Lynx AES16

192 kHz Multichannel AES/EBU Interface

User Manual

Contents

1   Introduction

Thank you for choosing the Lynx AES16™ PCI audio interface. The AES16 has been designed to provide you with the highest quality professional audio performance available, offering unequalled AES/EBU channel capacity and routing flexibility.

Even if you're an experienced audio professional, please take a few moments to read through this users' manual. It will help to streamline the installation procedure, and acquaint you with the AES16's superior feature set, allowing you to quickly realize the full potential of this powerful audio tool.

1.1   Overview

The AES16 turns your computer into a powerful digital audio workstation, giving you up to sixteen channels of professional AES/EBU digital input and output at sampling rates up to 192 kHz. Its integrated 32-channel software mixer provides zero-latency monitoring, with unprecedented control and matrixing flexibility. With support for Windows and Macintosh computers, the AES16 can store and recall an unlimited number of routing configurations and mixer scenes, providing you with a virtual digital patch bay.

The AES16 supports the latest single-wire AES/EBU 192 kHz standard for up to 16 channels of digital input and output, and is also compatible with existing dual-wire 96 kHz and 192 kHz devices. Up to four AES16 cards can be installed in a single host computer to deliver a total of 64 inputs and 64 outputs of ultra-high bandwidth audio performance.

With exclusive SynchroLock™ technology, the AES16 provides unmatched tolerance to jitter when synchronizing to external clocks, making it an ideal solution for longer cable runs and other sources where noise may be an issue. The SynchroLock output can also provide a clean and accurate clock output for other audio devices.

The AES16 provides ultra low latency drivers for most Windows protocols including WDM, MME, ASIO 2.0, GSIF, DirectSound and Direct Kernel Streaming, and for Macintosh protocols including ASIO 2.0 under OS9 and Core Audio under OS X.

1.2   Features

➢   16 channel "single-wire" digital I/O at sample rates up to 192 kHz

➢   8 channel "dual-wire" digital I/O at sample rates up to 192 kHz

➢   Eight stereo record and playback devices available to audio applications

➢   Transformer-coupled 24-bit AES/EBU inputs and outputs available on XLR or DB25 cables

➢   Eight channels of mastering-quality sample rate conversion available (on model AES16-SRC)

➢   Sync to external AES/EBU signals or word clocks

➢   SynchroLock™ technology provides superior immunity to jitter in clock sources

➢   On-board zero-latency digital mixer provides extensive routing capabilities with patch-bay functionality

➢   Optimized DMA engine offers extremely efficient PCI bus transfers

➢   Low-latency drivers for Windows 2000/XP – supports WDM, MME, ASIO 2.0, GSIF, DirectSound, and Direct Kernel Streaming

➢   Low-latency drivers for Macintosh – supports ASIO 2.0 for OS9 and Core Audio for OS X

➢   "Direct-connect" cabling available for digital mixers, recorders and converters from Yamaha, Sony, Tascam, Mackie, Wheatstone, Apogee, Benchmark Media and other manufacturers

➢   Designed and manufactured in the USA by Lynx Studio Technology, Inc.

1.3   Before you begin

Before you begin using the AES16, we recommend you read through this manual and familiarize yourself with the installation and operational procedures of this device. It is highly recommended that you have a good working knowledge of Windows and/or Macintosh operating system basics, and an understanding of computer hardware basics. This information is widely available on the web and from various computer hardware and software manufacturers.

We also strongly recommend you familiarize yourself with the basics of digital audio and computer recording, and particularly with the basic functionality of your chosen audio software. A solid grasp of the operational fundamentals of your Digital Audio Workstation software and its user interface will go a long way toward enhancing your experience with the AES16.

1.4   In the box

The following items are included in your AES16 carton:

➢ AES16 PCI card in cushioned antistatic bag
➢ Two AES16 cables (CBL-AES1604 six-foot cable with 8 XLR connectors. Included with models AES-16XLR and AES16-SRC only.)
➢ Lynx Installation CD containing current drivers and this manual
➢ Warranty registration card
➢ Quick Start Guide

If any items are missing or damaged, please contact your dealer or Lynx at http://www.lynxstudio.com.

1.5   System requirements

Below are listed the minimum hardware and operating system requirements for compatibility with the AES16. It is important to note that most professional audio applications place significant demands on your computer's resources, and it is therefore recommended that you meet or exceed the recommended system requirements for your Digital Audio Workstation software, which will likely be greater than those listed for the AES16. Please refer to your audio software's documentation for more information.

1.5.1   Windows

➢ Pentium II class computer or better
➢ 32 MB RAM
➢ One empty PCI slot
➢ PCI or AGP Graphics card
➢ Video display with 1024 x 768 minimum resolution
➢ Windows 2000 or Windows XP

NOTE: The AES16 is not supported under Windows 95, 98 or ME.

1.5.2   Macintosh

➢ Apple Macintosh G4 or later
➢ 32 MB RAM
➢ One empty PCI slot
➢ PCI or AGP Graphics card
➢ Video display with 1024 x 768 minimum resolution
➢ Macintosh OS 9.2.2 or OS X (10.2.8 or higher)

1.6   Nomenclature used in this manual

The following typographic conventions are used in this manual:

➢ Underlined text indicates characters that are to be typed using the computer keyboard.

➢ ALL UPPER CASE TEXT indicates the names of specific cable connectors.

➢ First Character Upper Case Text indicates Lynx mixer control names or menu options.

➢ Phrases, such as: Start > Programs > Lynx Studio Technology use the greater than symbol ("">"") to indicate multiple menu options or mouse selections.

2   Installation Procedures

The procedure for installing the AES16 requires that you physically install the AES16 card inside your computer before running the AES16 Setup Program.

The Setup Program will install the required driver files and the Lynx mixer application, as well as configure your system to recognize the AES16.

2.1   AES16 Hardware Installation

1.   Turn OFF the power to your computer system and disconnect the power cords.

2.   Touch a metal plate on your computer system to ground yourself and discharge any static electricity.

3.   Remove the cover from your computer chassis and select an empty PCI slot in your computer.

4.   You should refer to your computer system documentation for any special instructions on installing expansion cards and peripheral equipment.

5.   Unscrew and remove the slot cover from your selected PCI slot.

6.   Insert the AES16 into the selected PCI slot and press it down so that the contacts are securely seated.

7.   Secure the bracket of the AES16 card to the computer chassis using a chassis screw or retaining bracket.

8.   Replace the computer chassis cover and reconnect the power cord.

9.   Connect the Audio cables to the AES16. Refer to Section 3 Hardware Connections for more information.

10.   Install software using the installation procedure for your computer type and operating system from the following sections. Refer to Section 2.2 for Windows and Section 2.3 for Macintosh.

2.2   Windows Version 2 Driver Package (Windows 2000 and Windows XP)

The LynxTWO/AES16 Version 2 Driver Package provides the greatest compatibility with today's most popular audio and production software. Included are the following driver models:

➢   **ASIO** (Cubase, Nuendo, Sonar, Samplitude, Sequoia)
➢   **WDM/Direct Sound** (Sonar, Samplitude, Sequoia, Media Player)
➢   **MME** (Windows multi-media extensions)
➢   **GSIF** (Tascam GigaStudio)

The Version 2 driver also supports multi-channel playback for use with Surround Sound or other multi-channel encoded material.

In some cases, users require our older, NT4 based drivers for compatibility with their applications or context of use. Refer to the Appendix for installation information for the NT4 driver family.

2.2.1   Installation Files

The Lynx Installation CD contains all driver files mentioned in the subsequent installation steps, as well as the AES16 manual, driver release notes and test files. If you do not have a CDROM drive or need a more recent version, these files are available on our website at http://www.lynxstudio.com/download.html.
If you have downloaded newer drivers than those included on your Lynx Installation CD, please extract the driver to its default location, C:\Lynx. The following instructions can still be followed, simply type C:\Lynx as the location for driver files, rather than "removable media" as specified in these instructions.

2.2.2 Installing the Windows Version 2 Driver Package

1.   When you start Windows after installing the AES16 into your computer, the New Hardware Wizard will appear. Select "Install from a list or specific location" and click "Next >" to proceed. (NOTE: In Windows 2000, click "Next>" on the New Hardware Wizard welcome screen, on the Install Hardware Device Driver dialog box, choose "Display a list of the known drivers for this device" and click "Next>")

2.   From the next window, select "Search removable media". Click "Next >" to proceed. (NOTE: In Windows 2000 select "Sounds, video and game controllers" as a hardware type, and click "Next>". From the next screen click "Have Disk", then type in the drive letter of your CD-ROM drive, i.e. D:\, then click "OK". Select the AES16 or AES16-SRC from the list of choices and click "Next>".)
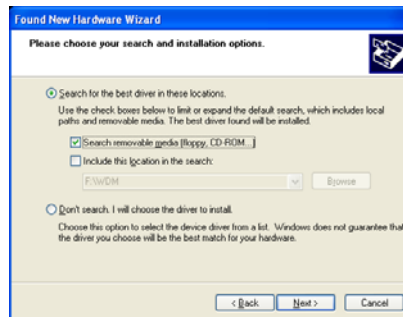
3.   Windows will begin to search for the appropriate driver files:

4.   You may receive a warning that the driver has not been digitally signed by Microsoft. It is perfectly safe to disregard this warning and select "Continue Anyway." (NOTE: In Windows 2000 click "Yes" to continue installation.)

5.   The driver installation will continue. After several moments, the new hardware wizard will indicate that it has completed the installation. Click "Finish":
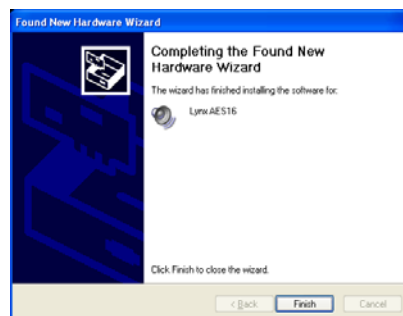
6.   Reboot the computer. The AES16 Card and Lynx Mixer application are now ready to use.

2.2.3 Uninstalling the AES16 Windows Version 2 Driver Package

1.   From the start menu, click on "Control Panel." (NOTE: In Windows 2000 click on Settings> Control Panel.)
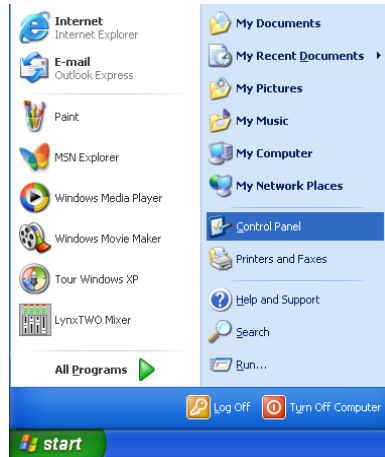
2.   Click "System" to launch System Properties:
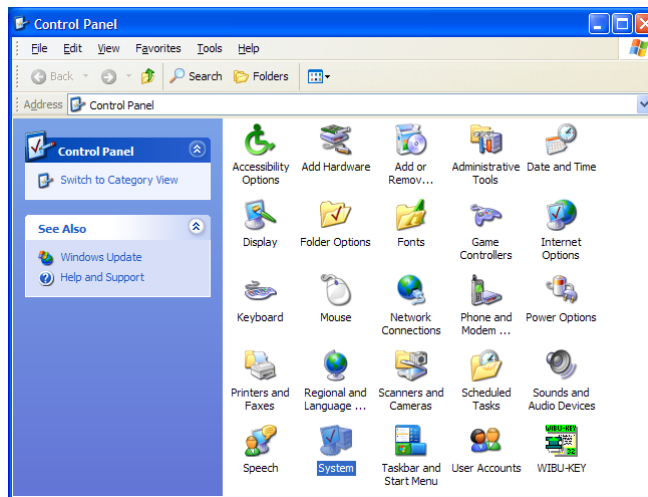
3.   Choose "Device Manager" from the "Hardware" tab:
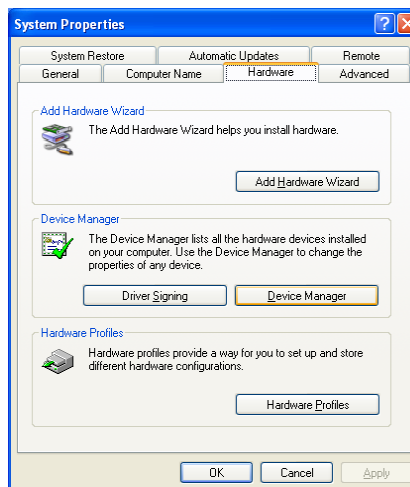
4. Expand the "Sound, video and game controllers" section of device manager be clicking its + sign:
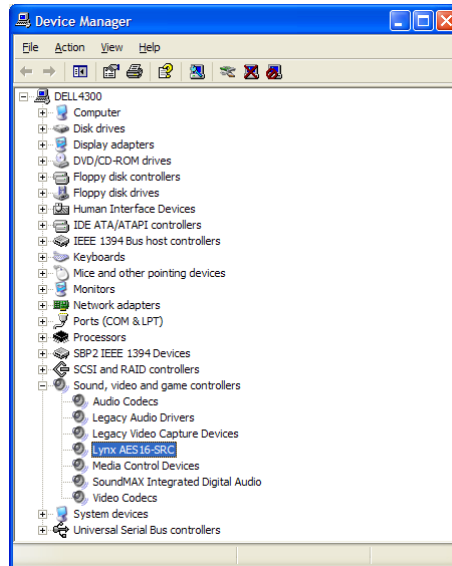
5. Right click on "Lynx AES16" and choose "Uninstall"
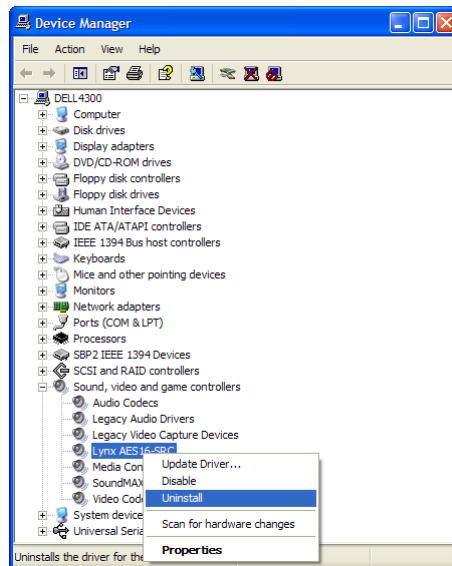
6. Confirm device removal by clicking "OK". (Note: In Windows 2000, click "Yes" when prompted to restart your computer.)
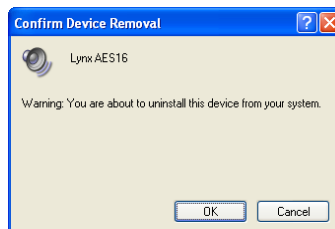
7. Reboot the computer

2.2.4 Updating an existing WDM driver:

Navigate your web browser to: http://www.lynxstudio.com/download.html. Scroll to the WDM driver section and click on the appropriate file to download.

1. Double-click the downloaded file to decompress, and accept the default destination folder of C:\Lynx.
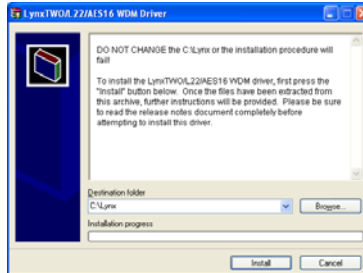
2. Click "Yes to All" when prompted to confirm the files to be replaced.
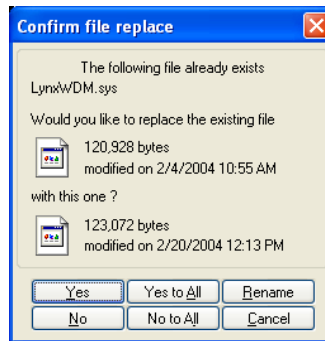
3. From the start menu, click on "Control Panel." (NOTE: In Windows 2000 click on "Settings > Control Panel.")

4.   Click "System" to launch System Properties.
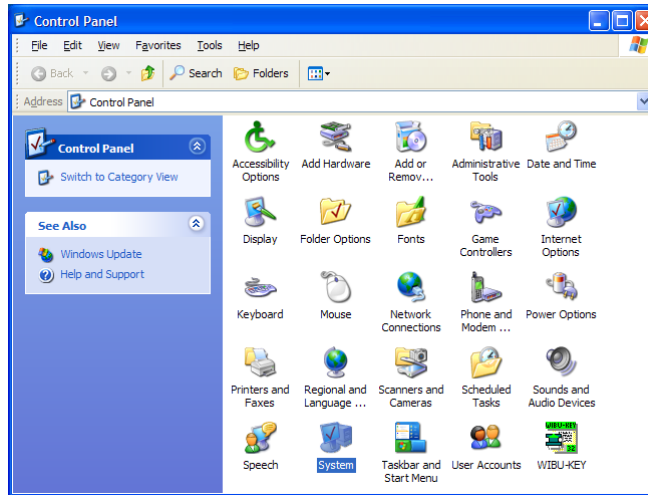
5.   Choose "Device Manager" from the "Hardware" tab.
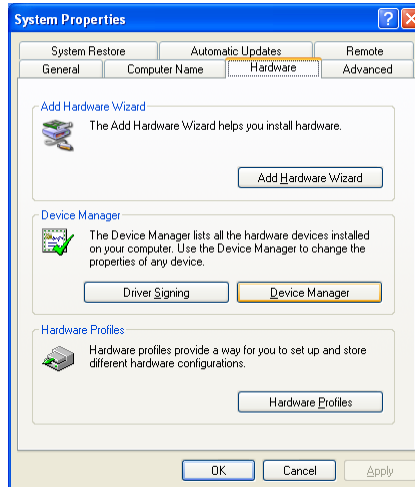
6.   Expand the "Sound, video and game controllers" section of device manager be clicking its + sign.
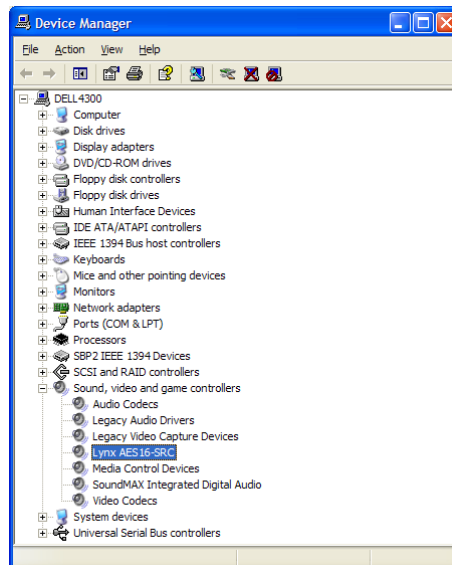
7.   Double click the "LynxAES16" entry to launch the LynxAES16 Properties dialog box. Click the "Driver" tab, then click "Update Driver…".
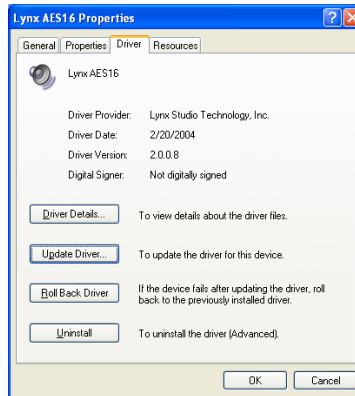
8.   When the Hardware Update Wizard box appears, choose "Install from a list or specific location (Advanced)" and click "Next>." (NOTE: In Windows 2000 click "Next>" on the Hardware Upgrade Wizard welcome screen.)

