ADA-8 Multi-channel A/D D/A Converter

Module Reference

Module Reference Revision History

Rev	Date	Author	Comments
1.00	11th January 2002	Andy Hudson & Ian Dennis	Initial release with 1.22 firmware
1.01	15th October 2002	Ian Dennis	Pro Tools HD I/O Module added
1.02	15th July 2003	Ian Dennis	DSD I/O Module added
1.03	10th March 2005	Gordon Mills	FireWire I/O Module added

Support Contacts

Prism Media Products Limited
William James House
Cowley Road
Cambridge CB4 0WX
UK

Prism Media Products Inc
21 Pine Street
Rockaway
NJ 07866
USA

Telephone:	+44 1223 424988		Telephone:	+1 973 983 9577
Fax:	+44 1223 425023		Fax:	+1 973 983 9588

Email: tech.support@prismsound.com
Web: http://www.prismsound.com

Or contact your local Prism Sound distributor as detailed on the website.

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In accordance with our policy of continual development, features and specifications are subject to change without notice.

Contents

1   Introduction

This section of the manual gives details of the various module options for the ADA-8, including fitment and connection details, performance specifications and any module-specific menus and operations.

General operation is covered in the Operation Manual, with full firmware-version-specific menu and operation details being provided in the Firmware Reference.

2   Utility Module PREV039/3/1

2.1   Overview

The Utility Module is fulfils a number of miscellaneous I/O functions:

• Stereo analogue Monitor output;
• Stereo digital Monitor output;
• AES11 Reference Sync Input and Output;
• Wordclock or video Reference Sync input;
• Wordclock or Superclock (256xfs) Reference Sync output;
• Serial COM port, RS-232, RS-485 or MIDI format;

The Utility Module is different from the analogue and digital I/O modules described elsewhere in this manual, which can be interchangeably fitted to the I/O slots. The Utility Module is fitted inside the ADA-8 chassis, and is connected with flying leads to the Utility Panel on the right-hand side of the rear panel (when viewed from the back).

It is unlikely that the user will ever need to replace or reconfigure the Utility Module, and the information in section 2.3 is provided for information only.

WARNING: Replacing or reconfiguring the Utility Module requires removal of the top cover of the ADA-8. This operation presents a risk of electric shock, therefore refer this operation to qualified personnel.

2.2   Connection

AES11 (DARS) Reference Sync input and output are provided on female and male XLR connectors respectively. The AES11 output impedance is 110Ω ; the input impedance is normally 110Ω, but the input termination can be removed via an internal jumper (as described below) to allow multiple inputs to be daisy-chained if required.
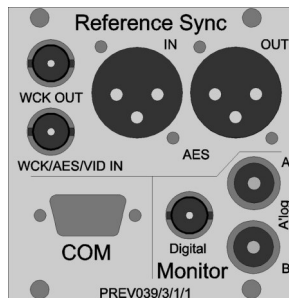
Wordclock Reference Sync input and output are provided on BNC connectors. The input impedance is normally 75Ω, but the input termination can be removed via an internal jumper (as described below) to allow multiple inputs to be daisy-chained if required. The input is also able to accept a 75Ω AES3-id reference, or an analogue video reference (PAL, NTSC or NTSC30). The output can be set to produce a Superclock (256xfs clock) instead of a Wordclock, if required, principally for use in Pro Tools applications. These selections are made through the Menu System, as described in the Firmware Reference.

The stereo output of the Monitor is available in both analogue and digital formats. The analogue outputs are on phono (RCA) connectors, but are balanced (see the jumper options below). The digital output is in AES3-id format on a BNC connector.

The Serial COM port is on a 9-pin male 'D' connector, and is configured by default as RS-232 with PC-compatible pinout allowing it to be connected to a PC using a null-modem cable. Other formats such as RS-485 and MIDI may be configured by jumpering as described below; see the Firmware Reference for details of support for these other formats.

2.3   Jumper Options

Various configurations of the Utility Module are possible by altering jumper positions, or selecting alternative headers for the connection of the Utility Panel connectors. The figure and table below describe these options:
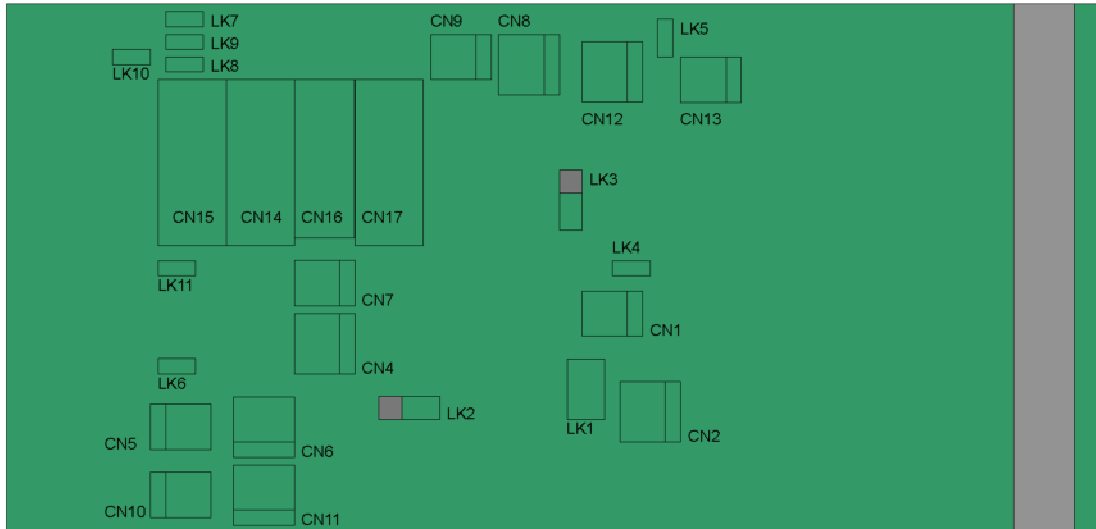
Jumper/Header	Function
CN1	Coaxial Ref Sync output (WCK, SCK, DARS)
CN2	XLR Ref Sync output (DARS)
CN4	Digital Monitor #1, balanced output for XLR (note 1)
CN5	Analogue Monitor, left channel, unbalanced output (note 1, 2)
CN6	Analogue Monitor, left channel, balanced output
CN7	Digital Monitor #1, unbalanced output for coaxial
CN8	Digital Monitor #2, balanced output for XLR (note 1)
CN9	Digital Monitor #2, unbalanced output for coaxial (note 1)
CN10	Right-channel, analogue monitor unbalanced output (note 1, 2)
CN11	Right-channel, analogue monitor balanced output
CN12	XLR Ref Sync input (DARS)
CN13	Coaxial Ref Sync input (WCK, DARS or video)
CN14	RS-232 COM port (plug 9wD ribbon here for RS-232, default)
CN15	RS-422/485 COM port (plug 9wD ribbon here for RS-422/485)
CN16	Alternative MIDI connector for panel with DIN connectors
CN17	MIDI COM port (plug 9wD ribbon here for MIDI)
LK1	Coaxial Ref Sync out format; 3-5, 4-6: WCK (default); 1-3, 2-4: S/PDIF
LK2	Digital Monitor #1 output format; 1-2: AES3; 2-3: S/PDIF (default)
LK3	Digital Monitor #2 output format; 1-2: AES3; 2-3: S/PDIF (note 1)
LK4	XLR sync input termination: fitted : 110R (default); not fitted: none
LK5	Coaxial sync input termination: fitted : 75R (default); not fitted: none
LK6	RS-232 COM-mode: fitted – RS-232 mode (default), not fitted - other
LK7	Terminate RS-422/485 Rx: fitted – 110R term, not fitted - none
LK8	RS-485 mode: fitted – RS-485 (half -dplx), not fitted RS-422 (full-dplx)
LK9	RS-485 mode: fitted – RS-485 (half -dplx), not fitted RS-422 (full-dplx)
LK10	RS-422/485 COM-mode: fitted – RS-422/485 mode, not fitted - other
LK11	MIDI COM-mode: fitted - MIDI mode, not fitted - other

Note 1: Unused in default configuration
Note 2: It is recommended that the 'balanced' configuration be used for analogue Monitor outputs at all times, even if the cold leg is grounded. The bootstrapping output circuit gives best results in this mode. The unbalanced connector gives 6dB gain reduction and may produce increased distortion.

Jumpers and headers not listed in the above table are either for factory use only, or reserved for unspecified future use. These should remain in the state in which they left the factory.

The 9-way 'D' connector pin-outs for the various serial COM formats are as follows:

Pin-out of 9w male 'D' for various serial COM formats:			
Pin	RS-232	RS-422/485	MIDI
1			IN+
2	RXD	RXD-	THRU+
3	TXD	TXD+	GND
4			OUT-
5	GND		GND
6		GND	IN-
7		RXD+	THRU-
8		TXD-	OUT+
9			GND

3   Analogue Line Input Module PREV039/4/1

3.1   Overview

The Analogue Line Input Module type PREV039/4/1 provides eight electronically-balanced analogue input channels to the ADA-8, on eight female XLR connectors.

Input line-up level (sensitivity) is variable for each channel over the range 0dBFS=+5.0dBu to 0dBFS=+24.0dBu, in 0.5dBu steps plus a fine trim.

Each channel has a Prism Sound Overkiller progressive limiter capability, which prevents the A/D converter from reaching full-scale, even when the input level significantly exceeds the selected input range. More information about the Prism Sound Overkiller can be found in the Technical Background section of the Operation Manual.

Control of the input line-up level and trim, and of the Overkillers, is via menus which are present in the ADA-8 Menu System if the Module is present.

3.2   Fitting the Module

In most cases, the Module has been factory-fitted so, unless you are fitting the module yourself, the remainder of this section may be ignored.

The Analogue Line Input Module can be fitted to either Analogue I/O Slot (AIO1 or AIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual). Although the ADA-8 can automatically accommodate the module in either position, it is conventional that analogue input modules are fitted in the upper slot (AIO1) and line output modules in the lower slot (AIO2). This will provide compatibility with operating examples quoted in these manuals. An exception is the case of ADA-8s configured for 16-channel A/D or D/A operation, where BOTH AIO slots would contain either line input or line output modules respectively.

For details of how to fit the Module, refer to the Adjustments and Upgrades section of the Operation Manual.

3.3   Connection

Connection from a balanced source is straightforward with conventional XLR pinouts: hot (+) on pin 2, cold (-) on pin 3, with pin 1 connected to the cable screen.

Unbalanced sources should still be connected to the ADA-8 between pins 2 (+) and 3 (-) of its input XLR, since the input circuit is balanced. Pin 1 may be commoned to pin 3 depending on the topology of the driving circuit.

It is important not to connect an unbalanced source between pins 2 and 1 of the ADA-8's input XLR with pin 3 unconnected, since incorrect levels and/or excessive interference may result.

3.4   Module Dependent Input Options Menus

When an Analogue Line Input Module is selected as an input to a Path, three menus become available for the appropriate Module Slot in the Module Dependent Input Options section of the Menu System for that Path. These menus can be reached either using Menu System navigation keys, or more easily by pressing the blue 'Access' button in the 'Source' box of the Mimic panel when it is selected to the desired Path.

The upper left-hand corner of these menus identifies the Module Slot (e.g. 'AI1'), followed by an abbreviated indicator of the module type, in this case 'Lin' to indicate Line Input.

For more information about the location of these menus within the overall Menu System, descriptions of the different menu types, key definitions etc. see the Firmware Reference.

3.4.1   AI Line Overkillers menu

```
AI1 Lin:
  [Overkillers]
```

The AI Line Overkillers menu is a Special menu. The 'Select/Change' keys and 'Enter/Accept' have no function. Overkillers for each of the eight channels are enabled and disabled by the Channel Select buttons. The enabled/disabled state of the Overkillers is reflected in the Channel Select LEDs whenever this menu is displayed: LEDs for channels with Overkillers enabled flash, whereas LEDs for channels with Overkillers disabled remain are unlit. The 'All' button may be used to quickly enable the Overkillers on all eight channels simultaneously, although they must be disabled individually.

The Overkillers' thresholds are set automatically in software, according to the input line-up level selected for each channel. For line-up levels below +8dBu (i.e. in the 0dBFS=+5.0dBu to 0dBFS=+8.0dBu range) the effectiveness of the Overkillers' transient limiting is less than for higher line-up levels.

It is possible to set the assignable 'Alert' LEDs to indicate when the Overkiller of each channel is actually limiting. This is described in the Alerts section of the Firmware Reference.

More information about the Prism Sound Overkiller can be found in the Technical Background section of the Operation Manual.

3.4.2   AI Line Level menu

```
AI1 Lin:+18.0dBu
  -1.02 [0dBFS]
```

The AI Line Level menu is a Per-Channel Selection menu. The input line-up adjustment is specified in terms of the analogue input amplitude which produces the peak handling level of the A/D converter (i.e. 0dBFS). The user may adjust the line-up level for each of the eight channels, over the range 0dBFS=+5.0dBu to 0dBFS=+24.0dBu, in 0.5dBu steps.

A real-time display of the peak-metered level of the current channel is provided on the bottom line of the screen to facilitate adjustment (this feature is primarily for use with the AI Line Trim menu, and is described below).

NOTE for Pro Tools users: the ADA-8 nomenclature for analogue line-up varies from that used by Pro Tools. Refer to section 6 for more details.

3.4.3 AI Line Trim menu

```
AI1 Lin:+0.00dB
 -1.02 [Trim]
```

The AI Line Trim menu is a Per-Channel Selection menu. The user may finely trim the line-up level for each of the eight channels by ±0.5dBu in 0.05dBu steps. This control is supplementary to the AI Line Level menu.

A real-time display of the peak metered level of the current channel is provided on the bottom line of the screen to facilitate adjustment. The level display shows peak amplitude in dBFS, i.e. dBs below digital full-scale. Although it should not be necessary to trim the ADA-8 to produce accurate line-up levels (the ranges are set very accurately at the factory), line-up with other equipment can be achieved by connecting the external reference level to the ADA-8 and adjusting the trims as follows. If, for example, a +4dBu (0VU) tone is connected, and the ADA-8 line-up is being adjusted for 0dBFS=+18dBu, each trim should be set so that the peak level display reads as close as possible to -14dBFS. Note that the peak level display does not function when 'All' is selected (it cannot show the level of all eight channels at the same time!).

3.5 Module Dependent Factory Default Stores

Several of the Factory Default Stores (which include A/D Paths) depend on the fitment of an analogue input module of some kind for correct operation (as described in the Firmware Reference). If no analogue input module is available, loading these Stores results in any available input module being assigned to the 'analogue input' Path, or no input module being assigned if there is none available.

3.6 Specifications

Unless otherwise stated, all performance specifications are rms, unweighted, band-limited 20Hz-20kHz, sampling at 96kHz, wordlength 24-bits, analogue I/O line-up at 0dBFS=+18dBu.

Electronically-balanced inputs on female XLR connectors (pin 2 hot)
Differential input impedance: 21k5Ω
Full-scale input range (software controlled):
      Range: +5dBu..+24dBu in 0.5dB steps
      Trim: ±0.5dB in 0.05dB steps
Absolute gain accuracy: ±0.05dB
Common-mode rejection ratio (CMRR):
      60Hz: <-100dB
      1kHz: <-90dB
      20Hz..20kHz: <-65dB
Overkiller (progressive analogue input limiter):
      On/off selection per channel
      Automatic software-controlled threshold adjustment
THD+n (997Hz, -1dBFS): -105dB (0.0006%)
Dynamic range (997Hz, -60dBFS): 112dB
IMD (SMPTE/DIN, 60Hz at -3dBFS and 7kHz at -12dBFS): <-90dB
Maximum aharmonic spurium: (997Hz, -1dBFS): <-130dBFS

Frequency response:

fs=96kHz, -0.05dB: 9.5Hz..40.0kHz
fs=96kHz, -3dB: 1.05Hz..46.6kHz
fs=48kHz, -0.05dB: 9.5Hz..22.0kHz
fs=48kHz, -3dB: 1.05Hz..23.3kHz
fs=44.1kHz, -0.05dB: 9.5Hz..20.2kHz
fs=44.1kHz, -3dB: 1.05Hz..21.4kHz

Passband ripple:

fs=96kHz: <0.003dB
fs=48Hz: <0.001dB

Interchannel phase difference: <0.03 degrees

Channel separation:

1kHz: >120dB
20Hz..20kHz: >115dB

Group delay: (analogue input to AES3 output): 47/fs
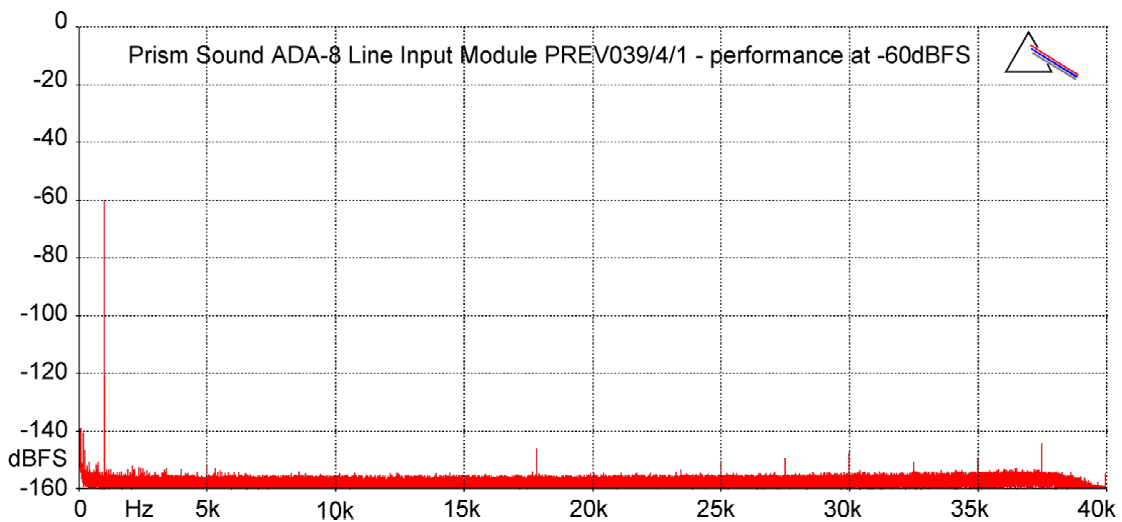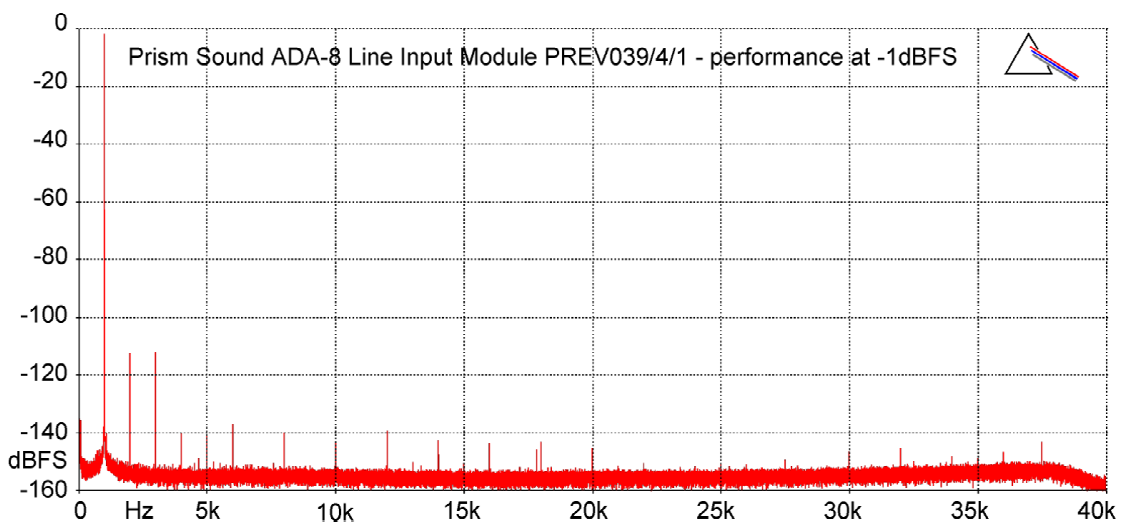
FFT plots made using Prism Sound dScope Series III at 997Hz, 256k points,
Prism-7 window, 16 averages, at fs=96kHz, +18dBu=0dBFS line-up level.

