ADA

8824

ADA8824
A/D - D/A Platform
(ADAT Interface)
User's Guide

TABLE OF CONTENTS

lucid
TECHNOLOGY

The Lucid ADA8824 (ADAT) Audio Interface is an eight-channel, 24-bit, A/D and D/A converter intended for use with digital audio workstations. [For clarity the ADA8824 (ADAT) will be referred to as the 8824 throughout the rest of this user's guide.] The 8824 provides ADAT lightpipe connections, eight analog I/O channels, and eight AES/EBU digital I/O channels.

Designed specifically for Alesis lightpipe (fiber-optic) connections, the 8824 provides a plug and play audio interface between your studio's audio gear and the Apple Macintosh or Windows computers. Created in a strategic partnership with Alesis Corporation, the 8824 delivers the flexibility and performance you need for leading-edge audio production by providing eight channel digital transfers at 24-bit resolution. Digitally controlled attenuation of analog input and output levels and high-resolution LED metering help you realize the maximum dynamic range from your digital audio system.

Alesis pioneered the use of fiber-optic connections for digital audio transfer through its proprietary format. The Alesis PCR card works on Macintosh and Windows computers and is compatible with products from a wide range of vendors. The growing popularity of ADAT-equipped gear and the introduction of the 8824 make it even easier for you to stay in the digital domain throughout most of the production process.

The 8824's analog I/O channels are equipped with XLR connectors, which accept or deliver either balanced or unbalanced signals. The AES/EBU digital I/O channels use XLR connectors and the lightpipe connections use TOSLINK connectors. The 8824 operates at +4dBu, -10dBV, and intermediate signal levels.

We recommend that you read this manual from cover to cover. Somewhere between the confines of the two covers you should find the answers to most of your questions, both technical as well as musical. Please feel free to contact us if you have questions, comments or suggestions.

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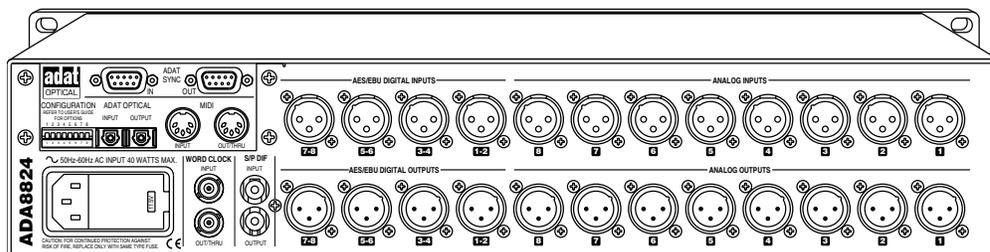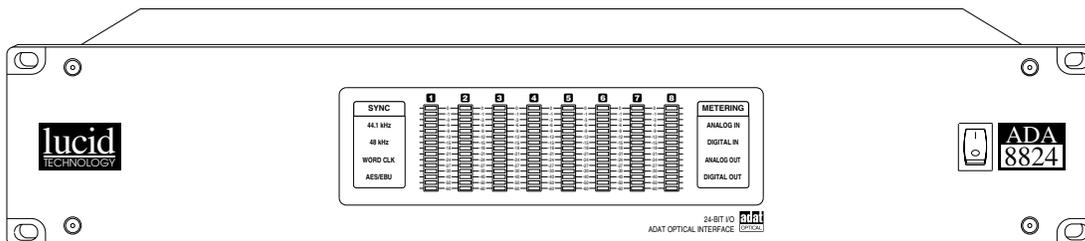
Equipment Markings

The lightning flash with arrowhead symbol within an equilateral triangle is intended to alert the user of the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product (i.e. this manual).

| CAUTION |
| RISK OF ELECTRIC SHOCK DO NOT OPEN |

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE

AVIS: RISQUE DE CHOC ELECTRIQUE NE PAS OUVRIR

SEE OWNERS MANUAL. VOIR CAHIER D'INSTRUCTIONS.
No user serviceable parts inside. Refer servicing to qualified service personnel.
Il ne se trouve a l'interieur aucune piece pourvant entre reparée l'usager.
S'adresser a un reparateur compétent.

Caution   To prevent electric shock, do not use the polarized plug supplied with the unit with any extension cord, receptacle, or other outlet unless the blades can be fully inserted.

Terms

Several notational conventions are used in this manual. Some paragraphs may use <u>Note</u>, *Caution*, or **Warning** as a heading or certain typefaces and capitalization are used to identify certain words. These are:

<u>Note</u>   Identifies information that needs extra emphasis. A <u>Note</u> generally supplies extra information to help you to better use the product.

Caution   *Identifies information that, if not heeded, may cause damage to the Lucid product or other equipment in your system.*

Warning   **Identifies information that, if ignored, may be hazardous to your health or that of others.**

CAPITALS   Controls, switches or other markings on the product's chassis.

Important Safety Instructions

Please read and keep these instructions. Heed and follow all warnings and instructions.

Mains Voltage Selection   The Line Voltage selector switch is located near the IEC power inlet connector. Set it to correspond to the nominal AC mains voltage used in your studio. The amperage of the fuse changes depending on the setting of the Line Voltage selector switch. (You must change the fuse to correspond with the new amperage.)
The fuse ratings are listed later in this section.

Power Source   This product is intended to operate from a power source that does not apply more than 250V rms between the power supply conductors or between either power supply conductor and ground. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation.

Grounding   The chassis of this product is grounded through the grounding conductor of the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle before making any connections to

the product. A protective ground connection, by way of the grounding conductor in the power cord, is essential for safe operation. **Do not defeat the safety purpose of the grounding plug.** The grounding plug has two blades and a third grounding prong. The third prong is provided for your safety. When the provided plug does not fit your outlet, consult an electrician for replacement of the obsolete outlet.

**Danger from
Loss of Ground**

If the protective ground connection is lost, all accessible conductive parts, including knobs and controls that may appear to be insulated, can render an electric shock.

Proper Power Cord

Use only the power cord and connector specified for the product and your operating locale. Use only a cord that is in good condition. **Protect the power cord** from being walked on or pinched, particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.

Proper Fuse

The user accessible fuse is a part of the IEC AC inlet connector. The fuseholder accepts 5 x 20mm diameter fuses.
For 117VAC operation, the correct value is 1/2A, 250VAC, slow blowing (Bussman type GDC-500MA).
For 230VAC operation, the correct value is 1/4A, 250VAC, slow blowing (Bussman type GDC-250MA).

Operating Location

Do not operate this equipment under any of the following conditions: explosive atmospheres, in wet locations, in inclement weather, improper or unknown AC mains voltage, or if improperly fused. Do not install near any heat source such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat. Unplug this apparatus during lightning storms or when unused for long periods of time.

Stay Out of the Box

To avoid personal injury (or worse), do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed. Only use accessories specified by the manufacturer. Clean only with a damp cloth.

User-serviceable parts

There are no user serviceable parts inside the ADA8824. In case of failure, refer all servicing to the factory. Servicing is required when the ADA8824 has been damaged in any way, such as when a power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

In its principal application, the 8824 connects the external world (analog and digital) of your studio with your computer using the ADAT lightpipe multichannel interface. In this setup you will also need a suitable computer (Wintel PC or Apple Macintosh) and a suitable interface card. Suitable cards are made by Alesis, Sonorus, Korg, Mark of the Unicorn (2408 system), MIDIMAN and others.

There are many reasons for using an external interface device rather than an all-in-one card that positions converters inside your computer. Some of these reasons are:

·   From an audio signal's point of view, the inside of your computer is a nasty environment, both noisy and plagued by RF. Using the 8824 removes the critical steps of A/D and D/A conversion from this noise-prone box and allows them to take place in an environment more conducive to high performance, 24-bit conversion.

·   Quite often, connecting the computer's ground system into your audio ground system causes hum. The lightpipe interface provides complete isolation between the computer's ground system and your audio system; each system's grounding is totally separate and isolated.

·   There isn't nearly enough room on the interface card's mounting bracket to house suitable connectors. The rear panel of the 8824 has enough space to house a full complement of the connectors that you already use in your audio system.

For all of these reasons, we think that the 8824 is the best solution for getting analog and digital signals into your ADAT lightpipe equipped computer.

Your studio may or may not utilize any Alesis ADAT modular digital multitrack (MDM) machines. If you use ADAT MDM's, the 8824 may be used to improve the quality of your audio conversion and dynamic range. However, you may wish to continue using the machine's internal A/D converters rather than the 8824, and your decision will most likely depend on which MDM you use. The 8824 has no dither capability, so using the 8824 instead of the MDM's internal converters may cause audible truncation when using 16-bit MDM's. Losing these bits won't cause the end of the world, or damage to anything, and you might even find the trade-off in dynamic range to be worthwhile. The degree of truncation you experience will depend on the converter resolution of your specific MDM.

