



**AD9624 & DA9624
24-Bit Converters
User's Guide**

TABLE OF CONTENTS

<i>Section 1</i>	Introduction	1
<i>Section 2</i>	Operator Safety Summary	2
<i>Section 3</i>	Fast Setup	
	AD9624	4
	DA9624	6
<i>Section 4</i>	Product Description	
	AD9624 Front Panel Overview	8
	AD9624 Rear Panel Overview	9
	DA9624 Front Panel Overview	10
	DA9624 Rear Panel Overview	11
<i>Section 5</i>	Using the AD9624 & the DA9624	12
<i>Section 6</i>	Specifications	
	AD9624	16
	DA9624	17
<i>Section 7</i>	Warranty and Service	18
<i>Section 8</i>	Declaration of Conformity	19

Rev C.00, 27 January, 2000

Lucid part number 5396240C00

Specifications subject to change without notice.

©2000 Lucid. All rights reserved.

Lucid is a registered trademark of Symetrix, Inc.

Mention of third-party products is for informational purposes only and constitutes neither an endorsement nor a recommendation. Lucid assumes no responsibility with regard to the performance or use of these products.

Under copyright laws, no part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, scanning, recording or by any information storage and retrieval system, without permission, in writing, from Lucid.

Lucid
6408 216th St. SW
Mountlake Terrace, WA 98043 USA
Tel: 425.778.7728
Fax: 425.778.7727
Email: lucid@lucidaudio.com
Website: www.lucidaudio.com

The Lucid AD9624 24-bit A/D Converter and DA9624 24-bit D/A Converter each provide 24-bit conversion for recording, mastering or post production systems. Both two-channel units also offer 96kHz conversion for maximum sampling bandwidth.

The AD9624 accepts two balanced or unbalanced analog audio signals and delivers 24-bit digital audio via AES/EBU, TOSLINK, or S/PDIF digital outputs. The internally generated sample rates are: 32kHz, 44.1kHz, 48kHz, 88.2kHz, and 96kHz. The AD9624 also provides optional 16-bit noise shaping on all outputs. Two twenty-segment LED meters allow easy yet accurate level setting. The AD9624 is intended for use in +4dBu signal level systems.

The DA9624 accepts one AES/EBU, TOSLINK, or S/PDIF 24-bit digital input and delivers two balanced or unbalanced analog outputs. The DA9624 provides digital-to-analog conversion at sample rates of 96kHz, 88.2kHz, 48kHz, 44.1kHz, and 32kHz. An independent headphone output allows instant monitoring. Two twenty-segment LED ladders guide you through output level setting. The analog output signals appear on XLR-3 and 1/4-inch TRS connectors for easy connection to both balanced and unbalanced systems. The DA9624 operates at +4dBu signal levels.

Both converters are housed in a half-rack sized chassis. The RM-4 rack mount tray (not supplied) mounts any two 9624 series modules in one unit of rack space.

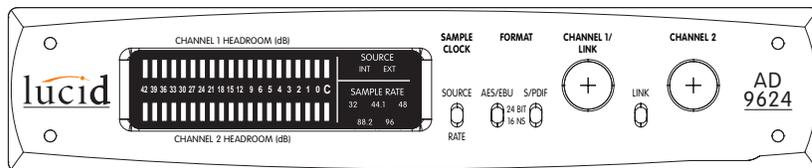
Both converters require an external power supply, the Lucid PS-3 or Lucid PS-3E (export). One supply is required for each converter.

This manual covers both products. 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 (98%) of your questions, both technical as well as musical. Please feel free to contact us if you have additional questions, comments or suggestions.

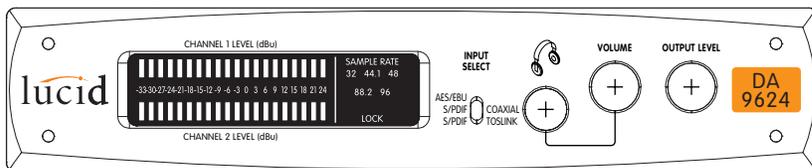
Phone: 425.778.7728

Fax: 425.778.7727

Email: lucid@lucidaudio.com



AD9624 24-Bit A/D Converter



DA9624 24-Bit D/A Converter

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 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.



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 pouvant etre reparaee l'usager.
 S'adresser a un reparaateur competent.

Terms

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

Note Identifies information that needs extra emphasis. A Note 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 AD9624 and DA9624 converters use an external power supply (Lucid PS-3 or PS-3E). The choice of power supply determines the mains voltage required for proper operation. Refer to power supply markings for the correct AC source value.

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.
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 attempt to disassemble the external power supply. 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.

This section discusses a multitude of things, all related to getting signals in and out of the AD9624 and getting on with using it.