9.   From the next window, select "Don't search, I will choose the driver to install". Click "Next >" to proceed. (NOTE: (In Windows 2000, choose "Display a list of the known drivers for this device…" and click "Next>).
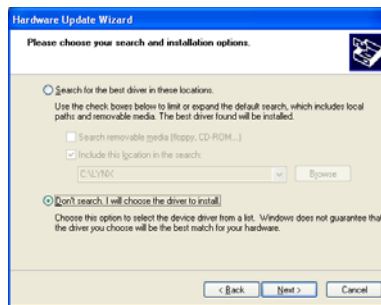
10.   When prompted to select a device driver, click "Have Disk".
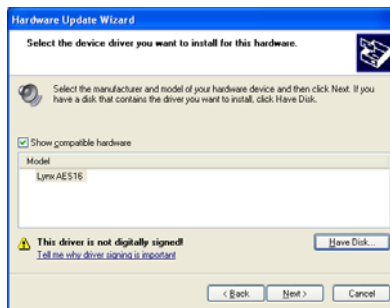
11.   Next, you'll be asked to insert the manufacturer's installation disk into the drive selected (the default is A:\) – type "C:\Lynx" in the text box, and click "OK".
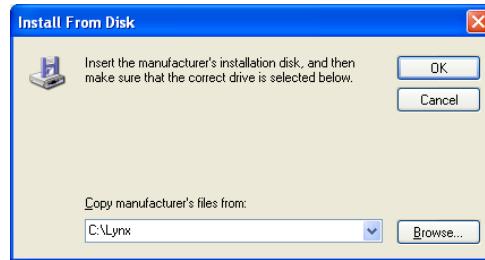
12.   You will be prompted to select the device driver you are installing. "Lynx AES16" will be your only choice. Select it and click "Next>". (NOTE: In Windows 2000, choose AES16 from the list, then click "Next>". Click "Next>" on the subsequent confirmation window as well).
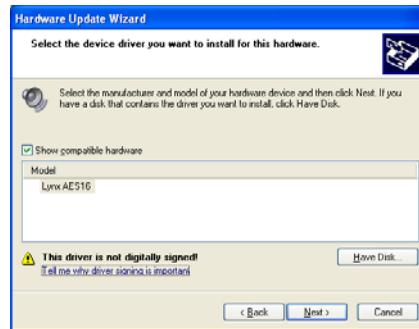
13.   You may receive a warning that the driver has not been digitally signed by Microsoft. It is perfectly safe to disregard this warning and click "Continue Anyway" to proceed with the installation. (NOTE: In Windows 2000 click "Yes" to continue installation.)
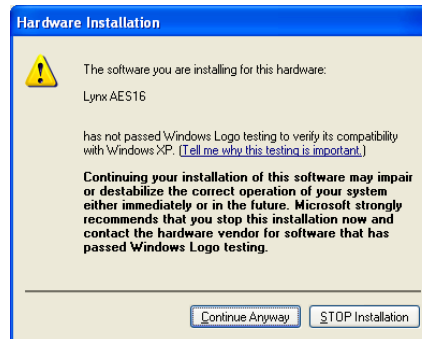
14.   The driver installation will continue. After several moments, the Hardware Update Wizard will indicate that it has completed the installation. Click "Finish". (NOTE: In Windows 2000 you will be prompted to restart the computer. There is one remaining step, so choose "No.")

15. Next, we need to update the Lynx Mixer. From the Start Menu, choose "My Computer." (NOTE: In Windows 2000 click the "My Computer" icon on the desktop.)

16. Double-click on the C: Hard Drive and look for the "Lynx" Folder. Double Click the folder to open it.
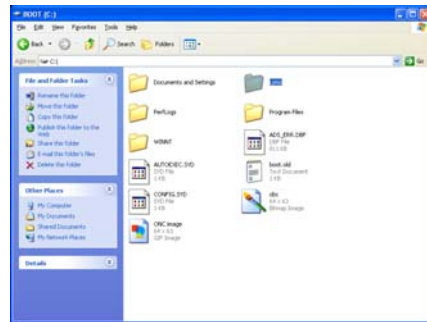
17. Right Click on the LynxApps file and click "Install"

18. The new Lynx Version 2 Driver Package is now ready to use.

2.3   Macintosh OS X

2.3.1   OS X Installation Files

The Lynx Installation CD contains all firmware and driver files mentioned in the subsequent installation steps, as well as the AES16 mixer, manual, driver release notes and test files. If you do not have a CDROM drive or need a more recent version, these files are available on our website at http://www.lynxstudio.com.

2.3.2   Firmware Update

For Macintosh compatibility, the firmware stored in the on-board flash memory must be updated prior to use. This is required because the AES16 ships from the factory with Windows firmware installed. To update the firmware:

1.   Locate the file L2Update_OSX.sit on the Lynx Installation CD and drag the file onto the computer desktop, or download the latest OS X firmware file from http://www.lynxstudio.com/download.html to the computer desktop.

2.   Double-click on the L2Update_OSX.sit file to launch the Stuffit Expander. If a simple double-click does not launch the Stuffit Expander, you may need to launch Stuffit Expander manually, and then open the L2Update_OSX.sit file using the Open command in the File menu. Drag the L2Update.app file to the desktop, which will decompress the firmware updater, and then close Stuffit Expander. An L2Update program icon should now be on your desktop.

3.   Make sure that no applications are open before running the firmware updater.

4.   Run L2Update by double clicking on the L2Update program icon.

5.   Enter your password in the Authenticate dialog box and click OK.

6.   In a few moments, the "Lynx Two Firmware Update" dialog box should appear. Confirm that the correct Lynx Card model appears under "Model" (please note: pictured below is the SRC version), and also confirm that the Firmware Version and New Firmware Versions are NOT the same. While the number "14" is seen on both the Firmware Version and New Firmware Version, the "W":is for Windows and the "M" is for Macintosh.

7.   Select "Update" and click OK when prompted to confirm the Update.

⚠ **While the firmware updater is programming the on-board flash memory, it is crucial that you do not power off the computer or interrupt the process in any way.**

8.   When the update is complete, you will be prompted to power off the computer.
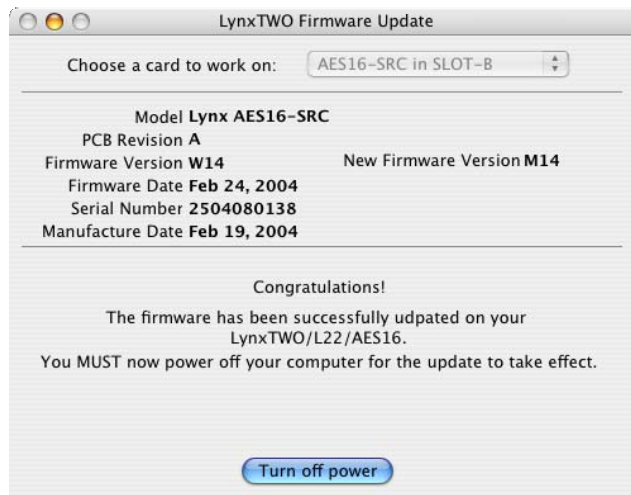
9.   After shutting down, wait for at least 10 seconds, then power the computer back on.

2.3.3 Install the AES16 Device Driver and Mixer

1.   Locate the file LynxTWO_OSX.sit on the AES16 Installation CD and drag the file onto the computer desktop, or download the latest OS X driver file from http://www.lynxstudio.com/download.html to the computer desktop.

2.   Double-click on the LynxTWO_OSX.sit file to launch the Stuffit Expander. If a simple double-click does not launch the Stuffit Expander, you may need to launch Stuffit Expander manually, and then open the LynxTWO_OSX.sit file using the Open command in the File menu.

3.   Drag the LynxTWO_OSX.pkg file to the desktop, which will decompress the driver file, and then close Stuffit Expander. A LynxTWO_OSX.pkg icon should now be on your desktop.

4.   Double-click on the LynxTWO_OSX.pkg file. This will start the driver installation.

5.   Click "Continue" at the "Install LynxTWO/L22/AES16 Audio Driver" dialog box.
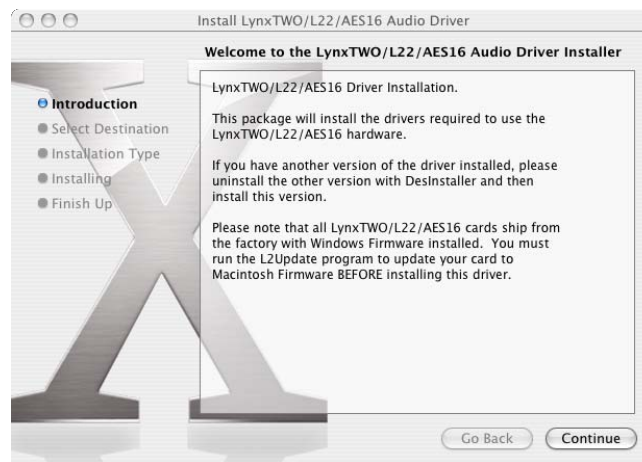
6.   When prompted to select a destination for the audio driver, click on "Macintosh HD" and then click "Continue".
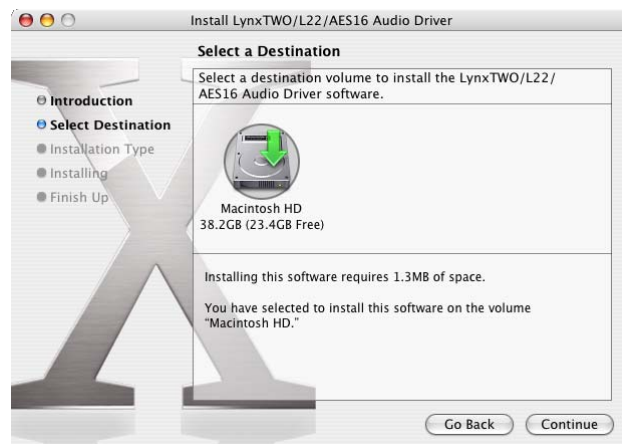
7.   Click "Install" on the next dialog box that appears.
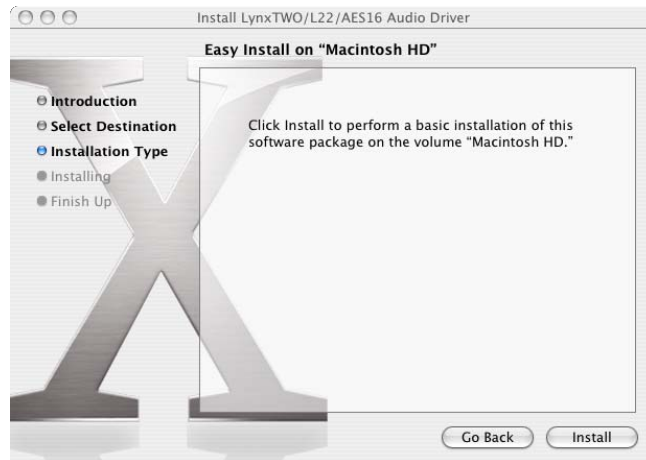
8.   Enter your password in the Authenticate dialog box and click OK.

9.   Click "Continue Installation" in the next dialog box that appears.
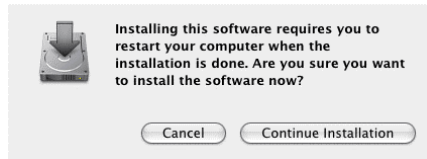
10.   When the install is complete, you will be prompted to restart the computer.

NOTE: The OS X installation process installs both the Core Audio driver and the Lynx Mixer application. The Lynx Mixer application is installed in the "Applications" folder.

2.3.4 Uninstalling the LynxTWO/L22/AES16 Device Driver and Mixer

To uninstall the driver, you will have to use a third-party uninstaller like DesInstaller, which you can get from: http://www.macfixit.com/library/osxu.shtml. Follow the uninstaller's instructions to remove the LynxTWO_OSX.pkg.

2.3.5 Updating the LynxTWO/L22/AES16 Device Driver and Mixer

To update the LynxTWO driver with a newer version, simply follow the instructions for uninstalling the driver and then install the newer version per the installation instructions. You may need to reconfigure the Lynx mixer and your recording application(s) after updating the driver.

2.4 Macintosh OS 9

2.4.1 Insert AES16 Installation CD in CD ROM Drive and Start Computer

The Installation CD contains all firmware and driver files mentioned in the subsequent installation steps, as well as the AES16 manual, driver release notes and test files. If you do not have a CDROM drive or need a more recent version, these files are available online at http://www.lynxstudio.com/download.html.
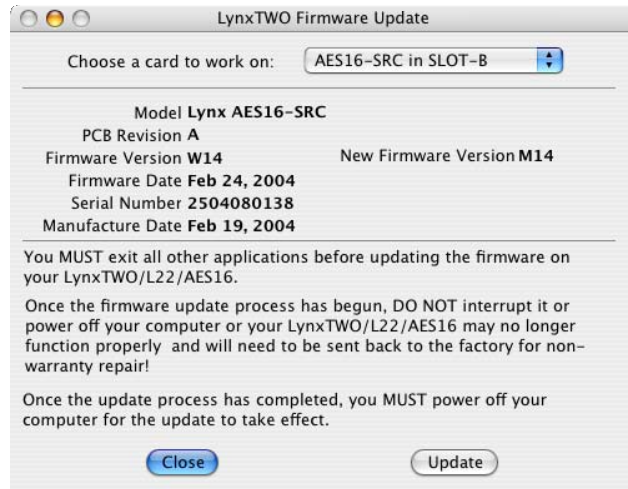
2.4.2 Firmware Update

For Macintosh compatibility, the firmware stored in the on-board flash memory must be updated prior to use. This is required because the AES16 ships from the factory with Windows firmware installed. To update the firmware:

1.   Locate the file L2Update_OS9.sit file on the AES16 Installation CD and drag the file onto the computer desktop, or download the latest OS9 firmware file from http://www.lynxstudio.com/download.html to the computer desktop.

2.   Expand the firmware updater to the desktop using Aladdin Expander 5.0 or higher. An L2Update program icon should now be on your desktop.

3.   Make sure that no applications are open before running the firmware updater.

4.   Run L2Update by double clicking on the L2Update program icon.

5.   In a few moments, the "LynxTwo/L22/AES16 Firmware Updater" dialog box should appear. Confirm that the correct Lynx Card model appears under "Model", and also confirm that the Firmware Version and New Firmware Versions are NOT the same.
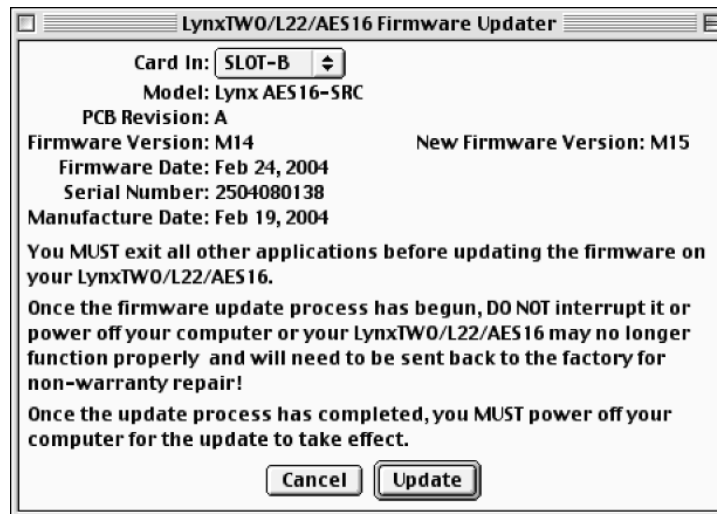

6.   Select "Update" and click "OK" when prompted to confirm the Update.

⚠ **While the firmware updater is programming the on-board flash memory, it is crucial that you do not power off the computer or interrupt the process in any way.**

7.　　　When the update is complete, you will be prompted to power off the computer.
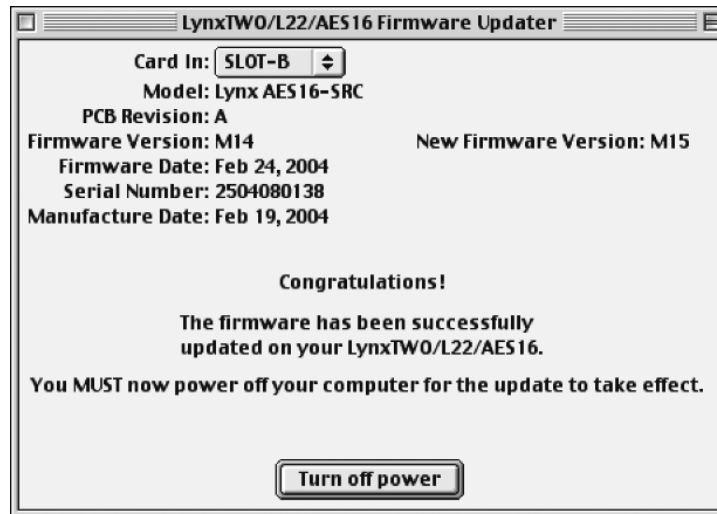
8.　　　After shutting down, wait for at least 10 seconds, and then power the computer back on.

2.4.3　Installing the OS9 ASIO Driver and Mixer

1.　　　Locate the file LynxTWO_OS9.sit file on the AES16 Installation CD and drag the file onto the computer desktop, or download the latest OS9 driver file from http://www.lynxstudio.com/download.html to the computer desktop.

2.　　　Expand the driver file to the desktop using Aladdin Expander 5.0 or higher. A "LynxTWO Mac ASIO Driver" folder should now be on your desktop.

3.　　　Open the LynxTWO Mac ASIO Driver folder and double click the "ASIO Drivers" folder to view the "LynxTWO" file.

4.　　　Locate the "ASIO Drivers" folder inside your audio application's folder. Move the LynxTWO file into this folder.

5.　　　Launch your audio application and choose the ASIO driver "LynxTWO" within the program. You can access the Lynx mixer program from within the ASIO control panel of your audio software.

2.4.4　Uninstalling the AES16 Device Driver and Mixer

To uninstall the driver, simply remove the LynxTWO file from the "ASIO Drivers" folder of your audio application.

2.4.5　Updating the AES16 Device Driver and Mixer

To update the AES16 driver with a newer version, replace the existing LynxTWO file from the "ASIO Drivers" folder of your audio application with the newer LynxTWO file.

3   Hardware Connections

3.1   Overview

The AES16 includes eight AES/EBU compatible inputs and outputs that provide sixteen channels of digital audio I/O. These signals are available on two bracket-mounted 26-pin high-density D connectors, labeled I/O Port A and I/O Port B as shown in Figure 1 below.

To accommodate a wide range of studio equipment, the signal routing on each of these ports can be configured using the I/O Configuration jumpers to support either four inputs and four outputs or eight inputs or outputs. Refer to Section 12.1 I/O Configuration Jumpers for more information on how to set these jumpers.