4   Analogue Line Output Module PREV039/5/1

4.1   Overview

The Analogue Line Output Module type PREV039/5/1 provides eight electronically-balanced analogue output channels from the ADA-8, on eight male XLR connectors.

Output line-up level (gain) is variable for each channel over the range 0dBFS=+5.0dBu to 0dBFS=+24.0dBu, in 0.5dBu steps plus a fine trim.

Control of the output line-up level and trim is via menus which are present in the ADA-8 Menu System if the Module is present.

4.2   Fitting the Module

In most cases, the Module has been factory-fitted so, unless you are fitting the module yourself, the remainder of this section may be ignored.

The Analogue Line Output Module can be fitted to either Analogue I/O Slot (AIO1 or AIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual). Although the ADA-8 can automatically accommodate the module in either position, it is conventional that analogue output modules are fitted in the lower slot (AIO2) and line input modules in the upper slot (AIO1). This will provide compatibility with operating examples quoted in these manuals. An exception is the case of ADA-8s configured for 16-channel A/D or D/A operation, where BOTH AIO slots would contain either line input or line output modules respectively.

For details of how to fit the Module, refer to the Adjustments and Upgrades section of the Operation Manual.

4.3   Connection

Connection to a balanced load is straightforward with conventional XLR pinouts: hot (+) on pin 2, cold (-) on pin 3, with pin 1 connected to the cable screen.

An unbalanced load should be connected between pins 2 (+) and 3 (-) of the output XLR. Pin 1 may be connected to pin 3 to ground reference the cold leg if required, and will often give better results, depending on the topology of the load circuit. Note that in this mode, line-up levels above 0dBFS=+20dBFS should not be used since the bootstrapping action of the output circuit may cause clipping.

It is possible to connect unbalanced loads across pins 2 (+) and 1 (gnd) of the output XLR, albeit with a gain loss of 6dB. This method is not recommended since it may cause increased distortion.

4.4   Module Dependent Output Options Menus

When an Analogue Line Output Module is assigned as an output Port from a Path, two menus become available for the appropriate Module Slot in the Module Dependent Output Options section of the Menu System for that Path. These menus can be reached either using Menu System navigation keys, or more easily by pressing the blue 'Access' button in the 'Dest' box of the Mimic panel when it is selected to the desired Path.

The upper left-hand corner of these menus identifies the Module Slot (e.g. 'AO1'), followed by an abbreviated indicator of the module type, in this case 'Lin' to indicate Line Output.

For more information about the location of these menus within the overall Menu System, descriptions of the different menu types, key definitions etc. see the Firmware Reference.

4.4.1 AO Line Level menu

```
AO1 Lin:+18.0dBu
[Set dBu=0dBFS]
```

The AO Line Level menu is a Per-Channel Selection menu. The output line-up adjustment is specified in terms of the analogue output amplitude which corresponds to the peak handling level of the D/A converter (i.e. 0dBFS). The user may adjust the line-up level for each of the eight channels, over the range 0dBFS=+5.0dBu to 0dBFS=+24.0dBu, in 0.5dBu steps.

NOTE for Pro Tools users: the ADA-8 nomenclature for analogue line-up varies from that used by Pro Tools. Refer to section 6 for more details.

4.4.2 AO Line Trim menu

```
AO1 Lin:+0.00dB
[Set dBu=0dBFS]
```

The AO Line Trim menu is a Per-Channel Selection menu. The user may finely trim the line-up level for each of the eight channels by ±0.5dBu in 0.05dBu steps. This control is supplementary to the AO Line Level menu.

4.5   Module Dependent Factory Default Stores

Several of the Factory Default Stores (which include D/A Paths) depend on the fitment of an analogue output module of some kind for correct operation (as described in the Firmware Reference). If no analogue output module is available, loading these Stores results in any available output module being assigned to the 'analogue output' Path, or no output module being assigned if there is none available.

4.6   Specifications

Unless otherwise stated, all performance specifications are rms, unweighted, band-limited 20Hz-20kHz, sampling at 96kHz, wordlength 24-bits, analogue I/O line-up at 0dBFS=+18dBu.

Electronically-balanced outputs on male XLR connectors (pin 2 hot)
Differential input impedance: 50Ω
Full-scale output range (software controlled):
      Range: +5dBu..+24dBu in 0.5dB steps
      Trim: ±0.5dB in 0.05dB steps
Absolute gain accuracy: ±0.05dB
Output balance: >54dB
THD+n (997Hz, -1dBFS): -101dB (0.0009%)
Dynamic range (997Hz, -60dBFS): 108dB
IMD (SMPTE/DIN, 60Hz at -3dBFS and 7kHz at -12dBFS): <-92dB
Maximum aharmonic spurium: (997Hz, -1dBFS): <-130dBFS

Frequency response:

        fs=96kHz, -0.05dB: 10.0Hz..35.0kHz

        fs=96kHz, -3dB: 3.9Hz..47.0kHz

        fs=48kHz, -0.05dB: 10.0Hz..21.4kHz

        fs=48kHz, -3dB: 3.9Hz..23.8kHz

        fs=44.1kHz, -0.05dB: 10.0Hz..19.6kHz

        fs=44.1kHz, -3dB: 3.9Hz..21.8kHz

Passband ripple: <0.005dB

Interchannel phase difference: <0.02 degrees

Channel separation:

        1kHz: >115dB

        20Hz..20kHz: >110dB

Group delay: (AES3 input to analogue output): 34/fs
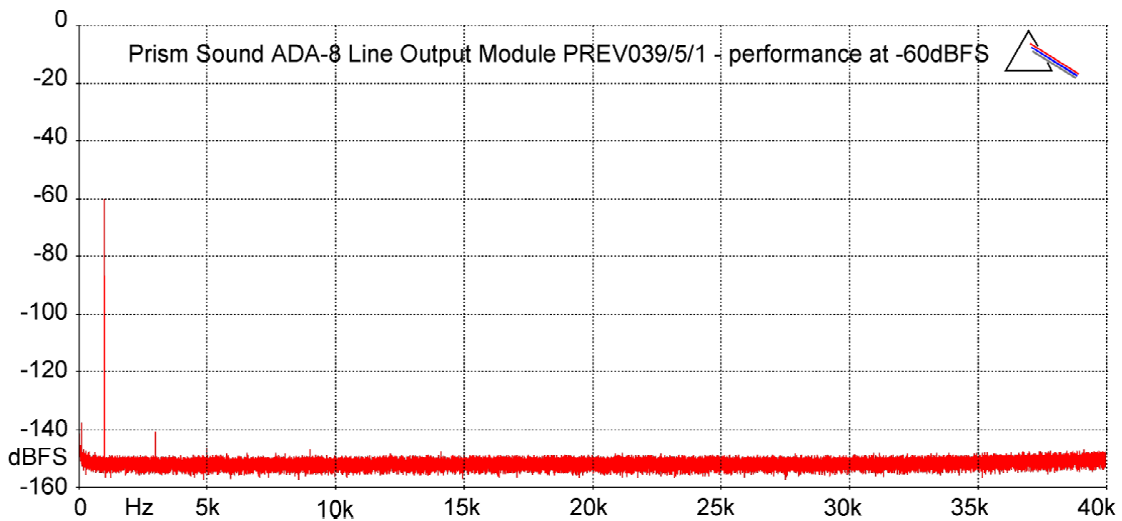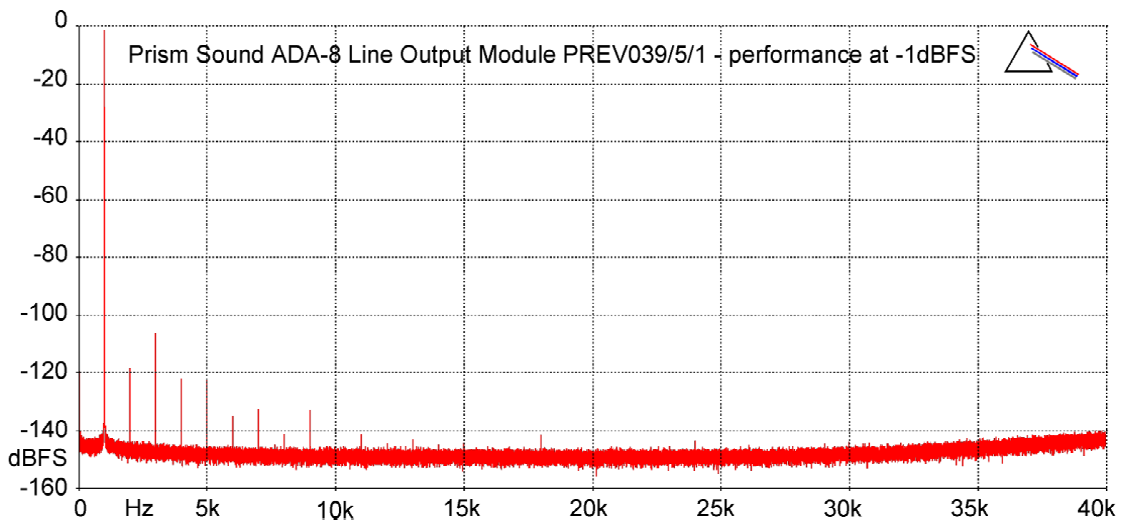
FFT plots made using Prism Sound dScope Series III at 997Hz, 256k points,
Prism-7 window, 16 averages, at fs=96kHz, +18dBu=0dBFS line-up level.

5   AES3 I/O Module PREV039/6/1

5.1   Overview

The AES3 I/O Module type PREV039/6/1 provides eight channels of digital audio input and output for the ADA-8 on four AES3 carriers in each direction. The input and output sections of the module are completely independent - that is, they can be assigned to different Paths with different sample rates, Sync Sources and other options. The AES3 I/O module can be thought of as two modules in one - one input module and one output module.

The module can accommodate extended sample rates in Split96 (two-wire) or high-speed (one-wire) modes, and can output consumer or professional Channel Status.   Inputs and outputs may be jumpered to comply with either AES3 or S/PDIF carrier voltage levels and impedances.

5.2   Fitting the Module

In most cases, the Module has been factory-fitted so, unless you are fitting the module yourself, the remainder of this section may be ignored.

The AES3 I/O Module can be fitted to either Digital I/O Slot (DIO1 or DIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual). Although the ADA-8 can automatically accommodate the module in either position, it is conventional that general-purpose (i.e. non-workstation) digital I/O modules are fitted in the upper slot (DIO1) if NO workstation card is fitted, and in the lower slot (DIO2) if a workstation I/O card is fitted. This will provide compatibility with operating examples quoted in these manuals. Where an ADA-8 is to be fitted for eight-channel Split96 operation, or for 16-channel analogue-to –AES3 or 16-channel AES3 to analogue operation, AES3 I/O Modules must be fitted to BOTH DIO slots.

For details of how to fit the Module, refer to the Adjustments and Upgrades section of the Operation Manual.

5.3   Connection

Connection to the AES I/O Module is by a female 25-way 'D' type connector on the rear panel. This carries all the connections needed for four input and four output AES3 carriers. The AES3 module is supplied with a 'squid' which breaks out the 25-way to 'D' to four female XLR connectors for the AES3 inputs and four male XLR connectors for the AES3 outputs.

To assist in custom cabling applications, the pinout of the squid is shown in section 5.12.

For coaxial connection with S/PDIF or AES3-id equipment, adapters can be used on the XLRs which connect pin 2 to the coaxial inner and pins 1 and 3 to the coaxial screen. Alternatively, wire to the 25-way 'D' using 'A' to inner and 'B' + 'Screen' to outer. In either case, set the jumpers for S/PDIF operation as described in section 5.11.

5.4   Module Dependent Input Options Menus

When an AES3 I/O Module is selected as an input to a Path, a DI AES Split96 menu for the relevant module slot becomes available in the Module Dependent Input Options section of the Menu System for that Path.

The upper left-hand corner of this menu identifies the Module Slot (e.g. 'DI1'), followed by an abbreviated indicator of the module type, in this case 'AES'.

For more information about the location of these menus within the overall Menu System, descriptions of the different menu types, key definitions etc. see the Firmware Reference.

5.4.1   DI AES Split96 menu

```
DI1 AES: Normal
Normal Split96
```

The DI AES Split96 menu is a Single Selection menu - the AES3 I/O Module in question may be set to 'Normal' (two channels per carrier) or 'Split96' (one channel per half-speed carrier). This option only applies to the selected module, when extended sample rates are in use, in the input direction. If two AES3 I/O Modules are selected as inputs to a Path, two DI AES Split96 menus are made available, one for each module. If Cascade Split96 mode is enabled (see section 5.6), setting a single module to Split96 input mode causes both AES3 I/O Modules to 'cascade' to provide eight input channels as described in section 5.9.

5.5   Module Dependent Output Options Menus

When an AES3 I/O Module is selected as an output from a Path, a DO AES Split96 menu and a DO AES Channel Status menu for the relevant module slot become available in the Module Dependent Output Options section of the Menu System for that Path.

The upper left-hand corner of this menu identifies the Module Slot (e.g. 'DO1'), followed by an abbreviated indicator of the module type, in this case 'AES'.

For more information about the location of these menus within the overall Menu System, descriptions of the different menu types, key definitions etc. see the Firmware Reference.

5.5.1   DO AES Split96 menu

```
DO1 AES: Normal
Normal Split96
```

The DO AES Split96 menu is a Single Selection menu - the AES3 I/O Module in question may be set to 'Normal' (two channels per carrier) or 'Split96' (one channel per half-speed carrier). This option only applies to the selected module, when extended sample rates are in use, in the output direction. If two AES3 I/O Modules are selected as outputs from a Path, two DO AES Split96 menus are made available, one for each module. If Cascade Split96 mode is enabled (see section 5.6), setting a single module to Split96 output mode causes both AES3 I/O Modules to 'cascade' to provide eight output channels as described in section 5.9.

5.5.2 DO AES Channel Status menu

```
DO1 AES:Pro
Pro Consumer
```

The DO AES Channel Status menu is a Single Selection menu. The user may choose the format of the Chanel Status information embedded in the AES3 or S/PDIF carrier. Two options are available, 'Pro' (professional) and 'Consumer'. The precise implementation of each mode is described in section 5.12.

5.6 *Module Dependent Preferences Menus*

5.6.1 DI Sync Input menu

```
DI1 Sync I/P: A
C1 C2 C3 C4 Auto
```

Each AES3 I/O Module fitted to the ADA-8 enables a DI Sync Input menu in the Module Dependent Preferences section of the Menu System. These Single Selection menus control which AES3 input carrier will be the Sync Source when a Path sourced from that module is set to sync from that 'DI' slot. Options are 'C1', 'C2', 'C3', 'C4' and 'Auto'. 'C1-4' select one of the four input carriers - fixing the Sync Source to that AES3 carrier. 'Auto' allows the ADA-8 to choose any locked carrier input as described in the section 5.8.

5.6.2 Cascade Split96 menu

```
Cascade S96 IO:N
No Yes
```

If two AES3 I/O Modules are fitted to the ADA-8, the Cascade Split96 menu is made available in the Module Dependent Preferences section of the Menu System. This is a Single Selection menu that enables or disables Cascade Split96 mode as described in section 5.9. The default selection is 'No', i.e. Cascade Split96 mode is disabled.

5.7 *Module Dependent Factory Default Stores*

Several of the Factory Default Stores depend on the fitment of a suitable 'general purpose' (i.e. non-workstation) digital I/O module for correct operation (as described in the Firmware Reference). If no such digital I/O module is available, loading these Stores results in any available input or output module being assigned to the affected Path, or no module at all being assigned if there is none available.

5.8 *Synchronization*

The AES3 I/O Module can act as a Sync Source for either Path of the ADA-8 (provided that at least one valid AES3 or S/PDIF carrier is connected to the module inputs). The user may select DI1 or DI2 in the Sync Source menu to synchronize that Path to the designated input of that I/O module. For correct operation, all the inputs to each AES3 I/O Module must be synchronous - that is, they must themselves share the same Sync Source and be at the same sample rate.

Only one of the four AES3 carriers can be used as the Sync Source at any given time. The user may choose the carrier with the DI Sync Input menu (Preferences). For each AES3 I/O Module, the sync may be fixed at any one of the four carriers, or the selection may be set to automatic, whereby the ADA-8 rotates through the four input carriers in turn until it finds one that is locked.

Automatic carrier selection is the default and will suffice for most purposes - the user can connect an AES3 input to any of the channels without having to worry about which one will be used for synchronization. There are, however, certain situations where automatic carrier selection is not appropriate and in these cases the sync carrier must be selected explicitly from the DI Sync Input menu.

One such cases arises because disconnecting a Path's Sync Source causes the Path to mute momentarily while a new Sync Source is found. If, for any reason, the user needs to disconnect an AES3 carrier without disrupting the other channels of the Path (for instance, if a Path's eight channels are being shared by more than one session), automatic selection should not be used, and a reliably-present carrier should be nominated explicitly.

Automatic selection should also be avoided when one or more of the input carriers to an AES3 I/O Module is itself synchronized from the Path, and the Path is synchronized to 'DI'. This would occur, for example, when some of the outputs of a digital-to-digital Path (AES3-AES3) are fed back into the inputs of that Path (possibly after passing through some other input-synchronized equipment). Such loops create problems with automatic carrier selection - if a carrier is selected whose sync is derived from the Path it is synchronizing, the Path will not lock correctly. In situations like this, the user should select a sync carrier that is not part of a dependency loop.

5.9   Split96 (two-wire) Operation

At extended sample rates (88.2kHz and 96kHz), the input and output stages of the AES3 I/O Module may be independently set to operate in Split96 mode, whereby each of the four carriers convey only one audio channel instead of the usual pair. In this mode, the AES3 carriers have a frame rate equal to half the sample rate of the Path to which the module is assigned. This means that only four input channels are available to a Path sourced from an AES3 module in Split96 mode. Similarly, a single module in Split96 mode can only transmit four of a Path's eight output channels. The four channels handled by a single AES3 I/O Module in Split96 mode are mapped to channels one to four (out of eight).

If the ADA-8 is fitted with two AES3 I/O Modules, the user may enable Cascade Split96 mode. In this mode, whenever one of the modules is operating in Split96 mode (input OR output), the other module is automatically used to provide the other four channels, allowing a total of eight channels of Split96 interfacing. Cascade Split96 mode effectively joins the two AES3 I/O Modules together so they operate as a single module capable of conveying eight extended sample rate audio channels on eight half-speed AES3 carriers. The module in DIO1 handles channels one to four while the module in DIO2 handles channels five to eight. Since the input and output stages of the AES3 I/O Module are independent, with separate Split96 controls, it is possible for example to have eight channels of Split96 input (spread across both modules), and eight channels of one-wire outputs (two channels per carrier) using one module. In this way, a D-D Path can perform conversion between two-wire and one-wire mode, or vice-versa.

Note that it is possible to select both AES3 I/O Modules as input or output for a Path using the Source Port and Destination Port menus, even when Cascade Split96 mode is not set. This is NOT the same as using Cascade Split96 mode to provide eight channels of Split96 interfacing, but rather provides parallel-output and per-channel input-selection as described in the Firmware Reference. If Split96 mode is set for input or output, but Cascade Split96 mode is NOT set, then this 'doubling up' of inputs or outputs simply acts over the first four channels. The only way to achieve full eight-channel I/O in Split96 mode is to enable Cascade Split96 mode.

When Split96 mode is active for a module, the 'Split96' LED for its DIO slot in either the 'Source' or 'Dest' box of the Mimic Panel will illuminate. If the LED flashes, this indicates that Split96 mode has been selected, but is not active, usually because the Path is not operating at an extended sample rate.

5.10 Channel Status

The AES3 I/O Module is tolerant of the Channel Status information embedded within each incoming AES3 or S/PDIF carrier - in most cases the audio path will not be disrupted even if the Channel Status information is incorrect or inconsistent.