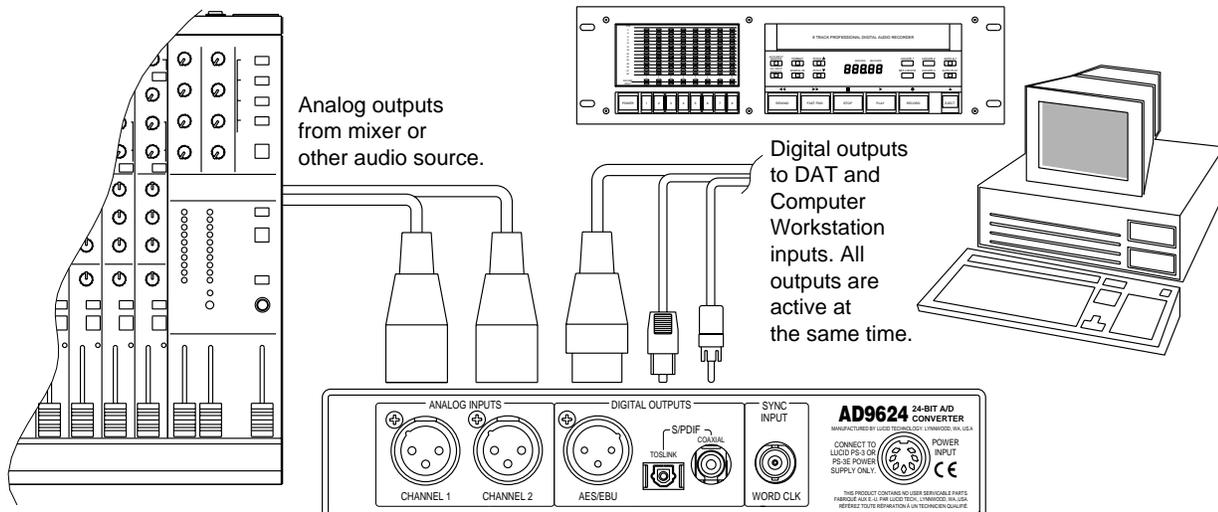


Figure 3-1. AD9624 Connections

Analog Input Connections

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 pin 3/cold to the source ground.

The AD9624 is designed to operate around nominal +4dBu signal levels.

Digital Output Connections

It is not necessary to connect to all of these connectors at any given time. The connectors used or not used depend on your specific application.

- Connect the AES/EBU output connectors to AES/EBU digital audio inputs.
- Connect the TOSLINK S/PDIF connectors to an optical consumer digital audio input.
- Connect the RCA (coaxial) S/PDIF connector to a consumer digital audio input.
- Connect the Sync/Word Clock input connector to a source of digital audio word clock.

Settings

Set the front panel switches as required by your situation and by the equipment connected to the rear panel connectors. If you are driving a 16-bit device, then use the 16-bit noise shaping to handle the lower eight bits of data.

Set your levels as you would for any digital audio processor. If you use a tone to line the meters up with your console, then with your console's meters at 0VU, set the level controls for either -18dBFS or -12dBFS on the AD9624's meters. This is just a starting point, and you may want to alter this relationship. Set your levels low enough that the CLIP indicator never illuminates.

The LINK switch makes the Channel 1 level control affect both channels simultaneously. When the switch is DOWN, the two level controls act independently.

FAST SETUP - DA9624

This section discusses a multitude of things, all related to getting signals in and out of the DA9624 and getting on with using it.

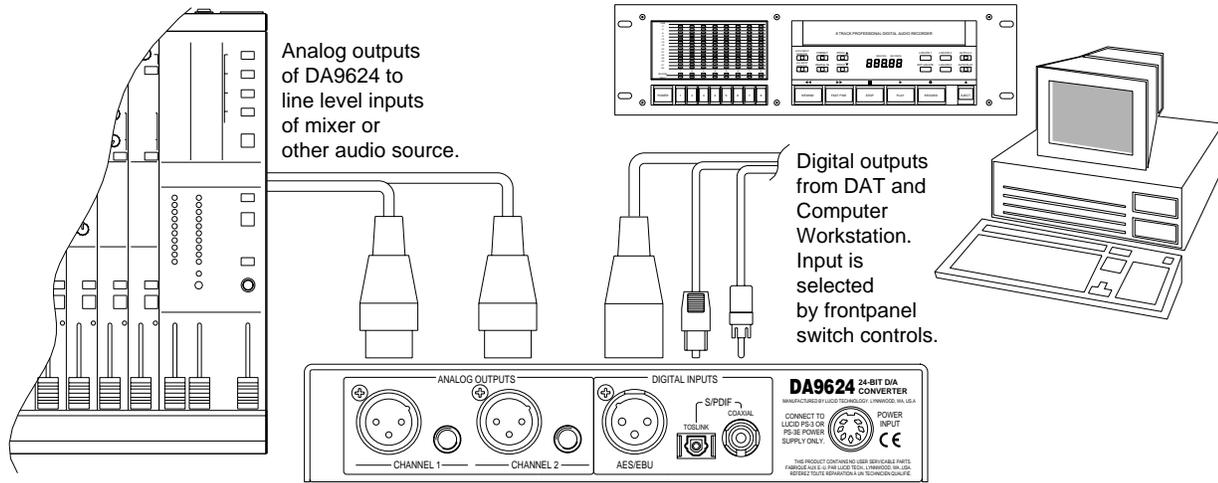


Figure 3-2. Connections

Analog Output Connections

It is not necessary to connect to all of these connectors at any given time. The connectors used or not used depend on your specific application.