Also shown in Figure 1 are CLOCK IN and CLOCK OUT connectors that provide word clock I/O for internal synchronization with other installed cards. The LStream Port provides a connection for optional Lynx LStream expansion cards.
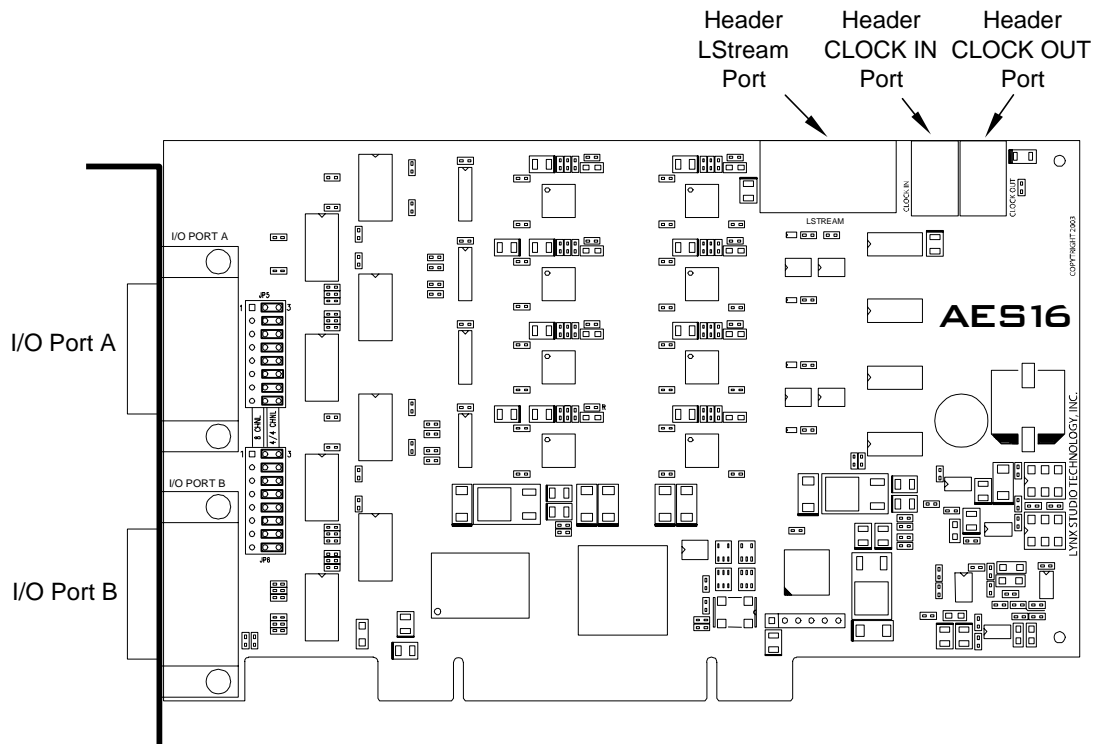
Figure 1: AES16 Board

3.2   AES/EBU Cable Connections

To minimize cabling issues, a variety of breakout cables are available for the AES16. The CBL-AES1604 cable, which is included with the AES16-XLR and AES16-SRC products, provides standard XLR connectors. The CBL-AES1603 and CBL-AES1605 are optional cables that provide 25-pin D-Sub connectors compatible with industry standard multi-channel digital equipment connectors. The following table describes these cables and their application. As listed in the table, the position of the I/O Configuration Jumper must match the cable used. Refer to Section 12.1 I/O Configuration Jumpers for more information.

Lynx Cable	Connector type and signals	Compatible Equipment	I/O Jumper Position
CBL-AES1603	Male DB25 for 8 AES in or out	Apogee AD16, AD16X, DA16, DA16X	8 CHNL
CBL-AES1604	4 male XLR for AES out, 4 female XLR for AES in, BNC for clock	Any device with standard AES/EBU XLR connectors	4/4 CHNL (default)
CBL-AES1605	Male DB25 for 4 AES in and 4 AES out (standard Yamaha pinout)	All Yamaha equipment with DB25 digital I/O including the following: • Apogee Rosetta 800 and AD-8000 • TC Electronics DSP 6000 • Mackie HDR24/96 and D8B	4/4 CHNL (default)

3.2.1   XLR Connections

The AES16-XLR and AES16-SRC include two CBL-AES1604 breakout cables with XLR connectors for digital audio signals and female BNC connectors for clock input and output. Connect the cables to I/O Ports A and B as shown in Figure 2 below. Tighten the thumbscrews on the cable shells for a secure connection.

It is important to note that the signals associated with each XLR and BNC connector depend on which I/O Port on is used. These signals are listed on the left side of the Figure 2.
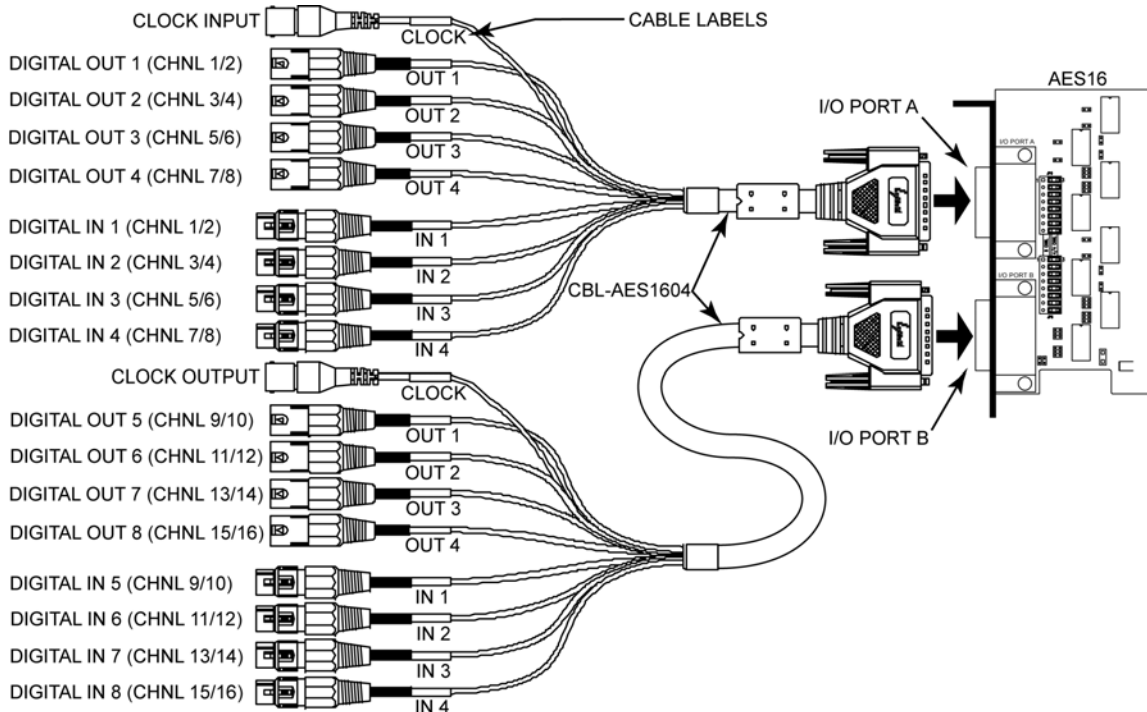
Figure 2: XLR Connections with CBL-AES1604 Cable

3.2.2 Connections to Equipment with 25-Pin AES/EBU D-Sub Connectors

The CBL-AES1603 and CBL-AES1605 breakout cables are provide 25-pin D-sub connections for industry standard equipment. Refer to the table in Section 3.2 AES/EBU Cable Connections for equipment compatibility information.

Connect the 26-pin high-density connecter on each cable to I/O Ports A and B. Connect the 25-pin D-sub connector on each cable to the external device. Tighten the thumbscrews on the cable shells for a secure connection.

The signals associated with each 25-pin D-sub connector depend on which I/O Port on is used according to the following table:

Lynx Cable	Port Connected To	Signals on 25-Pin D-sub
CBL-AES1603	I/O Port A	DIGITAL IN 1-8
CBL-AES1603	I/O Port B	DIGITAL OUT 1-8
CBL-AES1605	I/O Port A	DIGITAL IN 1-4 and DIGITAL OUT 1-4
CBL-AES1605	I/O Port B	DIGITAL IN 5-8 and DIGITAL 5-8

3.3 Clock Connections

In any system with more than one digital device, there can be only one master clock providing synchronization. Whether you designate the AES16 as the clock master (slaving all other devices to it) or slave the AES16 to another clock master, it is important that only a single device act as clock master, to prevent the occurrence of audible digital errors.

The AES16 provides connections that allow for synchronization with external equipment or internal devices within the computer.

3.3.1 External Clocking

Clock connections to external equipment are currently provided only with the CBL-AES1604 XLR breakout cable. However, the AES16 can still be synchronized to external equipment using its AES/EBU digital I/O.

With the CBL-AES1604 Cable connected to **I/O Port A** of the AES16, the BNC connector labeled CLOCK acts a clock *input*. This input supports TTL signal levels and is terminated with 75 ohms of impedance.

Connect this input to the clock output of an external device and select "External" as the Sample Clock Source in the Lynx Mixer. Adjust the Sample Clock Reference to match the incoming clock type.

With the CBL-AES1604 Cable connected to **I/O Port B** of the AES16, the BNC connector labeled CLOCK acts a word clock *output*. This output provides a 75-ohm TTL level signal at a frequency that tracks the sample clock rate of the AES16. Connect this output to the word clock input of an external device.

3.3.2   Internal Clocking and Multi-card Systems

Clock connections to internal equipment are provided via the header CLOCK IN and CLOCK OUT connectors on the AES16 board. Refer to Figure 1 for the location of these connectors. The connectors support 75-ohm, TTL level signals. If you are connecting to another Lynx digital audio card, the Lynx Internal Clock Cable (CBL-ICC) or Universal Clock Cable (CBL-UCC) should be used.

Connect the CLOCK IN connector to the clock output of an internal device and select "Header" as the clock source in the Lynx mixer. Adjust the clock Reference to match the incoming clock type.
The signal on the CLOCK OUT header is a word clock that tracks the sample rate of the AES16. Connect this output to the word clock input of an internal device or another AES16.

As shown below in Figure 3, multiple AES16s can be synchronized using the optional Internal Clock Cable. A daisy chain of CLOCK OUT to CLOCK IN is created so that all cards are tightly synchronized. Refer to Section 9 Configuring Multiple AES16's for more information.
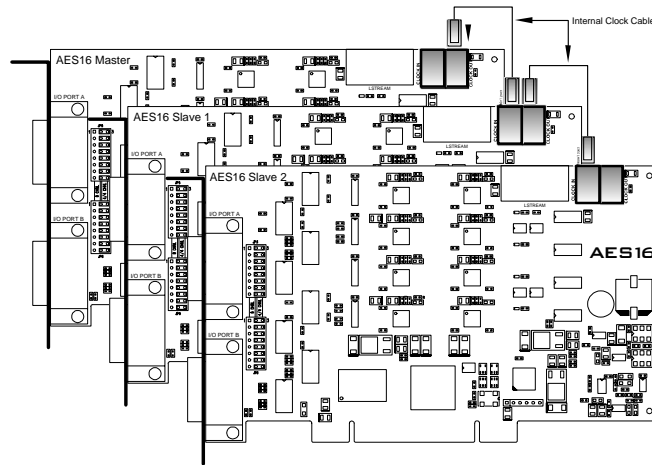
Figure 3: Synchronizing Multiple AES16's Using Internal Clock Connections

Note: If an appropriate internal clock cable is not available, multiple cards can be synchronized externally by using the BNC clock connections on the CBL-AES1604 cable. Use a standard 75-ohm BNC coaxial patch cable to connect the input clock signals to the output clock signals.

3.4   Common Studio Setups

This section describes typical studio setups using the AES16.

3.4.1   External A/D and D/A with Word Clock

The figure below illustrates the connection of an eight-channel A/D converter and an eight-channel D/A converter to I/O Port A of the AES16. This setup uses only half of the available I/O on the AES16. Additional converters can be connected to I/O Port B to provide up to 16 channels of A/D and D/A conversion.

Also shown is the use of the word clock output of the A/D as the system clock. This signal drives the word clock input of the AES16, which is available on the CLOCK BNC connector on the breakout cable attached to I/O Port A. Note: this connector is a word clock *output* when the cable is attached to I/O Port B. Also, a separate word clock connection is not always required since any of the four AES inputs connected to I/O Port A can be used as word clock sources.

I/O Configuration Jumper Settings
Confirm that the jumpers are set to the factory default 4/4 CHNL mode which accommodates the use of the CBL-AES1604 XLR cable. See Section 12.1 I/O Configuration Jumpers for more information.

AES16 Clock Settings
To select the external clock input as the sample clock source for the AES16, set the Sample Clock Source in the Adapter window of the Lynx Mixer to External. Set the Reference to Word.

External Equipment Clock Settings
Since the internal clock of the A/D converter is the clock master in this setup, change its clock setting to select its internal clock. Set the D/A converter to slave to one of its digital inputs. Alternatively, another word clock signal from the A/D or from I/O Port B of the AES16 could drive the word clock input of the D/A. In this case, the clock source of the D/A should be set to the appropriate setting for external word clock.
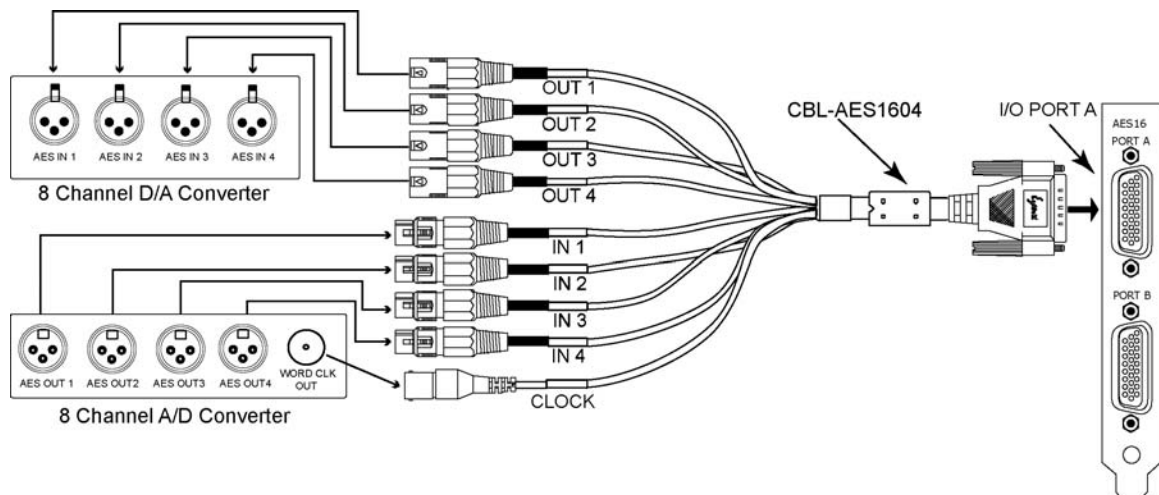
3.4.2   Digital Mixer

The figure below illustrates the connection to a digital mixer that has 16 channels of AES/EBU digital I/O. The D-Sub ports on the mixer must be compatible with the Yamaha multi-channel digital I/O standard. Each of these ports provides eight channels of input and eight channels of output.

In this setup, either the digital mixer or AES16 can act as the system clock master depending on the clock settings of each device. In each case, the clock is transmitted to the receiving device via the AES/EBU connection.

I/O Configuration Jumper Settings
Confirm that the jumpers are set to the factory default 4/4 CHNL mode which accommodates the use of the CBL-AES1605 XLR cable. See Section 12.1 I/O Configuration Jumpers for more information.

AES16 and External Equipment Clock Settings
To use the digital mixer as the clock master: set the Sample Clock Source in the Adapter window of the Lynx Mixer to Digital In 1. Set the Reference to Word. Change the clock source setting of the digital mixer to select its internal clock.

To use the AES16 as the clock master: set the Sample Clock Source in the Adapter window of the Lynx Mixer to Internal. Change the clock source setting of the digital mixer to select one of its digital inputs.
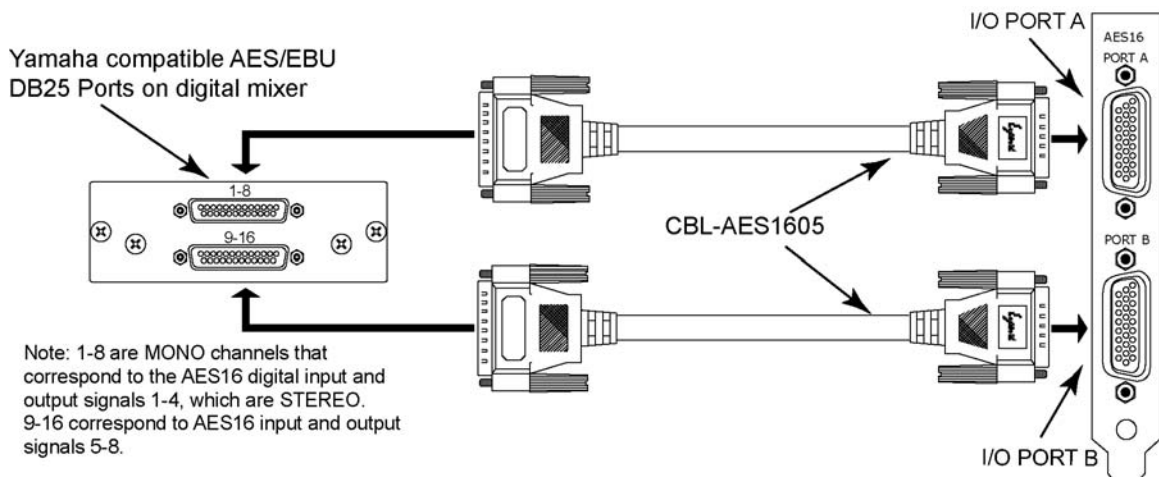
3.4.3 Combined Use of XLR and DB25 Cable sets

The figure below illustrates a "mixed mode" configuration, where the AES16 is connected to an Apogee AD16X 16-channel Analog-to-Digital converter and to some other 8-channel Digital-to-Analog converter. This represents a unique situation, in that the AD16X will utilize all 16 available input channels while connected to a single I/O port of the AES16, while only 8 output channels will be available to the D/A converter.
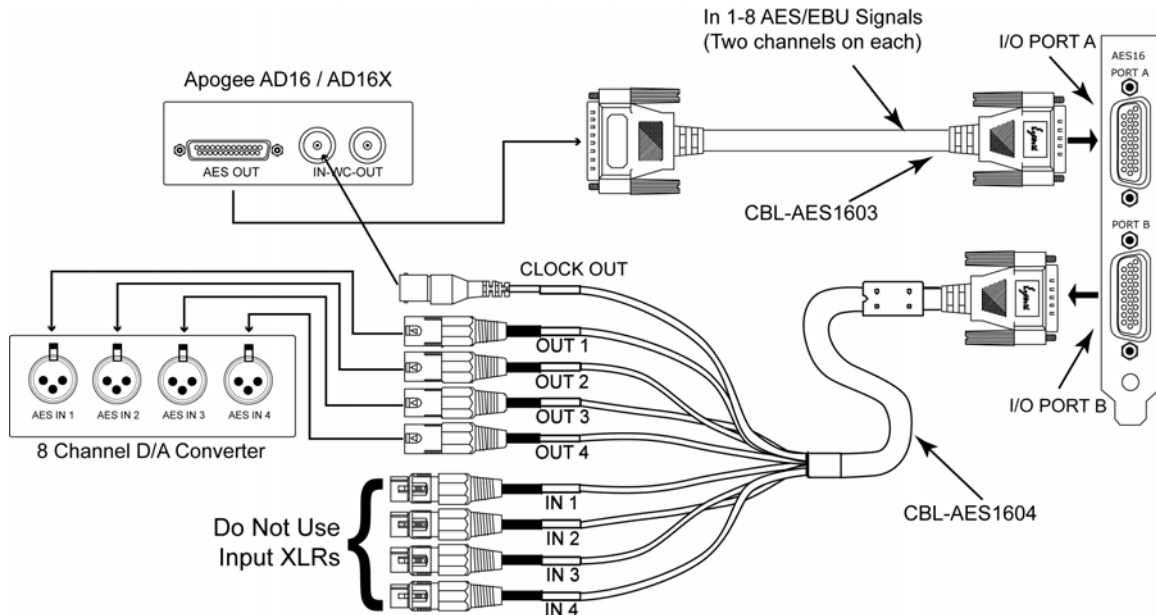
The AD16X is connected to the AES16 via our CBL-AES1603 cable, which is specifically designed to accommodate the Apogee 16-channel converters through their D-Sub port. I/O Port B in this example is connected to an 8-channel D/A converter using our CBL-AES1604 cable with standard XLR connections.