The only field in the input Channel Status respected by the ADA-8 is the indication of pre-emphasis. If an input channel has pre-emphasis indicated, that indication will be passed through to the corresponding output channels for that path, although how that indication is acted upon depends on the type of output module. In general, digital output modules re-transmit the appropriate pre-emphasis information whereas analogue output modules perform appropriate de-emphasis if possible.

Channel Status for the AES3 outputs is generated locally (with the exception of pre-emphasis indication) according to the Encode settings for the Path to which the outputs are assigned. Thus the Channel Status accurately reflects the attributes of the output audio data (sample rate, wordlength etc.) regardless of the accuracy of any relevant input Channel Status to the Path. Pre-emphasis is indicated on an output stream only if the corresponding input has such an indication.

The AES3 I/O Module can generate either Professional or Consumer (AES3 or S/PDIF) standard Channel Status, as set by the relevant Digital Output Channel Status menu in the DEST Access group. The table in section 5.12 shows the settings of the Channel Status fields in each case.

5.11 Jumper Options

There are a number of jumpers on the AES3 I/O Module that are used to set the characteristics of the inputs (impedance) and outputs (impedance, voltage, grounding). The user may configure each input and output carrier independently to handle either AES3 or S/PDIF carriers. The position of the relevant jumpers is shown in the diagram below.
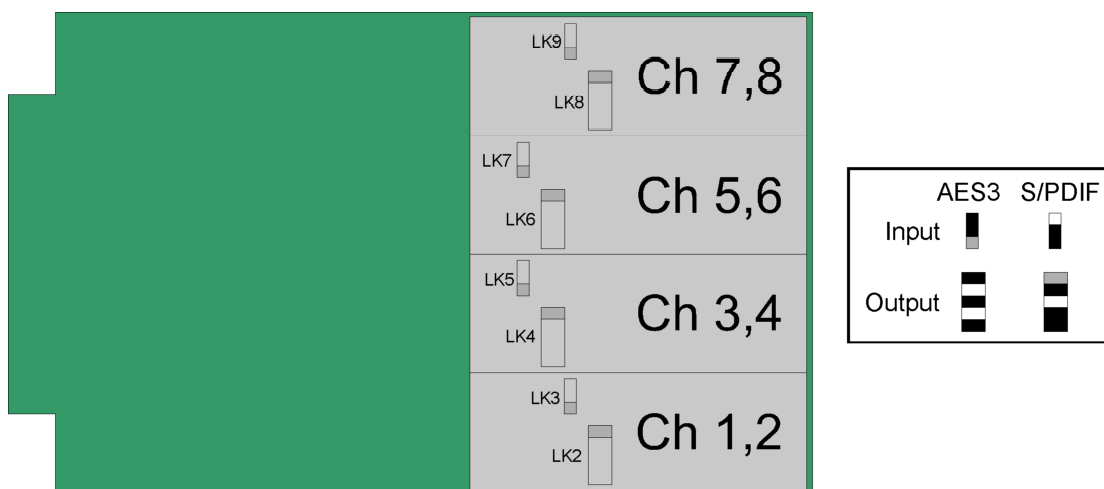
Jumpers LK2, LK4, LK6 and LK8 set output impedance, and carrier voltage and grounding for output carriers one to four respectively. Jumpers LK3, LK5, LK7 and LK9 set the input impedance for input carriers one to four respectively. The correct jumper configurations to use for AES3 and S/PDIF modes are shown for input and output.

5.12 Specifications

Transformer-coupled DB25 connector:
      AES3 mode:
            I/O impedance: 110Ω
            Output carrier amplitude (loaded): 3.2Vp-p
      S/PDIF mode:
            I/O impedance: 75Ω
            Output carrier amplitude (loaded): 0.5Vp-p
Output Channel Status: Professional or Consumer
Input jitter tolerance:
      <200Hz: 15UIp-p
      >8kHz: 0.5UIp-p
      (1UI = 163ns at fs=48kHz)
One-wire or two-wire (Split96) input and output modes at fs=88.2kHz or 96kHz
Wordlength: 16, 20 or 24-bit per channel

Input Channel Status: tolerant; only pre-emphasis indication noted
Output Channel Status implementation:

Professional Channel Status Implementation:		
Field	Position	AES3 Module Output
Channel status mode	Byte 0, Bit 0	Professional
Audio Mode	Byte 0, Bit 1	Linear PCM
Encoded audio signal Emphasis	Byte 0, Bits 2-4	Same as input, or no emphasis
Source sample frequency lock	Byte 0, Bit 5	Lock not indicated
Frame rate	Byte 0, Bit 6-7	Indicates current frame rate except when 88k2, 96k not indicated
Encoded channel mode	Byte 1, bit 0-3	2-channel mode for normal AES3, Single-channel double fs for Split96
Use of User bits	Byte 1, bit 4-7	No User information
Use of auxiliary sample bits	Byte 2, bit 0-2	Set according to channel wordlength
Audio sample wordlength	Byte 2, bit 3-5	
Multichannel mode	Byte 3, bit 7	Undefined multichannel mode
AES-11 Reference signal	Byte 4, bit 0-1	Not a reference signal
Sampling frequency	Byte 4, bit 3-6	Indicates current sampling rate
Sampling frequency scaling	Byte 4, bit 7	No scaling
Channel origin data	Byte 6-9	NULL – no channel origin data
Channel destination data	Byte 10-13	NULL – no channel destination data
Local sample address code	Byte 14-17	Permanently zero (default)
Time of day sample address code	Byte 18-21	Permanently zero (default)
Channel status reliability flags	Byte 22	Reliable
Cyclic redundancy check	Byte 23	Always correct
Consumer Channel Status Implementation:		
Field	Position	AES3 Module Output
Channel status mode	Byte 0, bit 0	Consumer
Audio mode	Byte 0, bit1	Linear PCM
Copyright	Byte 0, bit2	No copyright asserted
Additional format information	Byte 0, bit3-5	None
Category code	Byte 1	A-D converter without copyright information
Source number	Byte 2, bit 0-3	Zero
Channel number	Byte 2, bit 4-7	Zero
Sampling frequency	Byte 3, bit 0-3	Indicates current sample rate except when 88k2, 96k – shows 44k1, 48k instead
Clock accuracy	Byte 3, bit 4-5	Level 2
Audio sample wordlength	Byte 4, bit 0-3	Set according to channel wordlength

The pin-out of the squid is as follows:

25-way 'D' pin	Tentacle core	Tentacle ident	XLR type, pin
1	A	"1"	XLR1(F) pin 2
14	B		XLR1(F) pin 3
2	Screen		XLR1(F) pin 1
15	A	"2"	XLR2(F) pin 2
3	B		XLR2(F) pin 3
16	Screen		XLR2(F) pin 1
4	A	"3"	XLR3(F) pin 2
17	B		XLR3(F) pin 3
5	Screen		XLR3(F) pin 1
18	A	"4"	XLR4(F) pin 2
6	B		XLR4(F) pin 3
19	Screen		XLR4(F) pin 1
7	A	"1"	XLR5(M) pin 2
20	B		XLR5(M) pin 3
8	Screen		XLR5(M) pin 1
21	A	"2"	XLR6(M) pin 2
9	B		XLR6(M) pin 3
22	Screen		XLR6(M) pin 1
10	A	"3"	XLR7(M) pin 2
23	B		XLR7(M) pin 3
11	Screen		XLR7(M) pin 1
24	A	"4"	XLR8(M) pin 2
12	B		XLR8(M) pin 3
25	Screen		XLR8(M) pin 1

6   Pro Tools I/O Module PREV039/7/1

6.1   Overview

The Pro Tools I/O Module provides eight channels of digital audio input and output for the ADA-8 in a form compatible with Digidesign Pro Tools 24|MIX workstations.

The Pro Tools I/O Module enables the ADA-8 to replace a Digidesign 888|24 interface, providing superior audio performance and extra features.

To Pro Tools, an ADA-8 fitted with a Pro Tools I/O Module looks exactly the same as an 888|24 and it can be remote-controlled in the same way.

6.2   Getting Started with Pro Tools 24|MIX

To get started quickly, if your ADA-8 is already equipped for Pro Tools, go straight to section 6.10. and follow the interconnection and configuration instructions.

6.3   Fitting the Module

In most cases, the Pro Tools I/O Module (or modules) have been factory-fitted so, unless you are fitting the module yourself, the remainder of this section may be ignored.

The Pro Tools I/O Module can be fitted to either Digital I/O Slot (DIO1 or DIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual). Although the ADA-8 can automatically accommodate the module in either position, it is conventional that workstation digital I/O modules are fitted in the upper slot (DIO1), with a general-purpose digital I/O module (e.g. AES3) fitted in the lower slot (DIO2) if any is required. This will provide compatibility with operating examples quoted in these manuals. Where an ADA-8 is to be configured for 16 channels of A/D or 16-channels of D/A operation, TWO Pro Tools I/O Modules are required, one in each DIO slot.

For details of how to fit the Module(s), refer to the Adjustments and Upgrades section of the Operation Manual.

6.4   Hardware Configurations

Depending on the fit of I/O modules, the ADA-8 can be configured to provide a variety of I/O possibilities for Pro Tools. The basic hardware configurations available 'off the shelf' are:

8C-STD-PT	8 analogue inputs, 8 analogue outputs;
8C-STD-PT-AES	8 analogue inputs, 8 analogue outputs, 8 AES3 inputs and outputs;
8C-STD-PT-16AD	16 analogue inputs;
8C-STD-PT-16DA	16 analogue outputs;

It is also possible to configure other options, for example with a different digital I/O format, or with sub-fitted analogue I/O.

The 8C-STD-PT-AES configuration has the same basic functionality as a Digidesign 888|24 interface - mixed analogue and digital input to the workstation and parallel digital and analogue output from the workstation.

Since most users require both analogue inputs and outputs for Pro Tools, the 16-channel A/D and D/A configurations tend to be used alongside 8C-STD-PT or 8C-STD-PT-AES configurations to augment the number of analogue input or output channels, depending on the user's requirements. For example, it is a common practise to record and edit a multi-channel production on Pro Tools, and then to mix it down on an analogue mixer. In this application it is useful to have more D/A channels, and so a common (and economic) solution is to have one 8C-STD-PT-AES, plus one 8C-STD-PT-16DA, providing eight analogue inputs, 24 analogue outputs and eight AES3 inputs and outputs in only two chassis.

In all configurations, the ADA-8 operates as usual with two eight-channel Paths. In bi-directional configurations, Path 1 is usually configured to provide the inputs to Pro Tools, and Path 2 the outputs from Pro Tools. In 16AD or 16DA units, Path1 provides the first bank of eight channels and Path 2 the second bank. In both cases, the allocation of Paths is simply a matter of convention (Path 1 and Path 2 could be assigned the other way round).

Factory Default Stores are automatically created in all Pro Tools ADA-8s to allow the units to be instantly set up as required in the system, as described in section 6.6.

6.5   Module Dependent Preferences Menus

If one or more Pro Tools I/O Modules are fitted to an ADA-8, the Workstation Remote Control menu becomes available in the 'Module Dependent Preferences' section of the Menu System.

6.5.1   Workstation Remote Control menu
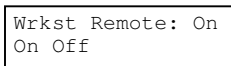
```
Wrkst Remote: On
On Off
```

This single selection menu allows the workstation remote control interface to be enabled or disabled. When enabled (set to 'On'), various parameters of the ADA-8 can be remotely controlled from Pro Tools, as described in section 6.8. When disabled (set to 'Off'), adjustments made from the workstation are ignored by the ADA-8.

6.6   Module Dependent Factory Default Stores

Three Pro Tools specific Factory Default Stores are made available when one or more Pro Tools I/O Modules are detected by the ADA-8. Stores are provided for Master, Slave or External Master operation, as described in section 6.7.

The names and details of the stores vary depending on whether the ADA-8 is configured for normal eight-in/eight-out operation, or for 16-channel A/D or D/A operation. The Store names for each mode are listed in the following table for each configuration:

	Eight in / eight out	16-channel D/A	16-channel A/D
Master	ProT:MASTER	ProT:MSTR 2xDAC	ProT:MSTR 2xADC
Slave	ProT:SLAVE	ProT:SLAVE 2xDAC	ProT:SLAVE 2xADC
External Mastr	ProT:Ext MASTER	ProT:ExMSTR 2xDAC	ProT:ExMSTR 2xADC

For eight-in / eight-out configurations without additional digital I/O (8C-STD-PT), and for 16-channel configurations (8C-STD-PT-16AD and 8C-STD-PT-16DA), these Stores are located in Bank 1, Stores 1..3. For eight-in / eight-out configurations with additional digital I/O (e.g. 8C-STD-PT-AES) they are located in Bank 3, Stores 1..3 because the first two Banks contain non Pro Tools A/D, D/A and D/D mode Stores.

6.7   Synchronization

Pro Tools 24|MIX workstations synchronize data transfer to and from their interfaces by taking a clock from one of them and distributing it to all the others via the Pro Tools data cables. The interface providing the clock to the workstation is the 'first in the chain' (if more than one interface is used), that is, the interface connected to the first card in the workstation, or to the 'A' leg of the 'Y cable' on that card, if a Y cable is used. This interface is referred to herein as the 'Master' interface, or the Master converter.

So considering a number of ADA-8s connected to Pro Tools 24|MIX: the Master ADA-8 has its record Path (usually Path 1) independently synchronized - either using its own crystal or an external source (e.g. Wordclock, AES11, or a digital input). Its playback Path (normally Path 2) and all the other Paths of all the other ADA-8s should be synchronized to the clock distributed on the Pro Tools data cable (DI1, if the Pro Tools I/O Module is located in DIO1). This arrangement ensures that the whole system is synchronized from a single source and that changes to the sample rate of that source will be reflected in all the ADA-8s. Note that ADA-8s connected to Pro Tools must run their two Paths synchronously, at the same sample rate.

It is possible to have a system where the Master interface does not have a record path, for example where the Master ADA-8 has only D/A Paths. In this case, the Path connected to the first Pro Tools card (again, usually Path 1) should be independently synchronized while all the other Paths should be synchronized to their respective DI (the Pro Tools I/O Module).

Like the 888|24, the ADA-8 is capable of providing digital as well as analogue inputs to a workstation, provided an appropriate digital I/O module is fitted (e.g. AES3). For correct operation, any digital inputs must be synchronous with the rest of the system. To achieve this, either the source of the digital inputs must be synchronized to the Master interface (or to its sync source) or the Master interface must be synchronized to its digital inputs (normally DI2).

ADA-8s may be used in Pro Tools 24|MIX systems alongside 888|24s, although the 888|24's synchronization requirements are somewhat more restrictive. The ADA-8 can extract all the information needed to synchronize and run its converters from the Pro Tools data cable. The 888|24 however, requires an extra, high-speed clock to run its converters that it cannot synthesize from the data cable, which is known as Superclock (SCK).

The ADA-8s do not need to work from a Superclock input, because their internal PLLs (phase-locked loops) synthesize all the necessary high-speed clocks for the converter devices locally. 888|24s need Superclock because they don't have the necessary PLLs to derive conversion clocks from lower-rate reference clocks such as Wordclocks. However, it is the PLLs in the ADA-8 which also reject incoming clock jitter to create a distortion-free conversion. The practice of distributing conversion clocks between equipment without local jitter filtering may create distortion levels unacceptable for high-quality applications.

All the 888|24s in a system must be fed SCK from the Master interface, regardless of whether that is an ADA-8 or another 888|24. The SCK output from the Master interface is connected to the Supeclock input of the first 888|24, whose output is fed to the input of the next, and so on. An 888|24 has SCK output permanently available on a connector on its rear panel, whereas an ADA-8 generates SCK from the Wordclock output on its rear panel when the appropriate option is set in the Wordclock Sync Output menu (see the Firmware Reference).

If all this sounds a little complicated, don't worry! The Factory Default Stores which are automatically available in ADA-8s fitted with Pro Tools I/O Modules make it a simple job to set up, simply by loading the appropriate Store, as detailed in section 6.6. The correct Store to choose for each ADA-8 in the system depends only on whether it is to be the Master interface and, if so, whether or not it is to be locally or externally synchronized. This will usually be local, unless a USD (Digidesign 'Universal Slave Driver') is in use in which case it will be external, from the USD's Wordclock output. The three Store options are described below. Note that for ADA-8s configured for 16-channel A/D or 16-channel D/A (or some other

configurations), there may be no playback Path or no record Path. This does not matter, just select the appropriate Store in the usual way.

6.7.1 Master

Only the first converter in the chain is the Master – the one connected to the first Pro Tools card, or to the 'A' leg of a Y cable on that card. The record Path, Path 1, has its Sync Source set to 'Local'. The playback Path, Path 2, has its sync-source set to 'DI1' to sync off the Pro Tools cable. Sample rate for Path 2 is set to '=Ext' to ensure that any changes in the sample rate of Path 1 is automatically reflected in the playback path.

6.7.2 Slave

All other converters in the chain should be configured as Slaves. In this case, both Paths are synchronized to DI1 with the sample rate set to '=Ext', ensuring that the sample rates of all Slave converters automatically follow the Master converter.

6.7.3 External Master

The External Master situation is exactly the same as the Master, except that the record Path, Path 1, is synchronized to its Wordclock input. This is the usual configuration when using a Universal Slave Driver (USD) to synchronize a Pro Tools system. The USD synchronizes the Master converter, which in turn synchronizes all the others. The USD itself may be sample-clock-referenced to its internal crystal or to an external sync source such as a video signal or LTC.

6.8   Remote Control

Certain parameters of the ADA-8 can be controlled remotely from the Pro Tools 24|MIX software in the same way as they can with an 888|24. The Hardware Setup dialogue in the Pro Tools environment can be used to alter the sample rate, the sync source and to select analogue or digital input channel pairs. Some controls in the Hardware Setup dialogue designed for the 888|24 do not affect the ADA-8 because it has no equivalent function in some areas (e.g. variable meter gain).

Unlike the 888|24, the ADA-8 does not rely on remote control from the Pro Tools software - all the ADA-8's parameters can be set from the front panel whereas the 888|24 has no front panel controls. This difference is a potential source of confusion since the Pro Tools software cannot detect parameter changes made using the ADA-8's front panel - it is therefore possible to set a parameter (e.g. sample rate) from Pro Tools and then change it on the front panel. In such cases, the ADA-8's front panel always reflects its true state even if the Pro Tools software does not. Such discrepancies will not disrupt recording or playback operation, but they may be confusing.

The following parameters may be remotely controlled from Pro Tools:

6.8.1 Sample Rate

The sample rate can be remotely controlled from Pro Tools, to either 44.1kHz or 48kHz. Such changes only affect ADA-8 Paths that have their sample rate set explicitly, i.e. those which do not have their sample rate set to '=Ext' in the Sample Rate menu. Slave Paths are normally

set to '=Ext', and automatically follow the rate of their Sync Source (i.e. the Pro Tools bus). Typically, only the record path (usually Path 1) of the Master converter has its sample rate set explicitly, with all other Paths in the system being set to follow it with '=Ext'. If a USD or other external reference sync is in use, even the Master converter may be set to '=Ext'.

6.8.2 Sync Source

Pro Tools can set the Sync Source of the Master converter to either 'Internal' or 'Digital'. In ADA-8 terms, these correspond to 'Local' and 'DI' respectively, where 'DI' is a digital I/O module (e.g. AES3). If no appropriate digital I/O module is fitted, selection of 'Digital' sync from Pro Tools will not cause any change. Changes to the Sync Source will only take effect if the sample rate for that Path is not set to '=Ext', i.e. if the unit is the Master converter.

6.8.3 Input Channel Selection

The Hardware Setup dialogue in Pro Tools can be used to select the source of each input channel pair as either analogue or digital. Obviously, this feature only applies to ADA-8s that have an appropriate digital I/O module fitted (e.g. AES3). Perhaps not so obvious is that the DIO slots from which the user wishes to make his selection must all be selected as input ports in the Source Port menu (see the Firmware Reference). The Hardware Setup dialogue is essentially changing the settings of the ADA-8's Input Channels menu, so remote control of input channel selection will only work if Input Selection Mode is set to 'Channel' rather than 'Path'. Also, this remote control feature will not work if the Input Channels menu has 'All' selected. The Factory Default Stores for Pro Tools, described above, automatically ensure that these conditions are met.