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, internal jumpers allow configuring the output as floating balanced. This configuration emulates a floating transformer winding and is tolerant of having one of its ends grounded. With the jumpers configured as supplied from the factory, you must float (don't connect it) pin 3 or the sleeve.

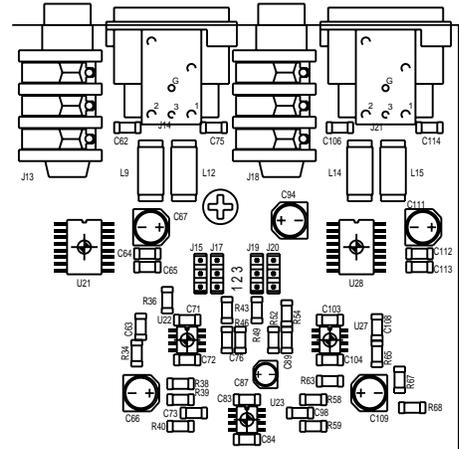
Unbalanced Output Jumpers

The DA9624 has a pair of floating-balanced output drivers that are available via internal jumpers. The floating balanced output emulates a floating transformer winding. You should use these when one or more of the following conditions are true:

- Your application requires that you be able to plug the outputs of the DA9624 into a wide variety of inputs that may be balanced or unbalanced.
- You want to use the DA9624 with an unbalanced input and you don't have a TRS cable with the ring connection open circuited.

To enable the floating balanced output:

1. Remove the cover from the DA9624 by removing the four top cover screws and the 2 screws on each side of the unit.
2. Remove the cover and set it aside.
3. Locate the jumpers (about an inch from the rear of the unit and between the two analog output XLR connections).
4. For floating balanced output, the four jumpers should be installed at positions 2-3 (four places). For the default differential balanced output, install the four jumpers at positions 1-2.
5. Replace the cover and reinstall the cover screws. It may be handy to add a piece of suitably marked tape to the unit indicating the jumper status.



When using the DA9624 with unbalanced inputs, it is extremely important that the conversion to an unbalanced signal occur at the DA9624 rather than at the receiving device.

This output configuration decreases the dynamic range by 1dB.

Digital Input Connections

It is not necessary to connect to all of these connectors at any given time. The connectors used or not used depend on your specific application.

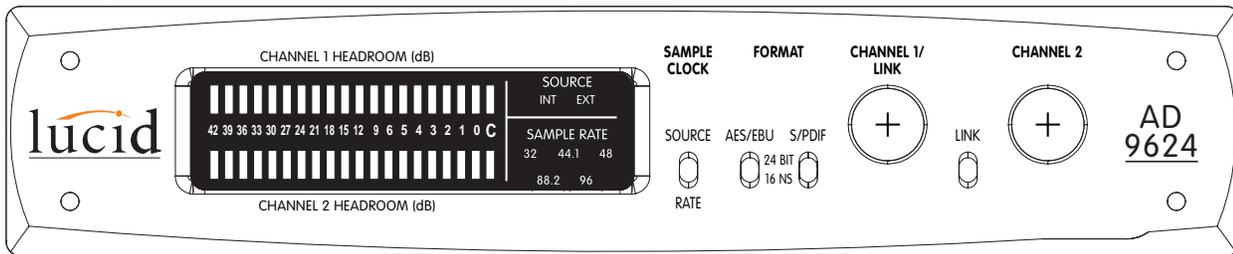
Connect the AES/EBU input connectors to AES/EBU digital audio sources.

Connect the S/PDIF connectors to consumer audio digital inputs. Use the TOSLINK optical connector for S/PDIF optical signals.

Select the appropriate input connector via the front panel switch.