It is critical that the AES/EBU inputs on the CBL-AES1604 cable NOT be connected to any external device since these inputs are connected electrically to inputs on I/O Port A. Doing so will degrade the quality of the digital signal received on I/O Port A. Consequently, this configuration is limited to 16 input channels and 8 output channels, rather than the 16 in and 16 out which are possible with other cable set combinations.

PLEASE NOTE: Since the CBL-AES1605 supports input and output signals through a single connector, it is not advisable to use the CBL-AES1605 with the CBL-AES1603 at the same time.

In this example, the AES16 will function as the system clock master, with the Apogee AD16X and 8-channel D/A converter acting as clock slaves. As shown, the word clock output available on the BNC connection of the CBL-AES1604 cable is connected to the word clock input on the Apogee AD16X. The D/A converter can receive its clock via the AES/EBU signal from the AES16, or from the word clock out of the AD16X. If the word clock is used, a connection from the AD16X word clock out to the D/A word clock in is required.

I/O Configuration Jumper Settings
When using the CBL-AES1603 connected to an Apogee 16-channel converter, the associated I/O port on the AES16 must be set to 8 CHNL mode. For this example, set the jumper for I/O Port A to 8 CHNL mode. Confirm that the I/O Port B jumper is in the factory default 4/4 CHNL mode. See Section 12.1 I/O Configuration Jumpers for more information.

AES16 Clock Settings
To setup the AES16 as the system clock master, set Sample Clock Source in the Lynx Mixer Adapter window to Internal.

External Equipment Clock Settings
Change the clock setting on the AD16X to word clock in. This will force the AD16X to slave to the word clock from the AES16. Change the clock setting on the D/A converter to select one of its AES/EBU inputs as the clock source. Alternatively, if a word clock is connected to the D/A, set the clock source appropriately.

Additional Setups with Apogee Converters
It is also possible for the AD16X to be the system clock master for the AES16 and D/A converter. Since the CBL-AES1603 cable does not have a BNC connection for an external word clock input, the AES16 must use one of its digital inputs to derive a clock source. In this case, the Sample Clock Source setting in the Lynx Mixer Adapter window should be set to Digital In 1. The AD16X should be set to use its internal clock, and the 8-channel D/A converter should be set to receive clock from one of its AES/EBU inputs, or from word clock if the AD16X word clock output is connected to the D/A converter's word clock input.

If 16 channels of D/A and 8 channels of A/D conversion are required, an Apogee DA16X can be used with some other 8-channel Analog-to-Digital converter. In this case:
- Connect the DA16X and CBL-AES1603 to I/O Port B, and the A/D converter and CBL-AES1604 to I/O Port A.
- Set the I/O Port B configuration jumper to 8CHNL mode. Set the I/O Port A jumper to 4/4 CHNL mode.
- The XLR connectors representing outputs on the CBL-AES1604 cable must NOT be connected for similar reasons as described above.

4   Getting Started

With the AES16 and its drivers properly installed in your computer, you can begin to use its capabilities with most popular third party audio applications. In order for these applications to access the AES16 you must select one of the AES16 audio devices in the application's audio device configuration menu. Refer to Section 8 Working with Third Party Applications for more information.

The following sections provide instructions for testing your installation.

4.1   Windows Quick Audio Test

The installation of your AES16 can be tested using the Lynx Mixer and the Lynx Demo application included on the AES16 Installation CD. This is a quick way of verifying that the AES16 card is installed correctly and properly connected to your external equipment.

1. Download the Demo32.exe application from http://www.lynxstudio.com/drivers, or locate this file on the AES16 Installation CD that came with your AES16.

2. Locate "SineWaveMinus16.wav" on the AES16 Installation CD. Drag the file to the computer's desktop.

3. Connect the outputs of the AES16 to a digital destination (digital mixer, DA converters, etc.) capable of delivering an audio signal for listening via headphones or speakers. Depending on your external equipment, you may be using the CBL-AES1603, CBL-AES1604 or CBL-AES1605 cables – please check Section 3 Hardware Connections of this manual for details on the proper connection of these cables to your equipment. Verify that DIGITAL OUT 1 of the AES16 is connected to your external equipment. This is the output used for this test.

4. Before testing playback, the clock relationship between the AES16 card and your external device must be established. For this test, the AES16 acts as the clock master, while your external device is the clock slave. Consult the manual for your connected equipment to determine how to set it to receive sample clock from a digital input.

5. Most digital devices offer several choices for sample clock status, with "Internal" generally being the default. If your device does not have the ability to receive its sample clock from a digital input, please consult Section 3.4 Common Studio Setups for information on creating an alternate clock relationship with the AES16. Keep in mind that the sample clock source of the AES16 is set to "Internal" primarily to confirm the validity of your connections and installation – ultimately you should create clock relationships that make the most sense for your specific situation.

6. Open the Lynx Mixer, which will be in the Lynx Studio Technology program directory (Start > All Programs > Lynx Studio Technology > LynxTWO Mixer.)
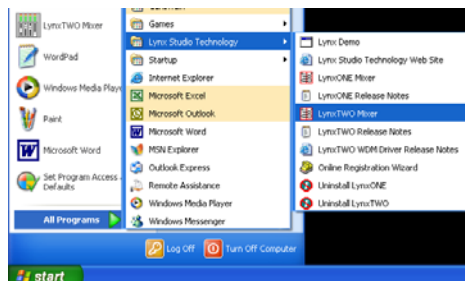
7. Choose "Restore Defaults" from the Mixer menu. This will insure that the sample clock source is set to Internal, that the output levels are at maximum, and that no channels are muted.
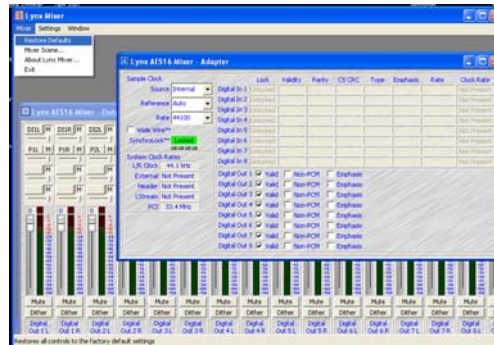
8. Launch the Lynx Demo application by double-clicking the Demo32.exe file. The Lynx Demo program should appear in the upper left corner of your screen. Make certain that the Play Device is set to Lynx AES16 Play 1.
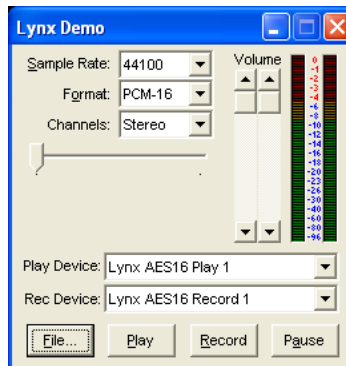
9. Click "File" and navigate to the computer's Desktop, then select "SineWaveMinus16.wav" and click "Open."

10. Click "Play." You should see the progress bar move from left to right.
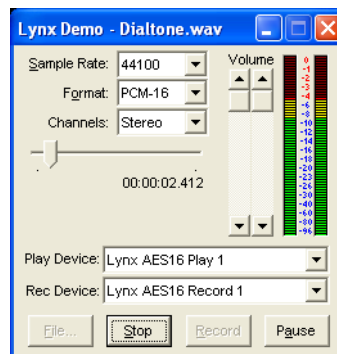
11. Check the Lynx Output mixer and confirm meter activity for Digital Out 1L and Digital Out 1R. If you have speakers or headphones connected to your destination device, you should hear audio as well as seeing meter activity.
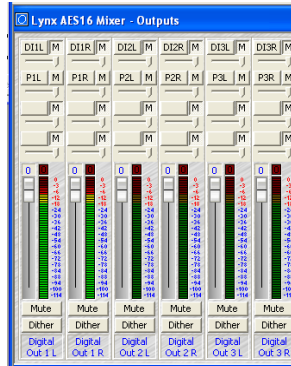
If the test did not operate as described or you received any errors, please refer to Section 10 Troubleshooting.

4.2 Macintosh OS X Quick Audio Test

The installation of your AES16 can be tested using the LynxTWO Mixer and the Demo version of Bias Peak that was included on your AES16 Installation CD. This is a quick way of verifying that the AES16 card is installed correctly and is connected correctly to your external equipment.

1.   Install the Bias Peak demo that is included on the AES16 installation CD, by clicking on the peakTrial.sit file and following the installation instructions.

2.   Locate "SineWaveMinus16.aif" on the AES16 Installation CD. Drag the file to the computer's desktop.

3.   Connect the outputs of the AES16 to a digital destination (digital mixer, DA converters, etc.) capable of delivering an audio signal for listening via headphones or speakers. Depending on your external gear, you may be using the CBL-AES1603, CBL-AES1604 or CBL-AES1605 cables - please check Section 3 Hardware Connections for details on correctly connecting these cables to your equipment. Verify that DIGITAL OUT 1 of the AES16 is connected to your external equipment. This is the output used for this test.

4.   Before testing playback, the clock relationship between the AES16 card and your external device must be established. For this test, the AES16 acts as the clock master while your external device is a clock slave. Consult the manual for your connected equipment to determine how to set it to receive sample clock from a digital input. Most digital devices offer several choices for sample clock status, with "Internal" generally being the default. If your device does not have the ability to receive its sample clock from a digital input, please consult Section 3.4 Common Studio Setups for information on creating an alternate clock relationship with the AES16. Keep in mind that the sample clock source of the AES16 is set to "Internal" primarily to confirm the validity of your connections and installation – ultimately you should create clock relationships that make the most sense for your specific situation.

5.   Open the LynxTWO Mixer, which will be in the OS X sidebar. Choose the "Adapter" tab, and verify that the Sample Clock Source is set to "Internal".
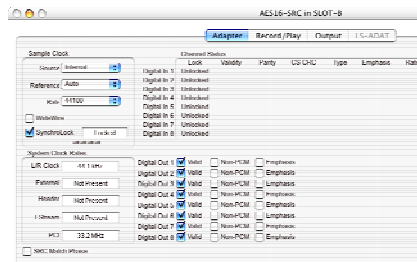
6.   Launch the Peak Demo application by clicking the Peak 4 icon in the OS X sidebar, or use Finder to launch Peak. Peak will prompt you to open an audio file. Choose "SineWaveMinus16.aif" on the desktop and click "Open".
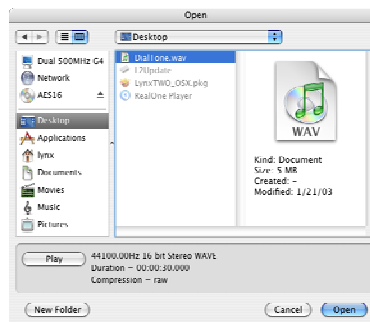
7.   In Peak, click "Audio Out" from the Audio menu. Verify that there is a check next to "CoreAudio…"

8.   Click "Hardware Settings…" from the Audio menu. Verify that the AES16 appears as the Output device. Click "OK".
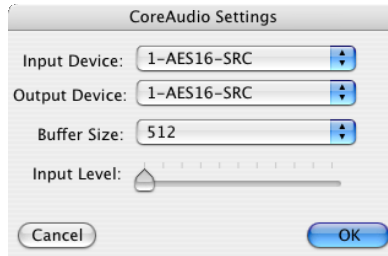
9.   Click "Play" from the Peak transport. You should see meter activity and the counter progressing.
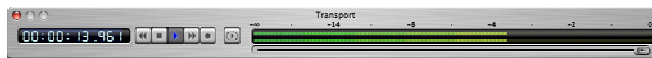
10.   Check the Lynx Output mixer and confirm meter activity for Digital Out 1L and Digital Out 1R. If you have speakers or headphones connected to your destination device, you should also hear audio and see meter activity.
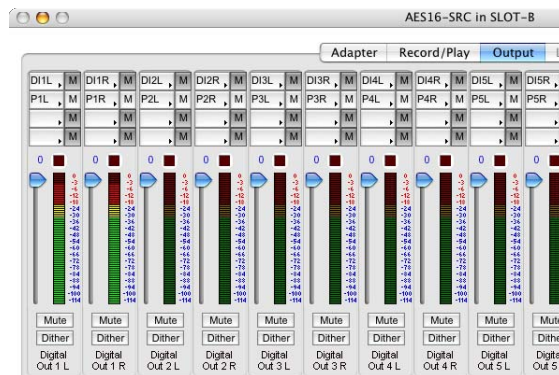
If the test did not operate as described or you received any errors, please refer to Section 10 Troubleshooting.

4.3   Macintosh OS9 Quick Audio Test

The installation of your AES16 can be tested using the Demo version of Bias Peak that was included on your AES16 Installation CD. This is a quick way of verifying that the AES16 card is installed correctly and is connected correctly to your external equipment.

1. Install the Bias Peak demo that is included on the AES16 installation CD, by clicking on the peakTrial.sit file and following the installation instructions.

2. Locate "SineWaveMinus16.aif" on the AES16 Installation CD. Drag the file to the computer's desktop.

3. Connect the outputs of the AES16 to a digital destination (digital mixer, DA converters, etc.) capable of delivering an audio signal for listening via headphones or speakers. Depending on your external gear, you may be using the CBL-AES1603, CBL-AES1604 or CBL-AES1605 cables - please check the Hardware Connections in this manual for details on correctly connecting these cables to your equipment. Verify that DIGITAL OUT 1 of the AES16 is connected to your external equipment. This is the output used for this test.

4. Before testing playback, the clock relationship between the AES16 card and your external device must be established. For this test, the AES16 acts as the clock master while your external device is a clock slave. Consult the manual for your connected equipment to determine how to set it to receive sample clock from a digital input. Most digital devices offer several choices for sample clock status, with "Internal" generally being the default. If your device does not have the ability to receive its sample clock from a digital input, please consult Section 3.4 Common Studio Setups for information on creating an alternate clock relationship with the AES16. Keep in mind that the sample clock source of the AES16 is set to "Internal" primarily to confirm the validity of your connections and installation – ultimately you should create clock relationships that make the most sense for your specific situation.

5. Launch the Peak Demo application by clicking the Peak icon in the OS9 Applications Folder. Peak will prompt you to open an audio file, choose "SineWaveMinus16.aif" on the desktop and click "Open".
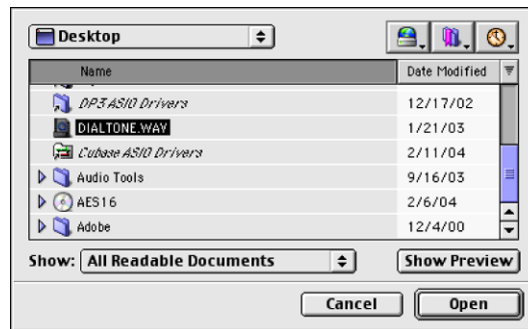
•   In Peak, click "Sound Out" from the Audio menu. Click "ASIO".

6. Click "Hardware Settings…" from the Audio menu. This should launch the LynxTWO ASIO Control Panel. Verify that the Sample Clock Source is set to "Internal". Click "Close".
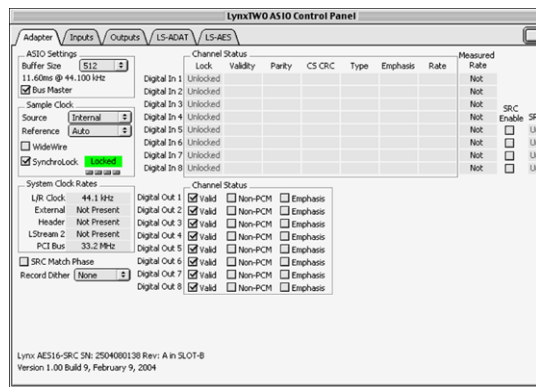
7. Click the keyboard spacebar to begin playback of the "SineWaveMinus16.aif" audio file in Peak. You should see the cursor scroll from left to right. If you have speakers or headphones connected to your destination device, you should hear audio and see meter activity.

If the test did not operate as described or you received any errors, please refer to Section 10 Troubleshooting.

5   Operational Overview

5.1   Signal Flow

As shown in the signal flow diagram below, the AES16 with its on-board digital mixer provides extensive signal routing capabilities that can adapt to any studio requirement. The mixer is implemented using a proprietary digital signal processor (DSP) that is optimized to maintain low latency and high signal quality.

The architecture of the digital mixer consists of 16 record channels and 16 play channels that are accessible to host applications as eight stereo record devices and eight stereo play devices. Submixers on each output provide low-latency mixing for record monitoring and output mixing.
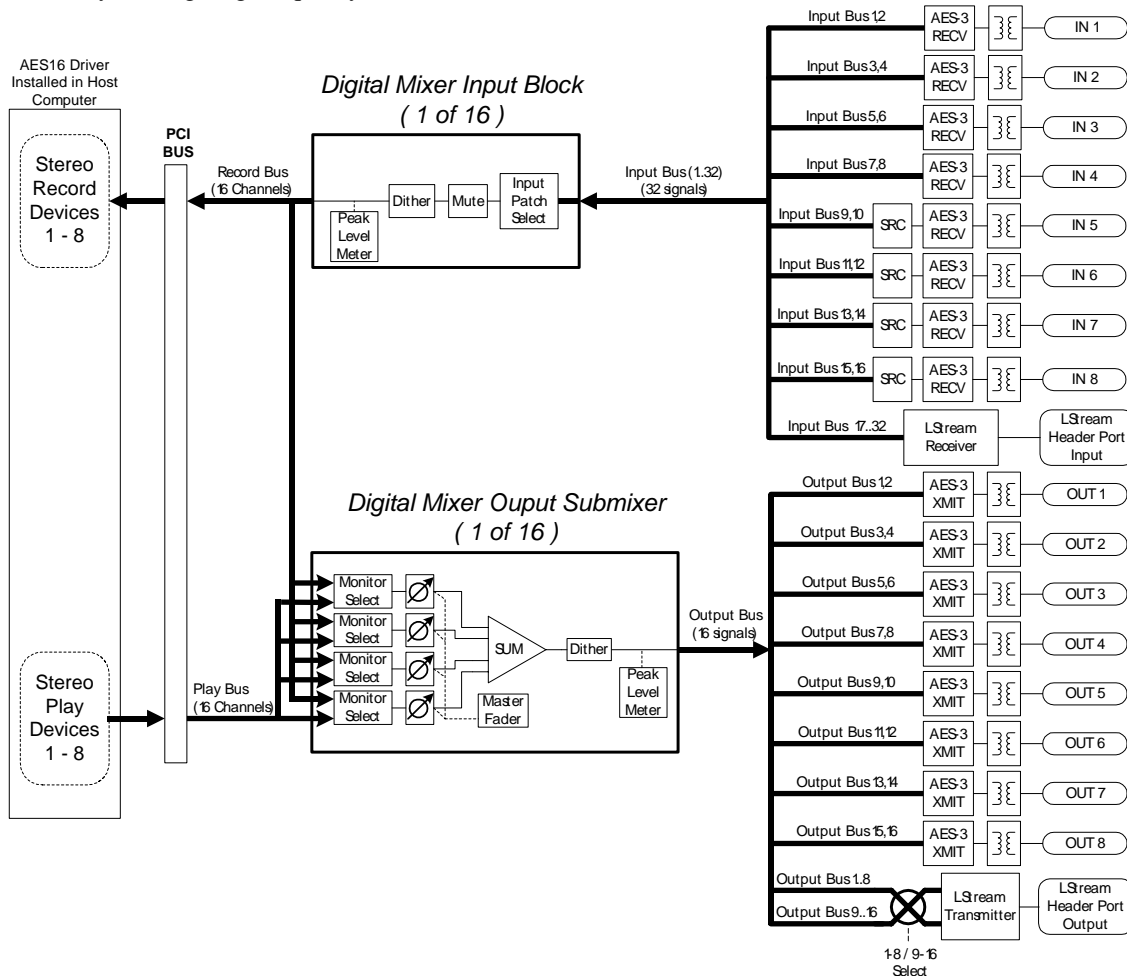
Figure 4: Signal Flow Diagram

5.1.1   Physical Inputs

Starting from the digital inputs in the upper right portion of Figure 4, each AES-3 input signal is routed through a transformer for isolation before arriving at an AES-3 receiver. The receiver extracts a word clock, using a low jitter phase-locked loop, and signal data that is passed to the Input Bus of digital mixer.