This section discusses a multitude of things, all related to getting signals in and out of the 8824 and getting on with using it.

ADAT Sync Connections

These connectors allow sending and receiving ADAT-specific information between daisy-chained ADAT machines or other hardware capable of sending or receiving ADAT Sync. The ADAT sync cable carries machine control, word clock, and timecode signals. These connectors, or the MIDI connectors, may be used for controlling the 8824. The only signal in the ADAT sync connection that matters to the 8824 is the machine control signal.

Note   If you are using the 8824 with the Alesis PCR card, the 8824 must be the first device connected after the PCR card. Doing so ensures that the 8824 can always receive commands (ADAT machines do not always pass ADAT Sync information through themselves.)

Lightpipe Connections

The lightpipe connectors accept TOSLINK fiber-optic cables. There are two such connectors; one for input, one for output. The optical signal at these connectors represents all eight channels. Connect the lightpipe connectors to and from your computer's lightpipe interface card. There is no provision within the unit to operate the lightpipe connectors in thru mode.

MIDI Connections

The MIDI connectors receive or send MIDI data. These connectors, or the ADAT Sync connectors, may be used for controlling the 8824.

Note   If you use the MIDI connectors, it is preferable to use a separate MIDI port on your computer (i.e. one that depends on a different IRQ than the lightpipe interface).

Analog I/O Connections

It is not necessary to connect to any or all of these connectors at any given time. The connectors used or not used depend on your specific application. In most situations, connect the sources and destinations that you do have to the 8824. You can then use it as a 'router' to patch your sources, destinations, and the computer workstation software together.

Connect your analog sources to the rear-panel analog input connectors. These connectors may be driven from a balanced or unbalanced, low-impedance source. When using an unbalanced source, the preferred connection method is to bring all three input connections through to the unbalanced source, tying the shield to the source ground, pin 2/hot to the source hot, and pin3/cold to the source ground.

Connect the analog outputs as required in your studio. These connectors deliver a balanced output signal from a simulated grounded center-tap source. For unbalanced use, either float pin 3 at the 8824 (preferred), or if necessary, connect it to pin 1 at the 8824.

Digital I/O Connections

It is not necessary to connect to any or all of these connectors at any given time. The connectors used or not used depends on your specific application. In most situations, connect the sources and destinations that you do have to the 8824. You can then use it as a 'router' to patch your sources, destinations, and the computer workstation software together.

Connect the AES/EBU input connectors to AES/EBU digital audio sources. Connect the AES/EBU output connectors to AES/EBU digital audio inputs. If you plan to sync to an AES input, be sure to use inputs 1-2, 3-4, or 5-6, but not 7-8.

Connect the S/PDIF connectors to consumer audio digital inputs.

Connect the Word Clock input connector to a source of digital audio word clock.

Connect the Word Clock output connector to any other unit requiring the word clock signal.
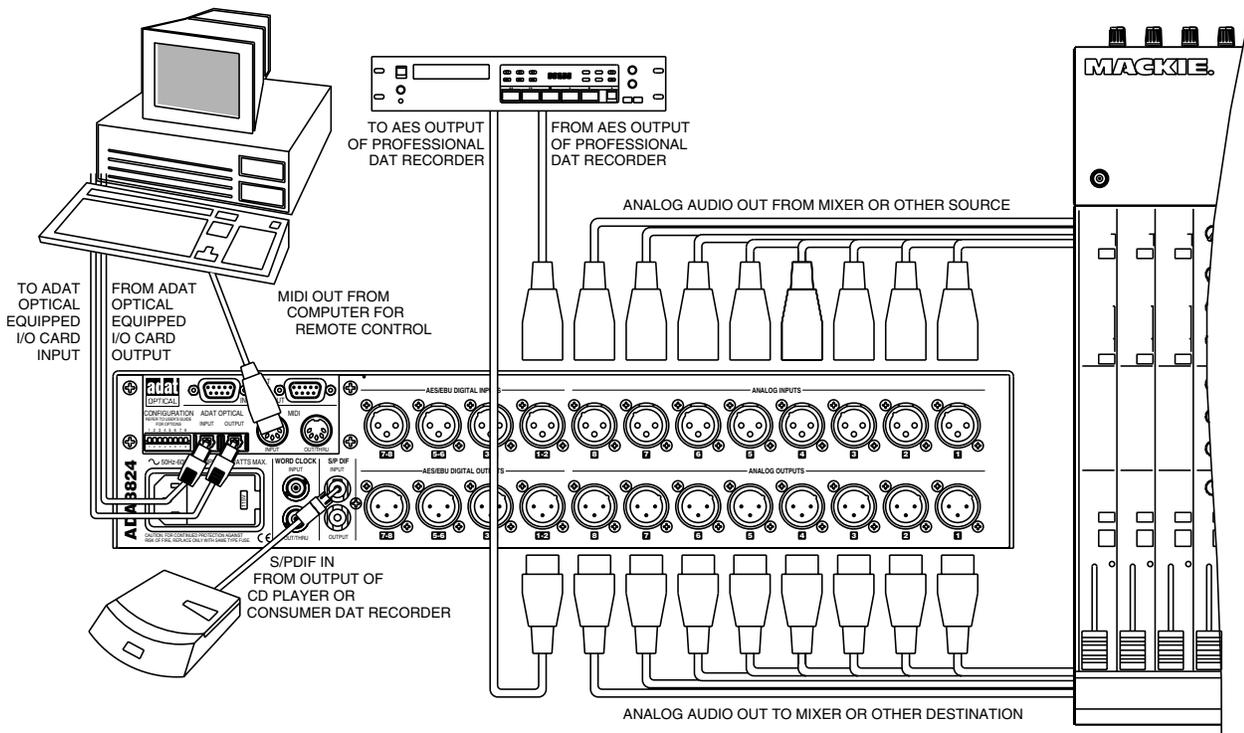

Figure 3-1. Computer Connections

Configuration Settings

The rear-panel configuration switches determine the initial conditions (power-up) of the 8824. For most applications use Remote mode (set SW1 down). Set SW2 thru SW4 as required by the input selection and clock source. Refer to Table 2.

SW5-8 have different functions depending on the mode selection (SW1). In Local mode, these switches determine the origins of the various output signals and the monitoring point for the meters. Refer to Table 1. In Remote mode, the arithmetic sum of the bit values of these switches (SW5-7) sets the MIDI device number (0-7). SW8 switches the MIDI command input between the ADAT Sync input and the DIN-5 MIDI input connectors. Refer to Table 3.

	SW1 Local/ Remote	SW2 ClkSel0	SW3 ClkSel1	SW4 ClkSel2	SW5 Analog Output Source	SW6 AES/EBU Output Source	SW7 Optical Output Source	SW8 Meter Select
UP	Local		See Table 2		AES	Analog	AES	Output
DOWN	Remote				ADAT	ADAT	Analog	Input

Table 1. Dip Switch Settings in Local mode (SW1 up at power-up).

Input Sync Source	Dip Sw Position		
	ClkSel0 (SW2)	ClkSel1 (SW3)	ClkSel2 (SW4)
ADAT Optical	DOWN	DOWN	DOWN
Word Clock Input	UP	DOWN	DOWN
Internal 44.1kHz clock	DOWN	UP	DOWN
Internal 48kHz clock	UP	UP	DOWN
AES Input 1	DOWN	DOWN	UP
AES Input 2	UP	DOWN	UP
AES Input 3	DOWN	UP	UP
S/PDIF Input	UP	UP	UP

Table 2. Clock Selector Switch Settings

	SW1 Local/ Remote	SW2 N/A	SW3 N/A	SW4 N/A	SW5 Device 0	SW6 Device 1	SW7 Device 2	SW8 MIDI Input Select
UP	Local		N/A			See		ADAT Sync (Input)
DOWN	Remote					Table 4		MIDI

Table 3. Dip Switch Settings in Remote mode
(SW1 down at power-up).

Device ID	SW5 Device 0	SW6 Device 1	SW7 Device 2
0	DOWN	DOWN	DOWN
1	UP	DOWN	DOWN
2	DOWN	UP	DOWN
3	UP	UP	DOWN
4	DOWN	DOWN	UP
5	UP	DOWN	UP
6	DOWN	UP	UP
7	UP	UP	UP

Table 4. Device ID selection.