The ADA-8 allows greater flexibility in the selection of inputs from its front panel than is possible from Pro Tools - the front panel may be used to select any number of input modules of either analogue or digital format provided that the appropriate modules are fitted. The Pro Tools software only allows selection between one analogue module and one digital module for each input pair. If more than one of each is selected in the Source Port menu, Pro Tools can switch each input pair between the first analogue module and the first digital module only. Also, the ADA-8 front panel can select the source of all eight inputs to a path individually, whereas the Pro Tools software can only select by channel pair.

6.9 Analogue Line-Up Nomenclature with Pro Tools

Some confusion may result from the different nomenclatures used in the ADA-8 and Pro Tools systems for expressing analogue line-up levels.

Pro Tools sets its analogue line-up by reference to 'headroom' above a nominal operating level of 0VU (+4dBu). The ADA-8's line-up is specified in terms of the dBu equivalent of full-scale digital (0dBFS). So, for example, to set a line-up on the ADA-8 equivalent to '14dB' in Pro Tools nomenclature, it is necessary to set 18dBu on the ADA-8 (+4dBu + 14dB).

6.10 System Interconnection Examples

Connecting ADA-8s to Pro Tools couldn't be simpler, since they generally only require the data cable to be connected (no Superclock or Wordclock is required). The exception to this is where a USD is in use, in which case a Wordclock must be run from the USD's Wordclock output to the Master ADA-8's Wordclock input.

However, when using a mixture of ADA-8s and Digidesign 888|24 interfaces, the situation becomes slightly more complicated since you need to provide Superclock to the chain of 888|24s. Refer to one of the sections below, depending on whether an 888|24 or an ADA-8 is the Master interface. In general, it is usually better for an 888|24 to be the master, since ADA-8s are more tolerant of clock quality in the slave state than are 888|24s.

6.10.1 Connecting ADA-8s to Pro Tools

The figure below shows how to connect ADA-8s to Pro Tools when NO OTHER INTERFACE TYPES are in use. If other interfaces are to be used, see the following sections. The Master interface is connected to the first Pro Tools card (or to the 'A' leg of a 'Y' cable thereon). The USD is optional, depending on synchronization requirements.

All the ADA-8s should be switched on (and loaded with the appropriate Factory Default Store, if not previously loaded) prior to starting the Pro Tools system. For the Master ADA-8, load 'ProT:MASTER', or 'ProT:Ext MASTER' if the USD is in use. For Slave ADA-8s, load 'ProT:SLAVE'.
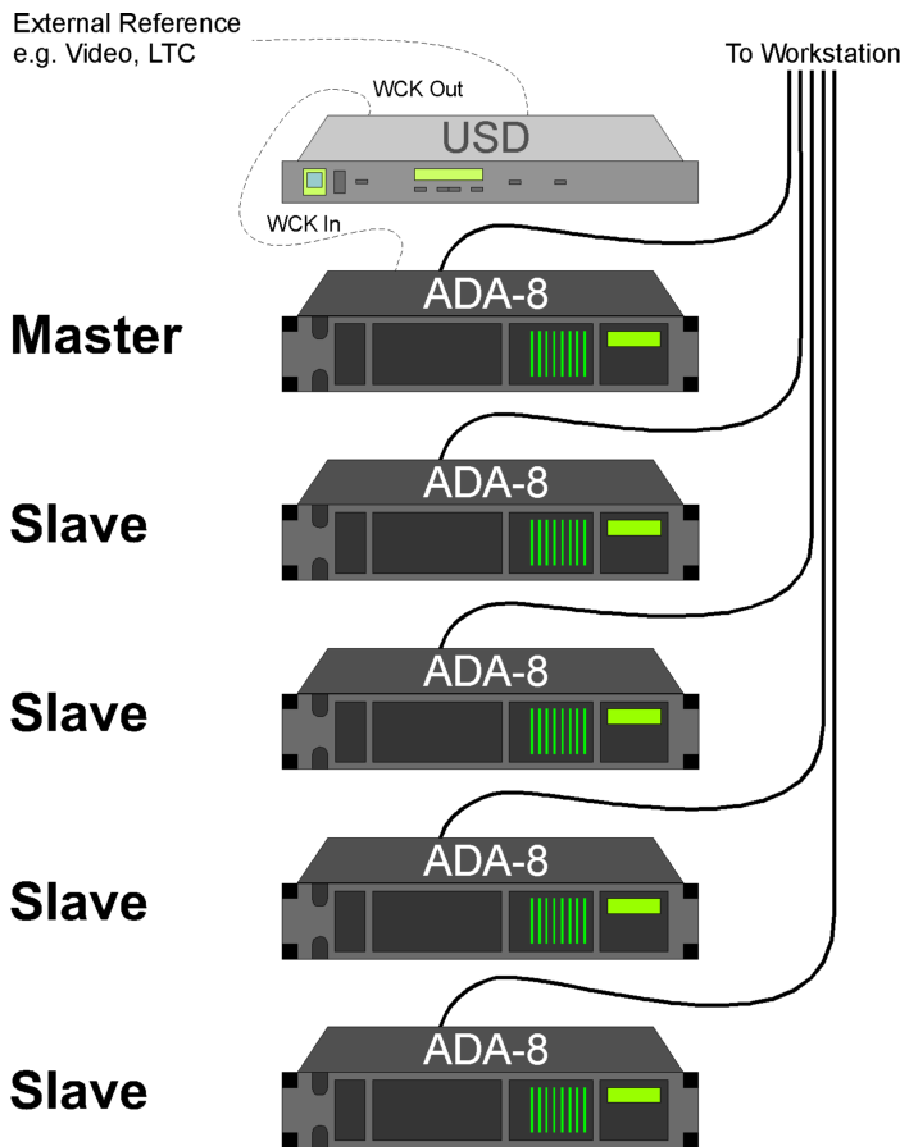
6.10.2 Combining with 888|24 interfaces, with 888|24 as master

The figure below shows how to connect a combination of 888|24s and ADA-8s, where one of the 888|24s is connected as the Master interface (i.e. connected to the first Pro Tools card, or to the 'A' leg of a 'Y' cable thereon). The USD is optional, depending on synchronization requirements.

All the ADA-8s should be switched on (and loaded with the 'ProT:SLAVE' Factory Default Store, if not previously loaded) prior to starting the Pro Tools system.
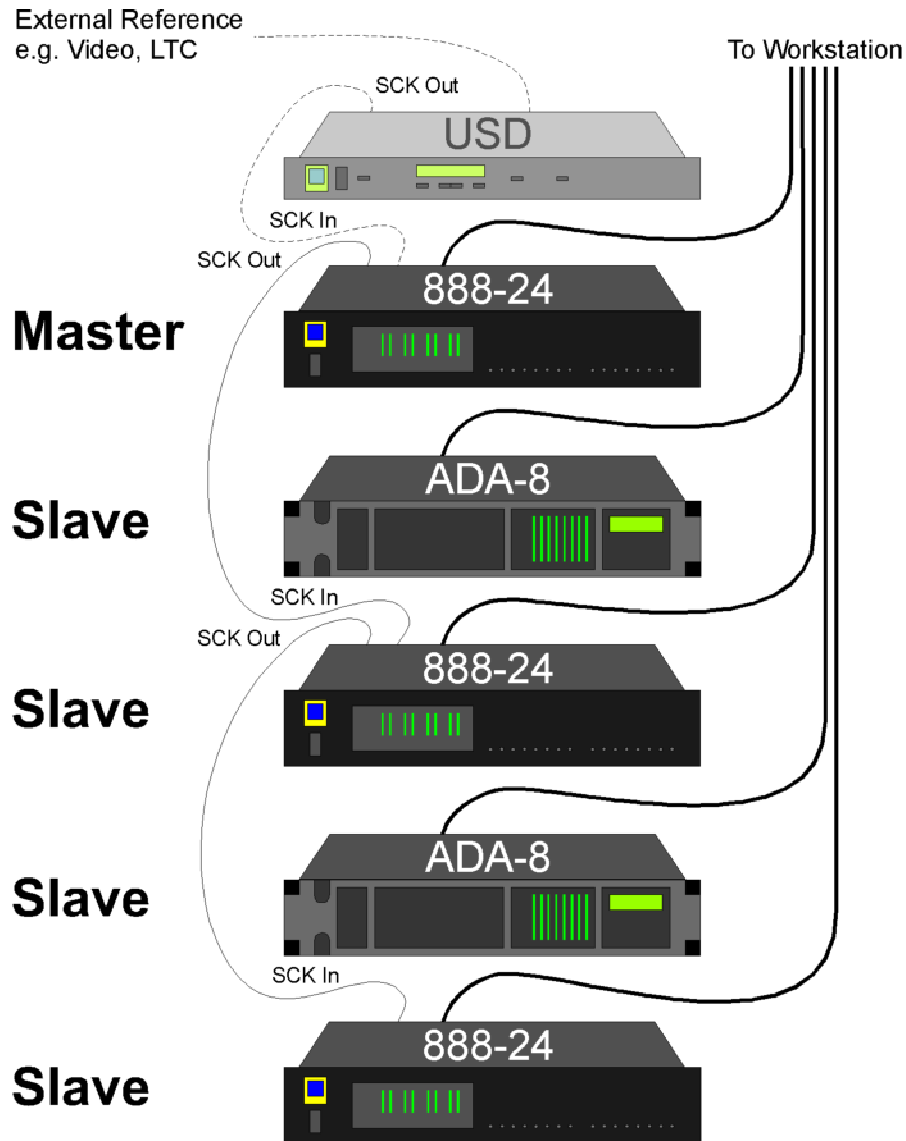
6.10.3 Combining with 888|24 interfaces, with ADA-8 as master

The figure below shows how to connect a combination of 888|24s and ADA-8s, where one of the ADA-8s is connected as the Master interface (i.e. connected to the first Pro Tools card, or to the 'A' leg of a 'Y' cable thereon). The USD is optional, depending on synchronization requirements.

All the ADA-8s should be switched on (and loaded with the appropriate Factory Default Store, if not previously loaded) prior to starting the Pro Tools system. For the Master ADA-8, load 'ProT:MASTER', or 'ProT:Ext MASTER' if the USD is in use. For Slave ADA-8s, load 'ProT:SLAVE'.
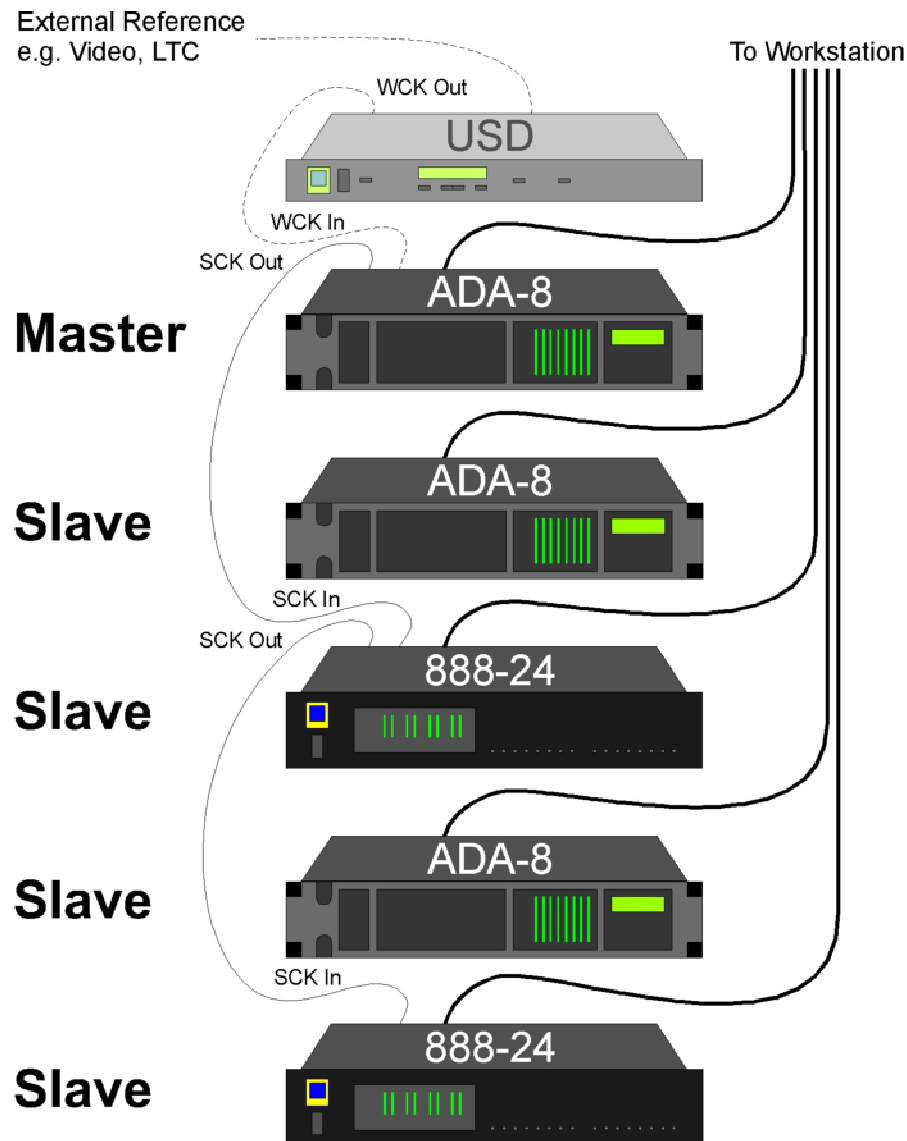
7   Pro Tools HD I/O Module PREV039/8/1

7.1   Overview

The Pro Tools HD I/O Module provides eight channels of digital audio input and output for the ADA-8 in a form compatible with Digidesign Pro Tools|HD workstations.

The Pro Tools HD I/O Module enables the ADA-8 to replace a Digidesign 96 I/O or 192 I/O interface, providing superior audio performance and extra features.

To the Pro Tools|HD software, an ADA-8 fitted with a Pro Tools HD I/O Module looks similar to a 192 I/O and operates in a similar way, but currently only supports sample rates up to 96kHz. The reason that an ADA-8 impersonates a 192 I/O rather than a 96 I/O is to take advantage of the extended number of I/O channels which the Pro Tools|HD software allows for a 192 I/O.

7.2   Hardware Configurations

Depending on the fit of I/O modules, the ADA-8 can be configured to provide a variety of I/O possibilities for Pro Tools|HD. The basic hardware configurations available 'off the shelf' are:

8C-STD-HD	8 analogue inputs, 8 analogue outputs;
8C-STD-HD-AES	8 analogue inputs, 8 analogue outputs, 8 AES3 inputs and outputs;
8C-STD-HD-16AD	16 analogue inputs;
8C-STD-HD-16DA	16 analogue outputs;

It is also possible to configure other options, for example with a different digital I/O format, or with sub-fitted analogue I/O.

The 8C-STD-HD-AES configuration has similar basic functionality to a Digidesign 192 I/O interface, providing mixed analogue and digital input to the workstation and parallel digital and analogue output from the workstation. However, because the Pro Tools|HD system allows for up to 16 analogue inputs OR outputs to be fitted to each 192 I/O, it is possible to configure a pair of 8C-STD-HD or 8C-STD-HD-AES ADA-8s to emulate a single 192 I/O, but with 16 analogue inputs AND outputs. If the AES I/O Module is fitted, the digital outputs appear in parallel with the analogue outputs, and the digital inputs can be selected instead of the analogue inputs on a per-channel basis. Two such pairs can be accommodated on a single Pro Tools|HD Core or Process card.

The 16AD and 16DA ADA-8 configurations represent an efficient solution for users who require more analogue inputs than outputs, or vice-versa. For example, it is a common practise to record and edit a multi-channel production on Pro Tools|HD, and then to mix it down on an analogue mixer, which requires a lot of analogue outputs from the Pro Tools|HD. Two 8C-STD-HD-16DA ADA-8s provide 32 analogue output channels in only two chassis, and can be accommodated on a single Pro Tools|HD Core or Process card.

In all configurations, the ADA-8 operates as usual with two eight-channel Paths. In bi-directional configurations, Path 1 is usually configured to provide the inputs to Pro Tools|HD, and Path 2 the outputs from Pro Tools|HD. In 16AD or 16DA units, Path1 provides the first bank of eight channels (1-8) and Path 2 the second bank (9-16). In both cases, the allocation of Paths is simply a matter of convention (Path 1 and Path 2 could be assigned the other way round).

Factory Default Stores are automatically created in all Pro Tools|HD compatible ADA-8s to allow the units to be instantly set up as required in the system, as described in section 7.6.

7.3   Getting Started with Pro Tools|HD

To get started quickly, if your ADA-8 is already equipped for Pro Tools|HD, go straight to section 7.7. and follow the connection and configuration instructions.

7.4   Fitting the Module

NOTE: In most cases, the Pro Tools HD I/O Module (or Modules) have been factory-fitted so, unless you are fitting the module yourself, the remainder of this section may be ignored.

The Pro Tools HD I/O Module can be fitted to either Digital I/O Slot (DIO1 or DIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual). Although the ADA-8 can automatically accommodate the module in either position, it is conventional that workstation digital I/O modules are fitted in the upper slot (DIO1), with a general-purpose digital I/O module (e.g. AES3) fitted in the lower slot (DIO2) if any is required. This will provide compatibility with operating examples quoted in these manuals. Where an ADA-8 is to be configured for 16 channels of A/D or 16-channels of D/A operation, TWO Pro Tools HD I/O Modules are required, one in each DIO slot.

For details of how to fit the Module(s), refer to the Adjustments and Upgrades section of the Operation Manual.
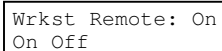
Having fitted the Pro Tools HD I/O Module(s), it will be necessary to 'Reload Factory Default Stores' so that the necessary ADA-8 Stores for Pro Tools|HD operation become available. This is done through the 'Preferences' menu, as described in the ADA-8 Operation Manual.

7.5   Module Dependent Preferences Menus

NOTE: This section describes additional menus which are available in ADA-8s fitted with Pro Tools HD I/O Modules. However, in normal use it is not necessary to access these menus since loading the relevant Stores, as described in the following sections, automatically selects the correct states of these menus.

If one or more Pro Tools or Pro Tools HD I/O Modules are fitted to an ADA-8, the 'Workstation Remote Control' and 'HD Workstation Main/Sub' menus become available in the 'Module Dependent Preferences' section of the Menu System.

7.5.1   Workstation Remote Control menu

```
Wrkst Remote: On
On Off
```

This single selection menu allows the workstation remote control interface to be enabled or disabled. When enabled (set to 'On'), various parameters of the ADA-8 can be remotely controlled from Pro Tools|HD, as described in section 7.8. When disabled (set to 'Off'), adjustments made from the workstation are ignored by the ADA-8. NOTE: It is strongly recommended that remote control is ALWAYS ENABLED for use with Pro Tools|HD, since there are many situations in which the system may fail otherwise.

Note that this setting is automatically set to the 'On' state when Pro Tools|HD specific Factory Default Stores are loaded, as described in section 7.6.

7.5.2   HD Workstation Main/Sub menu

```
D1 192 Emul:Main
Main Sub
```

This single selection menu allows the 192 I/O emulation mode of the ADA-8's Pro Tools HD I/O Module to be selected.

Where a single ADA-8 is to be configured to emulate a 192 I/O with only eight analogue inputs and outputs, it should be set to 'Main'. The ADA-8 then appears to occupy channels 1-8 of the '192 I/O'.

Where two ADA-8s to be connected in tandem to emulate a single 192 I/O, with up to 16 analogue inputs and outputs, the ADA-8 nearer the workstation is set to 'Sub' and the other to 'Main'. They then occupy channels 1-8 and 9-16 of the '192 I/O' respectively.

Where a single ADA-8 with 16 inputs or outputs is to occupy the input or output space of a single 192 I/O, two Pro Tools HD I/O Modules must be fitted, and this menu will appear separately for each Module. The Module connected nearer the workstation is set to 'Sub' and the other to 'Main'. They then occupy channels 1-8 and 9-16 of the '192 I/O' respectively.

Note that these settings are automatically set to the correct state when Pro Tools|HD specific Factory Default Stores are loaded, as described in section 7.6.

For more details about this setting see section 7.7.