In the case of the SRC version of the AES16, the signals on digital inputs 5 – 8 then pass through a high-performance sample rate converter before

merging with the Input Bus. This sample rate converter can be enabled or disabled under user control in the Lynx Mixer.

The LStream header on the AES16 is an expansion port that provides an additional 16 inputs from a Lynx LStream device, such as the LS-ADAT that offers 16 channels of ADAT lightpipe. The signals from the LStream header are routed through the LStream receiver, which feeds the Input Bus.

5.1.2   Digital Mixer Inputs

The digital mixer has 16 input blocks that receive data from the Input Bus and drive the 16 channels of the record bus. Each of these blocks has an input selector that allows selection of any signal on the Input Bus. This selector allows flexible patching of any AES16 physical input signal to any of the 16 Record Bus channels. After the selector, the signal passes through a mute switch and then through the dither block, which offers three popular dither algorithms and bit-depth control. The output of the dither block

is measured for peak level meters and feeds one of the Record Bus channels.

Software control of the digital mixer's input blocks is provided in the Record/Play window of the Lynx Mixer application. The input selector corresponds to the Input Source select buttons (above the faders for each record channel). Mute and dither controls are also provided for each channel on this window.

5.1.3   Record Bus and Devices

The 16 channels of the Record Bus are derived from the outputs of the mixer input blocks. These signals are routed to the host computer via the PCI bus to the AES16 driver and also feed the output section of the digital mixer to provide zero latency record monitoring.

The AES driver installed on the host computer assigns the 16 channels from the Record Bus to eight stereo record devices as follows:

➢ Record Bus Channel 1 feeds the left channel of Record Device 1
➢ Record Bus Channel 2 feeds the right channel Record Device 1
➢ Record Bus Channel 3 feeds the left channel Record Device 2
➢ (etc)
➢ (etc)
➢ Record Bus Channel 16 feeds the right channel Record Device 8

5.1.4   Play Bus and Devices

The Play Bus is derived from the 16 channels sent to the AES16 play devices from host applications. In other words, when an application is used to playback a file, the data from the file is sent to an AES16 play device. The AES16 driver routes this data to the Play Bus, which feeds the output section of the digital mixer. Similar to the Record Bus, the 16 channels of the Play Bus correspond to the AES16's eight play devices are follows:

➢ Left channel of Play Device 1 feeds Play Bus Channel 1
➢ Right channel of Play Device 1 feeds Play Bus Channel 2
➢ Left channel of Play Device 2 feeds Play Bus Channel 3
➢ (etc)
➢ (etc)
➢ Right channel of Play Device 8 feeds Play Bus Channel 16

5.1.5 Digital Mixer Outputs

The 16 output signals of the digital mixer are derived from 16 four-input submixers. The Record Bus and Play Bus feed the submixer inputs, which each have an associated selector (labeled Monitor Select in the diagram) and volume control. The submixers use 40-bit accumulators to maintain signal accuracy. The output of the submixers are dithered to 24-bits using triangular PDF dither and then measured for peak level metering in the Lynx Mixer application.

This architecture allows each digital mixer output to be a mix of up to four signals derived from any AES16 input or any play device receiving data from a host application in playback mode. The benefits of this architecture include the ability to:
➢ Route any input to any or all outputs
➢ Route any play device data from an application to any or all outputs
➢ Mix any input with any play device for recording monitoring
➢ Create sub mixes for digital effect sends
Since all mixing and routing is hardware-based, so called "zero latency" is achieved.

Software control of the digital mixer outputs is provided in the Outputs window of the Lynx Mixer application. The Monitor Select function in the diagram corresponds to the Output Monitor Source buttons in the Mixer. The volumes controls for the submixer inputs are below these buttons. The master fader on the Outputs window of the Mixer adjusts all of the submixer input volumes. Mute and dither controls are also provided for each channel on this window. The dither button enables the output TPDF dither.

5.1.6 Physical Outputs

The physical outputs of the AES16 include eight AES-3 signals and the output of the LStream port. As shown in Figure 4, the 16 channels of the Output Bus derived from the output submixers feed the physical outputs. Since there are 32 physical outputs (16 AES-3, 16 LStream) and only 16 signals on the Output Bus, data sent to the LStream output mimics data sent to the AES-3 outputs.

An AES-3 transmitter followed by an isolation transformer converts Output Bus signals to AES-3 signals.

An LStream transmitter formats data for the LStream output port. To provide more routing flexibility the "1-8 / 9-16 Select" function shown in the diagram allows routing of output signals to a bank of eight LStream channels. Output Bus signals 1-8 can be routed to LStream channels 9-16 if desired.

5.2 Sample Clock Generator

The AES16 utilizes a master sample clock generator to derive all clocks related to the digital audio sampling rate. As shown in Figure 5 below, the sample clock generator provides a selection of various clocks sources ands both a wide range and SynchroLock phase-lock loop (PLL).
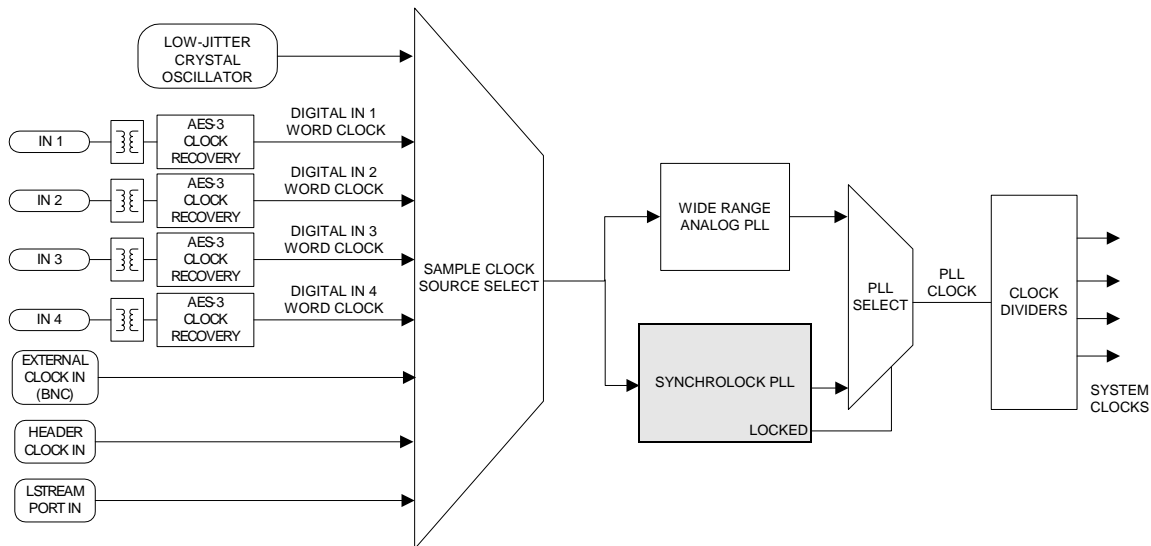
Figure 5: Sample Clock Generator

5.2.1 Sample Clock Sources

The sample clock generator can derive its reference clock from both an internal and various external sources. Only one source can be selected at any given time. User control of the sample clock source selector is provided on the Adapter window of the Lynx Mixer application. The available clocks sources are:

➢ On-board low-jitter oscillator (Internal)
➢ Digital In 1- 4: word clock recovered from one of the first four AES-3 inputs
➢ External Clock In: signal from the CLOCK IN BNC connector on the CBL-AES1604 break-out cable
➢ Header Clock In: signal from the board-mounted header connector
➢ LStream Port In: word clock from an LStream device connected to the LStream header port

5.2.2 Phase-lock Loops and Clock Dividers

A two-stage phase-lock loop system is used to generate a high-frequency PLL Clock while attenuating jitter in the selected sample clock source. Refer to the Section 5.3 SynchroLock™ for a description of the operation of the PLL's. Clock dividers derive required system clocks from the PLL clock.

5.3   SynchroLock™

The AES16 incorporates SynchroLock clock synchronization technology to provide extreme tolerance to noisy external AES/EBU and word clock signals while generating an ultra-low jitter clock. This technology is especially useful for combating noise induced on cables in complex studio installations. SynchroLock provides clock synchronization while insuring bit-perfect digital transmission. When the AES16 is connected in an AES/EBU daisy chain, SynchroLock acts like a jitter firewall to prevent the propagation of jitter to downstream devices.

By coupling statistical analysis with low-noise clock generation techniques, SynchroLock is capable of attenuating jitter on incoming AES/EBU signals by a factor of 3000:1. Compare this to attenuation of 100:1 or less for professional quality analog phase-lock loops (PLL). SynchroLock can easily handle AES/EBU signals with jitter levels in excess of 800 nanoseconds.

The SynchroLock sample clock is a two-stage system that is comprised of a fast-locking, wide-range analog PLL and digitally controlled crystal-based secondary stage. Due to extensive number crunching of the secondary stage, SynchroLock typically requires one to two minutes to achieve final lock. While the secondary stage is working, the analog PLL loop maintains lock, but with much less jitter attenuation than the secondary stage.

When the final lock state is achieved, the secondary stage is switched on line and becomes the system clock source. In some cases this switching process may cause a momentary disruption in digital I/O. Because of this, it is recommended that recording or playback not be started until the green LOCK indicator in the SynchroLock status window is observed. This status window is located on the Adapter window of the Lynx Mixer.

SynchroLock works on any external word clock signal. By default, SynchroLock is active when the Sample Clock source is set to a clock source other than Internal.

When the clock source is set to "External," "Header," or "LStream" the Reference must be set to "Word." SynchroLock can be disabled in the settings menu of the mixer by clicking on "Settings > Advanced > SynchroLock," but this is not recommended.

SynchroLock is capable of locking to word clock frequencies within +/- 100ppm of 44.1 kHz, 48 kHz, 88.2kHz, 96 kHz, 176.4 kHz, or 192 kHz. Signals that fall outside of the lock range will cause the red RANGE indictor to appear in the SynchroLock status window. In this case, the analog PLL is active and will source the system sample clock.

6   Lynx Mixer Reference

The Lynx Mixer, which is installed during setup, provides software control of the features of the AES16 and a visual indication of audio signal level during recording and playback. It can be used dynamically to change operational settings of the AES16, but in most cases once the settings are configured for a particular studio installation they require no further adjustment.

6.1.1   Starting the Mixer

Windows: After installation, the Lynx Mixer icon, will appear on the Windows Quick Launch bar in the lower portion of your screen.

By clicking on this icon, the Lynx Mixer will launch. If you do not have the Windows Quick Launch bar activated, the Lynx Mixer can be started be selecting "Start > Programs > Lynx Studio Technology > LynxTWO Mixer."

Macintosh: In OS X, the Lynx Mixer can be launched by clicking the "LynxTWO Mixer" icon in the OS X sidebar:

Or by clicking the LynxTWO Mixer in the Applications folder.

In OS9, you can access the Lynx Mixer by clicking the ASIO control panel from within your audio application.

6.1.2   General Operation

If you are simply recording and playing digital audio without synchronizing to an external clock source, you can begin using the AES16 by simply selecting the AES16 audio devices in your application software.

Typically, it is convenient to keep the Mixer running on your desktop to monitor signal levels or to allow immediate access to Mixer controls requiring dynamic changes. The Mixer can be forced to appear on top of other applications by selecting the "Always On Top" option in the Settings pull-down menu.

6.1.3   Mixer Configuration Recall

The state of the Mixer settings are saved each time your computer is shut down. The stored settings are automatically recalled the next time your computer is restarted.

6.2 Adapter Window
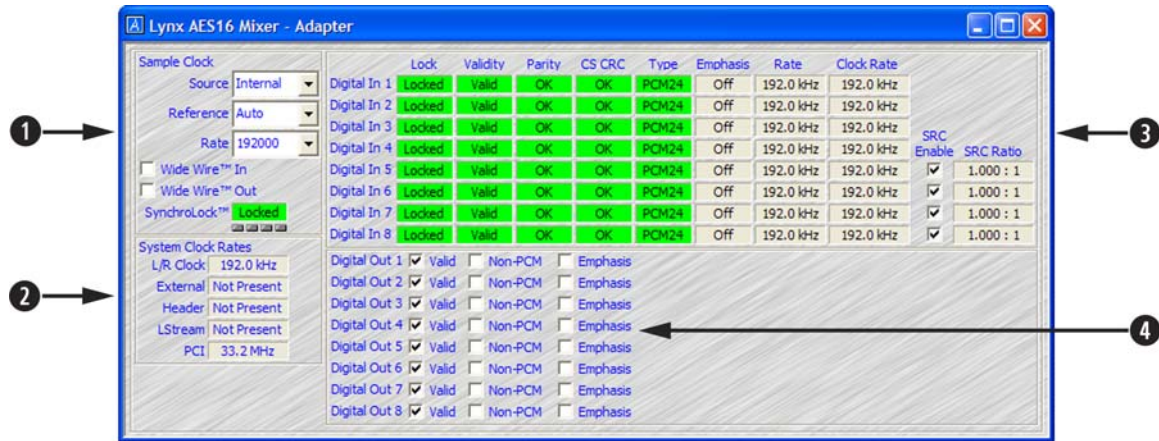
➊ Sample Clock Section

This section of the mixer provides control of the system sample clock generator. All AES16 audio devices on a single card MUST have identical sample rates since there is one on-board generator. Sample rates cannot be changed while AES16 is playing or recording.
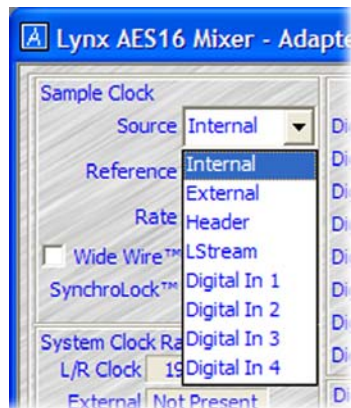
Source

This control selects the clock source that drives the sample clock generator from the following options:

Internal	Clock derived from the on-board crystal oscillator
External	Clock signal from BNC CLOCK connector
Header	Clock signal from the CLOCK IN header
LStream	Clock signal from the LStream port
Digital In 1	Clock signal from the Digital 1 Input
Digital In 2	Clock signal from the Digital 2 Input
Digital In 3	Clock signal from the Digital 3 Input
Digital In 4	Clock signal from the Digital 4 Input

Reference

Provides selection of the clock source reference type. This control must be set match the type of clock source selected as the sample clock source. The available choices are:

Auto	Automatic selection; valid for Internal, Digital, and Video clock sources
13.5 MHz	13.5 MHz video dot clock; valid for External and Header clock sources
27 MHz	27 MHz video dot clock; valid for External and Header clock sources
Word	Word clock; valid for External, Header, and LStream clock sources
Word256	256 times word clock; valid for External and Header clock sources

Rate

Displays the current sample rate of the AES16. When the AES16 is being used for recording or playback by an application, the rate shown is the rate set by the application. Applications are always the "master" in terms of setting the sample clock rate of the card.

The rate can also be adjusted manually using the adjacent pull down control. The rate will change only is the card is idle (not recording and playing). Manual adjustments are not required if the card is being used with an application.

WideWire In

Allows selection of AES/EBU dual-wire mode on ALL digital inputs for compatibility with legacy devices. Dual-wire mode is enabled when the check box is checked; otherwise the inputs operate in single-wire mode. Dual-wire mode is operational for sample rates greater than 50kHz. The number of available input channels is reduced to eight when this mode is active. Refer to Section 7.5 AES/EBU Dual-wire operation for more information.

WideWire Out

Allows selection of AES/EBU dual-wire mode on ALL digital output for compatibility with legacy devices. Dual-wire mode is enabled when the check box is checked; otherwise the outputs operate in single-wire mode. Dual-wire mode is operational for sample rates greater than 50kHz. The number of available output channels is reduced to eight when this mode is active. Refer to Section 7.5 AES/EBU Dual-wire operation for more information.

SynchroLock

Shows the status of SynchroLock clocking system.

SynchroLock is Lynx Studio Technology's proprietary technology for attenuating jitter on clock inputs and providing a stable clock for all digital signals passed through the AES16. The SynchroLock status window and LED indicators show the current state of the SynchroLock system as described below. Prior to achieving lock, the four green LED's give an indication of the completion of various lock stages. During this time the wide range analog PLL maintains lock. For more information on SynchroLock, refer to the Section 5.3 SynchroLock™.

Working: In this state SynchroLock is analyzing the input clock signal and making adjustments to frequency and phase. This process typically takes two to three minutes to complete. The four LED's show progress towards final lock: One green LED denotes frequency lock to 3.2 ppm accuracy, two LED's denote frequency lock to 1.6 ppm accuracy, three LED's denote frequency lock to 0.6 ppm and the transition to the phase lock stage, four LED's denote the start of the phase lock stage. When phase lock has been achieved, the Yellow "Working" indicator changes to the green "Locked" indication.

Locked: Indicates the SynchroLock system has achieved final lock to an incoming clock signal. This indicator will also appear when the Sample Clock Source is set to Internal and the sample clock frequency is a multiple of 44.1 kHz or 48 kHz.

Range: Indicates that the selected external clock source is not within the SynchroLock lock range.

Disabled: Indicates that SynchroLock has been manually disabled using the SynchroLock control in the Settings menu: Settings->Advanced->SynchroLock.

❷   System Clock Rates Section

This section of the Adapter Window displays real-time frequency measurements of system clocks. These measurements are very useful for evaluating and validating both internal and external clock sources. When synchronization or clocking issues are encountered, the user should refer to this information at the beginning of troubleshooting. Note: the measured rates of the AES/EBU inputs are available in the Digital Inputs section of the Adapter Window.