The 8824 Configuration Application

Included with the 8824 is a small application that implements a virtual front panel so you can alter the settings of the unit. If you have any familiarity with Windows or Macintosh applications, you'll be right at home.

<u>Installation</u>

On either Wintel or Macintosh platforms, make a separate folder and copy the appropriate file into that folder. On your desktop, create a shortcut to the configuration application that you just copied into the folder. Double-click on the shortcut to launch the application.

<u>Settings</u>

Unit Number	Dropdown menu selects unit number (0-7).
Analog Output Source	Select either ADAT or AES. The eight analog outputs are generated from this source.
AES Output Source	Select either ADAT or Analog (input). The four AES/EBU output pairs are generated from this source.
Optical Output Source	Select either Analog or AES. The lightpipe signal is generated from this source. There are four of these switch blocks; one for channels 1-2, 3-4, 5-6, 7-8.
A/D Sync Source	Select from the following: ADAT, Word Clock, Internal 44.1kHz, internal 48kHz, AES 1-2, AES 3-4, AES 5-6, S/PDIF. The 8824 locks its clock to the selected source. The front panel indicator relays this information. If ADAT is the sync source, then none of the front panel sync indicators illuminate. If the A/D sync source does not match a valid clock source, or if the optical outputs are fed by a mixture of analog and AES inputs AND the A/D sync source is not set to the appropriate AES input, audible distortion may occur.
Digital Input 1,2 Select	Select either AES or S/PDIF. Digital inputs 1-2 can use either the AES/EBU digital inputs (XLR) or the S/PDIF digital inputs (RCA/Coax).
Meters	Select from Analog Inputs (ADC), Digital Inputs (AES), Analog Outputs (DAC) or Digital Outputs (AES).
Apply button	Sends all settings to the 8824.
Quit button	Quits the configuration application without making any changes.
Save and Quit	Saves the changes made and quits the application.

<u>File Menu</u>

Print Screen	Prints the current screen display.
Print Setup	Modifies the current printer setup.
Exit	Exits the configuration application.

<u>MIDI Setup</u>

MIDI In Port   Select the MIDI In port via the dropdown menu. You must have preconfigured the MIDI device via the Control Panel.

MIDI Out Port   Select the MIDI Out port via the dropdown menu. You must have preconfigured the MIDI device via the Control Panel.

<u>I/O Setup</u>

Input Gain   Displays the Analog Input Gain Control dialog box. Eight virtual faders determine the input gain setting ahead of the A/D converters. Two push buttons set all inputs for +4dBu or -10dBV input levels.

                      Refer to the discussion on this topic below.

Output Gain   Displays the Analog Output Gain Control dialog box. Eight virtual faders determine the output gain setting after the D/A converters. Two push buttons set all outputs for +4dBu or -10dBV signal levels.

                      Refer to the discussion on this topic below.

Digital Output   Displays the Digital Output Channel Status dialog box. Select between
Configuration   AES and S/PDIF output format and the sample rate for the digital output.

<u>Help</u>

About   Version and copyright information for this application.

<u>Gain and Headroom</u>

The two gain control screens display virtual faders that adjust the amount of gain or attenuation applied to input or output signals. Two push buttons allow presetting the gain to accommodate nominal +4dBu or –10dBV signals. At 0dB of gain, an input signal of –4dBu corresponds to a reading of 0dBFS as read on the 8824's meter. These readings are based on the use of sinewaves. The same gain relationship applies at the output side of the 8824.

At the input side, the +4dBu button sets the input gain to –8dB, which translates to approximately 20dB of digital headroom (20dB below 0dBFS). Remember that the +4dBu number represents a signal level read on an average responding indicator (i.e. VU meter), and the metering in the 8824 responds to peaks. If the +4dBu signal has a 20dB peak to average ratio, then this means that the signal peaks correspond to +24dBu. If the program material allows, either due to your mixing style, compression or limiting, or just the material itself, you may wish to reduce the amount of headroom to place the signal as high as possible within the converter's dynamic range window. Likewise, for especially dynamic signals, you may want to increase the amount of headroom allowed for these signals.

For –10dBV signals, the –10dBV button sets the input gain to +4dB, which again translates to approximately 20 dB of dynamic range. The numbers may seem to be off until you recall that a –10dBV signal is the same as a –7.8dBu signal (1V = 0dBV and 1V = +2.2dBu).

For both input and output, there is up to 31dB of gain or 95dB of attenuation available.

<u>Note</u>   The balanced line receiver can accept signals up to +25dBu. This is independent of any input attenuation setting.
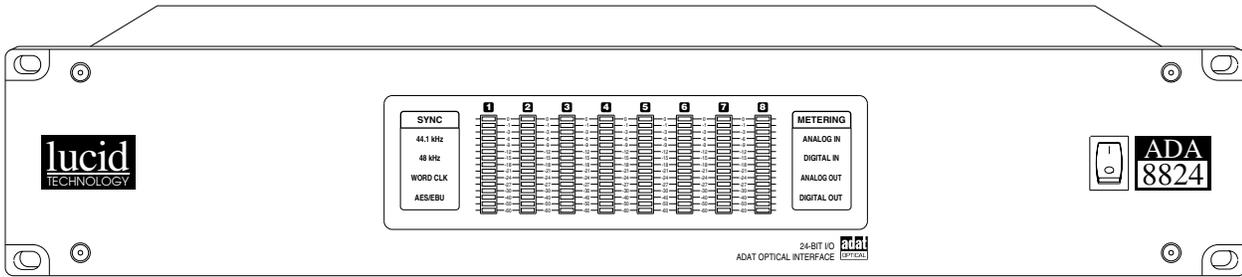
SYNC Window

Displays the source of digital audio sync: 44.1kHz internal, 48kHz internal, Word Clock, or AES/EBU digital input (inputs 1-2, 3-4, 5-6, or S/PDIF). If ADAT sync is selected the display will be unlit.
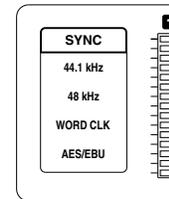

LED Meters

15-segment LED bargraph meters display digital or analog signal levels from either input or output. The source and mode selections are made via software from the host computer. The rear panel switches determine the source and mode when there is no host computer.
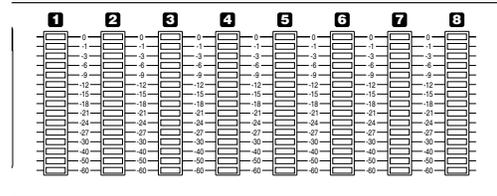
Metering Window

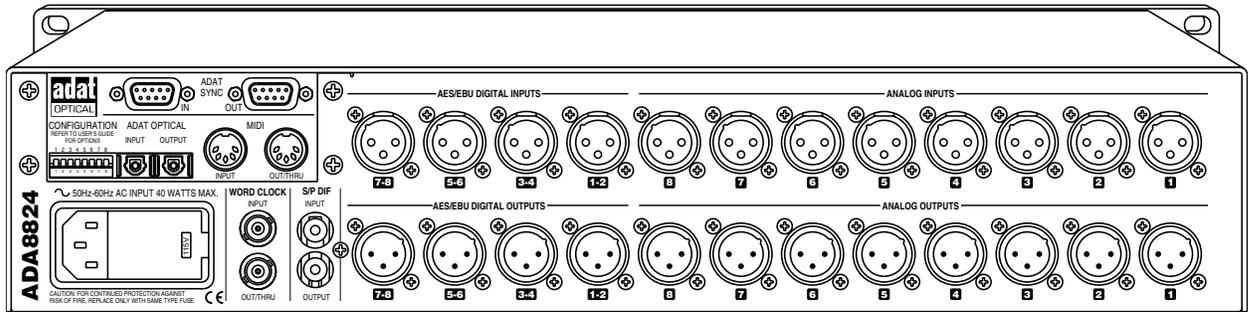Displays the source and mode of the meters: Analog Input, Digital Input, Analog Output, Digital Output.
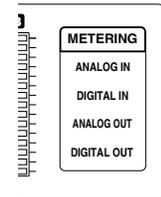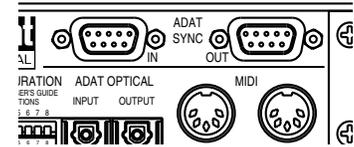

Power Switch

Turns the unit on.

| = On

O = Off

ADAT Sync connectors

Two DB-9 female connectors. These connectors accept and deliver ADAT Sync signals. ADAT Sync consists of three signals: machine control, ADAT word clock and time code. Include the ADA8824 (ADAT) first in the chain of ADAT sync devices.