7.6   *Module Dependent Factory Default Stores*

Three Pro Tools|HD specific Factory Default Stores are made available when one or more Pro Tools HD I/O Modules are detected by the ADA-8. Stores are provided for 'Main' and 'Sub' operation, or '16AD' or '16DA' operation, depending on module fitment, as described in sections 7.5.2 and 7.7.

The names and details of the stores vary depending on whether the ADA-8 is configured for normal eight-in/eight-out operation, or for 16-channel A/D or D/A operation. The Store names for each mode are listed in the following table for each configuration:

	Eight in / eight out	16-channel D/A	16-channel A/D
Main	`ProT HD: Main`	`ProT HD: 2xDAC`	`ProT HD: 2xADC`
Sub	`ProT HD: Sub`	(not applicable)	(not applicable)

For eight-in / eight-out configurations without additional digital I/O (8C-STD-HD), these Stores are located in Bank 1, Stores 1 and 2. For eight-in / eight-out configurations with additional digital I/O (e.g. 8C-STD-HD-AES) they are located in Bank 3, Stores 1 and 2 because the first two Banks contain non Pro Tools A/D, D/A and D/D mode Stores. For 16-channel configurations (8C-STD-HD-16AD and 8C-STD-HD-16DA), the single Store is located in Bank 1, Store 1.

7.7   Interconnection and Synchronization

In general, a single ADA-8 with Pro Tools HD I/O Module is connected to the Pro Tools|HD in exactly the same way as a 192 I/O. If pairs of ADA-8s are to emulate a single 192 I/O, or if 16AD or 16DA ADA-8s are to be used, it is important to follow the connection schemes detailed below.

Having connected each ADA-8s as shown, the appropriate Store must be loaded as described in each section. The Store is loaded by pressing the 'Bank' button to select the desired Bank, and then the Store number button. When the desired Store name is displayed, press the 'Enter' key.

7.7.1   Connecting a Single ADA-8 as a 192 I/O

Connect the Primary Port of the ADA-8's Pro Tools HD I/O Module to the desired Core or Process card in the workstation using a standard DigiLink cable. A further Digidesign or Prism Sound I/O can be connected to the Expansion Port in the usual way. The Wordclock I/O BNC connections on the ADA-8's Utility Module can be used for Loop Sync I/O if required.

Loop Sync in   Primary Port

WCK In   Primary

WCK Out   Expansion

ADA-8, 8AD/8DA

Main Ch 1-8

Loop Sync out   Expansion Port
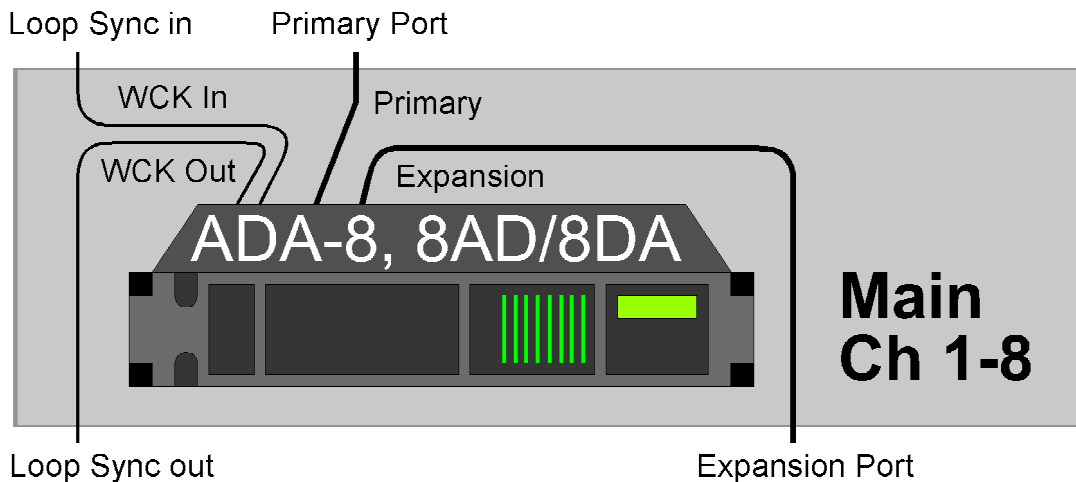
Having connected the ADA-8 as above, switch it on and load the 'ProT HD Main' Store. This is located in Bank 1, Store 1 for ADA-8s without additional digital I/O, and in Bank 3, Store 1 for ADA-8s with additional I/O.

7.7.2   Connecting a Pair of ADA-8s as a Single 192 I/O

The 'first' ADA-8 (i.e. the one which will carry the earlier-numbered channels) is designated 'Sub', the other as 'Main'. Connect the Primary Port of 'Sub' to the desired Core or Process card in the workstation, and the Expansion Port of 'Sub' to the Primary Port of 'Main' using standard DigiLink cables. A further Digidesign or Prism Sound I/O can be connected to the Expansion Port of 'Main' in the usual way. The Wordclock I/O BNC connections on 'Main's Utility Module can be used for Loop Sync I/O if required. NOTE: no sync connections are required on 'Sub'. It should not be included in any Loop Sync scheme.

Loop Sync in   Primary Port

Primary   Expansion

ADA-8, 8AD/8DA

**Sub
Ch 1-8**

WCK In   Primary

WCK Out   Expansion

ADA-8, 8AD/8DA

**Main
Ch 9-16**

Loop Sync out   Expansion Port
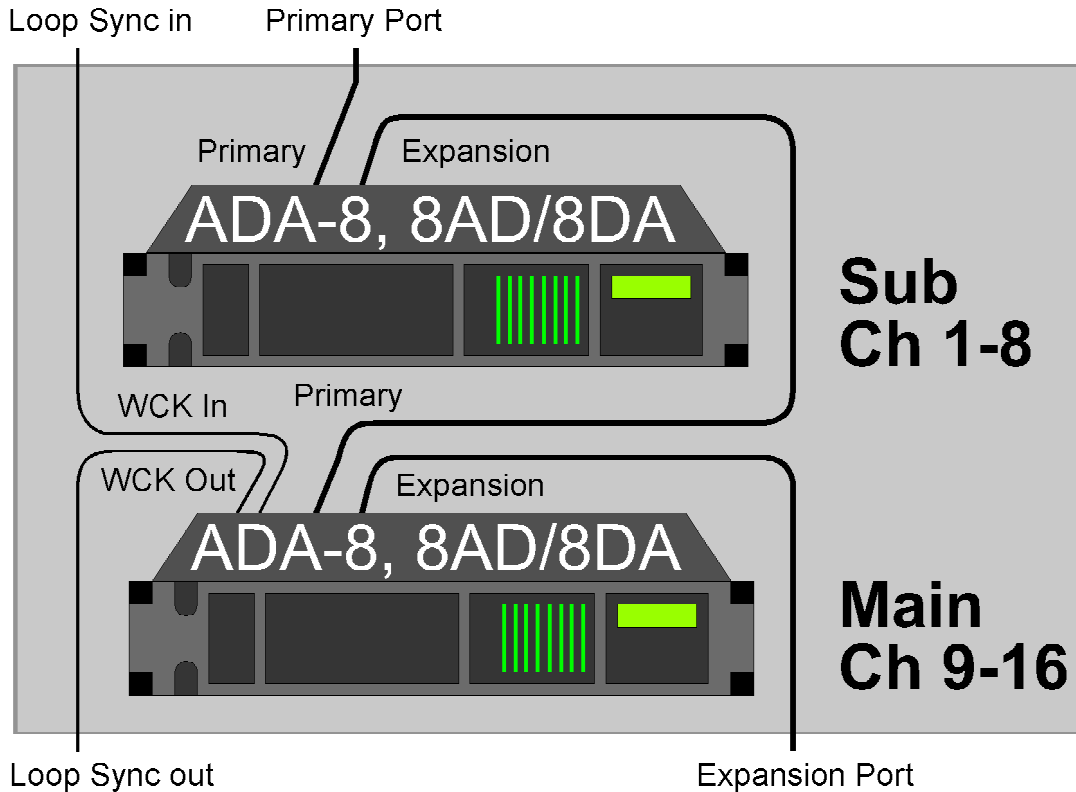
Having connected the ADA-8s as above, switch them on and load the following Stores (these are located in Bank 1 for ADA-8s without additional digital I/O, and in Bank 3 for ADA-8s with additional I/O). For 'Main', load the 'ProT HD Main' Store (Store 1); for 'Sub', load the 'ProT HD Sub' Store (Store 2).

7.7.3   Connecting a 16AD ADA-8 as a 192 I/O

ADA-8s equipped with 16 analogue inputs are be fitted with two Pro Tools HD I/O Modules. The Module in the upper DIO Slot is designated 'D1', and the lower 'D2'. Connect the Primary Port of 'D1' to the desired Core or Process card in the workstation, and the Expansion Port of 'D1' to the Primary Port of 'D2' using standard DigiLink cables. A further Digidesign or Prism Sound I/O can be connected to the Expansion Port of 'D2' in the usual way. The Wordclock I/O BNCs on the Utility Module are used for Loop Sync I/O if required.

Loop Sync in   Primary Port

WCK In   D1 Primary

D1 Expansion to D2 Primary

WCK Out   D2 Expansion

ADA-8, 16AD

**16AD
Ch 1-16**

Loop Sync out   Expansion Port

Having connected the ADA-8 as above, switch it on and load the 'ProT HD 2xADC' Store. This is located in Bank 1, Store 1.

7.7.4 Connecting a 16DA ADA-8 as a 192 I/O

ADA-8s equipped with 16 analogue outputs are fitted with two Pro Tools HD I/O Modules. The Module in the upper DIO Slot is designated 'D1', and the lower 'D2'. Connect the Primary Port of 'D1' to the desired Core or Process card in the workstation, and the Expansion Port of 'D1' to the Primary Port of 'D2' using standard DigiLink cables. A further Digidesign or Prism Sound I/O can be connected to the Expansion Port of 'D2' in the usual way. The Wordclock I/O BNCs on the Utility Module are used for Loop Sync I/O if required.
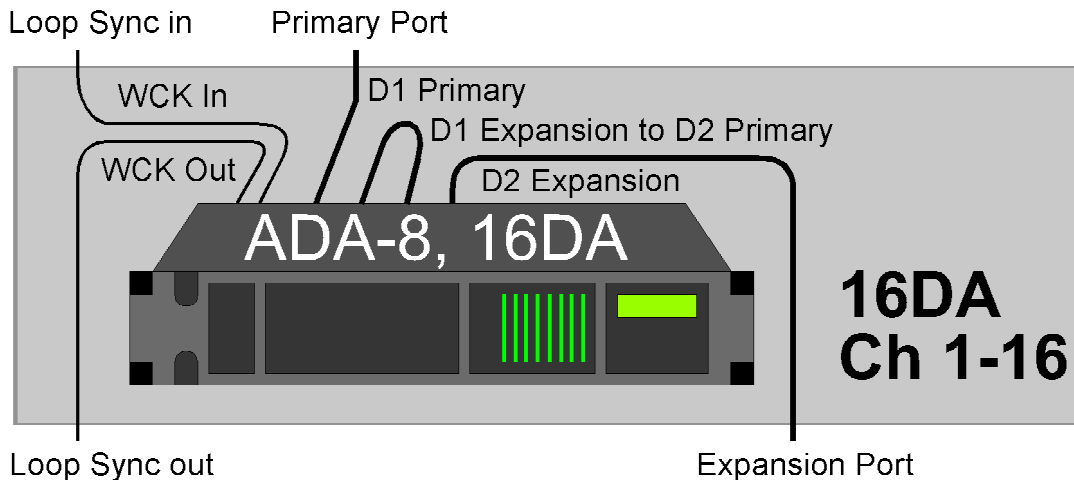
Having connected the ADA-8 as above, switch it on and load the 'ProT HD 2xDAC' Store. This is located in Bank 1, Store 1.

7.7.5 Connecting an ADA-8 to the 'Legacy Port' of a 96 I/O or a 192 I/O

An ADA-8 fitted with a Pro Tools I/O Module (i.e. a pre-HD Pro Tools module) can be connected to the 'Legacy Port' of a 96 I/O or a 192 I/O in the same way as a Digidesign 888|24. In this case, the ADA-8 should be loaded with the 'ProT:SLAVE' Store. No sync connections are required since the ADA-8 obtains its sync from the Legacy Port. The maximum sample rate supported is 48kHz.

7.7.6 Synchronization

If more than one I/O is used (unless only two ADA-8s are used, emulating a single 192 I/O), the usual 'Loop Sync' scheme should be used, wherein the Loop Sync output of one I/O is connected to the Loop Sync input of the next, and so on until the output of the last I/O feeds the input of the first. If a Digidesign SYNC I/O is used, this should be included in the Loop Sync in the usual way.

If external sync is to be connected via an ADA-8 (e.g. from a digital input, or from an AES11 ref sync input), this can be selected from the Pro Tools|HD user-interface in the normal way. If the external sync is a wordclock, the Loop Sync must be broken at the designated ADA-8, since its wordclock input is needed to connect the external sync. Note that sync cannot be provided from a digital input of the 'Sub' ADA-8 in a pair, since the 'Sub' is always a sync slave to the 'Main' ADA-8.

7.8   *Controlling ADA-8s from the Pro Tools|HD User-Interface*

Certain parameters of the ADA-8 are controlled remotely from the Pro Tools|HD user-interface as described below. Because the ADA-8 is emulating a 192 I/O, and because the capabilities of the ADA-8 and 192 I/O are not identical, some functions are not supported and others do not operate in the same way as with a 192 I/O.

7.8.1 Input and Output Routing

The input and output port assignment menus in the 'Main' tab of the 'Hardware Setup' dialogue box is not supported by ADA-8s. In the case of an ADA-8, the input and output ports always appear in the nominal fixed order on the channels of the emulated 192 I/O. For ADA-8s with analogue and digital outputs, the digital outputs always appear in parallel with their respective analogue outputs. The routing matrices in the 'I/O Setup' dialogue box operate in the usual way.

7.8.2 Sample Rate

In common with Digidesign I/Os, the sample rate of connected ADA-8s is automatically set according to the rate of the loaded session. ADA-8s support a maximum sample rate of 96kHz.

7.8.3 Sync Source

ADA-8s can be nominated as Loop Sync masters in the usual way (using the 'Clock Source' selection in the 'Hardware Setup' dialogue box), and can be set to provide system sync from one of their external sync (e.g. WCK or AES11) or digital audio (e.g. AES3) inputs. Note that in the latter case, when a specific pair of digital input channels is selected from the drop-list, the ADA-8 remains in its 'Auto' mode (not provided in Pro Tools|HD), wherein it takes sync from any AES3 carrier input which is active - in most cases this is more versatile. However, if a specific AES3 carrier must be nominated, this can be done manually through the ADA-8's menu system. For more details see section 7.7.6. and the ADA-8 Operation Manual.

7.8.4 Analogue / Digital Input Selection

Suitably-equipped ADA-8s allow selection of the digital or analogue input on a per-channel basis. Since the Pro Tools|HD user-interface does not have a specific analogue/digital input channel selection, the 'Reference Level' selection in the 'Analog In' tabs of the 'Hardware Setup' dialogue box is 'hijacked' for this purpose when an ADA-8 is connected. For each channel, clicking '+4dBu' selects the analogue input, clicking '-10dBV' selects the digital input.

7.8.5 Soft Clip / Overkiller

The 'Soft Clip' selection in the 'Analog In' tabs of the Hardware Setup' dialogue box enable and disable the Overkillers (progressive limiters) in the analogue inputs of the ADA-8s on a per-channel basis. For more information about the operation of the ADA-8's Overkillers see the ADA-8 Operation Manual.

7.8.6   Identify I/O

Clicking the 'Identify' button on the Hardware Setup dialogue box identifies an ADA-8 (or a pair of ADA-8s emulating a single 192 I/O) by lighting all its front-panel LEDs, in the same way as for a 96 I/O or a 192 I/O.

7.8.7   Miscellaneous

Analogue input and output line-up levels of the ADA-8 are not controllable from the Pro Tools|HD user-interface. They are precisely controlled in software from the ADA-8 menu system, and comprise a nominal and a trim component per channel. Thus the 'Input Trims' in the 'Analog In' tab of the Hardware Setup dialogue box and the 'Output Trims' in the 'Analog Out' tab do not function. Since analogue line-up more commonly depends on the connected equipment rather than a particular session, it is usually an advantage to be able to recall a session without overriding line-ups. If a variety of line-ups do need to be stored and recalled, this can be done using the ADA-8's Store system providing that recall of analogue line-ups is enabled. See the ADA-8 Operation Manual for more details of this.

Settings to do with digital I/O formats not supported by the ADA-8 obviously do not function. These include the 'Digital Format', 'S/PDIF Format', 'Port Settings' and 'Ext Clock Output' settings on the 'Main' tab, and the 'Input Format' and 'SR Conversion' settings on the 'Digital' tab of the 'Hardware Setup' dialogue box.

7.9   Analogue Line-Up Nomenclature with Pro Tools

Some confusion may result from the different nomenclatures used in the ADA-8 and Pro Tools systems for expressing analogue line-up levels.

Pro Tools sets its analogue line-up by reference to 'headroom' above a nominal operating level of 0VU (+4dBu). The ADA-8's line-up is specified in terms of the dBu equivalent of full-scale digital (0dBFS). So, for example, to set a line-up on the ADA-8 equivalent to '14dB' in Pro Tools nomenclature, it is necessary to set 18dBu on the ADA-8 (+4dBu + 14dB).

7.10 Using the ADA-8 with Digidesign Interfaces at high sample rates

This section concerns issues related to the use of the ADA-8 in Pro Tools|HD systems alongside Digidesign 192 and 96 I/O units at sample rates of 88.2 and 96kHz. A scheme by which ADA-8s and 96/192 I/O units may by synchronized using a combination of Loop Sync and Wordclock at the higher sample rates is described.

7.10.1 Sync differences between the ADA-8 and Digidesign interfaces

I/O units in Pro Tools|HD systems are synchronized by means of a Loop Sync whereby all interfaces in a system are connected in a ring using BNC cables. The synchronization signal takes the form of a TTL-level square wave similar to a Wordclock. One of the interfaces is nominated by the application 'Hardware Setup' dialogue as the master, and this interface outputs the synchronization signal on its Loop Sync output. All the other interfaces synchronize to the clock on their Loop Sync input and also repeat it on their Loop Sync output. This means that any of the interfaces may be nominated as master without any change in the cabling between the units. ADA-8s may normally be included in the Loop Sync system using their Wordclock input and output.

However, at sample rates of 88.2kHz and above, 192 and 96 I/Os run their Loop Sync at the base rate of either 44.1kHz or 48kHz from which their actual sample rate is derived. That is, sessions running at 44.1kHz, 88.2kHz or 176.4kHz run their Loop Sync at 44.1kHz; sessions running at 48kHz, 96kHz or 192kHz run their Loop Sync at 48kHz. 192 and 96 I/Os cannot synchronize to a Loop Sync of greater than 48kHz.

The ADA-8, by default, outputs a Wordclock at the same rate as its sample rate when in the recommended Pro Tools|HD configuration. Similarly, Pro Tools|HD configured ADA-8s run at the same rate as their Wordclock input when they are not selected as master. These differences in behaviour require a different synchronization scheme in sessions running at 88.2kHz or 96kHz where ADA-8s and Digidesign interfaces are combined. This issue does NOT affect systems that ONLY use ADA-8s, or ANY sessions running at 44.1kHz or 48kHz.

7.10.2 Modified Loop Sync cabling scheme

The solution is to effectively break the Loop Sync cabling scheme into two:

Only include the 192/96 I/Os in the main Loop Sync, along with a SYNC I/O if there is one in the system. Connect the Wordclock output from one of the 192/96 I/Os to the Wordclock input of the first ADA-8 configured as 'Main'. Connect the Wordclock output of this ADA-8 to the Wordclock input of the next ADA-8 configured as 'Main', and so on until every ADA-8 configured as 'Main' is included.

Do NOT include any ADA-8 configured as 'Sub' in the chain. Do NOT select any of the ADA-8s to be clock master from the 'Hardware Setup' dialogue in the Pro Tools software. Ensure that the 'Ext. Clock Output' setting in the 'Hardware Setup' dialogue for the 192 or 96 I/O providing the Wordclock is set to the appropriate rate (88.2k or 96kHz).