Level Setting

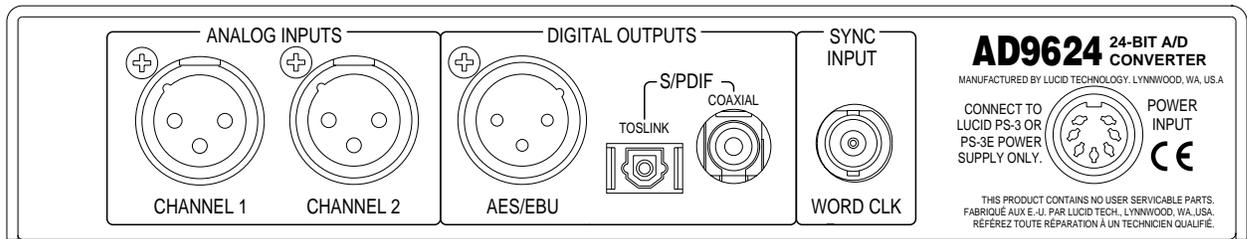
The front panel level control determines the output level of the DA9624. The meters monitor the analog outputs of the unit. Set the level control so that the output level remains below clipping. Note that it is possible for the input of the receiving device to clip before the DA9624's output do. In most cases, reducing the gain setting of the receiving (downstream) device doesn't help, as the source of the overload is ahead of the gain control. The proper course of action here is to reduce the output level of the DA9624 by reducing the setting of the Output Level control.



- METER window Displays the signal levels, sample rate, output protocol, and presence of valid word clock.
- LED meters 20-segment LED bargraph meters display digital output signal levels. These meters are peak responding with peak-hold. The (labeled 'C') indicator requires three consecutively clipped samples to illuminate.
- Clip
- Sample Rate display Displays the selected sample rate as well as the source of Word Clock.
- SAMPLE RATE switch Three-position momentary toggle switch. Toggling the switch UP selects between internal and external clock sources. Toggling the switch DOWN selects between 32, 44.1, 48, 88.2, and 96kHz sample rates.
- WORD LENGTH switches Selects between 24-bit and 16-bit word lengths for the AES/EBU and S/PDIF outputs. The 16-bit setting incorporates noise shaping into the conversion process.

Note You may select different word lengths for the different protocols.
- CHANNEL 1/LINK Adjusts sensitivity of the analog input(s). When the LINK switch is control set to the LINK position, this control simultaneously adjusts the level of both channels.
- CHANNEL 2 control Adjusts the sensitivity of the analog input for channel 2. This control is only active when the LINK switch is set to the DOWN position.

PRODUCT DESCRIPTION - AD9624 REAR PANEL OVERVIEW



Analog Inputs

Two XLR-3 female connectors. These connectors accept analog audio signals from balanced or unbalanced sources. The input impedance is 10k balanced or 5k unbalanced. The input topology is a simple differential amplifier. The maximum input level is +25dBu. This connector should be driven from a low source impedance. Be sure to ground the low side of the input (pin 3) when connecting unbalanced sources. Ideally pin 3 would be connected to pin 1 at the unbalanced source.

AES/EBU Output

XLR-3 male connector. This connector delivers digital audio signals using the AES-3 protocol. A front-panel switch determines the word length for this output.

S/PDIF Output

TOSLINK (optical) and RCA female (coaxial) connector. These connectors deliver S/PDIF digital audio signals. A front-panel switch determines the word length for this output.

Sync/Word Clock

BNC male connector. This connector accepts word clock signals. Word clock is a method of synchronizing multiple digital audio signals.

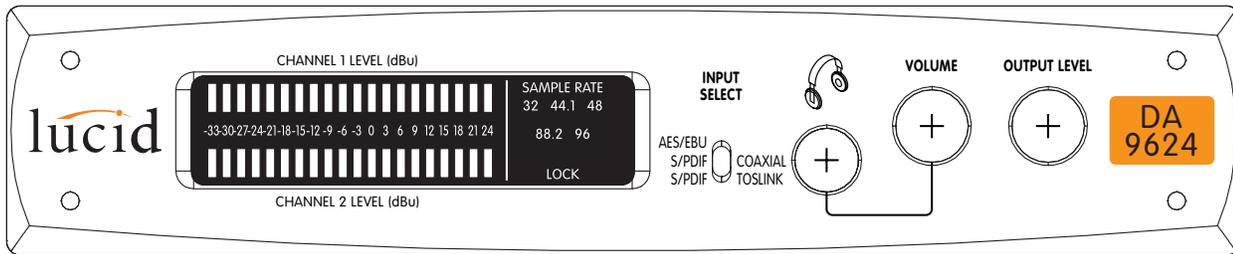
AC Power Input

7-pin DIN connector. Use only Lucid PS-3 or Lucid PS-3E power supplies. Connect only to appropriate AC power source. Refer to power supply marking for correct AC source value.

The choice of power supply determines the proper AC mains voltage required for operation.

Note There are no fuses, user accessible or not.