Configuration Switches

DIP switch. This switch has six functions: local/remote operation, input sync source, analog and digital output (AES/EBU and optical) source, and meter source select. This switch is read at initialization (power-on). The remaining switches are meaningless when a remote computer is used.
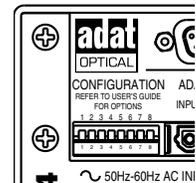
The local/remote switch allows operation without the use of a separate computer. The UP position is local operation (no computer), DOWN is remote. This might be useful in a stand-alone situation, or if your computer crashes.

The analog output source switch determines whether the source for the analog output will be the signal at the AES/EBU output of the ADAT output. UP is AES, DOWN is ADAT.

The AES/EBU output source switch determines whether the source for the AES/EBU digital output is the signal at the analog outputs or the ADAT outputs. UP is analog, Down is ADAT.

The optical output source switch determines whether the source for the optical output is the AES/EBU or analog output signals. UP is AES, DOWN is analog.

The meter source select switch determines whether the default meter signal source is the output (up) or input (down).

Note   Refer to discussion of dip switch settings and tables on page 7.

ADAT Optical connectors

TOSLINK optical (fiber-optic) connectors accept or deliver ADAT optical signals. The ADAT Optical signal is a multitrack 24-bit digital audio interconnection standard.
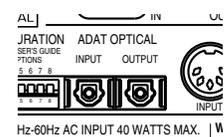
MIDI Input and Output

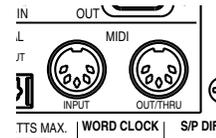5-pin female DIN connectors accept or deliver MIDI signals. The ADA8824 (ADAT) uses MIDI for control when not being operated in stand-alone or ADAT Sync modes. The ADA8824 (ADAT) uses Sysex commands for control.
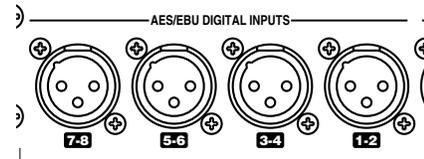
AES/EBU Inputs

XLR-3 female connector. This connector accepts digital audio signals using the AES-3 protocol (which includes older AES/EBU signals). The connectors are paired (marked 1-2, 3-4, etc.) because each AES-3 signal represents two digital audio channels.

Inputs 1-2, 3-4, or 5-6 are also used for external AES/EBU sync inputs.

ANALOG INPUTS

XLR-3 female connector. This connector accepts analog audio signals from balanced or unbalanced sources. The input impedance is 20-kilohms, balanced (diff-amp input). The maximum input level is +25 dBu. This connector should be driven from a low source impedance.
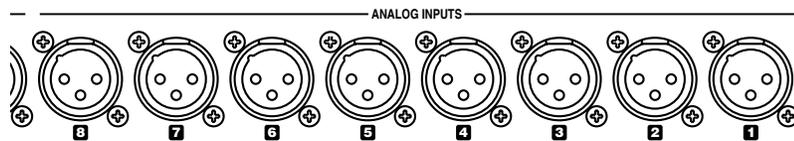
Analog Outputs

XLR-3 male connector. This connector delivers balanced audio signals from a 320-ohms source. The output stage emulates a grounded center-tap transformer. The maximum output level is +25 dBu For unbalanced loads, either float the unused output pin (usually pin 3), or ground it at the ADA8824 (ADAT). Floating pin 3 is the preferred method.
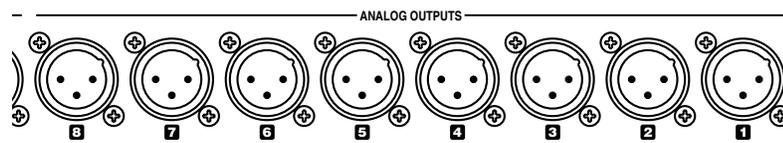
AES/EBU OUTPUTS

XLR-3 male connector. This connector delivers digital audio signals using the AES/EBU. The connectors are paired (marked 1-2, 3-4, etc.) because each AES/EBU signal represents two digital audio channels.
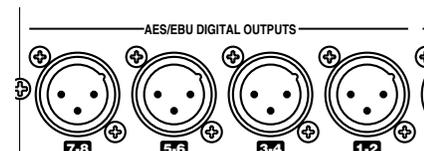
S/PDIF Input And Output

RCA female connectors. These connectors accept or deliver S/PDIF digital audio signals. The S/PDIF input can also be used as an external sync source.

Word Clock Input and Output/Through

BNC male connectors. These connectors accept or deliver word clock signals. Word clock is another method of synchronizing multiple digital audio signals. The word clock output is synchronized to the AES/EBU digital outputs. If the AES/EBU outputs are fed from the analog inputs, the word clock output gets its signal from the A/D sync source. If the AES/EBU outputs are fed from the ADAT optical input, the word clock output gets its signal from that input.
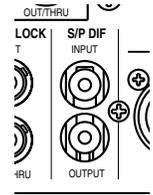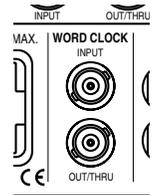
AC Power Input, Voltage Selector, and Fuse

IEC-power connector. Connect only to appropriate AC power source. Refer to rear-panel marking for correct AC source value.

The Line Voltage selector switch determines the proper AC mains voltage required for operation. Set this switch to correspond with the nominal AC mains voltage used in your studio.

The user accessible fuse is a part of the IEC AC inlet connector. The fuseholder accepts 5 x 20mm diameter fuses.

For 117VAC operation, the correct value is 1/2A, 250VAC, slow blowing (Bussman type GDC-500MA).

For 230VAC operation, the correct value is 1/4A, 250VAC, slow blowing (Bussman type GDC-250MA).
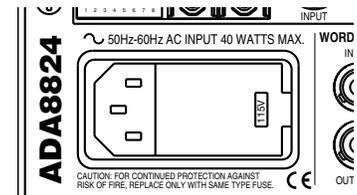
Overview

This section of the manual discusses some technical issues that you'll need to be familiar with and a few applications scenarios. This information may be useful if you want to get everything you can from the 8824.

Now that you're familiar with the 8824, use the Fast Setup section of this manual to integrate the unit into your studio. If you're using the unit without a host computer, be sure to set the configuration switches located at the rear of the unit.

Level Setting

Like any A/D converter, the converter's output represents a fixed window that must properly frame the audio signal. Set it too low, and lose the signal peaks; set it too high and lose the low-level detail.

In the 16-bit world, when that was all there was for conversion, the placement of the converter window was more critical due to the larger step size represented by each bit of the digital output. The low level details in the signal represent things like ambience and soundstage; thus they are critical details. Capturing these details faithfully means becoming more adept at either setting the window properly or fitting the signal into the window itself via dynamic range compression.

A 24-bit converter eases this task somewhat. Since the steps are smaller, you now have the option of placing the audio signal either a bit higher (better resolution for low-level signals, but lower headroom) or lower (less resolution for low levels, but higher headroom). Of course, if the signal is already recorded, then it's just a matter of getting levels set properly and then making the transfer into your workstation.

It's conceivable that you might want to make a 24-bit recording directly into your workstation. In this case, set your levels carefully and/or use some preprocessing in the analog domain to make the audio signal fit into the conversion window.

Clock and Sync Issues

Any time that you have multiple digital audio signals at one time the issue of sync becomes important. Sync between the signals is important because the converters in the 8824 share a common clock; therefore external digital signals need to arrive in-sync. This is not a problem if the signals come from a digital multitrack, however it may be a problem if the signals come from separate sources. In this case, you may need to provide a sync signal for each of these devices.

It is also possible to sync the 8824's converters to an external source. You can sync to an external AES/EBU signal via the 1-2 Digital Inputs or to the Word Clock input. Source selection occurs at the 8824 configuration application. The 8824 does not use the ADAT word clock signal in the ADAT sync connector. However, it can sync to ADAT signals delivered via the lightpipe connectors.

Note   The word clock output is synchronized to the AES/EBU digital outputs. If the AES/EBU outputs are fed from the analog inputs, the word clock output gets its signal from the A/D sync source. If the AES/EBU outputs are fed from the ADAT optical input, the word clock output gets its signal from that input.

MIDI Implementation

MIDI control is performed by using either the standard MIDI connectors, OR by using the ADAT Sync connectors. The ADAT Sync connectors are not used for any other purpose, with the exception of allowing ADAT specific information to be daisy-chained to multiple ADATs. To switch between MIDI or ADAT Sync connectors, see below, under switch configuration.