This method of synchronization confers no sonic penalty on the ADA-8.

8   DSD I/O Module PREV039/9/1

8.1   Overview

The DSD I/O Module type PREV039/9/1 provides eight channels of 'Direct Stream Digital' input and output for the ADA-8. The DSD interface format carries an over-sampled one-bit representation of the audio signal as delivered on Super Audio CDs (SACDs).

The DSD I/O Module can transact the DSD data in either SDIF-2 (sometimes known as DSD-RAW) or SDIF-3 formats, using coaxial cables via a breakout squid, and optionally in the MAC-DSD / SuperMAC format using a CAT5E cable.

When combined with the ADA-8's Analogue Line Input and Output modules, the DSD I/O Module provides eight channels of analogue-to-DSD and DSD-to-analogue conversion. The Module also allows for PCM to DSD and DSD to PCM conversion where a PCM-type I/O Module is fitted, such as an AES3 I/O Module. In this case, PCM synchronous sample rate conversion can also be performed between the PCM input and output for all eight channels.

When used in conjunction with a dedicated workstation I/O Module, such as a Pro Tools HD I/O Module, the DSD I/O Module allows DSD audio sources and destinations to be connected to the workstation directly.

Whilst the DSD format uses a fixed sample rate of 2.8224MHz the ADA-8's DSD I/O Module allows the user to run DSD-connected Paths with any of the ADA-8's sample rate and sync options.

8.2   Fitting the Module

In most cases, the DSD I/O Module has been factory-fitted so, unless you are fitting the Module yourself, the remainder of this section may be ignored.

The DSD I/O Module can be fitted to either Digital I/O Slot (DIO1 or DIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual). Where an ADA-8 is to be fitted for 16-channel analogue-to-DSD or 16-channel DSD-to-analogue operation, DSD I/O Modules must be fitted to BOTH DIO slots.

For details of how to fit the Module, refer to the Adjustments and Upgrades section of the Operation Manual.

8.3   Connection

The DSD I/O Module supports three different interface standards.

The male 25-way 'D' connector is used for either SDIF-2 or SDIF-3 formats, selected using the ADA-8's menu system. You should check the interface format of the connected equipment to ensure correct operation, however no damage will result from a logical format mismatch as the interface is electrically the same in both cases. The input and output interface formats of the DSD Module are individually selectable. An optionally-supplied 'squid' breaks out the 25-way 'D' to eight blue BNC plugs for the DSD inputs, eight red BNC plugs for the DSD outputs, and one black BNC plug for the interface clock output. To assist in custom cabling applications, the pinout of the squid is shown in section 8.10.6.

If the DSD I/O Module is fitted with the MAC-DSD / SuperMAC interface option, the RJ-45 connector can be used to connect to other suitably capable equipment using a CAT5E cable.

It is possible to use both the 'squid' and MAC-DSD interfaces simultaneously, providing output on both interfaces and input from the selected interface.

8.4   Module Dependent Input Options Menus

When a DSD I/O Module is selected as an input to a Path, the Input Format Selection Menu for the relevant module slot becomes available in the Module Dependent Input Options section of the Menu System for that Path.

The upper left-hand corner of this menu identifies the Module Slot (e.g. 'DI1'), followed by an abbreviated indicator of the menu function.

For more information about the location of this menu within the overall Menu System, descriptions of the different menu types, key definitions etc. see the Firmware Reference.

8.4.1   DI Input Format Selection Menu

```
DI1 I/P fmt: SD3
SDIF-2 SDIF-3 M→
```

The DI I/P format menu is a Single Selection menu - the DSD I/O Module in question may be set to:

'SDIF-2' - inputs are via 'squid' cable in SDIF-2 (DSD-RAW) format
'SDIF-3' - inputs are via 'squid' cable in SDIF-3 format
'MAC-DSD' - inputs are via CAT5E cable in MAC-DSD / SuperMAC format
'SRC' - inputs are connected to module outputs internally (used for sample rate conversion)

This option only affects the selected Module.

8.5   Module Dependent Output Options Menus

When a DSD I/O Module is selected as an output from a Path, the Output Format Selection Menu for the relevant Module slot becomes available in the Module Dependent Output Options section of the Menu System for that Path.

The upper left-hand corner of this menu identifies the Module Slot (e.g. 'DO1'), followed by an abbreviated indicator of the menu function.

For more information about the location of this menu within the overall Menu System, descriptions of the different menu types, key definitions etc. see the Firmware Reference.

8.5.1   DO Output Format Selection Menu

```
DO1 O/P fmt: SD3
SDIF-2 SDIF-3
```

The DO O/P format menu is a Single Selection menu - the DSD I/O Module in question may be set to:

'SDIF-2' - 'squid' cable outputs are in SDIF-2 (DSD-RAW) format
'SDIF-3' - 'squid' cable outputs are in SDIF-3 format

This option only affects the selected Module, and does not affect the outputs of the MAC-DSD / SuperMAC interface which are always present if the option is fitted.

8.6   Module Dependent Preferences Menus

8.6.1   DI Sync Input Menu

```
DI1 Sync I/P: C1
←5 C6 C7 C8 Auto
```

Each DSD I/O Module fitted to the ADA-8 enables a DI Sync Input menu in the Module Dependent Preferences section of the Menu System.

This Single Selection menu controls which DSD input carrier will be the Sync Source when a Path is set to sync from 'DI' of the selected Module. Options are 'C1', 'C2', 'C3', 'C4', 'C5', 'C6', 'C7', 'C8', and 'Auto'. 'C1-8' select one of the eight input carriers - fixing the Sync Source to that DSD carrier. 'Auto' allows the ADA-8 to choose any locked carrier input as described in the section 8.8.

Note that this menu selection is only valid when using SDIF-3 DSD input carriers; SDIF-2 input carriers cannot be used as a synchronization source since they do not contain a synchronization clock.

When the input source is set to 'MAC-DSD' in the Input Format Selection Menu, the DI Sync Input Menu setting is ignored as the MAC-DSD / SuperMAC interface carries a single synchronization signal for all eight input channels.

8.6.2   DSD Lineup Menu

```
D1 DSD Lineup: N
Normal Hot
```

Each DSD I/O Module fitted to the ADA-8 enables a DSD Lineup menu in the Module Dependent Preferences section of the Menu System.

With this option set to 'Normal' the maximum DSD output level is 0dB SACD, or 50% modulation depth; the maximum allowable DSD input level is also 0dB SACD. This is the default DSD lineup setting.

With this option set to 'Hot' the maximum DSD output level is +3.1dB SACD, or 71% modulation depth; the maximum allowable DSD input level is also +3.1dB SACD. This setting is useful for monitoring or recording DSD material at the maximum modulation depth allowed by the SACD specification (Scarlet Book).

Note that the maximum specified DSD level corresponds to full-scale level within the ADA-8 Path. No output signal above the specified level can be generated by DSD outputs from the Path, and any DSD input to the Path above the specified level will be clipped. The ADA-8's meters display the channels' levels as usual, with the selected DSD level being aligned to the top of the meter (0dBFS).

8.7 Module Dependent Factory Default Stores

A selection of Factory Stores have been created for various common applications of the DSD I/O Module:

Function	Store Name	PCM
Analogue to DSD / DSD to Analogue	`Alg-DSD/DSD-Alg`	
Analogue to DSD / DSD to Analogue (MAC-DSD Mastr)	`A-DSD DSD-A MACM`	
Analogue to DSD / DSD to Analogue (MAC-DSD Slave)	`A-DSD DSD-A MACS`	
Analogue to DSD and PCM	`A-DSD+44k,16b`	●
PCM to DSD / DSD to PCM	`PCM-DSD DSD-PCM`	●
PCM to PCM (+ DSD)	`Sample Rate Conv`	●

The Factory Stores are made available automatically when Default Stores are reloaded (Preferences menu) after installation of a DSD I/O Module. If an additional PCM-type digital I/O Module is fitted, the above Stores (including those marked as requiring a PCM-type Module) will be loaded into the Store Bank above the non-DSD Stores. If no PCM-capable I/O Module is present only the non-PCM DSD Stores are made available.

Analogue to DSD / DSD to Analogue

Use this store for common A/D and D/A applications.

Path 1 is configured for analogue to DSD conversion, the DSD output format is SDIF-3 and the Path is synchronized to the wordclock input of the Utility Module (if detected, otherwise local sync).

Path 2 is configured for DSD to analogue conversion, the DSD input format is SDIF-3 and the Path is synchronized to the SDIF-3 inputs using automatic channel selection.

Analogue to DSD / DSD to Analogue (MAC-DSD Master)

Use this store when the ADA-8 is to be the master in a MAC-DSD / SuperMAC connection. Path 1 is configured for analogue to DSD conversion, the DSD output appears on the MAC-DSD interface and the Path is synchronized to the wordclock input of the Utility Module (if detected, otherwise local sync).

Path 2 is configured for DSD to analogue conversion, the DSD input format is MAC-DSD and the Path is synchronized to the MAC-DSD interface.

Analogue to DSD / DSD to Analogue (MAC-DSD Slave)

Use this store when the ADA-8 is to be the slave in a MAC-DSD connection.

Path 1 is configured for analogue to DSD conversion, the DSD output appears on the MAC-DSD interface and the Path is synchronized to the MAC-DSD interface.

Path 2 is configured for DSD to analogue conversion, the DSD input format is MAC-DSD and the Path is synchronized to the MAC-DSD interface.

<u>Analogue to DSD and PCM</u>

Use this store when mastering for SACD and CD simultaneously.

Path 1 is configured for analogue to DSD conversion, the DSD output format is SDIF-3 and the Path is synchronized to the wordclock input of the Utility Module (if detected, otherwise local sync).

Path 2 is configured for synchronous sample rate conversion, and the Path is synchronized to Path 1, with a modified rate of 44.1kHz. The output is routed to an additional PCM-type digital I/O Module (for example an AES 3 I/O Module) with 16-bit wordlength and SNS2 noise shaping.

<u>PCM to DSD / DSD to PCM</u>

This store demonstrates the flexible D-D conversions possible with the DSD I/O Module.

Path 1 is configured for PCM to DSD conversion using an additional PCM-type digital I/O Module (for example an AES3 I/O Module); the Path is synchronized to the PCM I/O Module input using automatic channel selection and follows the sample rate of the PCM data. The DSD I/O Module generates SDIF-3 DSD output.

Path 2 is configured for DSD to PCM conversion; the DSD input format is SDIF-3 and the Path is synchronized to the SDIF-3 inputs using automatic channel selection at a modified rate of 96kHz. The 24-bit PCM output of the Path is routed to the additional PCM-type digital I/O Module.

<u>PCM to PCM (+ DSD)</u>

This store demonstrates the PCM synchronous sample rate conversion, with simultaneous DSD output, possible with the DSD I/O Module.

Path 1 is configured for PCM to DSD conversion using an additional PCM-type digital I/O Module (for example an AES3 I/O Module); the Path is synchronized to the PCM I/O Module input using automatic channel selection and follows the sample rate of the PCM data. The DSD I/O Module generates SDIF-3 DSD output.

Path 2 is configured for synchronous sample rate conversion, and the Path is synchronized to Path 1, with a rate of 96kHz. The output is routed to the PCM I/O Module.

8.8   Synchronization

There are a number of synchronization options available when using the DSD I/O Module as described below.

8.8.1   Synchronizing to SDIF-3 Inputs

The DSD I/O Module can act as a Sync Source for either Path of the ADA-8 (provided that at least one valid SDIF-3 input is connected to the Module). The user may select DI1 or DI2 in the Sync Source menu to synchronize that Path to the designated input of that I/O Module. For correct operation, all the inputs to each DSD I/O Module must be synchronous - that is, they must themselves share the same Sync Source.

In the SDIF-3 case, only one of the eight DSD input channels can be used as the Sync Source at any given time. The user may choose which channel using the DI Sync Input menu (Preferences). For each DSD I/O Module, the sync may be fixed at any one of the eight channels, or the selection may be set to automatic, whereby the ADA-8 rotates through the eight input channels in turn until it finds one that is locked.

Automatic input selection is the default and will suffice for most purposes - the user can connect a DSD input to any of the channels without having to worry about which one will be used for synchronization. There are, however, certain situations where automatic channel selection is not appropriate and in these cases the sync channel must be selected explicitly from the DI Sync Input menu.

One such case arises because disconnecting a Path's Sync Source causes the Path to mute momentarily while a new Sync Source is found. If, for any reason, the user needs to disconnect a DSD input without disrupting the other channels of the Path (for instance, if a Path's eight channels are being shared by more than one session), automatic selection should not be used, and a reliably-present stream should be nominated explicitly.

Automatic selection should also be avoided when one or more of the input channels to a DSD I/O Module is itself synchronized from the Path, and the Path is synchronized to 'DI'. This would occur, for example, when some of the outputs of a digital-to-digital Path are fed back into the inputs of that Path (possibly after passing through some other input-synchronized equipment). Such loops create problems with automatic stream selection - if a channel is selected whose sync is derived from the Path it is synchronizing, the Path will not lock correctly. In situations like this, the user should select a sync channel that is not part of a dependency loop.

8.8.2 Synchronizing to SDIF-2 (DSD-RAW) Inputs

The DSD I/O Module cannot act as a sync source for the ADA-8 when the 'SDIF-2' option is selected in the DI I/P Format Selection Menu. This is because SDIF-2 carriers do not contain a synchronization clock The ADA-8 Path should instead be synchronized to the connected equipment using a standard wordclock or AES11 connection, or else the ADA-8n should be clock master and the source equipment should be slaved from it.

8.8.3 Synchronizing to the MAC-DSD Interface

When the 'MAC-DSD' option is selected in the DI Input Format Selection Menu the MAC-DSD input can act as a Sync Source for either Path of the ADA-8 (provided that a valid MAC-DSD stream is connected to the Module input). The user may select DI1 or DI2 in the Sync Source menu to synchronize that Path to the MAC-DSD input of that I/O Module.

8.8.4 DSD I/O Module Synchronization Output

If the ADA-8 is to be the synchronization source (i.e. clock master) for the DSD equipment that it is interfaced to, the black BNC plug on the squid cable should be connected to the equipment clock input (or alternatively it may be possible to synchronize the equipment from an SDIF-3 or MAC-DSD data feed). This DSD I/O Module clock cable carries a wordclock at 1/64 of the DSD output rate, and is functionally independent of the assignment of the wordclock output on the Utility Module.

8.9   Sample Rate and Format Conversion

When the DSD I/O Module is used in conjunction with a PCM digital I/O Module (for example an AES3 I/O Module) it becomes possible to perform direct digital PCM-to-DSD and DSD-to-PCM conversion at any of the ADA-8 supported sample rates. Furthermore it becomes possible to perform PCM-to-PCM conversion at any combination of input and output rates.

PCM-DSD conversion can be achieved by assigning the PCM I/O Module as the input to a Path and the DSD I/O Module as the output. Conversely, to perform DSD-PCM conversion a Path is simply set up with the DSD I/O Module as the input source and the PCM I/O Module as the output destination. The sampling rate of the Path is set to the required PCM rate and may be different on each Path.

By selecting the 'SRC' option in the DI Input Format Selection Menu, the input source for the DSD I/O Module can be internally routed from the DSD I/O Module outputs. This method of bridging the two ADA-8 Paths results in a signal flow which has one set of input channels, but two sets of output channels, one on each Path.

If the input source for the DSD output Path is assigned to an Analogue Input Module, and the output destination for the DSD input Path is assigned to a PCM I/O Module, simultaneous analogue to DSD and analogue to PCM conversion is possible, with the PCM output being at any sample rate or wordlength.

If the input source for the DSD output Path is assigned to a PCM I/O Module, and the output destination for the DSD input Path is also assigned to the PCM I/O Module, simultaneous PCM-DSD and PCM-PCM conversion is possible, with different PCM input and output sample rates and wordlengths.

8.10 Specifications

Unless otherwise stated, all performance specifications are quoted rms, A-weighted, bandlimited 20Hz-20kHz, with PCM sampling at 96kHz and wordlength 24 bits, and with DSD lineup normal. Note that quotation of performance using A-weighting filters is not generally the policy of Prism Sound; however, the noise-shaped nature of DSD signals means that A-weighted measurements are more representative of subjective performance than are unweighted measurements.

8.10.1 PCM to DSD Performance

Maximum output level: 0dB SACD (Normal) / +3.1dB SACD (Hot)
Absolute gain accuracy: +0.05dB
THD+n (997Hz, -1dBFS): -118dB (0.00013%)
Dynamic range (997Hz, -60dBFS): 120dB
Frequency response:
       fs=96kHz, -3dB: 0Hz…43.5kHz
       fs=88.2kHz, -3dB: 0Hz…40kHz
       fs=48kHz, -1dB: 0Hz…22kHz
       fs=44.1kHz, -0.05dB: 0Hz…20kHz
       fs=32kHz, -0.05dB: 0Hz…14.5kHz

8.10.2 Analogue to DSD Performance

As the Analogue Line Input Module, see Section 3 of this reference, except for the following:

Maximum output level: 0dB SACD (Normal) / +3.1dB SACD (Hot)
Absolute gain accuracy: ±0.1dB
THD+n (997Hz, -1dBFS): -103dB (0.0007%)
Dynamic range (997Hz, -60dBFS): 110dB
Frequency response:
      -0.05dB: 10Hz…35kHz
      -3dB: 3.9Hz…42kHz

8.10.3 DSD to PCM Performance

Maximum input level: 0dB SACD (Normal) / +3.1dB SACD (Hot)
Absolute gain accuracy: -0.05dB
THD+n (997Hz, -1dBFs): <-126dB (0.0005%, limited by DSD input signal)
Dynamic range (997Hz, -60dBFS): >128dB (limited by DSD input signal)
Frequency response:
      fs=96kHz, -3dB: 0Hz…41kHz
      fs=88.2kHz, -3dB: 0Hz…38.5kHz
      fs=48kHz, -1dB: 0Hz…22kHz
      fs=44.1kHz, -0.05dB: 0Hz…20kHz
      fs=32kHz, -0.05dB: 0Hz…14.5kHz

8.10.4 (PCM to) DSD to Analogue Performance

The following DSD to Analogue specifications are measured using an ADA-8 Path in PCM to DSD mode as the signal source (since no standard DSD test source is available). They are as the Analogue Line Output Module, see Section 4 of this reference, except for the following:

Maximum input level: 0dB SACD (Normal) / +3.1dB SACD (Hot)
Absolute gain accuracy: ±0.1dB
THD+n (997Hz, -1dBFs): <-100dB (0.001%)
Dynamic range (997Hz, -60dBFS): >106dB
Frequency response:
      -0.05dB: 10Hz…35kHz
      -3dB: 3.9Hz…40kHz

8.10.5 PCM to PCM (Synchronous Sample Rate Converter) Performance

The following specifications are unweighted and apply to all combinations of input and output rates unless otherwise stated.

Absolute gain accuracy: -0.05dB
All input and output rates except 32kHz:
  THD+n (997Hz, -1dBFs): <-130dB (0.000032%)
  Dynamic range (997Hz, -60dBFS): >130dB
  Frequency response:
    -0.05dB: 0Hz…20kHz
    -3dB: 0Hz…45% of lowest fs
Input and/or output at 32kHz:
  THD+n (997Hz, -1dBFs): <-126dB (0.00005%)
  Dynamic range (997Hz, -60dBFS): >128dB
  Frequency response:
    -0.05dB: 0Hz…14.5kHz

8.10.6 DB25 Connector

I/O Impedance: 75Ω
Output carrier amplitude (loaded): 3.6V p-p
Pinout:

25-way 'D' pin	Signal	Tentacle
1	DSD Input 1	Blue "1"
14	DSD Input 2	Blue "2"
2	GND	Screen (1 & 2)
15	DSD Input 3	Blue "3"
3	DSD Input 4	Blue "4"
16	GND	Screen (3 & 4)
4	DSD Input 5	Blue "5"
17	DSD Input 6	Blue "6"
5	GND	Screen (5 & 6)
18	DSD Input 7	Blue "7"
6	DSD Input 8	Blue "8"
19	GND	Screen (7 & 8)
7	DSD Output 1	Red "1"
20	DSD Output 2	Red "2"
8	GND	Screen (1 & 2)
21	DSD Output 3	Red "3"
9	DSD Output 4	Red "4"
22	GND	Screen (3 & 4)
10	DSD Output 5	Red "5"
23	DSD Output 6	Red "6"
11	GND	Screen (5 & 6)
24	DSD Output 7	Red "7"
12	DSD Output 8	Red "8"
25	GND	Screen (7 & 8 & CLK)
13	CLK Output	Black

9   FireWire I/O Module PREV039/10/1

9.1   Overview

The FireWire I/O Module type PREV039/10/1 provides up to eight channels of digital audio input and output for the ADA-8 or ADA-8XR over a FireWire (also known as IEEE-1394) bus connection.