The sources of the system clocks begin measured are:

L/R Clock	System sample clock generator word clock output
External	External clock from CLOCK connection on I/O Port A
Header	Clock signal from CLOCK IN header connector
LStream	Clock signal from LStream port
PCI	Computer's PCI Bus speed (should always be about 33 MHz)

The Settings Menu offers a "High Resolution Clock Rate" option that provides three decimal places of accuracy instead of the default single decimal place. With this option enabled, lower digits may fluctuate rapidly as a result of measurement resolution. This is typically not an indication of clock jitter.

❸   Digital Input Status Section

This section displays status information pertaining to the AES16's eight inputs. The data displayed indicates the quality of the AES/EBU connections as well as channels status data sent by a transmitting device. The information displayed in this section is very useful for troubleshooting digital input connection issues. For more information about AES/EBU channel status data, refer to the AES-3 specification available from the Audio Engineering Society web site at http://www.aes.org.

Lock

Locked (green)	Indicates the digital receiver is locked to a valid AES/EBU source
Unlocked (gray)	Indicates the digital receiver is not locked to a valid AES/EBU source

When the Unlocked indicator is shown, all of the fields to the right will be blank.

Validity

Valid (green)	Indicates the Valid channel status bit is set
Invalid (red)	Indicates the Valid channel status bit is not set

The Valid bit is set by a transmitting device to indicate the validity of the audio data being transmitted. A DAT machine for example may mark the data as invalid when it is not in play mode.

Parity

OK (green)	Indicates accurate transmission of audio data
Error (red)	Indicates an audio data error occurred during transmission

The parity bit is included in the AES/EBU data stream to validate the transmission of audio data. A parity error indicates an audio data error was cased either by the transmitting device or the connecting cables.

CS CRC

OK (green)	Indicates valid transmission of channel status data

Error (red)　　　　　　Indicates a transmission error in the channel status data

This indicator represents the state of Channel Status Cyclic Redundant Check used to validate the transmission of the channel status data embedded in the AES stream. An error indicates a channel status data error was caused either by the transmitting device or the connecting cables. Some devices do not transmit CS CRC. In this case an error will be displayed, but the audio data can still be transmitted without errors.

Type

This indicator represents the type of data stream being transmitted by the external device. The external device indicates type using specific bits in the channel status data. Typically PCM types are shown with green background and non-PCM types, such as Dolby AC3, have a yellow background.

Valid linear PCM types (bit width):

PCM	**PCM16**	**PCM18**
PCM19	**PCM20**	**PCM22**
PCM23	**PCM24**	

Valid compressed, non-PCM types:

Dolby AC-3		
MPEG1L1	**MPEG1L2**	**MPEG2**
MPEG2AAC	**MPEG2L1**	**MPEG2L2**
MPEG2L3	**MPEG-4**	
DTS I	**DTS II**	**DTS III**
ATRAC	**ATRAC2/3**	

Emphasis

Off (gray)	Emphasis is off
50/15us (green)	50/15us pre-emphasis
J17 (green)	CCITTJ.17 emphasis
Unknown (green)	Emphasis not indicated

The emphasis bit is part of the channel status data and is used by a transmitter to indicate if the audio data being transmitted has been encoded with audio signal emphasis.

Rate

This indicator represents sample rate encoded in the channel status data.

Valid Rates include the following:

32.0; 44.1; 48.0; 88.2; 96.0; 176.4; 192.0 kHz (all in green) or Unknown (red)

Note: it is the responsibility of the transmitting device to send rate status that matches the actual rate of the audio data stream being sent. However, it is possible for a rate discrepancy to exist during a valid transmission.

Clock Rate

Clock Rate displays a real-time measurement of the sample rates of the incoming signals. These measurements are very useful for evaluating and validating digital inputs when synchronization or clocking issues are encountered.

The Settings Menu offers a "High Resolution Clock Rate" option that provides three decimal places of accuracy instead of the default one decimal place. With this option enabled, lower digits may fluctuate rapidly as a result of measurement resolution.

When WideWire In is checked to enable AES dual-wire operation on input, Clock Rate should read half of the encoded channel status rate described above. For example, when running at 192 kHz with dual-wire inputs, the Clock Rate should indicate 96.0 kHz and the LR Clock should indicate 192 kHz.

SRC Enable

This checkbox will only appear when using an AES16-SRC. This checkbox controls the state of the sample rate converter for a specific digital input. When checked, the incoming signal is routed through the sample rate converter so the sample rate will match the currently selected sample rate of the AES16-SRC. For example, when the device connected to Digital In 5 is running at 48 kHz, the AES16-SRC is running at 44.1 kHz, and SRC Enable for Digital In 5 is ON, the AES16-SRC will convert the sample rate from 48 kHz to 44.1 kHz and the SRC Ratio (see below) will indicate approximately 0.918:1.

SRC Ratio

This indicator will only appear when using an AES16-SRC. Indicates Sample Rate Conversion Ratio when the SRC Enable checkbox is turned on.

④ Digital Outputs Control Section

This section provides control of status bits embedded in the AES/EBU stream for each digital output. For more information about the use of these bits, refer to the AES-3 specification available from the Audio Engineering Society web site at http://www.aes.org.

Valid

This checkbox controls the state of the Valid bit. When checked, the Valid bit is turned on to indicate to the receiving device that the audio data being transmitted is valid. This is the default state.

Non-PCM

This checkbox controls the state of the Non-PCM channel status bit. When checked, the Non-PCM bit is turned on to indicate that audio data other than linear PCM (such as Dolby AC3 or DTS) is being transmitted.

Emphasis

This checkbox controls the state of the emphasis channel status bits. When checked, the 50/15us emphasis mode is indicated in the transmitted channel status.

6.3   Record/Play Window
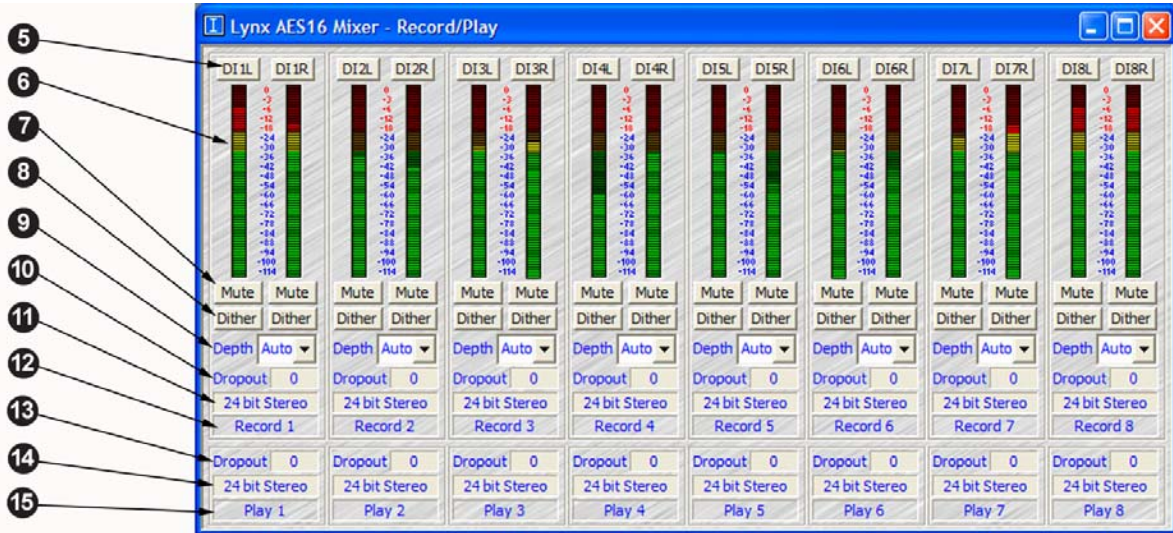
⑤   Input Source Select Buttons

These buttons control the patching of physical inputs to record device channels of the digital mixer. Each device channel can derive its source from any one of the 32 available inputs, which include 16 from I/O Port A and B and 16 from the LStream port. The button on the left side of each record device panel corresponds to the left channel of the device.

Clicking on any of the Input Source Select buttons launches a pop-up menu displaying the available sources that can be selected.

In this example, LStream In 1 is being routed to the left channel of record device 1. This input would be valid if an LS-ADAT ADAT card was connected to the AES16's LStream Port.

⑥   Peak Meter

These meters display the instantaneous peak level of audio being sent to the AES16 input selected by the Input Source Select buttons.

7 **Mute**

This button enables the mute function for the associated input.

8 **Dither**

This button enables dithering for the associated input. The Record Dither Type control in the Settings menu determines the type of dither applied to the input.

Dither is useful for improving signal fidelity when reducing the bit depth of incoming data from 24 bits to 20, 16, or 8 bits.

9 **Depth**

This control sets the bit depth used for recording on each input. The options are 8 bit, 16 bit, 20 bit, 24 bit, and Auto. When Auto is selected, the bit depth is set according to the sample format requested by an application accessing the record device. For example, if the sample format is 16 Bit Stereo, the bit depth will be set to 16 bit.

10 **Record Dropout**

This status indicator represents the number of audio dropouts that have occurred during recording on a record device. Dropouts can produce audible glitches in audio files. They are typically caused by a computer's inability to process data from the AES16 fast enough. The indicator is reset at the start of recording.

11 **Record Sample Format**

This status indicator represents the sample format of a recording device. The format, which is set by an application accessing the device, determines the format of the data sent to the host computer for storage or processing. The sample format indicates bit depth and mono or stereo mode. In the case of 32 bit formats, the lower eight bits are set to zero.

12 **Record Device Label / Status Indicator**

This label panel specifies the record device number associated with each input panel. When an application is accessing a record device, the color of this label turns red to indicate the device is in record mode. Observing this indicator can be very useful while debugging communication problems with third party applications.

13 **Play Dropout**

This status indicator represents the number of audio dropouts that have occurred during playback on a play device. Dropouts can produce audible glitches in audio files. They are typically caused by a computer's inability to send data to the AES16 fast enough. The indicator is reset at the start of playback.

14 **Play Sample Format**

This status indicator represents the sample format of a play device. The format, which is set by an application accessing the device, determines the format of the data sent from the host computer to the play device. The sample format indicates bit depth and mono or stereo mode. In the case of 32 bit formats, the lower eight bits are set to zero.

15 **Play Device Label / Status Indicator**

This label specifies a play device number associated with the Play Dropout and Play Sample Format indicators described above. When an application is accessing a play device, the color of this label turns red to indicate the device is in play mode. Observing this indicator can be very useful while debugging communication problems with third party applications.

Please note play device information is unrelated to the record device controls contained in the same vertical panel on the Record/Play Window. The location of this information was chosen in order to provide a compact view of record and play device status.

6.4　Outputs Window
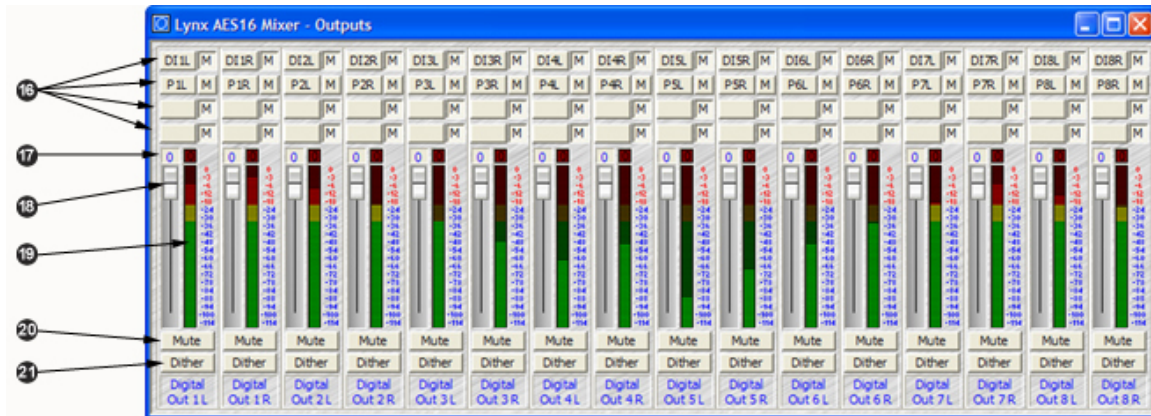
⓰　Output Monitor Source Buttons

These buttons control the routing of record and playback sources that feed each of the 16 output channels. Since each output is derived from the sum of the four sources, each button controls the selection of one of the sources.
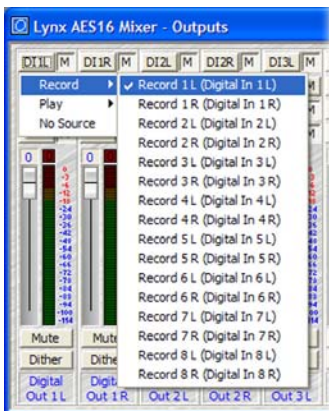
When a button is clicked, a pop-up menu is launched that displays the available sources that can be selected. A **Record** submenu lists inputs and their corresponding the record devices (which is dynamically updated to reflect Input Source selections in the Record/Play window). A **Play** submenu lists the left and right channels of the eight play devices. The **No Source** option disables a monitor source.

The example to the left shows Digital In 1 L being selected as one of the four sources for OUT 1 L.

After a monitor source is selected, a four-character abbreviation of the selection is placed on the button. For example, DI1L indicates Digital In 1 Left.

⓰　Output Monitor Mute Buttons

The buttons, labeled **M,** located to the right of each Output Monitor Source Button control the muting of the adjacent monitor source. When the button is "pushed in", the mute function is enabled.

⓱　Overload Indictor

This indicator represents the number of signal overloads that have occurred on an output. Overloads occur when the summation of the four monitor sources feeding an output exceeds the full scale digital output level.

18   **Volume Faders**

Theses faders provide digital attenuation of the output signal prior to D/A conversion. With the volume fader at its maximum position, the vertical line within the fader turns black, to indicate zero attenuation. In this case the audio stream is unaltered. This is the recommended position for critical recording and mixdown sessions in which the highest signal quality is required. When the volume fader is not at its maximum or minimum position, the vertical line within the fader turns red to indicate that the volume control is active.

19   **Peak Meters**

These meters display the instantaneous peak level of the output signal.

20   **Mute**

This button enables the mute function for the associated output.

21   **Output Dither**

This button enables the addition of triangular probability density dither for each associated output. Dither is recommended for improving signal fidelity when more than one monitor source is driving an output or when the volume fader is not at its maximum.

6.5   Mixer Menu

The Mixer menu, located at the top left of the screen, allows selection of global mixer functions.
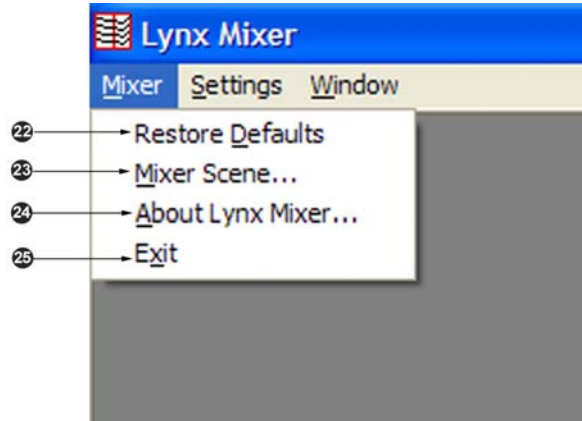
㉒   Restore Defaults

This option restores all user-selectable parameters to factory default settings. This feature should be used as a first step when mixer settings issues are encountered.

㉓   Mixer Scene

This feature provides the ability to save and recall all user-selectable parameters. "Scenes" that contain the state of all mixer settings can be saved to scene memory. Scenes may be recalled to quickly reconfigure the mixer.

Scene memory is global to all users on a single computer and is initially empty. There is no limit to the number of scenes that can be stored.

When the Mixer Scene option is selected, a dialog box will appear that lists stored scenes and allow entry of new scenes. Restore, Save, and Delete buttons handle scene management as follows:

> Restore – To restore a scene from memory, select the scene name from the list, and then click the Restore button. The scene will be instantly recalled from memory and all mixer parameters will be restored to the saved state.
>
> Save – To save a scene into memory, type the name of the scene into the Edit Window, then click the Save button. The current mixer parameters will be stored into scene memory. Selecting an existing scene name and clicking the Save button will overwrite that scene with the current parameters.
>
> Delete – To delete a previously saved scene from memory, select the scene name from the list and click the Delete button. The Mixer Scene dialog box will remain open to allow further editing/deleting of scenes.

NOTE: When the computer is shut down, the current mixer state is saved. When the computer is restarted, the mixer state is restored. This function is independent of Mixer Scene operation.

24   **About Lynx Mixer**
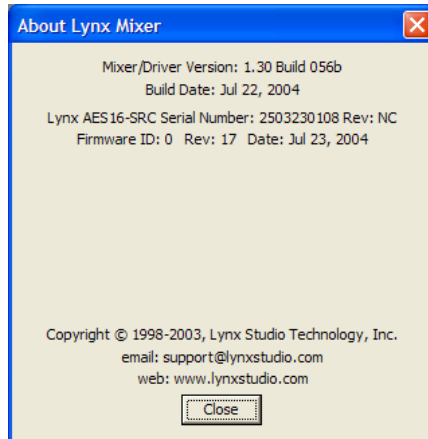
PLEASE NOTE: The About Lynx Mixer window will
display different information than what is shown here.

This option displays information about the Lynx Mixer, driver, and firmware as follows:

> **Mixer/Driver Version:** Displays the current driver version and build number.
> **Build Date**: Displays the date the driver and mixer were released.
> **Adapter Name:** Displays the name of the Lynx audio adapter installed. Up to four Lynx audio adapters may be shown.
> **Serial Number**: Displays the serial number of the Lynx audio adapter installed.
> **PCB Revision**: Displays the revision of the printed circuit board.
> **Firmware ID:** Displays the firmware identification number (typically 0).
> **Firmware Revision:** Displays the firmware revision.
> **Firmware Date:** Displays the date the firmware was released.

25   **Exit**

This option closes the Lynx Mixer application.

6.6   Settings Menu

The Settings Menu offers access to advanced settings and an alternative method of accessing commonly used functions that appear in the Adapter Window.
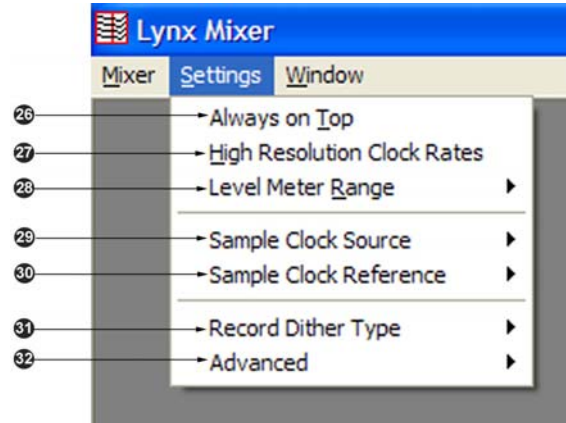
㉖   Always on Top

When this option is checked, the Lynx Mixer window stays on top of other active windows.