All MIDI control of the 8824 is performed by MIDI Sysex commands. This sequence is composed of the Sysex start byte (F0) followed by the Lucid Manufacturer ID (00 00 5E), followed by the 8824's ID (58 hex = 88 decimal), and the particular command and data. The structure of each Sysex is as follows (all bytes in hexadecimal):

F0 00 00 5E 58 x y <z_1 z_2 .. z_n> F7

where x is the 8824's specific device number (0 to 7),

y is the command code, and

z_1 through z_n is the data associated with the command (the length varies depending on the command)

Command information:

Set Mode : F0 00 00 5E 58 x 20 z F7

where z is defined as follows:
Bit 0 : Analog/Digital Meter Select (0 = analog; 1 = digital)
Bit 1 : Input/Output Meter Select (0 = input; 1 = output)
Bit 2 : Digital Input 1 Selector (0 = AES; 1 = S/PDIF)

Set Sync : F0 00 00 5E 58 x 21 z F7

where z is a 3-bit field (ClkSel0::2), defined as follows:

Input Sync	Three Bit Field		
Source	ClkSel0	ClkSel1	ClkSel2
ADAT Optical	0	0	0
Word Clock Input	1	0	0
Internal 44.1kHz clock	0	1	0
Internal 48kHz clock	1	1	0
AES Input 1	0	0	1
AES Input 2	1	0	1
AES Input 3	0	1	1
S/PDIF Input	1	1	1

Set Optical Output Source : F0 00 00 5E 58 x 22 z F7

where z = 0 selects analog inputs; z = 1 selects AES inputs

Set Analog Output Source : F0 00 00 5E 58 x 23 z F7

where z = 0 selects ADAT optical input; z = 1 selects AES inputs

Set AES Output Source : F0 00 00 5E 58 x 24 z F7

where z = 0 selects ADAT optical input; z = 1 selects analog inputs

Set Analog I/O Gain : F0 00 00 5E 58 x 30 $z_1 z_2$ .. z_{16} F7

where z_1 through z_{16} is the analog gain/attenuation for each analog I/O channel, ordered with inputs first, then outputs, and reverse ordered from channels 8 through 1 for both inputs and outputs.

The gain value is a 7-bit number (from 0 to 7F) which provides gain control in 1dB increments from -95dB to +31dB.

With the *input* gain set to -8dB (hex 58), a +4dBu input translates to approximately -20dbFS (i.e. 20dB digital headroom). With the *input* gain set to +4dB (hex 64), a -10dBV input translates to approximately -20dbFS (again, 20dB of digital headroom).

Similarly, with the *output* gain set to +1dB (hex 61), a -20dBFS input translates to approximately +4dBu into 600ohms. With the *output* gain set to -11dB (hex 55), a -20dBFS input translates to approximately -10dBV. In both of these cases, the actual headroom before clipping depends on the inputs of the mixer, power amplifier, etc, that the 8824 is driving.

Set digital output control : F0 00 00 5E 58 x 40 z1 z2 F7

where z1 is the address in the digital output buffer to write, and z2 is the encoded data to write.

For this command, there are 2 areas of control. Firstly, the digital outputs must be initialized by sending:

F0 00 00 5E 58 x 40 03 08 F7
F0 00 00 5E 58 x 40 02 03 F7
F0 00 00 5E 58 x 40 23 08 F7
F0 00 00 5E 58 x 40 22 03 F7
F0 00 00 5E 58 x 40 43 08 F7
F0 00 00 5E 58 x 40 42 03 F7
F0 00 00 5E 58 x 40 63 08 F7
F0 00 00 5E 58 x 40 62 03 F7

Then, the channel status bits may need to be set, depending on what digital equipment you are transmitting to. There are 8 addresses of interest to set, 2 for each output channel (each channel is offset by 20 hex bytes). The table on the next page summarizes the addresses and data for common setups. Formats can be mixed on a per channel basis. *All data is shown in hexadecimal.*

| | **Professional Mode** | | | | **Consumer Mode** | | |
Address	32k	44.1k	48k	N.I.*	32k	44.1k	48k
08	31	11	21	01	00	00	00
0B	00	00	00	00	03	00	02
28	31	11	21	01	00	00	00
2B	00	00	00	00	03	00	02
48	31	11	21	01	00	00	00
4B	00	00	00	00	03	00	02
68	31	11	21	01	00	00	00
6B	00	00	00	00	03	00	02

* Not indicated

The 8824's MIDI implementation table may be found in Section 8 of this manual.

Applications

It is impossible to anticipate exactly how you'll use the ADA8824 (ADAT) in your studio, but we can make a few educated guesses.

Digital Audio Workstation

In this application, the 8824 may find itself used alone or with accompanying ADAT machines. The 8824 becomes the computer's link to the analog and digital world. Since the unit performs routing functions in addition to analog and digital conversion, it is a convenient way to route and deliver digital and analog signals to and from your workstation.

In conjunction with most DAW applications, such as Cakewalk Pro Audio, the 8824's configuration application determines the 'front panel' settings of the unit. For analog sources, the 8824 converts these signals into 24-bit digital audio, and routes them to the computer via the lightpipe interface. On the return trip, the 8824 can route signals to the S/PDIF connectors, to any of the AES/EBU digital outputs, or to the analog outputs. For digital sources, the 8824 bundles them into the 8-channel ADAT lightpipe format and ships them off to the computer. Returning from the computer, the 8824 can deliver signals as AES/EBU digital signal pairs, analog audio, or S/PDIF signals.

If you are mixing to DAT or for CD release, be sure that your workstation software has been set to reduce the 24-bit signals to 16-bit and to perform dithering. The 8824 has no facilities for dithering its output signal.

Note: You can not record 24-bit signals onto a DAT recorder unless your DAT machine is one that has 24-bit recording capability. The DAT format is 16-bit by design. Trying to record longer word lengths onto a DAT simply results in losing the extra bits (truncation). The resulting tape will play, but the audio, particularly at the lowest levels, will suffer.

On the Wintel platform, it is easier to use the 8824 if you use a separate MIDI interface card rather than that provided (if any) on your lightpipe interface card. A Windows 95/98 limitation prevents one MIDI port from being used by more than one application. This limitation requires you to open the configuration application alone, make your configuration adjustments, close the configuration application, and then start your DAW application. Making any changes later requires closing the DAW application first, reopening the configuration application, making the configuration changes, etc. Not impossible, but certainly tedious. Having a physically separate MIDI interface allows the configuration application to remain open while running your DAW application.

When using any ADAT MDM machines and transferring data into your workstation, you'll need to disconnect the 8824's output (lightpipe) connection so that you can move it to the ADAT machine. The 8824's ADAT lightpipe connections have no provision for thru operation. Of course, if your lightpipe interface card has multiple lightpipe I/O connections (highly recommended), then you can leave the MDM's connected all the time and make the switch in software.

Multitrack Recording

By configuring the 8824 for 8-channel A/D conversion with output on the lightpipe connector, you can use the unit for 24-bit hard disk recording. Depending on your computer hardware, you may or may not be able to record 8 (or more) tracks simultaneously. Experiment first, before you commit yourself to learning this the hard way (with clients present).

For more than 8-tracks simultaneously, you'll need additional 8824s. Remember the caveat above regarding simultaneous multitrack recording.

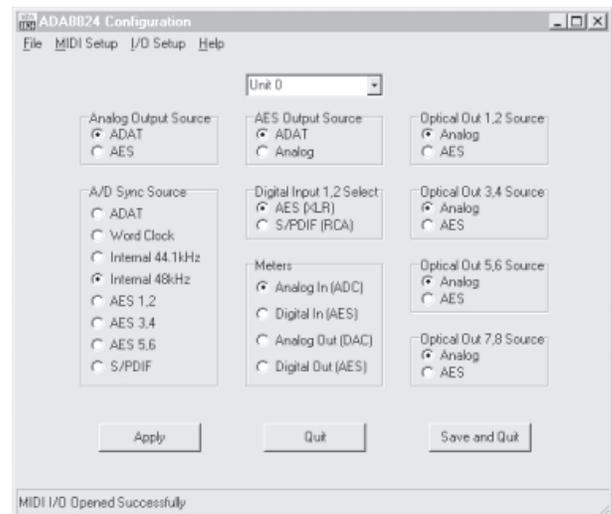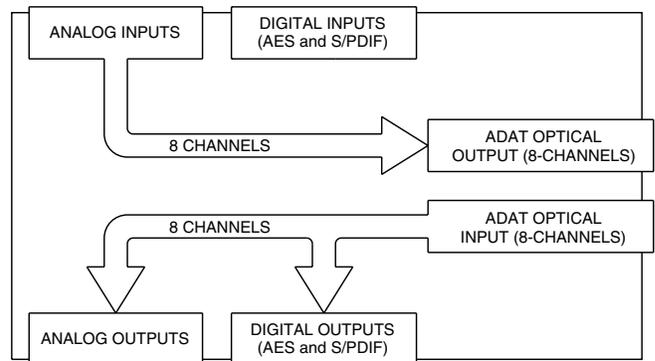## A/D - D/A Converter with ADAT Optical I/O

In this application, the 8824 operates as an eight-channel 24-bit A/D and D/A converter connected to a host computer equipped with an ADAT lightpipe I/O card. Refer to figures at right.