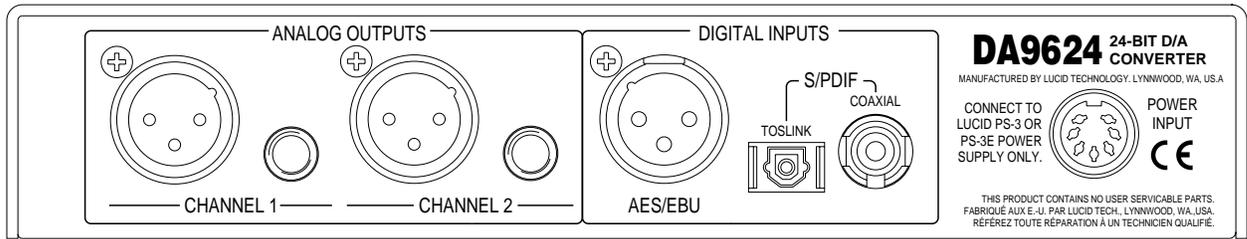
PRODUCT DESCRIPTION - DA9624 FRONT PANEL OVERVIEW



METER window	Displays the signal levels, sample rate, and presence of valid digital audio source data.
LED meters	20-segment LED bargraph meters display analog output signal levels.
INPUT SELECT	Three-position toggle switch selects between AES/EBU, S/PDIF coaxial, and S/PDIF TOSLINK digital audio inputs.
Headphone jack	1/4" TRS jack for stereo headphones. Suitable for headphones with 60-ohm impedance or higher. For maximum stereo, use headphones similar to the Sony MDR-7506, or anything that you can drive to reasonable levels using a Sony Walkman®. ¹
VOLUME	Adjust volume level of Headphone Jack.
OUTPUT LEVEL	Ganged control simultaneously adjusts the output level of Left and Right analog outputs.

¹Walkman is a trademark of Sony Corporation.

PRODUCT DESCRIPTION - DA9624 REAR PANEL OVERVIEW



Analog Outputs

XLR-3 male and 1/4-inch TRS connectors. These parallel-wired connectors deliver balanced audio signals from a 102-ohms source. The output stage emulates a grounded center-tapped transformer. The maximum output level is +25 dBu. For unbalanced loads, either float the unused output pin (usually pin 3 or ring), or if you have no other choice, ground it at the DA9624.

Digital Inputs

Select the desired input via the front panel switch.

XLR-3 female

This connector accepts digital audio signals using the AES-3 connector protocol (which includes older AES/EBU signals).

TOSLINK optical

This connector accepts digital audio signals using the S/PDIF connector protocol.

Coaxial connector

This RCA-female connector accepts digital audio signals using the S/PDIF protocol.

AC Power Input

7-pin DIN connector. Use only Lucid PS-3 or Lucid PS-3E power supplies. Connect only to appropriate AC power source. Refer to power supply marking for correct AC source value.

The choice of power supply determines the proper AC mains voltage required for operation.

Note There are no fuses, user accessible or not.

This chapter discusses various aspects of the operation of each converter. For the most part, this applies to both units, but if it doesn't, we'll let you know.

Why 24-bit?

The obvious answer is: "More is better." If you need more, consider:

- The trouble zone for any converter is the last (lowest) one or two bits of resolution. At 24-bit resolution, the amount of signal represented gets smaller, which means that if there is trouble in the lowest bits, this represents less of the overall signal. Remember that the output signal swing is fixed, so we're simply dividing the output signal into smaller and smaller pieces. Yes, in 24-bit converters, the output noise floor is also lower, and so we're actually getting two extra benefits for using a higher resolution converter.
- If you're mastering directly to DAT, using a 24-bit converter and letting the converter dither the result to 16-bit is superior to using the 16-bit converters in your DAT machine.
- For some material (especially if it has little dynamic range), you may get superior results by converting to 24-bit and throwing away the last 8 bits (truncation).
- If you're downloading into a digital audio workstation (DAW) directly from your mixer (and you have a 24-bit capable DAW), then it makes sense to use a high-resolution converter. Perform all workstation tasks at 24-bit wordlength, and do the final dithering to 16-bit when you record the CD master disk. When you fiddle with signals in DSP, the simple act of changing the gain can increase your wordlength. Having the extra resolution at the onset means less error when the increase in wordlength exceeds the internal capabilities of your DAW software (rounding error).

AD9624 Level Setting

Like any A/D converter, the converter's digital 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. 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 more 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 digital recorder or workstation.

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

Because our ears are unable to detect short-duration clipping, the AD9624's meter requires three consecutively clipped samples in order to indicate clipping. Whatever you do, you should try to avoid seeing the C (clip) segment on the AD9624's meter.

Clock and Sync Issues

Any time that you have multiple digital audio signals at one time the issue of sync becomes important. If you are using multiple AD9624s for multitrack work, it may be necessary to synchronize the converters in all of the different converter boxes. You do this by using the Word Clock input on the rear of the unit. You can chain multiple units together by using a Tee connector. In many cases, the digital multitrack can handle non-synchronized sources, so this may not be an issue. Experimentation (before that important session) is the key here.

To Dither or not to Dither, That is the question.

What is dither? Dither takes two forms: very low level white noise added to the signal before conversion, or a similar process performed after conversion via a DSP chip. In some respects, dither allows 16-bit digital to act more like good old-fashioned analog. No, there's no tape compression, but the ability to resolve details that reside in the noise floor (like ambience, decay, and space) remains.