㉗   High Resolution Clock Rates

When checked, this option enables the display of measured clock rates with 1-hertz resolution. Otherwise, rates are displayed with 100-hertz resolution. This feature controls the display of all System Clock Rates and the Digital Input Clock Rates on the Adapter Window of the mixer.

NOTE: With this option enabled, lower digits may fluctuate rapidly as a result of measurement resolution. This is typically not an indication of clock jitter.

㉘   Level Meter Range

This option provides control of the range displayed by the peak meters on the Record/Play and Output windows of the mixer. The available ranges are 70dB, 96dB, and 114dB (default). Decreasing the range will increase the resolution of the meter display, which may be required for more critical monitoring. This is a universal setting for all meters – it is not possible to set multiple ranges.

㉙   Sample Clock Source

This menu selection replicates the Sample Clock Source selection on the Adapter window (see Section 6.2 Adapter Window), for added convenience. In some situations it may be preferable to access this parameter via this menu.

30 **Sample Clock Reference**

This menu selection replicates the Sample Clock Reference selection on the Adapter window (see Section 6.2 Adapter Window), for added convenience. In some situations it may be preferable to access this parameter via this menu.

31 **Record Dither Type**

This option provides selection of the type of dither used on all record channels. The following options are available:

None - Dither is disabled. Volume processing utilizes rounding prior to truncation.

Triangular - Enables the addition of triangular probability density dither. Triangular is the preferred dither type in most cases.

Shaped Triangular - This type of dither is essentially high-pass filtered triangular dither that places most of the dither energy at higher frequencies making it less audible to the human ear. Shaped triangular dither decreases signal-to-noise by 4.8 dB

Rectangular - This type of dither decreases the signal-to-noise ratio by 3 dB (less than triangular), but is less desirable because of its noise modulation effects.

In order to enable the selected dither type on a record channel, the Dither button on the associated channel on the Record/Play window must be "pushed in". See Section 6.3 Record/Play Window.

32 **Advanced**

This option provides access to several advanced menu functions.

SRC Match Phase – This option will only appear when using an AES16-SRC. When checked, enables the SRC Match Phase mode to ensure that all locked digital inputs using the sample rate converter are in phase. Digital In 5 must have SRC Enabled to enable SRC Match Phase mode.

SyncStart™ – When checked, enables the SyncStart feature, which provides sample accurate synchronization of multiple record and playback devices. Enabled by default.

Mixer Lock – When checked, enables a locking feature that prevents changes to any of the mixer controls by any application, including the Lynx Mixer.

SynchroLock™ – When checked, enables the SynchroLock clock generator. This should be disabled only when locking to external clocks that are near the limit of the SynchroLock lock range. Enabled by default.

7   Using the AES16

This section describes how to perform common tasks with AES16. Additional information is available in the Frequently Asked Questions (FAQ) section on the Lynx web site (http://www.lynxstudio.com).

7.1   Mixer Scene Storage and Recall

Once you have configured the mixer's routing and other parameters, you may save that configuration in memory as a mixer "Scene." Saved scenes may be recalled to quickly reconfigure the mixer.

When the computer is restarted after being shut down, the mixer will restart with its last-used configuration. This function is independent of the Mixer Scene memory.

For more information on saving and recalling mixer scenes, refer to Section 6.5 Mixer Menu.

7.2   Input Patching

The physical inputs of the AES16 can be patched to any Record Bus channel of the on-board digital mixer. This feature allows complete flexibility in routing inputs to tracks and record devices within software applications.

As described in Section 5.1.2 Digital Mixer Inputs and shown below, the digital mixer has 16 input blocks, each with an Input Patch Select switch. The Input Bus originates from the physical inputs. The Record Bus feeds the record devices of the driver.

Digital Mixer Input Block
(1 of 16)
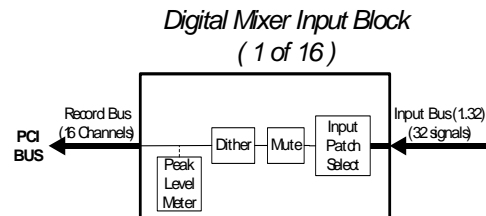
Access to the Input Patch Select switch is provided via the Input Source select buttons on the Record/Play window of the Lynx Mixer.

By clicking on one of these buttons at the top of a mixer channel strip, you can select from any of the available inputs and route the selected input to that record mixer channel.

Each mixer record channel can derive its source from any of the 32 physical inputs (16 AES-3 digital inputs and 16 LStream port signals).

For more information on the Lynx Mixer input patching, refer to Section 6.3 Record/Play Window.

7.2.1   Monitoring Theory

Low latency monitoring can be enabled using the AES16's on-board digital mixer. This method avoids delays caused be monitoring through application software. The digital mixer can be setup manually using the Lynx Mixer application or within applications that support direct monitoring.

As discussed in Section 5.1.5 Digital Mixer Outputs, each output of the AES16 is derived from a four-input submixer. This submixer is shown below. The inputs to the submixers include both input signals and playback signals. Enabling record monitoring is simply a matter of selecting a desired input signal for mixing on a particular output.

Digital Mixer Ouput Submixer
(1 of 16)
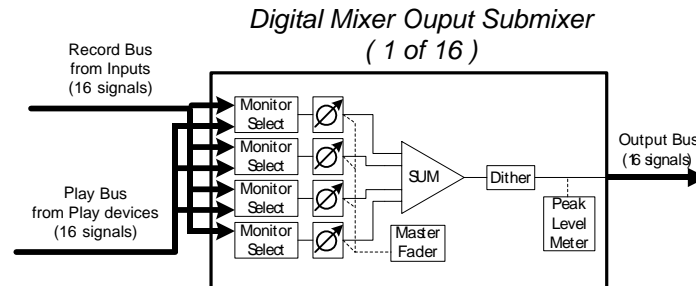
7.2.2   Monitor Setup Using Lynx Mixer

The Outputs window of the Lynx Mixer provides access to the submixer connected to each physical output. Controls on this window allow manual setup of monitoring.

The four Monitor Select blocks shown in the submixer diagram correspond to the four Output Monitor Source buttons above the faders on each output channel of the Lynx Mixer. A mouse click on one of these buttons launches a menu of Record and Playback sources. Selecting a Record source causes in input signal to be routed to the output.

Horizontal faders below these buttons correspond to the submixer input volume controls, , shown in the diagram above.
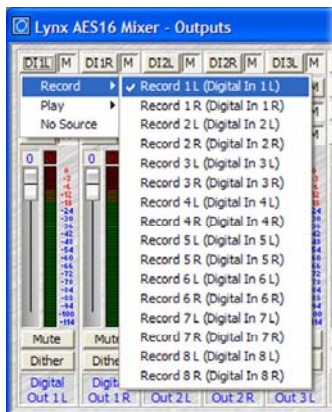
In this example, Digital In 1 is being selected as a monitor source for Output 1 Left. The "M" button next to the Output Monitor Source button must be in the "out" position to unmute a monitor source. After the source is selected, a corresponding four-letter pneumonic will appear on the button.

7.2.3   Using Direct Monitoring in an ASIO Application

The Direct Monitoring (sometimes referred to as "hardware monitoring") feature offered in many popular third party applications provides a means to enable low-latency monitoring supported by the AES16's on-board digital mixer. Instead of using the Lynx Mixer to manually enable monitoring as discussed in the previous section, controls within the application provide convenient access to this functionality.

Additionally, some applications offer "tape type" monitoring whereby inputs are monitored only when recording is taking place. When utilizing Direct Monitoring from a recording application, it is preferable to NOT make alterations to the Lynx mixer directly, as these changes may cause Direct Monitoring to produce unexpected results.
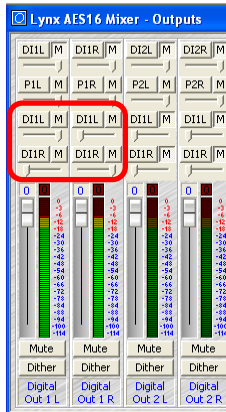
When Direct Monitoring is enabled in an application, Output Monitor Source Buttons C and D are automatically assigned monitor sources.
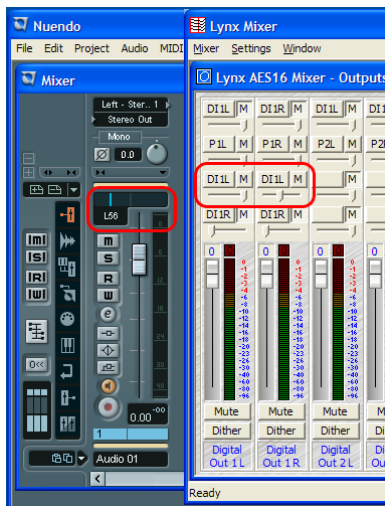
Since panning of mono input sources is available with Direct Monitoring, even though pan controls are not a feature of the Lynx mixer, each mono source is assigned to both the left and right channels of an output channel strip. When a mono signal is panned from within the host application, the level sliders under each instance of the monitor source will move accordingly. As an example: If Digital In 1 Left is being monitored on Digital Out 1 Left & Right, when you pan the input signal to the left the Monitor Source Volume for Digital Out 1 Left increases and the Monitor Source Volume for Digital Out 1 Right decreases.

Since this feature relies upon code within a third party application to operate, different software versions may behave differently than described.

Click the speaker icon in the Cubase 2/Nuendo 2 Mixer window to enable Direct Monitoring.
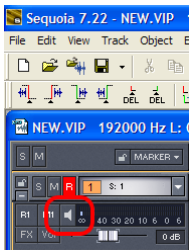
Click the speaker icon in Samplitude/Sequoia to enable Direct Monitoring.

7.3 Playback Routing and Mixing

In addition to standard monitoring of inputs through physical outputs, the Lynx mixer is capable of sophisticated routing and mixing of playback and record sources. One can monitor playback from several applications through a single output, combine live input and playback streams, and record a single source into several applications with the power of this flexible tool.
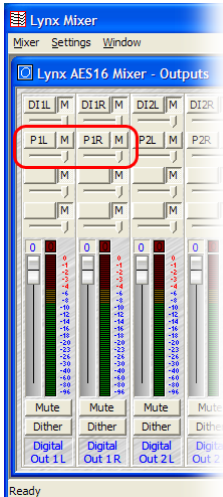
In the Lynx Mixer Output Window, clicking one of the four Output Monitor Source Buttons for each channel provides the opportunity to select a "Play" source, which can be any of the 16 playback device channels available to the system. For Digital Out 1 (Left and Right), the system default is to monitor Play1 (Left and Right), which appear as the monitor sources P1L and P1R. In this state, any audio assigned to play out Play1 would be heard out of Digital Out 1.
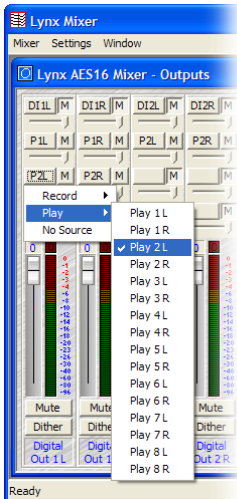
Selecting Play 2 (P2L and P2R) in the next set of Monitor Source Buttons down, and un-muting this source, allows you to monitor audio from Play 1 and Play 2 out of Digital Out 1 at the same time. If one application or playback stream is assigned to Play 1, and another to Play 2, you would hear audio from both out of Digital Out 1. You can adjust the relative level of these two sources with the volume slider directly underneath each Monitor Source Button.

Similarly, Record sources can be added so that up to four combinations of live input, and pre-recorded playback can be routed and mixed to a single output. In this way, headphone mixes, alternate house feeds, or a seamless blend of canned and live broadcast material can be easily routed to appropriate outputs on the AES16 card.

7.4   Clock selection and control

A valid clock source signal must be connected to the appropriate AES16 clock connector when the Sample Clock Source is set to "External," "Header," or one of the Digital Inputs. If a signal is not present, the sample clock generator will run very slowly or erratically. Symptoms of this problem include audio files that sound either fast, slow or garbled.

The AES16 also includes a SynchroLock clocking system to provide robust synchronization to degraded input clock signals. Refer to Section 5.3 for a detailed description of SynchroLock.

When a valid clock source is present, the frequency and type of clock signal must match the Sample Clock Reference setting selected on the Adapter window the Mixer. The frequency of word clock sources, chosen by setting the Sample Clock Source/Reference to "External/Word," "Header/Word," or "Digital In/Auto," must match the sample rate specified when recording new files, or the sample rate associated with a previously recorded file during playback.

For example, if a 44.1 kHz word clock is connected to the external clock input, the Sample Clock Source/Reference must be set to "External/Word" and the sample rate must be set to 44.1 kHz when a new file is being recorded in an application. Failure to do so will result in files being recorded at the wrong sample rate.

7.5   AES/EBU Dual-wire operation

The AES16 supports dual-wire AES/EBU operation in which each physical input or output connection passes a single channel AES/EBU signal running at half the system sample rate. This capability provides compatibility with legacy devices that do not support single-wire AES running at sample rates greater than 50kHz.

Dual-wire mode can be enabled independently for inputs and outputs using the WideWire In and WideWire Out controls on the Adapter window of the Lynx Mixer. See Section 6.2 for more information. When dual-wire mode is enabled the number of available audio channels is reduced to eight.

With WideWire In enabled, the AES16 translates dual-wire input signals internally to input channels of the on-board mixer according to the first table to the right. In this mode, input channels 5 – 8 are not active.

NOTE: Mixer Input Channel selection is available using the Input Source select buttons on the Record/Play window of the Lynx Mixer. See Section 6.3. Record/Play Window

With WideWire Out enabled, the AES16 translates output signals to dual-wire connections according to the second table. In this mode, output channels 5 – 8 are not active.

Input Connector	*Mixer Input Channel*
IN 1	Digital In 1L
IN 2	Digital In 1R
IN 3	Digital In 2L
IN 4	Digital In 2R
IN 5	Digital In 3L
IN 6	Digital In 3R
IN 7	Digital In 4L
IN 8	Digital In 4R

Dual-wire Input Routing

Mixer Output Channel	*Input Connector*
Digital Out 1L	OUT 1
Digital Out 1R	OUT 2
Digital Out 2L	OUT 3
Digital Out 2R	OUT 4
Digital Out 3L	OUT 5
Digital Out 3R	OUT 6
Digital Out 4L	OUT 7
Digital Out 4R	OUT 8

Dual-wire Output Routing

7.6   ASIO Specific Setup

Several control parameters of the AES16 are accessible from the ASIO Control Panel within applications that utilize the AES16 ASIO driver. Specific controls may vary, but most applications offer access to buffer size, clock selection, sample rate and number of active I/O channels. One of the benefits offered by this inter-application control, is that these parameters can be saved with a project – allowing consistent performance conditions each time a project is opened.

For this reason, it is preferable to initiate these settings from within the ASIO application, rather than from the Lynx Mixer Adapter window whenever possible.

For specific information about the parameters available from within the most popular audio applications, please see the application notes on our website, at:
http://www.lynxstudio.com/support.html

7.6.1   ASIO Positioning Protocol

The AES16 drivers support Steinberg's ASIO Positioning Protocol (APP) for users that need timecode synchronization capabilities and use an application that supports ASIO Positioning Protocol. In order to take advantage of this feature, a Lynx LS-ADAT card would need to be

used in conjunction with the AES16 in order to provide a sync source to the system. With a valid sync source connected to the ADAT Sync In port on the LS-ADAT, sample-accurate synchronization is possible via APP.

7.7   Bus Mastering

The AES16 hardware incorporates PCI Bus Mastering, which greatly improves bus transfer efficiency without utilizing CPU cycles. With this feature enabled, an application can typically run with smaller buffers, which translates to lower latency.

This feature is enabled by default in the driver. It should only be disabled if absolutely necessary in order to accommodate PCI bus conflicts with other devices.

7.8   Controlling latency by changing buffer size

Latency in an audio interface can be defined as the time required to process a sample requested from an application to the interface's audio output. A number of factors determine the achievable latency performance of a system housing the AES16 card: processor speed, operating system, sample rate, number of utilized record or play channels, system efficiency, etc.

Latency can be manipulated by changing the size of the buffers used to transfer data to and from the AES16. When using an ASIO application (i.e. Cubase, Samplitude, Sonar) the buffer settings can be accessed via the application's ASIO control panel. Additionally, the AES16 Mixer Adapter window provides access to a global buffer setting, which can define a single buffer size available to WDM, ASIO and GSIF applications.

The smaller the buffer size the lower the latency will be. However, if a buffer size is too small for the system or context, audio anomalies such as clicks and pops can occur. One should become familiar with altering the AES16 buffer size to best suit their projects. Project sample rate is a critical factor in determining an appropriate buffer size. It is important to consider that as sample rate increases, latency at the same buffer size decreases. For instance, at a sample rate of 48 kHz, a buffer size of 128 samples will produce a latency of 2.66ms. At 96 kHz, the same buffer size would produce a latency value of 1.55ms. Consequently, at the higher sample rate, it is likely that you would need to increase the buffer size to get the same performance.

7.9   Sample Rate Conversion

Information to be updated soon.

8 Working with Third Party Applications

8.1 Compatibility

The drivers included with your AES16 provide compatibility with all standard third party digital audio applications that communicate with Windows Wave audio, DirectSound, Audio Units and ASIO devices. A list of applications that have been tested for compatibility is provided on the Lynx web site at http://www.lynxstudio.com/swlist.html.

8.2 AES16 Devices

Third party applications communicate with the AES16 through its installed driver. The driver presents the AES16's audio capabilities to applications as standard multimedia, DirectSound or ASIO devices. Most, if not all, third party applications provide device selection in configuration, options, or preference setting windows or menus.

For two channel or stereo audio applications, a separate selection option is typically provided for the input or recording device and the output or playback device. Multitrack applications provide multiple input and output device selection menus or windows. Refer to the documentation included with your application to determine how to select audio devices.

With the AES16 properly installed in your computer, the digital audio devices will be available to applications, and their names will appear in their device selection menus as follows:

AES16 Record 1 AES16 Play 1
AES16 Record 2 AES16 Play 2
AES16 Record 3 AES16 Play 3
AES16 Record 4 AES16 Play 4
AES16 Record 5 AES16 Play 5
AES16 Record 6 AES16 Play 6
AES16 Record 7 AES16 Play 7
AES16 Record 8 AES16 Play 8

When more than one AES16 is installed in your system, the device names will contain a numeric adapter ID assigned by the operating system. For example, the analog output device on adapter 2 would be listed as "AES16 2 Record 1". Refer to the "Configuring Multiple AES16's" section below for more information.

8.3   Controlling Audio Bit Depth

The creation of an audio file with a particular bit depth (or resolution) is controlled through an application's recording settings. These settings are typically adjusted in an audio device configuration menu or in a recording setup window just prior to recording. When recording is initiated the AES16 will generate audio samples of the desired resolution.

Bit depth control during playback of an audio file is also an application issue. When a file is played, the recorded bit depth is read from the file's header by the application. The application uses this information to set the resolution of the AES16.

The AES16 supports file types with 8, 16, 24, or 32 bit word widths. Note that 32-bit files contain 24-bit data with zero data in the least significant bit positions.

The Lynx Mixer application displays the currently selected bit depth for each device just above the device name in the Record/Play window.

8.4   Full Duplex Operation

The sixteen audio devices of the AES16 operate completely independent in terms of whether they are in recording or playback modes and their associated audio files. This implies that the devices can operate simultaneously and support the so-called "full duplex" mode where, for instance, the AES16 Record 1 device is recording while the AES16 Play 1 device is playing.