The DIP switch settings shown are for operation in Local mode. Refer to page 7 for a detailed discussion of the 8824's dip switch settings.

The screen shot of the configuration application shows the selections needed to make this application scenario operate in Remote mode.

Analog input signals enter the 8824 via the eight analog inputs. After conversion to digital form, the 8824 performs format conversion and delivers the audio to the computer via the lightpipe connector.

On the return trip, the 8824 receives digital audio from the computer via the lightpipe connector. This signal is then converted to analog form and delivered via the eight analog outputs. The signal is also converted to AES/EBU form and delivered via the AES/EBU output connectors and the S/PDIF connectors.

REAR DIP SWITCH
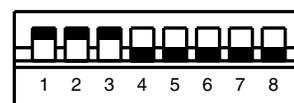
(LOCAL MODE)

A/D - D/A Converter, ADAT Optical I/O

In this application, the 8824 operates as a stand-alone eight-channel 24-bit A/D and D/A converter. There is no host computer required for audio I/O. Refer to figures at right.

The DIP switch settings shown are for operation in Local mode. Refer to page 7 for a detailed discussion of the 8824's dip switch settings.

The screen shot of the configuration application shows the selections made to make this application scenario operate in Remote mode. Note that it is the DIP switch that makes the various source, output, and sync selections. The configuration program is not needed.

Analog input signals enter the 8824 via the eight analog inputs. After conversion to digital form, the 8824 performs format conversion and delivers the audio to the AES/EBU outputs. (In this example, the A/D inputs also drive the optical outputs.)

On the return trip, the 8824 receives digital audio via the AES/EBU connectors. These signals are then converted to analog form and delivered via the eight analog outputs.
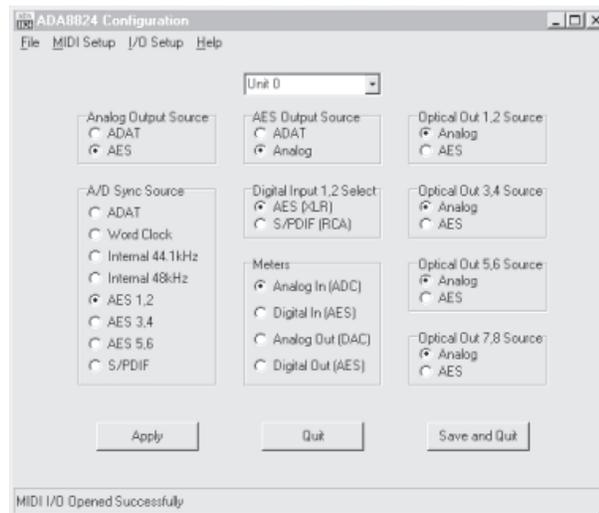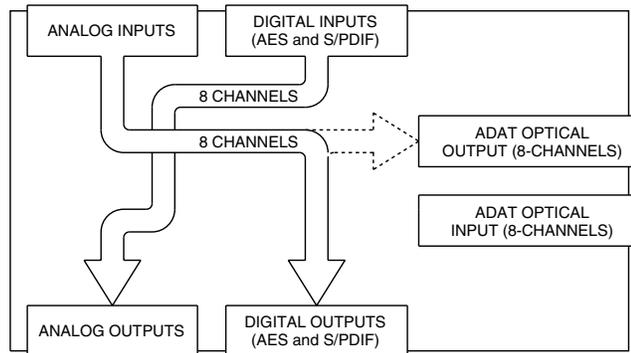
Digital I/O to ADAT Optical I/O, Plus Analog Monitoring of Host Outputs

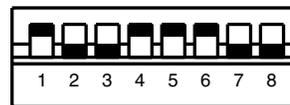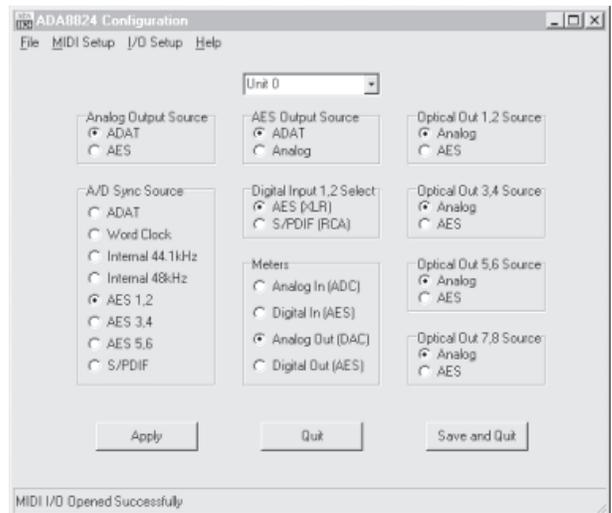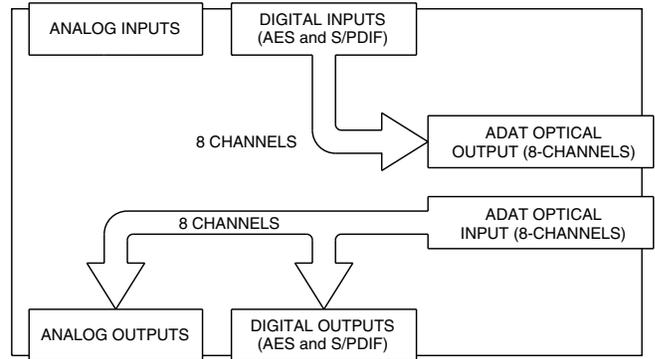In this application, the 8824 takes in four AES/EBU digital signal pairs and delivers them to the host computer via the lightpipe connector. The computer sends eight channels of digital audio to the 8824 which converts them to both analog audio and AES/EBU digital signal pairs. Refer to figures at right.

The DIP switch settings shown are for operation in Local mode. Refer to page 7 for a detailed discussion of the 8824's dip switch settings.

The screen shot of the configuration application shows the selections made to make this application scenario operate in Remote mode.

Digital audio signals enter the 8824 via the four AES/EBU inputs. After conversion to lightpipe format, the 8824 delivers the audio to the lightpipe connector.

On the return trip, the 8824 receives digital audio from the lightpipe input connector. These signals are then sent to the AES/EBU and S/PDIF digital outputs. They are also converted to analog form and delivered via the eight analog outputs.

ANALOG INPUTS

DIGITAL INPUTS
(AES and S/PDIF)

8 CHANNELS

ADAT OPTICAL
OUTPUT (8-CHANNELS)

8 CHANNELS

ADAT OPTICAL
INPUT (8-CHANNELS)

ANALOG OUTPUTS

DIGITAL OUTPUTS
(AES and S/PDIF)

ADA8824 Configuration

File MIDI Setup I/O Setup Help

Unit 0

Analog Output Source
ⓒ ADAT
◯ AES

AES Output Source
ⓒ ADAT
◯ Analog

Optical Out 1,2 Source
ⓒ Analog
◯ AES

A/D Sync Source
◯ ADAT
◯ Word Clock
◯ Internal 44.1kHz
◯ Internal 48kHz
ⓒ AES 1,2
◯ AES 3,4
◯ AES 5,6
◯ S/PDIF

Digital Input 1,2 Select
ⓒ AES (XLR)
◯ S/PDIF (RCA)

Optical Out 3,4 Source
ⓒ Analog
◯ AES

Meters
◯ Analog In (ADC)
◯ Digital In (AES)
ⓒ Analog Out (DAC)
◯ Digital Out (AES)

Optical Out 5,6 Source
ⓒ Analog
◯ AES

Optical Out 7,8 Source
ⓒ Analog
◯ AES

Apply   Quit   Save and Quit

MIDI I/O Opened Successfully

REAR DIP SWITCH

1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8

(LOCAL MODE)

Syncing Two Units

In this application, two 8824s are slaved together for sixteen channels of 24-bit A/D conversion. Refer to figures below and on the next page. The DIP switch settings shown are for operation in Local mode. Refer to page 7 for a detailed discussion of the 8824's dip switch settings. The screen from the configuration application shows how to configure the units via computer.