The second dither method mentioned above takes place in the digital domain. Having a 24-bit wordlength allows this with a minimum of compromise. We can add white noise at a sufficiently low level to only modulate the last one or two bits of the 16-bit signal. This has the effect of putting a slight veil on the signal, resulting in reduced soundstage, definition, and clarity.

An improved method (which of course is what the AD9624 uses) is known as "noise shaping." Noise shaping alters the audibility of the dither signal by equalizing or shaping its spectrum. This minimizes its audibility by moving the noise away from the parts of the spectrum where our ears are most sensitive (-3kHz) and placing it into an area where our ears are less sensitive (10-22kHz).

When should you dither? Once, and once only. Dithering should be your last step upon leaving the 24-bit domain and entering the 16-bit domain.

System Interface

Interfacing any recently manufactured piece of audio equipment into your studio can be challenging, perhaps even painful. It doesn't have to be. Still, with the wide variety of different input and output circuit topologies, it doesn't hurt to have a bit of background information.

Input

The AD9624 has two balanced inputs, appearing on XLR connectors. Pin 1 is ground, and it connects directly to the chassis as well as to the internal circuit ground. Pin 2 is hot, and pin 3 is cold. A simple differential amplifier implements the balanced input.

Coming from a balanced system, it should be as simple as plug and play. Leave pin 1 connected unless you hear hum. You can try lifting it (at the source). Use whichever method results in the lowest noise floor. Ideally, you should only hear hiss.

Coming from an unbalanced system, the best connection method takes advantage of the AD9624's balanced input (in spite of the unbalanced source). Do this by running shielded twisted pair (that's 2 wires plus the shield; i.e. balanced mike cable) from the AD9624's balanced input to the output of the unbalanced device. Once there, connect the hot lead to the unbalanced source's hot lead, connect the low lead and the shield together and connect them to the ground of the unbalanced device.

Note If you want the absolute lowest noise floor, then you really should operate the AD9624 in a fully balanced environment.

Output

The DA9624 has two balanced outputs that appear both on XLR connectors as well as 1/4-inch TRS connectors. The connectors are wired in parallel, so doing something electrically to one affects the other. Two cascaded inverting amplifiers implement the balanced output. This simulates a transformer winding with its center tap connected to ground.

In a balanced system, simply plug and play. Again, pin 1 is ground, pin 2 hot, and pin 3 cold. You may need to float pin 1, preferably at the DA9624.

In an unbalanced system, things get a bit more complicated. There are three options.

1. Float (do not connect) the cold side of the output. For the XLR connector, this is pin 3, for the TRS connector it is the ring. Note that there is a -6dB level difference for this connection.
2. Insert a tip-sleeve phone plug into the TRS connector and go for it. The bad part of this method is that one side of the balanced output gets to drive a dead short. The worst of it is that the short circuit current (which is not musical in the least) flows into the ground system, where it could cause trouble.
Please: try to do this only when forced to.

-
-
3. If you're going to be installing the DA9624 into a situation where its outputs may be driving an unbalanced input one moment and a balanced input the next, it is worth your while to get inside the box and rearrange some jumpers. This configures the output stage as a floating-balanced (cross-coupled) line driver and the balanced outputs behave like an ungrounded (floating) transformer winding.

The advantage to doing this is that there is no level difference between balanced and unbalanced, and the circuit could care less if you ground the cold side to make it unbalanced. If you do need to operate the DA9624 with its outputs unbalanced, do the unbalancing right at the rear panel of the DA9624.

The procedure for changing the jumper settings can be found in Section 3 - Fast Setup.

Configuring the output this way reduces the dynamic range by about 1dB.

Digital I/O

The AD9624 has three digital outputs: AES/EBU (XLR-M), TOSLINK (optical), and Coaxial (RCA). The TOSLINK and Coaxial outputs use the S/PDIF protocol primarily used by consumer equipment. The TOSLINK output is limited to about 30 feet (approx. 10 meters), and the coaxial output is limited to about 10 feet (approx. 2 meters), depending on the quality of the coaxial cable.

The AES/EBU output is balanced, and for long cable runs, you may want to use 110-ohm cable to match the characteristic impedance of the output. (Belden 1800A as an example. Runs of several hundred feet are easily accomplished with this cable.)

Note The AD9624 has two front panel switches that select the noise shaping/wordlength for the two output protocols. There are three different output jacks, and all of them are active during use. You can use any combination of the outputs simultaneously. Be aware that the S/PDIF switch affects both the coaxial (RCA) and TOSLINK connections.

The DA9624 has three digital inputs: AES/EBU (XLR-F), TOSLINK (optical) and Coaxial (RCA). The AES/EBU input is balanced, and the coaxial input is unbalanced. However, both inputs are transformer-isolated.