The FireWire I/O Module enables the ADA-8 to be used as a high quality 'soundcard', or I/O interface, for native PC and Macintosh workstation applications. Up to four ADA-8s may be connected on the same FireWire bus allowing up to 32 channels of simultaneous recording and playback.

Note that, currently, the Macintosh Driver does not support more than one FireWire Audio Device and so only one ADA-8 FireWire I/O Module may be used with a Macintosh Workstation at any given time. Concurrent operation with multiple FireWire I/O Modules will be supported in a future release of the OS X Operating System.

For Windows XP PC applications a driver is supplied with the module, which makes the ADA-8(s) appear as Windows Driver Model and ASIO compliant audio device(s).

For Macintosh OS X applications, the Operating System will automatically recognise the connected ADA-8 and make it available to applications as an OS X Core Audio device.

9.2   Software Installation

The FireWire I/O Module is supplied with a Workstation Software Installation CD-ROM, this section describes how to install the software. Please ensure that your system meets the requirements below before commencing installation.

9.2.1   Windows PC Workstation

System requirements:
- Microsoft Windows XP Home or Professional (Service Pack 1 or greater)
- FireWire (IEEE-1394a) Port
- CPU: Celeron or Pentium compatible @ 900MHz or greater
  (Pentium compatible @ 2GHz recommended for high sample rates or multiple units)
- Memory: 256MB RAM or greater
- Display / Colours: 800x600 @ 65,536 colours or greater

Before installing the drivers for the FireWire I/O Module first ensure that there are no devices attached to the FireWire ports of the PC. Then, insert the installation CD-ROM and carefully follow the instructions on screen.

Note that during the installation Windows XP will report that the driver, 'has not passed Windows Logo Testing', select 'Continue Anyway' when this dialogue appears.

9.2.2 Apple Macintosh Workstation

System Requirements:
- Mac OS X 10.3.7 or greater
- FireWire 400 Port
- CPU: PowerPC G4 or G5 @ 700MHz or greater
  (G4 @ 1.2GHz recommended for high sample rates)
- Memory: 256MB RAM or greater
- Display / Colours: 800x600 @ 65,536 colours or greater

The installation CD-ROM is <u>not</u> required for Macintosh applications. The Operating System will automatically detect any connected ADA-8 device and make it available to applications.

9.3   Fitting the Module

In most cases, the module has been factory-fitted so, unless you are fitting the module yourself, the remainder of this section may be ignored.

The FireWire I/O Module can be fitted to either Digital I/O Slot (DIO1 or DIO2) in the rear of the ADA-8 (as shown in the Layout section of the Operation Manual).

Where an ADA-8 is to be fitted for 16-channel AD, 16-channel DA, or 8-channel AD/DA at 176.4kHz and 192kHz sampling rates, operation FireWire I/O Modules must be fitted to BOTH DIO slots.

For details of how to fit the Module, refer to the Adjustments and Upgrades section of the Operation Manual.

9.4   Connection

The FireWire I/O Module has two six-pin FireWire sockets for connection to the bus. The module may only be connected to FireWire 400 (1394a) buses. The module does NOT support direct connection to FireWire 800 (1394b) buses.

The module does not require FireWire bus power in order to operate and so may be connected, using the appropriate lead, to the four-pin FireWire connector type often found on notebook computers. When connected to a six-pin, power providing, FireWire interface the module passes power straight through to the next device on the bus.

In a single ADA-8 application simply connect a FireWire cable between the workstation and either of the module's six-pin sockets. In most cases you will require a six-pin to six-pin FireWire cable (for desktop computers), or a four-pin to six-pin cable (for notebook computers).

Additional ADA-8 units may be added to the bus, by connecting a six-pin to six-pin cable between the unused socket on the first unit to either of the sockets on the next unit.

Do NOT connect a cable back to the workstation from the last unit in the chain, as this will create a loop, which will stop the FireWire bus from operating correctly.

In the case that two FireWire I/O Modules are fitted to the same ADA-8, the modules must be connected together externally using a six-pin to six-pin cable.

9.5   Module Dependent Preferences Menus

NOTE: This section describes additional menus which are available in ADA-8s fitted with FireWire I/O Modules. However, in normal use it is not necessary to access these menus since loading the relevant Stores, as described in the following sections, automatically selects the correct states of these menus.

If one or more FireWire I/O Modules are fitted to an ADA-8, the 'Workstation Remote Control', 'FireWire I/O Configuration' and 'FireWire GUID' menus become available in the 'Module Dependent Preferences' section of the Menu System.

9.5.1   Workstation Remote Control Menu

```
Wrkst Remote: On
On Off
```

This single selection menu allows the Workstation Remote Control Interface to be enabled or disabled. When enabled the synchronization source and sample rate of the ADA-8 can be remotely controlled from the workstation. When disabled any adjustments made from the workstation are ignored by the ADA-8. It is not recommended, and should not be necessary, to disable the Workstation Remote Control Interface when using the FireWire I/O Module.

9.5.2   FireWire I/O Configuration Menu

```
D1 FW I/O: 8I/8O
8I/8O 2I/8O 8I/→
```

Each FireWire I/O Module fitted to the ADA-8 enables an I/O Configuration Menu in the Module Dependent Preferences section of the Menu System. This setting changes the number of input and output channels that the FireWire I/O Module handles. The options available are 8 in / 8 out, 2 in / 8 out, 8 in / 2 out, and 4 in / 4 out (only available on XR model).

The maximum sampling rate supported by the FireWire I/O Module is 96kHz, unless the 4 in / 4 out configuration is selected, in which case it is 192kHz (only applies to XR model).

Note that changes to this setting take effect the next time you switch on your ADA-8. It is also necessary to disconnect and then re-connect your ADA-8(s) and workstation, so that the workstation Operating System notices that a different device type is present. However, this setting should rarely need to be changed.

9.5.3   FireWire GUID Menu

```
D1 FireWire GUID
0011980000000001
```

Each FireWire I/O Module fitted to the ADA-8 enables a GUID menu in the Module Dependent Preferences section of the Menu System. This menu displays the GUID, or Globally Unique Identifier, of each FireWire I/O Module fitted to the ADA-8. This is useful for identifying individual FireWire I/O Modules in a multiple node system.

9.6 Module Dependent Factory Stores

A selection of Factory Stores have been created for various applications of the FireWire I/O Module, they are described below.

9.6.1 Analogue to Digital / Digital to Analogue (+ Digital)

If your ADA-8 is fitted with a single FireWire I/O Module, the "FireWire AD/DA" store will appear in the store banks when the Factory Stores are recalled. Use this store for common A/D and D/A applications with sample rates up to and including 96kHz.

When this store is recalled the FireWire I/O Module is configured for 8 in / 8 out operation. Giving a total of 8 input channels and 8 output channels.

If you have an ADA-8 XR and wish to use this store with sample rates above 96kHz, you can do so by adjusting the FireWire I/O configuration to 4 in / 4 out as described in section 9.5.2. The unit will operate as before, except that input and output channels 5 to 8 will not be active.

Path 1 is configured for analogue to digital conversion. The path synchronization source and sample rate are controlled by the workstation. See sections 9.7 and 9.8 for further information on controlling the ADA-8 from the workstation.

Path 2 is configured for digital to analogue conversion. The path is synchronized to the FireWire I/O Module and the path sample rate is set to '=Ext'. These settings ensure that Path1 and Path 2 are synchronous.

Note that if an AES3 I/O Module is also fitted to the ADA-8, Path 2 will be set up to use both the analogue and AES3 outputs.

9.6.2 16 Channel Analogue to Digital

If your ADA-8 is fitted with two FireWire I/O Modules, and two Analogue Line Input Modules, the "FireWire 2xADC" store will appear in the store banks when the Factory Stores are recalled. Use this store for 16 channel A/D applications with sample rates up to and including 96kHz.

When this store is recalled each FireWire I/O Module is configured for 8 in / 2 out operation. Giving a total of 16 input channels and 4 dummy output channels (the dummy output channels are required to maintain synchronization between FireWire I/O modules).

Path 1 is configured for analogue to digital conversion. The path synchronization source and sample rate are controlled by the workstation.

Path 2 is configured for analogue to digital conversion. The path synchronization source and sample rate are controlled by the workstation.

See sections 9.7 and 9.8 for further information on controlling the ADA-8 from the workstation.

9.6.3 16 Channel Digital to Analogue

If your ADA-8 is fitted with two FireWire I/O Modules, and two Analogue Line Output Modules, the "FireWire 2xDAC" store will appear in the store banks when the Factory Stores are recalled. Use this store for 16 channel D/A applications with sample rates up to and including 96kHz.

When this store is recalled each FireWire I/O Module is configured for 2 in / 8 out operation. Giving a total of 16 output channels and 4 dummy input channels (the dummy input channels are required to maintain synchronization between FireWire I/O modules).

Path 1 is configured for digital to analogue conversion. The path synchronization source and sample rate are controlled by the workstation.

Path 2 is configured for digital to analogue conversion. The path synchronization source and sample rate are controlled by the workstation.

See sections 9.7 and 9.8 for further information on controlling the ADA-8 from the workstation.

9.6.4   Analogue to Digital / Digital to Analogue Cascade

If you have an ADA-8 XR that is fitted with two FireWire I/O Modules, an Analogue Line Input Module, and an Analogue Line Output module the "FWire AD/DA Casc" store will appear in the store banks when the Factory Stores are recalled. Use this store for common A/D and D/A applications with sample rates up to and including 192kHz.

When this store is recalled each FireWire I/O Module is configured for 4 in / 4 out operation. Giving a total of 8 input channels and 8 output channels.

Path 1 is configured for analogue to digital conversion. The path synchronization source and sample rate are controlled by the workstation. Input channels 1 to 4 are handled by the FireWire I/O Module in DIO Slot 1 and input channels 5 to 8 are handled by the FireWire I/O Module in DIO Slot 2.

Path 2 is configured for digital to analogue conversion. The path synchronization source and sample rate are controlled by the workstation. Output channels 1 to 4 are handled by the FireWire I/O Module in DIO Slot 1 and output channels 5 to 8 are handled by the FireWire I/O Module in DIO Slot 2.

See sections 9.7 and 9.8 for further information on controlling the ADA-8 from the workstation.

9.7   Macintosh Workstation Control Panel

The Driver Control Panel for Macintosh Workstations is built-in to the Operating System. This Control Panel can be found in Applications >> Utilities >> 'Audio MIDI Setup'. You can use the Control Panel to set the sampling rate and synchronization mode of your ADA-8.

To make changes to the ADA-8 settings, first be sure that you have selected the ADA-8 unit in the 'Properties For' drop down menu as shown below.
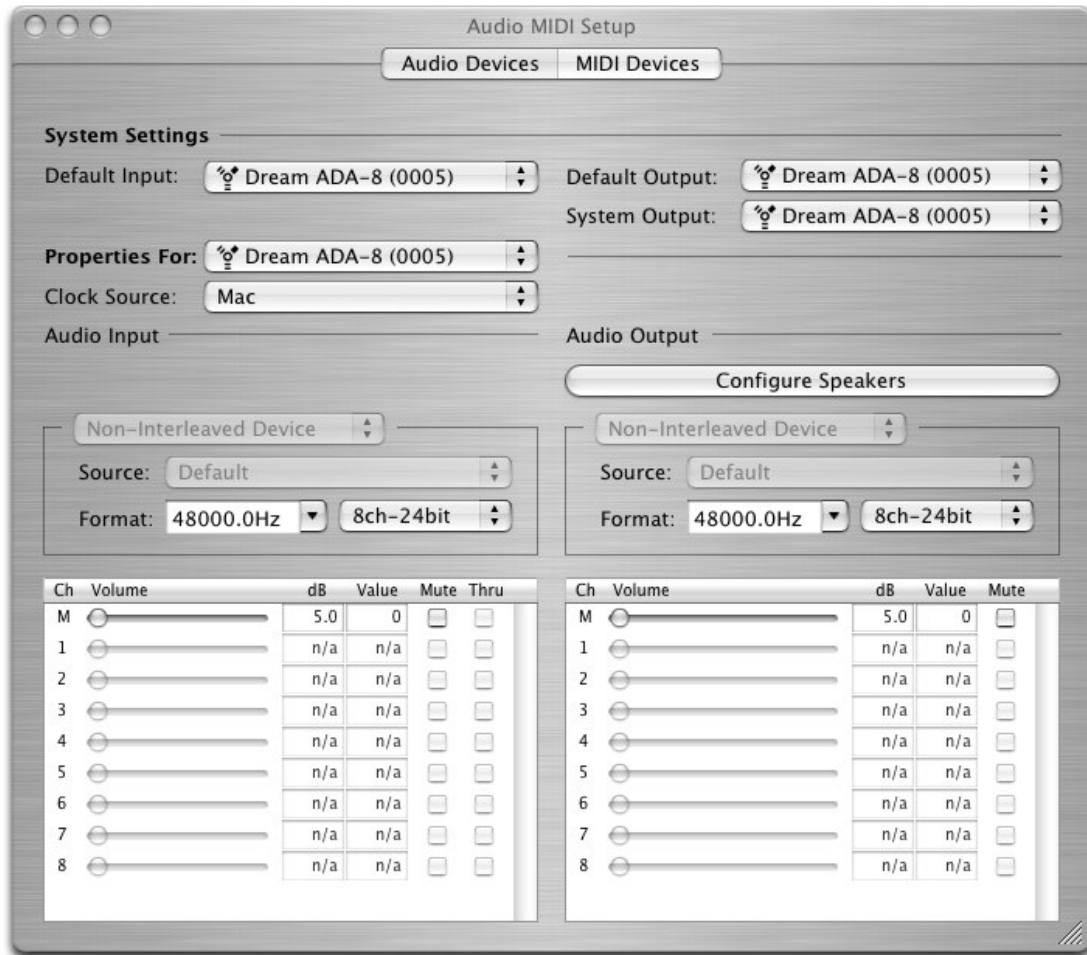
You should also select the ADA-8 unit to be your 'Default Input' and 'Default Output' device using the drop down menus. You may choose to leave the 'System Output' routed to 'Built-in Audio' if you wish.

9.7.1   Sampling Rate

To change the sampling rate of your ADA-8 select the desired rate in either the Audio Input, or the Audio Output, Format drop down menu. The change will automatically be applied to the other drop down menu, because the sampling rate of the FireWire I/O Module's inputs and outputs must be the same.

The sampling rates available are 32kHz, 44.1kHz, 48kHz, 88.2kHz and 96kHz. If your setup consists of an ADA-8 XR unit fitted with a FireWire I/O Module that is operating in the

4 in / 4 out I/O Configuration Mode, the 176.4kHz and 192kHz sampling rates will also be available.

9.7.2 Synchronization Modes

There are several synchronization options available to the user when using the FireWire I/O Module with a Macintosh workstation, these are described in the following section.

9.7.2.1   Synchronize to FireWire Bus

You can use this setting if you do not need to synchronize your ADA-8(s) to an external clock source or digital input. In this mode the workstation, and all audio devices on the FireWire bus, are synchronized to the FireWire Cycle Start Packet (CSP).

To setup your system to synchronize to the FireWire bus, open the Audio MIDI Setup Applet. Then, using the 'Clock Source' drop down menu, select 'Dream ADA-8 (xxxx) Internal'. Despite the labelling, this does NOT select the ADA-8 Local Clock as the synchronization source, instead it selects the FireWire CSP.

Note that some FireWire interfaces do not have the highest accuracy clocks and so, when using this method of synchronization, the sampling clock is subject to a frequency accuracy of ±200ppm (±0.02%). In the vast majority of cases this will suffice, but if you require greater frequency accuracy than this you should synchronize to your ADA-8 unit as described in Section 9.7.2.3.

9.7.2.2   Synchronize to Workstation

This is the default setting of the Macintosh Workstation Driver. You can use this setting if you do not need to synchronize your ADA-8 to an external clock source or digital input. In this mode all audio devices on the FireWire bus are synchronized to the workstation by means of a FireWire Synchronous Timestamp (SYT).

To setup your system to synchronize to the FireWire bus, open the Audio MIDI Setup Applet. Then, using the 'Clock Source' drop down menu select 'Mac'.

Note that some workstations do not have the highest accuracy clocks and so, when using this method of synchronization, the sampling clock is subject to a frequency accuracy of ±200ppm (±0.02%). In the vast majority of cases this will suffice, but if you require greater frequency accuracy than this you should synchronize to your ADA-8 unit as described in Section 9.7.2.3.

9.7.2.3   Synchronize to ADA-8

This method of synchronization allows the use of any of the usual ADA-8 Clock Sources, including Local Clock, AES Reference, Word Clock or a Digital Input.

To setup your system to synchronize to the ADA-8, open the Audio MIDI Setup Applet. Then, using the 'Clock Source' drop down menu select one of the four following synchronization sources:

Dream ADA-8 Ext Plug 0   -   This is the ADA-8 Local (Internal) Clock
Dream ADA-8 Ext Plug 1   -   This is the Utility Module AES-11 Reference Input
Dream ADA-8 Ext Plug 2   -   This is the Utility Module Wordclock Input
Dream ADA-8 Ext Plug 3   -   This is the 'Other' Digital I/O Module (e.g. AES 3)

Note that the (Ext DIO Ref Input) source is only valid if you have a digital I/O module, other than a FireWire I/O module, fitted in one of the DIO slots of your ADA-8.

9.7.3 Driver Latency

The latency of the Macintosh driver is fixed, at 10ms, and cannot be changed by the user.

9.7.4 Volume Control

The 'Audio MIDI Setup' applet displays volume control sliders for every input and output channel of the FireWire I/O Module. These are not active in the current version of OS X, or the module firmware, but may be used to adjust the input and output line-up gains of the ADA-8 Analogue Input and Output Modules in future versions.

9.8   Windows PC Workstation Control Panel

After running the Driver Installation CD-ROM you will find a 'Prism Sound 1394 Audio' icon in your Windows Control Panel. You can use this Driver Control Panel to perform several tasks including renaming devices and channels, optimising the driver latency, and changing the sampling rate and synchronization mode of your ADA-8(s).