There are three optional configuration differences possible. Option A syncs the two 8824s together via the Word Clock connections. Option B uses AES/EBU pair 1-2 for the sync connection. Option C uses the ADAT optical input for sync.
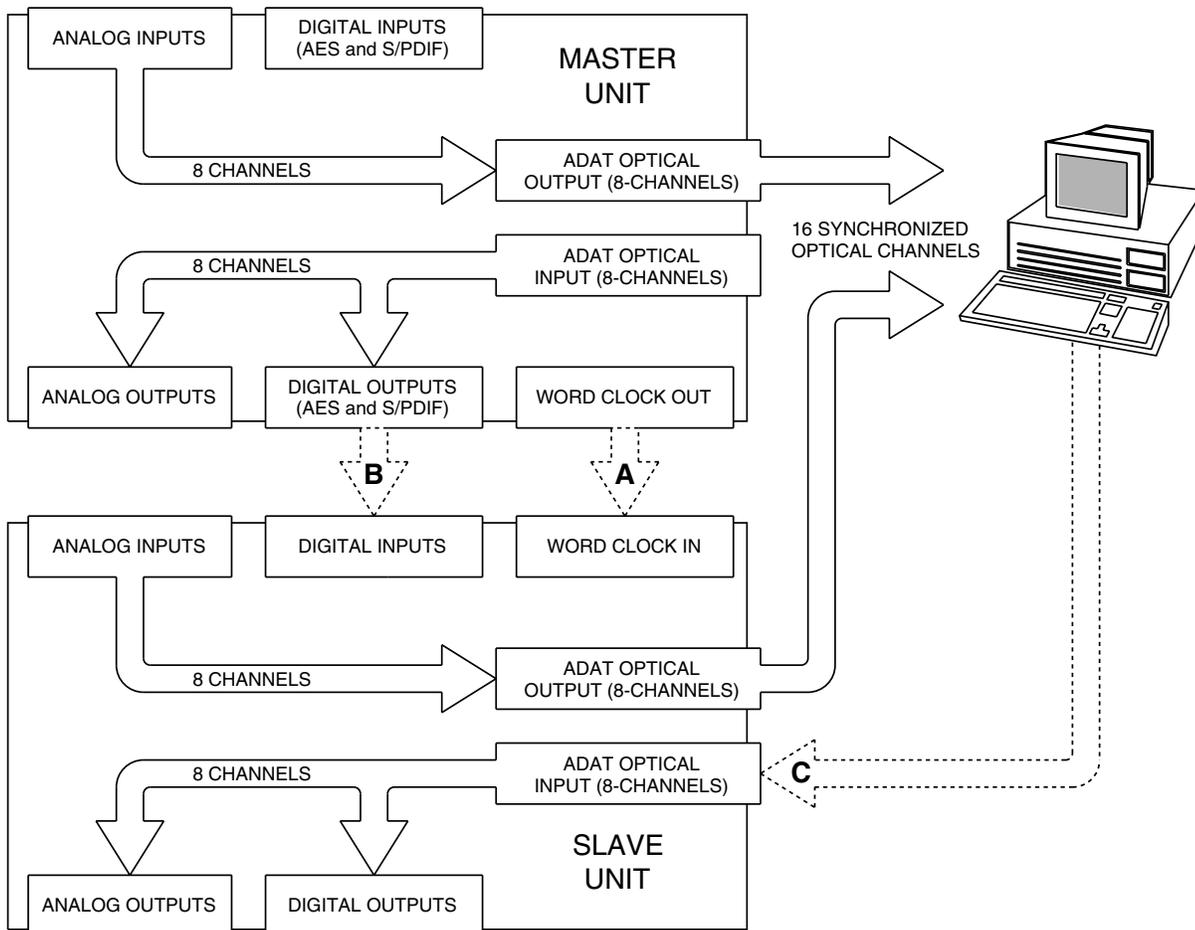
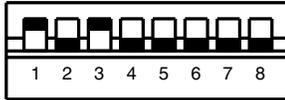Analog input signals enter the 8824 via the eight analog inputs. After conversion to digital form, the 8824 performs format conversion and delivers the audio to the lightpipe connector.

On the return trip, the 8824 receives digital audio from the lightpipe connector. This signal is delivered to the AES/EBU digital outputs as well as converted to analog form and delivered to the eight analog outputs.
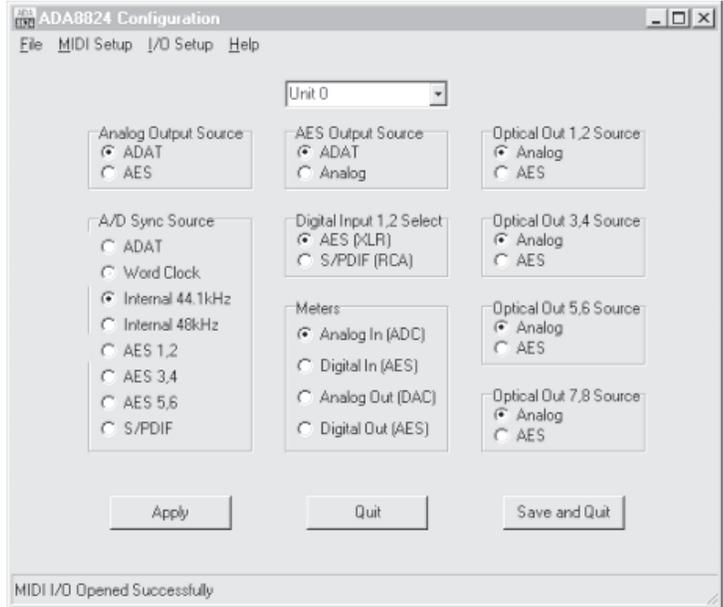
MASTER
REAR DIP SWITCH
1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8

(LOCAL MODE)

ADA8824 Configuration

File   MIDI Setup   I/O Setup   Help

Unit 0

Analog Output Source
ADAT
AES

A/D Sync Source
ADAT
Word Clock
Internal 44.1kHz
Internal 48kHz
AES 1,2
AES 3,4
AES 5,6
S/PDIF

AES Output Source
ADAT
Analog

Digital Input 1,2 Select
AES (XLR)
S/PDIF (RCA)

Meters
Analog In (ADC)
Digital In (AES)
Analog Out (DAC)
Digital Out (AES)

Optical Out 1,2 Source
Analog
AES

Optical Out 3,4 Source
Analog
AES

Optical Out 5,6 Source
Analog
AES

Optical Out 7,8 Source
Analog
AES

Apply   Quit   Save and Quit

MIDI I/O Opened Successfully

SLAVE
REAR DIP SWITCH
1 2 3 4 5 6 7 8

A
1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8

B
1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8

C
1 2 3 4 5 6 7 8

(ALL LOCAL MODE)

ADA8824 Configuration

File   MIDI Setup   I/O Setup   Help

Unit 1

Analog Output Source
ADAT
AES

A/D Sync Source
option C ADAT
option A Word Clock
Internal 44.1kHz
Internal 48kHz
option B AES 1,2
AES 3,4
AES 5,6
S/PDIF

AES Output Source
ADAT
Analog

Digital Input 1,2 Select
AES (XLR)
S/PDIF (RCA)

Meters
Analog In (ADC)
Digital In (AES)
Analog Out (DAC)
Digital Out (AES)

Optical Out 1,2 Source
Analog
AES

Optical Out 3,4 Source
Analog
AES

Optical Out 5,6 Source
Analog
AES

Optical Out 7,8 Source
Analog
AES

Apply   Quit   Save and Quit

MIDI I/O Opened Successfully

Function		Transmitted	Recognized	Remarks
Manufacturer ID			00 00 5E	hex notation
Unit ID			58	hex notation
Basic Channel	Default Channel	X	X	
Mode	Default	X	X	
	Messages	X	X	
	Altered	X	X	
Note Number		X	X	
	True Voice	X	X	
Velocity	Note ON	X	X	
	Note OFF	X	X	
After Touch	Key's	X	X	
	Ch's			
Pitch Bender		X	X	
Control Change		X	X	
Program Change	True#	X	X	
System Exclusive		O	O	
System	:Song Pos	X	X	
	:Song Sel	X	X	
Common	:Tune	X	X	
System Real Time	:Clock	X	X	
	:Commands	X	X	
Aux Messages	:Local ON/OFF	X	X	
	:All Notes OFF	X	X	
	:Active Sense	X	X	
	:Reset	X	X	