Note The DA9624 has a front panel switch that selects the input connection to be used. It is permissible to have something connected to any of the inputs in any combination.

For More Information

Consult Bob Katz' website: <http://www.digido.com>. Bob is a well-known and respected mastering engineer and his website has a wealth of information on it. This is worth your time.

Input/Output

Analog Inputs	Two balanced XLR
Digital Outputs	One AES/EBU (XLR), One S/PDIF (coaxial), One S/PDIF (TOSLINK optical)
Word Clock	BNC
Analog input impedance	10k Ω balanced, 5k Ω unbalanced
Maximum analog input level (at full CCW)	+25 dBu balanced
Maximum analog input level (at full CW)	+4 dBu balanced

Performance Data

Internally generated sample rates	96kHz, 88.2kHz, 48kHz, 44.1kHz, and 32kHz and external sync via Word Clock	
Conversion	24-bit delta/sigma	
THD+Noise	< 0.002% (-1dBFS out, 1kHz)	
Dynamic Range	> 115dB, A-weighted, input level at full CCW, 48kHz sampling rate	
Frequency Response		
	For sample rates of 88.2kHz and 96kHz	20Hz - 40kHz (+/-1dB)
	For sample rates of 44.1kHz and 48kHz	20Hz - 20kHz (+/-0.5dB)
	For sample rate of 32kHz	20Hz - 15kHz (+/-0.5dB)

Physical

Size (hwd), in & cm	1.72 in. (h) x 8.5 in. (w) x 8.25 in. (d) 4.37 cm. (h) x 21.59 cm. (w) x 20.96 cm. (d)
Weight, lbs & kg	3.7 lbs (1.665 kg) net 6.6 lbs (2.97 kg) shipping

Electrical

Power requirements	117V AC nominal, 105-125VAC 50-60 Hz, 10 watts 230V AC nominal, 205-253V AC 50 Hz, 10 watts
Power supply	External AC (Lucid PS-3 or PS-3E) via 7-pin DIN connector

Note: The maximum operating ambient temperature is 25 degrees C.

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

SPECIFICATIONS - DA9624

Input/Output

Digital Inputs	One AES/EBU (XLR), One S/PDIF (coaxial), One S/PDIF (TOSLINK optical)
Analog Outputs	Two balanced XLR, two balanced and unbalanced 1/4" TRS, One front panel-mounted headphone output (stereo 1/4" TRS)
Analog output impedance	100 Ω balanced, 50 Ω unbalanced, Optional floating balanced line driver
Analog output gain range	- ∞ to +25dB (+/-2dB)
Maximum analog output level	+25dBu (+/-1dB)
Maximum headphone output level	20V peak to peak into 2000 Ω , 80 Ω output impedance

Performance Data

Conversion	24-bit delta/sigma
THD+Noise	< 0.002% (-1dBFS in, 1kHz)
Dynamic Range	> 114dB, A-weighted
Frequency Response	
For sample rates of 88.2kHz and 96kHz	20Hz - 40kHz (+/-1dB)
For sample rates of 44.1kHz and 48kHz	20Hz - 20kHz (+/-0.5dB)
For sample rate of 32kHz	20Hz - 15kHz (+/-0.5dB)

Physical

Size (hwd), in & cm	1.72 in. (h) x 8.5 in. (w) x 8.25 in. (d) 4.37 cm. (h) x 21.59 cm. (w) x 20.96 cm. (d)
Weight, lbs & kg	3.7 lbs (1.665 kg) net 6.6 lbs (2.97 kg) shipping

Electrical

Power requirements	117V AC nominal, 105-125VAC 50-60 Hz, 10 watts 230V AC nominal, 205-253V AC 50 Hz, 10 watts
Power supply	External AC (Lucid PS-3 or PS-3E) via 7-pin DIN connector

Note: The maximum operating ambient temperature is 25 degrees C.

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

Warranty

Following are the terms and limitations of the Lucid warranty.

Lucid expressly warrants to the original purchaser ("Buyer"), subject to the terms and conditions set forth below, that the Product will be free from defects in material and workmanship as a result of normal commercial use for (18) months from the date of shipment.

Some Lucid products contain embedded software and may also be accompanied by control software intended to be run on a personal computer. Said software is specifically excluded from this warranty.

Lucid's warranty obligation is limited to the repair, replacement, or refund at Lucid's sole discretion, of the part or parts of the Product which may thus prove defective in materials or workmanship within (18) months from date of shipment under normal use and which our examination discloses to our satisfaction to be thus defective, provided that Buyer gives Lucid prompt notice of its warranty claim and satisfactory proof thereof.

Lucid will make every reasonable effort to ensure that parts are available to support the repair of our products under warranty. In the event that a product or component part thereof becomes obsolete, unavailable or irreparable, Lucid reserves the right to refund a prorated portion of the purchase price in full satisfaction of all warranty claims.

