	3	silence monitors/AES present	N/A	4.1	N/A – 1.1

6.2 Sample problems and their solution

The Power OK LEDs are not illuminated

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

There are no audio outputs

Check for audio signals using headphones connected to the front PCB mini jack

Check that functioning analogue or digital audio output cards are fitted securely

Check that any audio cabling is intact

Check that audio channel levels have not been inadvertently set to zero gain

The digital audio is not timed with the video (lip sync error)

Check the digital audio delay for each channel and that either a T1 or T2 tracking reference is selected if required

The digital audio output produces clicks and pops in downstream equipment

Check that an appropriate external reference synchronous with the system audio clock is connected

Check that the downstream equipment is properly referenced to the system audio reference

AES output relative timing is incorrect

Check the output phase timing adjustment for both TTL/AES references available under Statesman or from the card-edge controls.

The rear audio monitoring does not work

Check that the rear audio BUS is set to the appropriate format; analogue/AES

The card no longer responds to Statesman/front panel control

Check that the card is seated correctly and that the Power OK LED is lit

Check that the Comms LED in an Indigo frame flashes when Statesman communication control is attempted

Check any active control panel/Statesman cabling

Check if the control panel/Statesman can control another card in the same rack

If necessary re-set the card

Statesman settings change unexpectedly

Active control panel or card edge control settings may have overridden Statesman settings if they were changed more recently

Card edge settings have changed unexpectedly

Statesman or active control panel settings may have overridden card edge control settings if they were changed more recently

Active control panel settings change unexpectedly

Statesman or card edge control settings may have overridden control panel settings if they were changed more recently

Re-setting the card

If required, 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 safe to re-insert the card whilst the rack is powered.

7 Specification

TAD202 motherboard

Inputs

Audio inputs	Dependent on sub PCBs fitted - 2 analogue stereo or 2 AES inputs
TTL tracking source	2 x TTL tracking inputs of the same video standard and of positive or negative polarity. The period should be 1 video frame with a pulse width equal to the video delay being tracked. The minimum high or low pulse width is 5 µs (microseconds).
External reference	Digital output sub PCBs may have an external AES/EBU reference See section 7.2 on sub PCBs for more information

Outputs

Audio	Dependent on sub PCBs fitted - 2 analogue stereo or 2 AES outputs
Monitoring	1 x miniature front mounted audio jack and switch selects individual stereo audio analogue monitoring on both input and output. Also available on rear connector as analogue or AES

Standard selection	525/625 automatic
Delay	Dual channel digital audio delay - pre-settable in 1ms steps from 1 – 681ms Tracking delay auto or OFF
Silence threshold delay	Silence threshold delay for both sides is pre-settable for the amount of time a signal is allowed to remain below –50dB wrt Full Scale before a silence error is flagged. Values start at 1.5s, 8s and then in increments of 8s to 120s
Setups	Sixteen set-ups are available to store setup data. They may be recalled either from the board control or through the use of external GPIs
GPIs	Four GPIs are available for external recall of setups and two are available to provide alarm monitoring
Status monitoring	Front card edge visual monitoring with alphanumeric and LED indicators Remote control panel also available Maskable GPI output of inputs/references present and silence
Weight	250g with two sub PCBs fitted

AIP2: Dual analogue audio input sub-PCB

Audio input	2 analogue stereo pairs or 4 mono channels, 20 bit quantising A to Ds, High input impedance (20KOhm) balanced
Level range	0dBFS = +28dBu max / 0dBFS = +12dBu min Default level: 0dBFS = +18dBu or +24dBu by on-board link
Signal to noise	-82dBu / -100 dBFS (+18dBu) rms., 22Hz to 22kHz typ.
Total harmonic distortion	0.005% THD+N rms., 22Hz to 22kHz typ.
Interchannel crosstalk	-116 dB @ 1kHz, -92 dB @ 20 kHz, rms., typ.
Synchronisation	Digitised output of analogue A to D is automatically locked to video

AOP2: Dual analogue audio output sub-PCB

Audio output	2 analogue stereo pairs or 4 mono channels, 20 bit quantising A to Ds, Low output impedance (66Ohm) balanced
Level range	0dBFS = +28dBu max / 0dBFS = +12dBu min Default level: 0dBFS = +18dBu or +24dBu by on-board link
Signal to noise	- 80dBu / -98 dBFS (+18 dBu) rms., 22Hz to 22kHz typ.
Total harmonic distortion	0.0025% THD+N rms., 22Hz to 22kHz typ.
Interchannel crosstalk	-112 dB @ 1kHz, -98 dB @ 20 kHz, rms., typ.

DIP2RS: Dual digital audio input sub-PCB

Audio input	2 x 20 bit stereo pairs. AES3 110Ohm or HiZ (balanced) D-Type, or AES3-id (unbalanced) 75Ohm BNC. Set by on-board links
Synchronisation	Synchronous audio to video 48kHz Asynchronous audio to video 48kHz + or – 50 ppm

DOP2-110 and DOP2-75: Dual digital audio output sub PCBs

Audio output	2 x 20 bit AES/EBU stereo pairs. DOP2-110, 110Ohm or DOP2-75 (unbalanced) 75Ohm BNC. Factory configuration only
Reference	Available instead of 2nd buffered output on some rear connector modules. Link selected May be AES reference or Word clock – link select