Notes
O : Yes
X : No
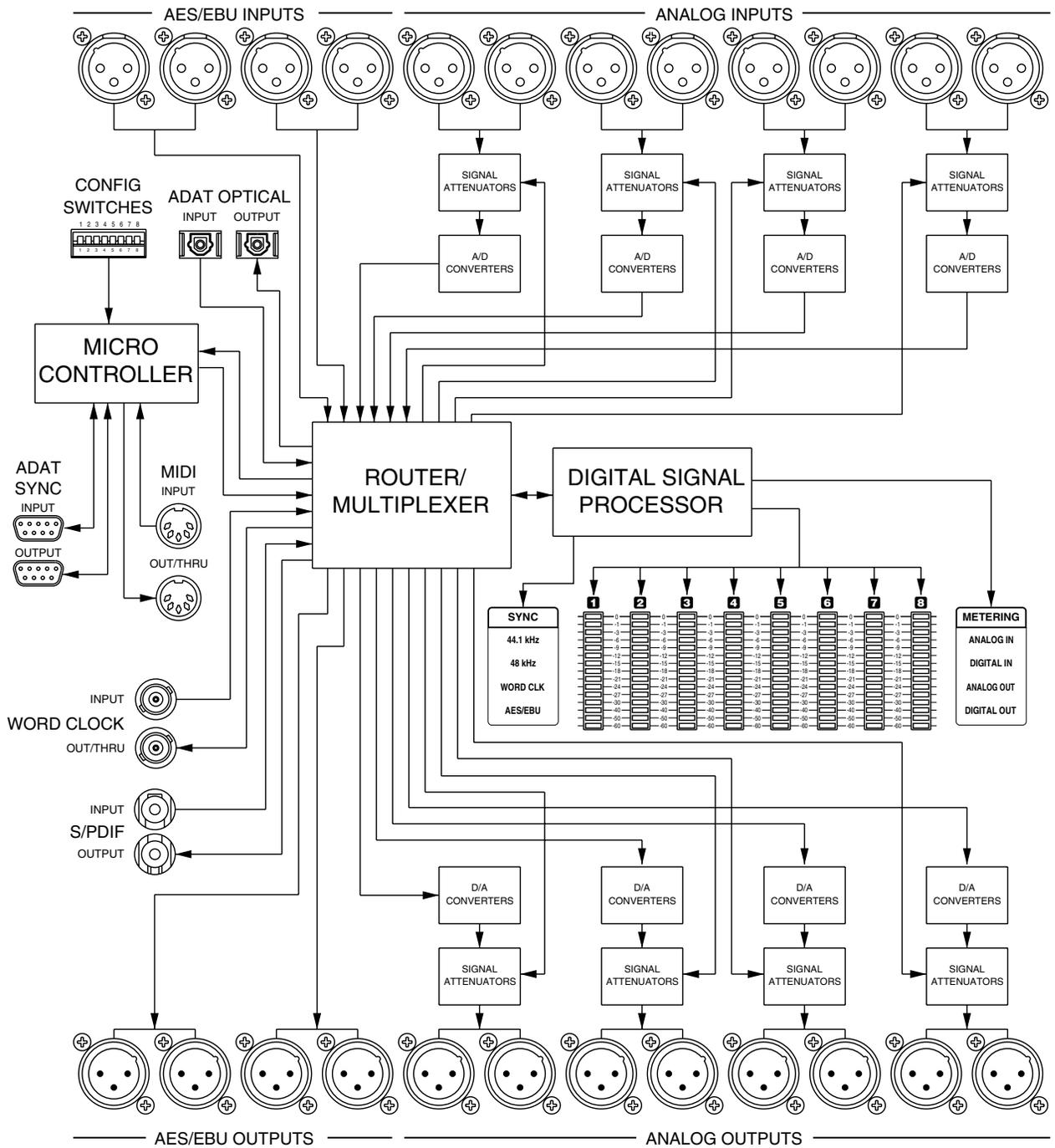
Input/Output

Analog Inputs	Eight, XLR-female, 20-kilohms line-level balanced bridging
Analog Outputs	Eight, XLR male, 320-ohms source impedance, balanced

Digital Audio I/O		
	AES-3 Input;	Four, XLR-female
	AES-3 Output:	Four, XLR-male
	S/PDIF I/O:	Two, RCA female
	Optical (ADAT):	Two, TOSLINK optical

Other Digital I/O		
	Word Clock:	Two, BNC male
	MIDI Input:	One, DIN-5 female
	MIDI Output:	One, DIN-5 female
	ADAT Sync Input:	One, DB9 female
	ADAT Sync Output:	One, DB9 female

Maximum input level	+25 dBu
Maximum output level	+25 dBu open circuit

Performance Data	Analog-to-Digital
Conversion	24-bit delta/sigma
Signal to Noise Ratio (A-weighted)	> 113dBFS
THD+Noise	< 0.005%, 0dBFS, 1kHz
Frequency Response	20 - 20kHz +/-0.5 dB
Dynamic Range	> 113dB

Performance Data	Digital-to-Analog
Conversion	24-bit delta/sigma
Signal to Noise Ratio (A-weighted)	> 105dBFS
THD+Noise	< 0.005%, 0dBFS, 1kHz
Frequency Response	20 - 20kHz +/-0.5 dB
Dynamic Range	> 105dB

Physical

Size (hwd), in & cm	3.469 x 19 x 8.5 in (8.81 x 48.26 x 21.59 cm)
Weight, lbs & kg	14 lbs (6.36kg) net 15 lbs (6.82kg) shipping

Electrical

Power requirements	117V AC nominal, 105-125VAC 50-60 Hz, 40 watts 230V AC nominal, 205-253V AC 50 Hz, 40 watts

Note   The maximum operating ambient temperature is 25 degrees C.

In the interest of continuous product improvement, Lucid reserves the right to alter, change, or modify these specifications without prior notice.

Lucid Limited Warranty

Lucid expressly warrants that the product will be free from defects in material and workmanship for a period of (18) months from the date of shipment. Lucid's obligation under this warranty will be limited to repairing or replacing, at Lucid's option, the part or parts of the product which prove defective in material or workmanship within one year from date of purchase, provided that the Buyer gives Lucid prompt notice of any defect or failure and satisfactory proof thereof. Products may be returned by Buyer only after a Return Authorization number (RA) has been obtained from Lucid. Buyer will prepay all freight charges to return the product to the Lucid factory. Lucid reserves the right to inspect any products which may be the subject of any warranty claim before repair or replacement is carried out. Lucid may, at its option, require proof of the original date of purchase (dated copy of original invoice). Final determination of warranty coverage lies solely with Lucid. Products repaired under warranty will be returned freight prepaid by Lucid via United Parcel Service (surface shipping), to any location within the continental United States. At Buyer's request, the shipment may be returned via airfreight at Buyer's expense. Outside the continental United States, products will be returned freight collect.

The foregoing warranties are in lieu of all other warranties, whether oral, written, express, implied or statutory. Lucid expressly disclaims any IMPLIED warranties, including fitness for a particular purpose or merchantability. Lucid's warranty obligation and Buyer's remedies hereunder are SOLELY and exclusively as stated herein.

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Lucid does not authorize any third party, including any dealer or sales representative, to assume any liability or make any additional warranties or representation regarding this product.

This limited warranty gives the buyer certain rights. You may have additional rights provided by applicable law.

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<u>Declaration of Conformity</u>

We, **Lucid**, a division of Symetrix Inc., 6408 216th St. SW,
Mountlake Terrace, Washington, USA, declare under our sole responsibility that the product:

<u>ADA8824 A/D - D/A Platform</u>

to which this declaration relates, is in conformity with the following standards:

EN 60065
Safety requirements for mains operated electronic and related
apparatus for household and similar general use.

EN 55103-1
Electromagnetic compatibility - Generic emission standard
Part 1: Residential, commercial, and light industry.

EN 55103-2
Electromagnetic compatibility - Generic immunity standard
Part 1: Residential, commercial, and light industry.

The technical construction file is maintained at:

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Mountlake Terrace, WA, 98043
USA

The authorized representative located within the European Community is:

World Marketing Associates
P.O. Box 100
St. Austell, Cornwall, PL26 6YU, U.K.

Date of issue: <u>April 12th, 1999</u>

Place of issue: <u>Mountlake Terrace, Washington, USA</u>

Authorized signature:

Dane Butcher, President, **Lucid**