In order to serve you better we require that the Buyer shall, prior to shipping Product to Lucid for warranty service, contact Lucid and secure a Return Authorization Number that shall be included with the returned Product. This will facilitate our efforts to keep track of your Product and process your warranty repair as quickly as possible. Buyer will prepay all freight charges to ship the Product to Lucid for warranty inspection and service. This warranty is subject to Lucid's inspection of the Product at its facilities and, upon Lucid's request, satisfactory proof of purchase (dated copy of original retail dealer's invoice.)

Lucid reserves the right to effect repairs to the product with reconditioned components/parts. Products once repaired under warranty will be shipped to Buyer freight prepaid by Lucid via United Parcel Service (surface) or any similar shipper, to any location designated by buyer within the Continental United States. At Buyer's request and expense Product will be returned via airfreight. Outside the continental United States, repaired or replaced products will be returned freight collect.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, ARISING BY LAW OR OTHERWISE (INCLUDING, WITHOUT LIMITATION ANY OBLIGATIONS OF THE SELLER WITH RESPECT TO CONSEQUENTIAL DAMAGES) INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES ON OUR PART, AND WE NEITHER ASSUME, NOR AUTHORIZE ANY OTHER PERSON TO ASSUME FOR US, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THE PRODUCT. THIS WARRANTY SHALL NOT APPLY TO THIS PRODUCT OR ANY PART THERE OF WHICH HAS BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. WE MAKE NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY US. THE TERM ORIGINAL PURCHASER, AS USED IN THIS WARRANTY SHALL BE DEEMED TO MEAN THAT PERSON OR COMPANY THAT ORIGINALLY PURCHASED THE PRODUCT.

This Lucid product has been designed and manufactured for use in professional/industrial systems and is not intended for other usage. This warranty only applies to Buyers using the Product in professional/industrial systems. With respect to others, including but not limited to consumers for personal, family, or household use, Lucid expressly disclaims all warranties, including but not limited to warranties of merchantability and fitness for a particular purpose and the express warranties as otherwise provided herein.

Lucid reserves the right to modify the design or make additions to, or improvements to, its product lines without making similar upgrades to Product purchased by Buyer. Lucid does not authorize any third party, including any dealer or sales representative, to assume any liability, effect any repairs or modifications to the Product, or make any additional warranties or representation regarding the Product or Product information on behalf of Lucid.

Lucid's total liability on any claim, whether in contract, tort (including negligence) or otherwise arising out of, connected with, or resulting from the manufacture, sale, delivery, resale, repair, replacement or use of Product will not exceed the purchase price of the Product or any part thereof which gives rise to the claim. In no event will Lucid be liable for any incidental or consequential damages including but not limited to damage for lost revenue, cost of capital, claims of customers for service interruptions or failure to supply, and costs and expenses incurred in connection with labor, overhead, transportation, installation or removal of products or substitute facilities or supply houses as a result of Product failure.

This limited warranty gives Buyer certain rights. Buyer may have additional rights under applicable law.

LIMITATION OF LIABILITY

The total liability of Lucid on any claim, whether in contract, tort (including negligence) or otherwise arising out of, connected with, or resulting from the manufacture, sale, delivery, resale, repair, replacement or use of any product will not exceed the price allocable to the product or any part thereof which gives rise to the claim. In no event will Lucid be liable for any incidental or consequential damages including but not limited to damage for loss of revenue, cost of capital, claims of customers for service interruptions or failure to supply, and costs and expenses incurred in connection with labor, overhead, transportation, installation or removal of products or substitute facilities or supply houses.

How to contact Lucid Tech Support

US callers should phone:	(425) 778-7728
International callers should phone:	(01) 425-778-7728
Fax:	(425) 778-7727
E-mail:	tech@lucidaudio.com
Web site:	www.lucidaudio.com

Servicing your Lucid product

For US Customers:

If you have determined that your Lucid product requires repair services and you reside in the US, please contact our Customer Service Department for a return authorization (RA) number. Phone (425) 778-7728 or email: tech@lucidaudio.com

If the warranty period has passed, you'll be billed for all necessary parts, labor, packaging materials, and freight charges. Please remember, you must call for an RA number before sending the unit to Lucid.

For International Customers:

If you live outside of the United States, please contact your local Lucid dealer or distributor for instructions on how to obtain service.

Declaration of Conformity

We, **Lucid**, 6408 216th St. SW, Mountlake Terrace, Washington, USA,
declare under our sole responsibility that the products:

AD9624 & DA9624 Converters

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

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:

Lucid

6408 216th St. SW
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.

Completion date: July 13th, 1999

Place of issue: Mountlake Terrace, Washington, USA



Authorized signature:

Dane Butcher, President, **Lucid**

lucid

6408 216th St. SW

Mountlake Terrace, WA 98043 USA

Tel: 425.778.7728

Fax: 425.778.7727

Email: lucid@lucidaudio.com

Website: www.lucidaudio.com