9.8.1 Device and Channel Names

When you first open the Control Panel it will appear with the Devices tab highlighted, as shown below.
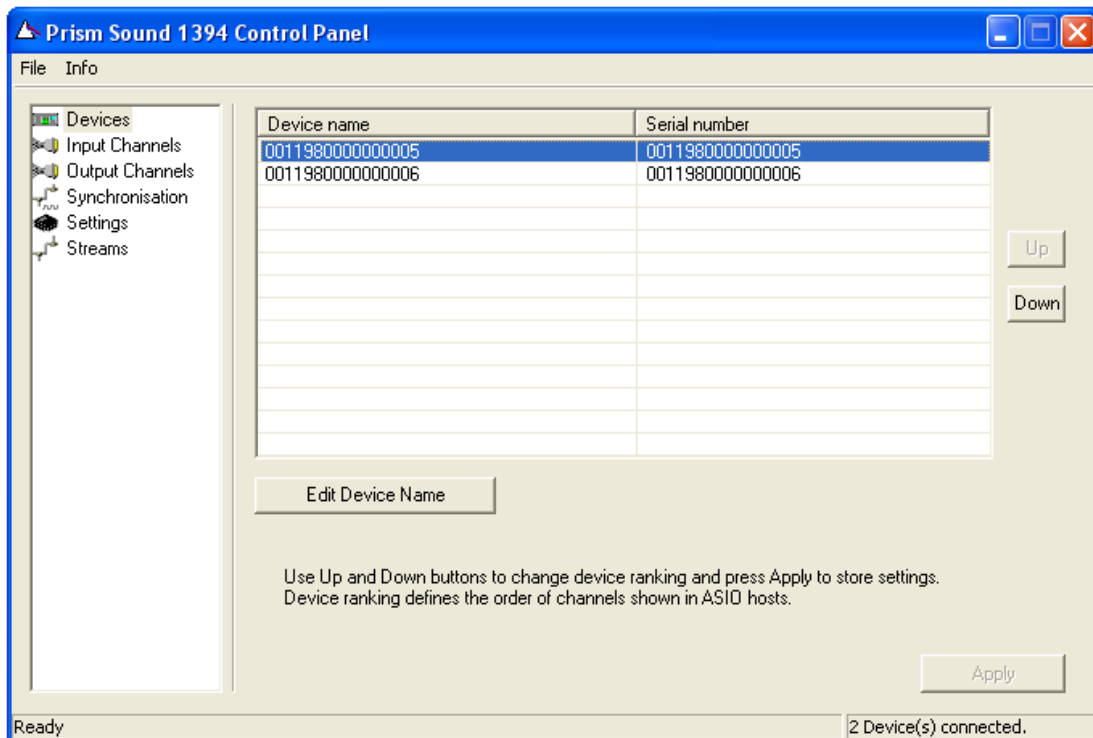
Each ADA-8 device connected to your workstation will appear in the device list, the default name for each device is its GUID. You can find out the GUID of a FireWire I/O Module using the ADA-8 menu system, as described in Section 9.5.3. Note that if your ADA-8 is fitted with two FireWire I/O modules they will both appear in the list as separate devices.

You may prefer to use a name for your ADA-8(s). You can do so by selecting the device and pressing the 'Edit Device Name' button. The name that you enter here will be the one shown when selecting the device driver in your workstation applications.

Individual input and output channels can also be renamed from the Driver Control Panel in a similar fashion. Select the Input Channels tab or Output Channels tab to perform these operations.

9.8.2 Sampling Rate

To change the sampling rate of your ADA-8(s) first select the Synchronization tab in the Driver Control Panel as shown below.
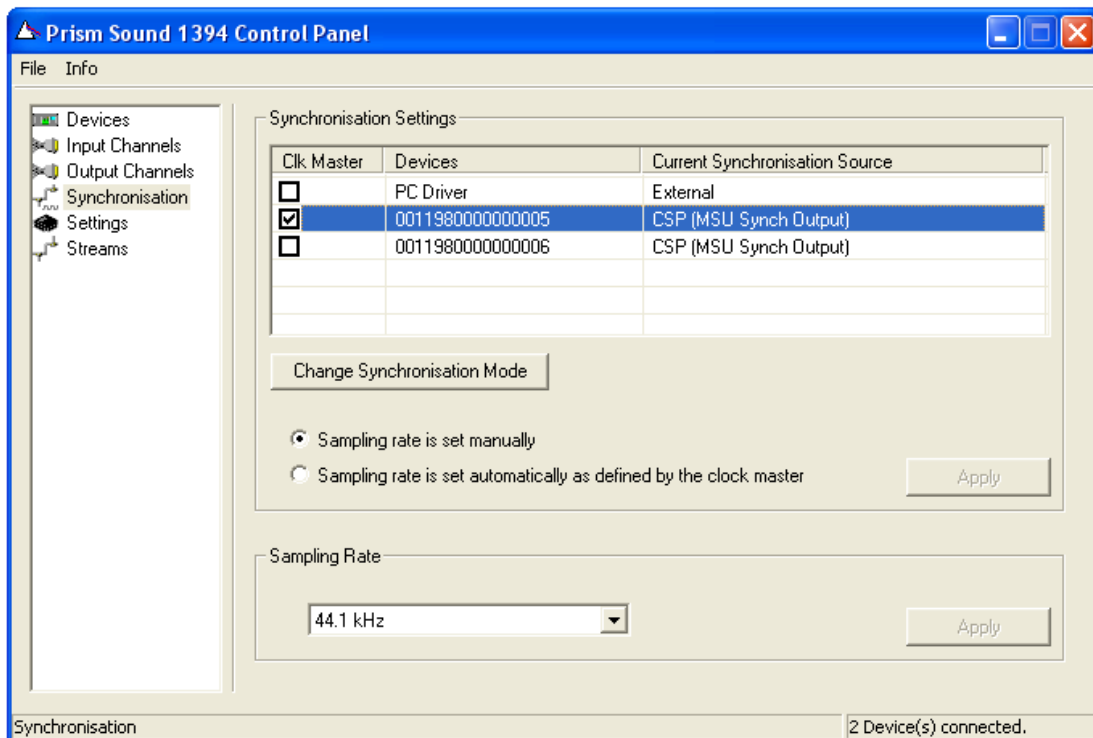
First ensure that the 'Sampling rate is set manually' radio button is selected, as this is the only valid setting for the ADA-8.

With any of your ADA-8 devices selected in the list, use the drop down Sampling Rate menu to select the desired rate and then press 'Apply'. The change will automatically be applied to all of the devices, because the sampling rate of all connected devices must be the same.

The sampling rates available are 32kHz, 44.1kHz, 48kHz, 88.2kHz and 96kHz. If your setup consists of ADA-8 XR unit(s) fitted with FireWire I/O Module(s) that are all operating in the 4 in / 4 out I/O Configuration Mode, the 176.4kHz and 192kHz sampling rates will also be available.

9.8.3   Synchronization Modes

Firstly we shall describe the methods for changing the synchronization mode of the PC Driver and the ADA-8, then we will discuss some valid configurations.

The synchronization mode of the Workstation Driver has two settings, 'Internal' and 'External'. This can be changed to 'Internal' by checking the Clk Master box next to the PC Driver in the device list, and changed to 'External' by checking the Clk Master box next to any other device in the list.

The synchronization mode of each ADA-8 FireWire I/O Module has a number of settings, this can be changed by selecting the device in the list and pressing the 'Change Synchronization Mode' button as shown below.
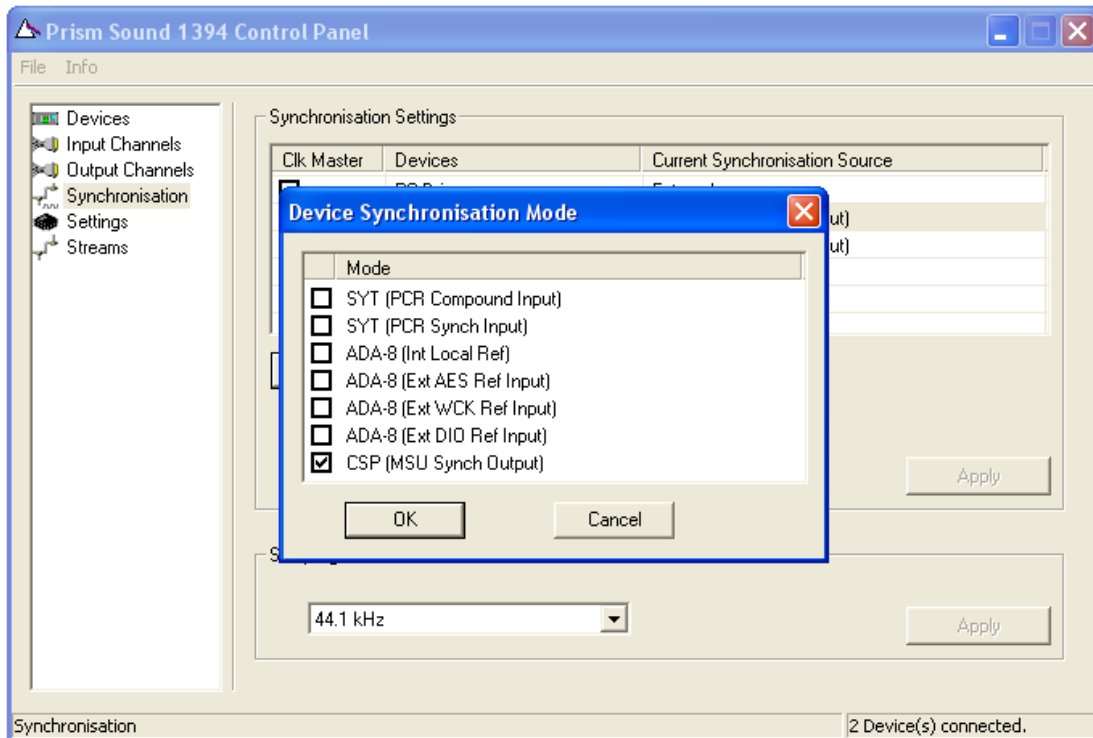
Changes to the synchronization mode of the PC Driver and Device(s) do not take effect until the 'Apply' button is pressed. This is so that changes to multiple devices can take place at the same time.

Note that this operation may take several seconds to complete, the delay is unavoidable and due to the design of the Windows Operating System.

We will now describe the valid synchronization schemes.

9.8.3.1   Synchronize to FireWire Bus

This is the default setting of the PC Workstation driver. You can use this setting if you do not need to synchronize your ADA-8(s) to an external clock source or digital input. In this mode the workstation, and all audio devices on the FireWire bus, are synchronized to the FireWire bus Cycle Start Packet (CSP).

To setup your system to synchronize to the FireWire bus, open the Driver Control Panel, and select the Synchronization tab.

If it is not already, set the PC Driver synchronization source to 'External'. You can do this by checking the Clk Master box next to any ADA-8 FireWire I/O Module in the list.

Next select an ADA-8 FireWire I/O Module and press the 'Change Synchronization Mode' button. Select the CSP (MSU Synch Output) option in the dialogue box that appears and press 'OK'.

Repeat for all of the ADA-8 FireWire I/O Modules in your system, and then press 'Apply'. Your system should now be correctly synchronized.

Note that some FireWire interfaces do not have the highest accuracy clocks and so, when using this method of synchronization, the sampling clock is subject to a frequency accuracy of ±200ppm (±0.02%). In the vast majority of cases this will suffice, but if you require greater frequency accuracy than this you should synchronize to one of your ADA-8 units as described in Section 9.8.3.3.

9.8.3.2   Synchronize to Workstation

You can use this setting if you do not need to synchronize your ADA-8(s) to an external clock source or digital input. In this mode all audio devices on the FireWire bus are synchronized to the workstation by means of a FireWire Synchronous Timestamp (SYT).

To setup your system to synchronize to the workstation open the Driver Control Panel, and select the Synchronization tab.

If it is not already, set the PC Driver synchronization source to 'Internal'. You can do this by checking the Clk Master box next to PC Driver in the device list.

Next select an ADA-8 device and press the 'Change Synchronization Mode' button. Select the SYT (PCR Compound Input) option in the dialogue box that appears and press 'OK'.

Repeat for all of the ADA-8 FireWire I/O Modules in your system, and then press 'Apply'. Your system should now be correctly synchronized.

Note that some workstations do not have the highest accuracy clocks and so, when using this method of synchronization, the sampling clock is subject to a frequency accuracy of ±200ppm (±0.02%). In the vast majority of cases this will suffice, but if you require greater frequency accuracy than this you should synchronize to one of your ADA-8 units as described in Section 9.8.3.3.

9.8.3.3   Synchronize to ADA-8

This method of synchronization allows the use of any of the usual ADA-8 Clock Sources, including Local Clock, AES Reference, Word Clock or a Digital Input. The trade off is that it is slightly more complicated to manage in systems with multiple units or multiple FireWire I/O modules.

Firstly you must choose one of your FireWire I/O Modules to be the Clock Master of the system. If you wish to use an external clock source, this should be a FireWire I/O Module that is located in the ADA-8 unit that is to be connected to the external clock source. Otherwise, if you are using the ADA-8 Local Clock, you may choose any FireWire I/O Module as the Clock Master. In the case that there is only one FireWire I/O Module in the system then this module should be nominated as the Clock Master.

To nominate the Clock Master FireWire I/O Module open the Driver Control Panel, and select the Synchronization tab.

Check the Clk Master box next to the appropriate FireWire I/O Module in the device list, the PC Driver clock source should now read 'External'. Next, select the Clock Master FireWire I/O Module and press the 'Change Synchronization Mode' button. You may select one of four synchronization sources for the Clock Master ADA-8. They are as follows:

ADA-8 (Int Local Ref)   -   This is the ADA-8 Local (Internal) Clock
ADA-8 (Ext AES Ref Input)   -   This is the Utility Module AES 11 Reference Input
ADA-8 (Ext WCK Ref Input)   -   This is the Utility Module Wordclock Input
ADA-8 (Ext DIO Ref Input)   -   This is the 'Other' Digital I/O Module (e.g. AES 3)

Note that the (Ext DIO Ref Input) source is only valid if you have a digital I/O module, other than a FireWire I/O module, fitted in one of the DIO slots of your ADA-8.

If there is more than one FireWire I/O Module located in the Clock Master ADA-8 unit (e.g. in an ADA-8 configured for 16 channel DA operation) you must also select the same synchronization source for the second module.

Finally, any other FireWire I/O Modules in the system should have SYT (PCR Compound Input) selected as their synchronization source.

Once you are happy with these settings press 'Apply'. Your system should now be correctly synchronized.

9.8.4 Driver Latency

By selecting the Setting tab in the Driver Control Panel it is possible to modify the latency of the WDM and ASIO audio paths. Drag the appropriate slider until the latency you require is displayed and then press 'Apply'.
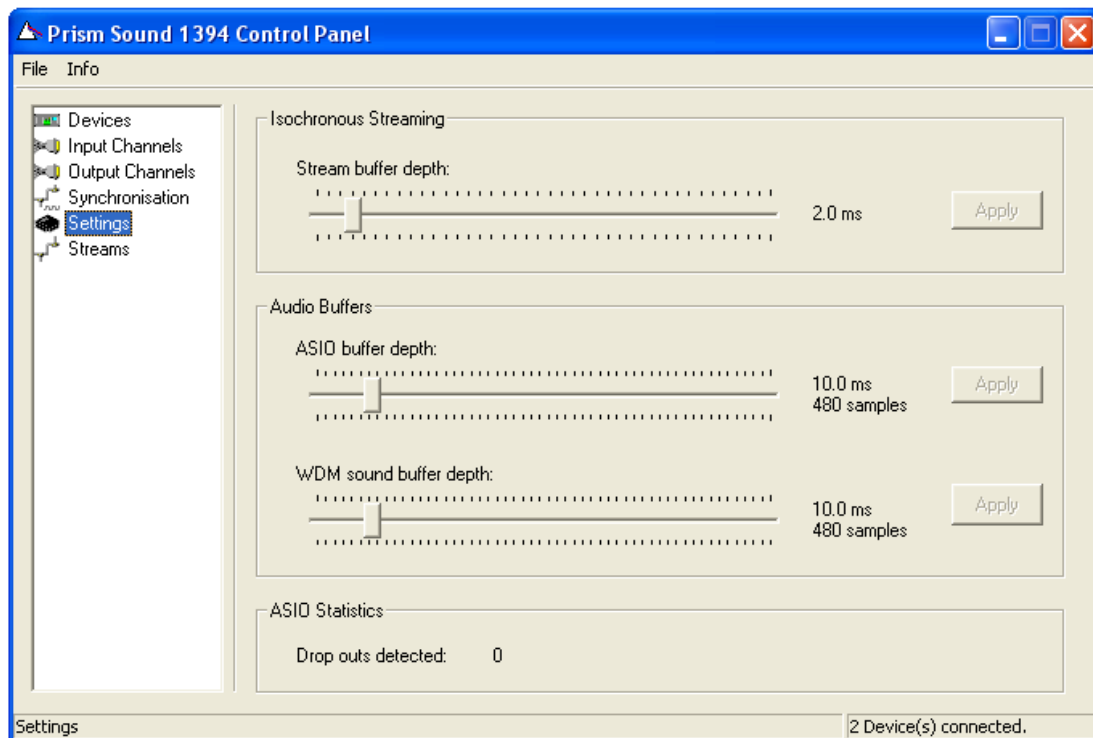
The default setting is 10ms as this gives plenty of margin for reliable operation on the majority of workstations. If you have a requirement for a lower latency you can adjust the buffer depths downwards. You should verify that the new setting works reliably in your environment.
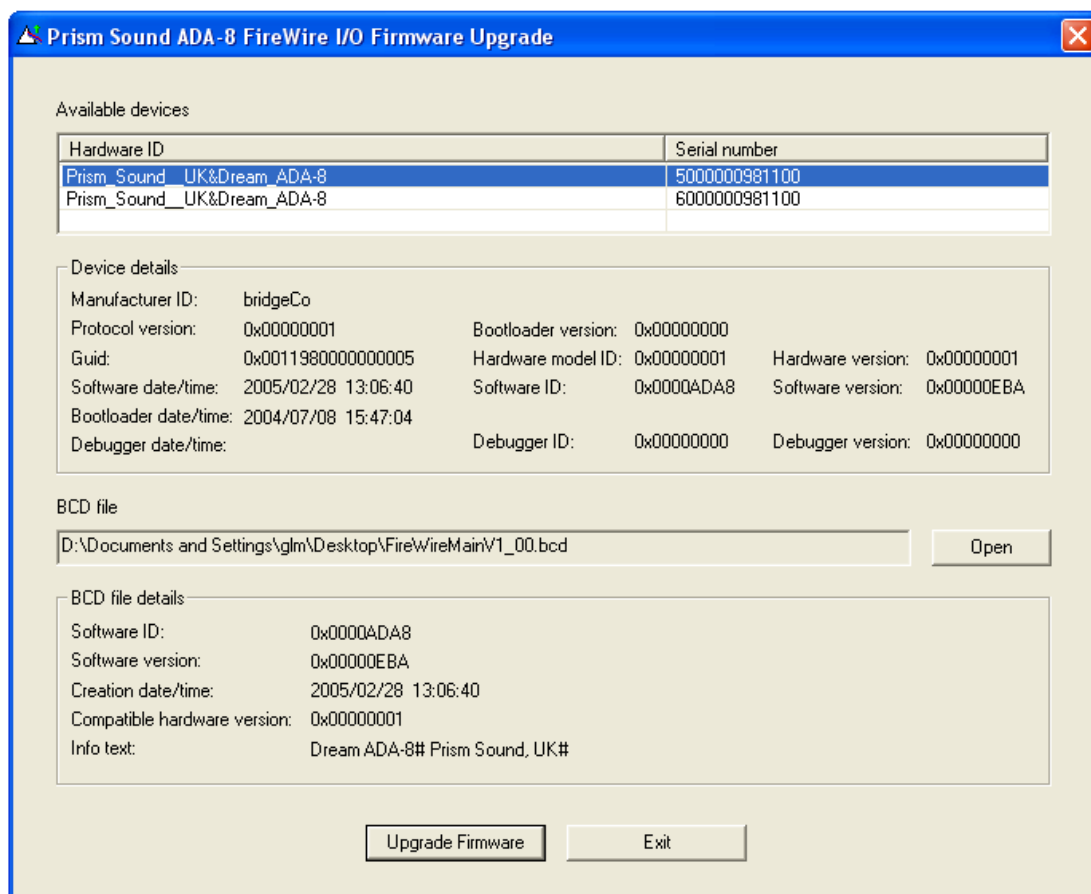
9.9   Module Firmware Upgrade

From time to time software updates for the FireWire I/O Module may become available from the Prism Sound website. These updates can be applied to the module using the Firmware Upgrade Application that is installed with the PC Driver.

To update the Firmware in your FireWire I/O Module first ensure that the PC Driver has been installed as described in Section 9.2, and that the module(s) you wish to update are connected to your PC.

Next navigate to Start Menu >> Programs >> Prism Sound ADA-8 1394 Driver, where you will find the Firmware Upgrade Application, run the application.

Select a device from the list and then press the 'Open' button, navigate to the new firmware file and select it. The firmware file will be named FireWireMainVx_xx.bcd, or similar.

Your screen should now look like this:

Finally press the 'Upgrade Firmware' button to start the download, the module will automatically restart after the download. Repeat for each module in your system.

9.10 Specifications

Electrical Interface:	2 x 6 Pin IEEE-1394a Compliant
IEEE-1394 Power Class:	4
Audio Format:	IEC 61883-6 (2nd Edition)