Although the devices act independently, when multiple devices are being used to record or play multiple audio files simultaneously, the AES16

driver has the capability to synchronously start all devices with sample accuracy. This is especially important for maintaining synchronization during playback of multiple devices and overdubbing.

By using all of the record and play devices, sixteen-track recording and playback is possible. Again, control of this multi-channel operation is simply a matter of device selection in any compatible multitrack audio application.

9   Configuring Multiple AES16's

More than one AES16 card can be installed in a computer for additional audio channels. If required, all AES16's in a computer can be configured to maintain sample accurate synchronization during digital audio recording and playback.

Cards are synchronized in a master-slave arrangement. One card is selected as the master, which provides the word clock source for the other slave cards in the system. From the master, the word clock signal is daisy-chained from one slave to the next.

Word clock signals can be connected internally using the CBL-ICC Internal Clock Cable, which is available from Lynx. The CLOCK OUT header of one card is connected to the CLOCK IN header of the next card. A separate cable is required for each slave card in the system. Alternatively, the CLOCK connectors on the CBL-AES1604 cables can be connected externally with a standard 75 ohm BNC patch cable.

9.1   Designating clock master and slaves

In order to select master and slave AES16's in a system, each adapter ID must be first physically associated with a AES16 installed in a computer slot. Windows 2000/XP or Macintosh OS assigns the adapter IDs from the lowest slot number to the highest slot number. The procedure is as follows:

➢ Connect at least OUT1 of each AES16 to your external mixing console or other equipment that will provide audio monitoring.
➢ Choose an audio application that allows selection of wave audio devices for audio playback.
➢ Select "AES16 1 Play 1" as the playback device.
➢ Listen to the playback of any wave file and note which AES16 card is generating the

audio signal. In this case, the card generating audio is adapter 1.
➢ Repeat steps 3 and 4, for "AES16 2 Play 1", "AES16 3 Play 1", and so on until all AES16's in your system have been identified.

The next step is to choose which AES16 will act as a master. This choice is based on preference only, but for ease of connection it makes sense to choose an AES16 that is on one end of the PCI slot array on your motherboard.

Alternatively, if clock connections are made externally using the CLOCK connectors on the CBL-AES1604 cables, use BNC cables to make connections between cards in the same sequence as described above

.

9.2   Adapter ID′s

When multiple AES16 cards are installed in a computer they are automatically assigned unique adapter ID numbers. These adapter ID's provide a means to identify and communicate with each AES16 when using the Lynx Mixer application and to select audio devices in third party applications.

In the Lynx Mixer, the adapter that a user wishes to control is selected from the "Window" pull-down menu. In a system with four AES16's the adapters will be listed as follows:

AES16 1 Mixer
AES16 2 Mixer
AES16 3 Mixer
AES16 4 Mixer

In each case, the adapter ID is the numeric character just before the word "Mixer" in each selection.

Most third party applications provide a setup or configuration menu for selecting a desired wave audio device for recording and playback. With multiple AES16's in a system, each device name will contain the adapter ID. For example, the first play device on adapter 2 is listed as "AES16 2 Play 1".

9.3   Cable connections

Starting with the master AES16, insert the plug on one end of a Lynx Internal Clock Cable into the CLOCK OUT header, until it clicks and locks into place. This header is polarized to ensure the correct orientation of the cable plug.

Insert the plug on the free end of the cable into the CLOCK IN header, on the nearest slave AES16. Connect each slave in a similar manner. Refer to the figure below:
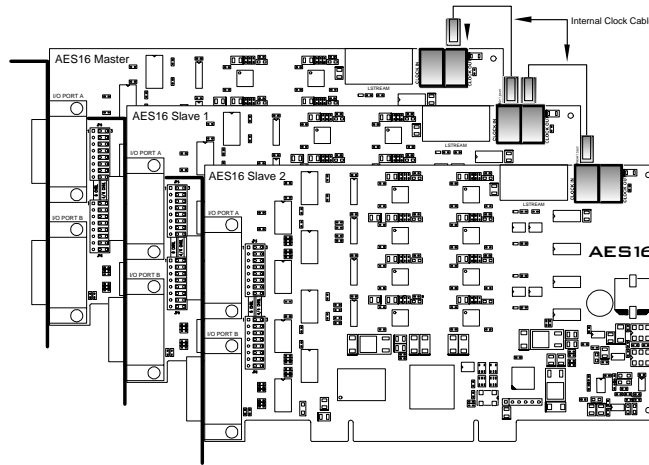
9.4   Mixer settings

With the clock connections in place, the sample clock settings of each AES16 must be adjusted using the Lynx Mixer.

For the master AES16:

➢ Select the master AES16 Adapter window of the Lynx Mixer.
➢ Select a desired Sample Clock Source.
➢ Select a desired Sample Clock Reference.

For each slave AES16:

➢ Select the master AES16 Adapter window of the Lynx Mixer.
➢ Set the Sample Clock Source to Header if internal clock connections are used or External if external clock connections are used.
➢ Set the Sample Clock Reference to Word.

10 Troubleshooting

Clicking, popping or crackling noises in your audio:

1. Check clock master settings. In any digital audio configuration, there can be one, and only one master clock. All other digital audio devices must be configured as slaves to the designated master clock. Since the AES16's SynchroLock™ technology provides an extremely stable and jitter-resistant clock, we recommend setting the AES16 as the master clock in your digital audio system.

2. Check buffer settings in your audio application software. Smaller buffer sizes are preferred because they reduce latency (the time it takes for an audio signal to travel through your audio software). In some cases, however, setting too small a buffer size can overtax your computer's processor, particularly when running multiple tracks and/or a number of DSP plug-ins. This can result in clicks and pops in your audio playback. Try increasing the buffer size and see if your playback performance improves.

Audio plays back at a faster or slower rate than expected:

This is usually the result of mismatched clock rates and multiple clock masters. For example, if you are playing back a file recorded at 44.1 kHz, but you have set the clock for 48 kHz, the file will play back faster and at a higher pitch than expected. Make certain you have set only one device as clock master.

No audio:

If you see signal appearing on the AES16's output meters, verify your output connections, making certain you have a valid signal flow from the AES16's outputs to your mixer or other D/A device, and from that device to your speakers.

If you see no signal appearing on the AES16's input meters, verify your connections, making certain you have valid signal flow from your digital audio source to the AES16's inputs.

11 Support

We are devoted to making your experience with AES16 trouble-free and productive. If you have questions or comments regarding the operation of your AES16 please check the "Troubleshooting" section of this manual and the FAQ and Troubleshooting topics on the Support section of the Lynx web site at: http://www.lynxstudio.com/support.html

11.1 Contact us

If you are unable to find information about your problem please send us a support request by filling out the form at: http://www.lynxstudio.com/supportrequest.html

In your email message include the following information:
• The serial number of your AES16.
• Which operating system you are using.
• The type of computer you are using.
• The name of the application you are using.

• A detailed description of the problem including any error messages you received.

We will provide a response in a timely manner.

Telephone support is available by calling (949) 515-8265 ext 206 from 9AM to 5PM Pacific Time, Monday through Friday, excluding United States Holidays. Please be sure to have the above information available before calling.

11.2 Registering your AES16

Lynx is committed to providing you with the best service possible. To help us serve you better, please be sure to register your AES16 using one of the following methods:

➢ Fill out and mail the Warranty Registration Card included with your AES16.

➢ Use the Online Registration Wizard. To start the wizard, click on Start > Programs > Lynx Studio Technology > Online Registration Wizard.

➢ If you do not have an internet connection on the computer you into which you installed your AES16, simply copy the REGISTER.EXE program from the C:\Program Files\Lynx Studio Technology folder to a computer with an internet connection and run REGISTER.EXE from there.

➢ Register on the web at: http://www.lynxstudio.com/support.html

Once you are registered you will automatically receive notifications of new products and upgrades.

11.3 Locating the Serial Number of Your AES16

To register your AES16, you must supply its serial number. The serial number is located on a label attached to the back of the card, and on the shipping carton.

You can also determine the serial number of your card by selecting About Mixer in the Mixer menu of the Lynx Mixer.

When registering with the Online Registration Wizard, the serial number will be automatically entered.

12 Appendices

12.1 I/O Configuration Jumpers

I/O Port A and I/O Port B can be configured to support two different I/O routing modes. The routing mode is selected by the position of two 8-position I/O Configuration Jumpers on headers JP5 and JP6. The mode selected must be compatible with the AES16 breakout cable being used.
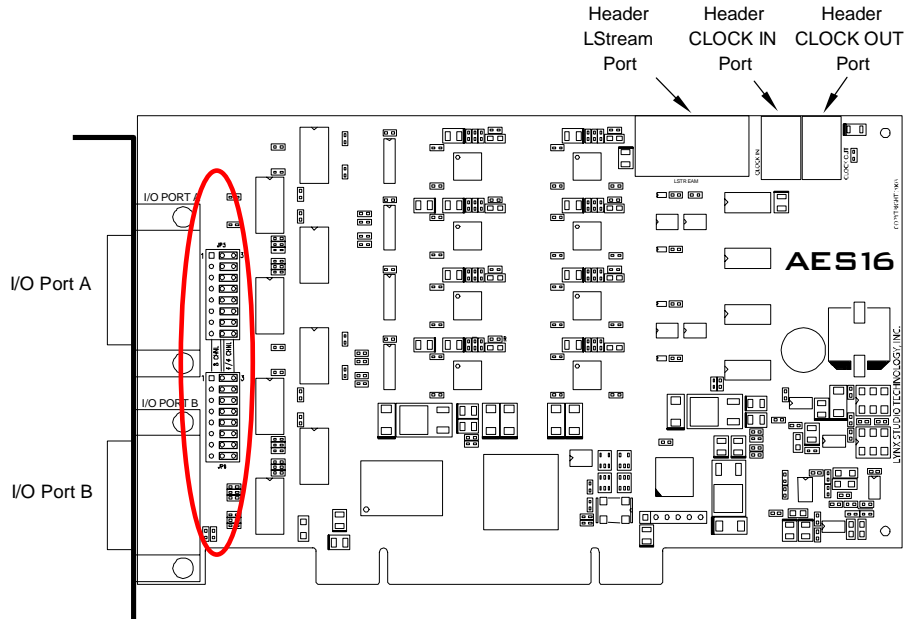
I/O Configuration Jumpers JP5 and JP6
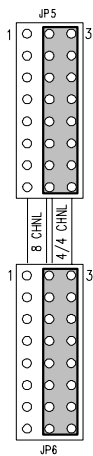
For connections to equipment with D25 connectors supporting four AES/EBU inputs and outputs, both of the I/O Configuration Jumpers should be set to the 4/4 CHNL position on JP5 and JP6 as shown at left. This is the factory default position and is the position required for the CBL-AES1604 and CBL-AES1605 cables.
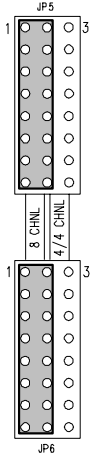
For connections to equipment with D25 connectors supporting eight channels of input or eight channels of output, the I/O Configuration Jumpers should be set to the 8 CHNL position on JP5 and JP6 as shown below. In this position, I/O Port A provides eight AES/EBU inputs and I/O Port B provides eight AES/EBU outputs. This is the required position for CBL-AES1603.

In either I/O Configuration mode, a clock input signal is available on I/O Port A and a clock output signal is available on I/O Port B. These signals are available on the BNC connectors on CBL-AES1604 breakout cable

12.2 Specifications

DIGITAL I/O	
Number / Type	Eight inputs and eight outputs, 24-bit AES/EBU format, transformer coupled
Channels	16 in/out in single-wire mode, 8 in/out in dual-wire mode
Sample Rates	All standard rates and variable rates up to 192 kHz in both single wire and dual-wire modes
Sample Rate Conversion	Eight channels available with support for conversion ratios up to 16:1. Dynamic range: 142 dB. Multiple-input SRC phase matching. AES16-SRC model only.
ARCHITECTURE	
Core	FPGA-based core contains custom PCI interface, data routing and formatting, device/stream control, digital mixing, clock routing and control, and DMA engine. 256 Kbytes of on-board RAM for data buffering. Support for field upgrades of firmware.
Audio Devices	Card is visible to host applications as eight record devices and eight play devices. Each device has two channels and can be used independently for multi-client functionality.
CLOCKING	
Sources	Digital inputs 1 – 4, external word clock (XLR model only) on BNC, internal word clock on header, on-board low-jitter crystal oscillator
SynchroLock	Multi-stage, VCXO-based clock generation system with high jitter attenuation. Wide mode tracks off-frequency clocks, narrow mode generates ultra-low jitter output for standard frequencies.
ON-BOARD DIGITAL MIXER	
Type	Hardware-based, low-latency
Routing	Ability to route any input to any or multiple outputs
Mixing	Up to four input or playback signals mixed to any output, 40-bit precision
Status	Peak levels to -114 dB on all inputs and outputs.
LSTREAM EXPANSION PORT	
Compatibility	Supports Lynx LStream expansion cards including the LS-ADAT 16-Channel ADAT I/O card
Type	High-speed serial, up to 16 channels @ 24-bits. 14-pin internal connector.
CONNECTIONS	
I/O Ports	Two bracket-mounted 26-pin high-density female D-sub connectors. Can be configured to support eight channel or four channel AES connections.
External Clock	75-ohm BNC word clock input and output provided on XLR breakout cables
Internal Clock	Two 75-ohm board mounted 2-pin headers for word clock input and output
SOFTWARE	
Windows Drivers	Windows 2000 / XP platforms: MME, ASIO 2.0, WDM, and DirectSound
Macintosh Drivers	ASIO 2.0 for OS9 and Core Audio for OS X
Mixer Application	Multi-window GUI provides complete control of digital mixer and all hardware settings.
GENERAL	
PCI Bus	Version 2.2 compliant
Data Transfers	Up to 132 Mbytes/sec using custom 16-channel, zero-wait state, scatter-gather DMA engine. Bus mastering supported.
Size	5.0" H X 7.4" W X 0.75" D (standard half-size PCI card)

CABLES	
Included with AES16-XLR and AES16-SRC	CBL-AES1604 (qty 2): 26-pin high-density male D-sub to four female XLR's (AES inputs), four male XLR's (AES outputs), and two female BNC's (word clock I/O). Six- foot, 110-ohm shielded twisted pair cabling.
Optional cables for AES16 Standard Model	CBL-AES1603: 26-pin high-density male D-sub to 25-pin male D-sub. Supports either 8 channels of input or output. Compatible with Apogee AD16 and DA16. Twelve-foot, 110-ohm shielded twisted pair cabling. CBL-AES1605: 26-pin high-density male D-sub to 25-pin male D-sub. Supports 4 channels of input and output. Compatible with devices with standard Yamaha digital I/O pinout from Yamaha, Apogee, Mackie, and others. Twelve- foot, 110-ohm shielded twisted pair cabling. Other cables to be offered for connection to equipment from Tascam, Sony, and Digidesign

12.3 Updating From the AES16 Standard NT4 Driver

If updating from the standard NT4 driver, you will need to uninstall the NT4 driver before you can load the WDM driver.

- From the start menu, click on "Lynx Studio Technology", and then click "Uninstall LynxTWO".
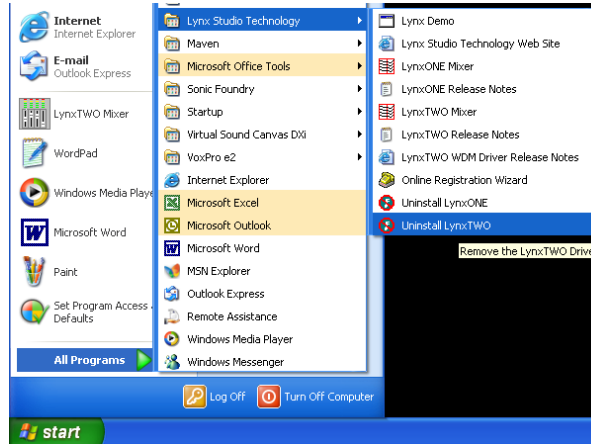
- Choose "Uninstall" from the next screen that appears.
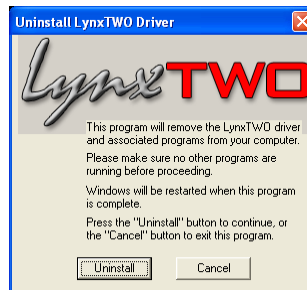
- Restart the machine when prompted.

You can now install the Version 2/WDM driver per instructions in Section 2.2 Windows Version 2 Driver Package (Windows 2000 and Windows XP).

12.4 Safety instructions

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC 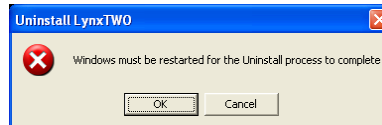Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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➢ Reorient or relocate the receiving antenna.

➢ Increase the separation between the equipment and receiver.

➢ Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

➢ Consult the dealer or an experienced radio/TV technician for help.

In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with nonapproved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

12.5 EMC Certifications

12.5.1 FCC DECLARATION OF CONFORMITY

TRADE NAME:	Computer Audio Card
MODEL NUMBER:	AES16
COMPLIANCE TEST REPORT NUMBER:	Covered by European Standards Report #B30915V1
COMPLIANCE TEST REPORT DATE:	November 2, 2003
RESPONSIBLE PARTY (IN USA):	Lynx Studio Technology, Inc.
ADDRESS:	711 West 17th Street, Suite H3, Costa Mesa, CA 92627
TELEPHONE:	(949) 515-8265

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If the unit does cause harmful interference to radio or television reception, please refer to your user's manual for instructions on correcting the problem.

I the undersigned, hereby declare that the equipment specified above conforms to the above requirements.

Costa Mesa, California
January 1, 2004

Robert Bauman
Compliance Engineer

12.5.2 EC DECLARATION OF CONFORMITY

MANUFACTURERS NAME:	Lynx Studio Technology, Inc.
MANUFACTURER ADDRESS:	711 West 17th Street, Suite H3
	Costa Mesa, CA 92627, U.S.A.
COMPLIANCE TEST REPORT NUMBER:	B30915V1
COMPLIANCE TEST REPORT DATE:	November 2, 2003
TYPE OF EQUIPMENT:	Information Technology Equipment
EQUIPMENT CLASS:	Residential, Commercial and Light Industry
MODEL NUMBER:	AES16
CONFORMS TO THESE STANDARDS:	EN50022: 1998, EN55024:1998 + A1:2001, CISPR 16:1993
	IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5,
	IEC 61000-4-6, IEC 61000-4-8, IEC 61000-4-11
YEAR OF MANUFACTURE:	2003

I the undersigned, hereby declare that the equipment specified above conforms to the above directives and standards.

Newport Beach, California
January 1, 2004

Robert Bauman
Compliance Engineer

13 License Agreement

This legal document is an agreement between you and Lynx Studio Technology, Inc. By opening the sealed board package, or written materials, you are agreeing to become bound by the terms of the agreement, which includes this License and Limited Warranty (collectively the "Agreement"). This Agreement constitutes the complete agreement between you and Lynx Studio Technology, Inc. If you do not agree to the terms of the Agreement, DO NOT OPEN the anti-static bag containing the AES16 board. Promptly return the unopened package and all other items using the original packaging to the location of purchase.

14 Warranty Information

Lynx Studio Technology, Inc. ("Lynx") warrants this product to be free of defects in material and workmanship for a period of one year from the date of original retail purchase. This warranty is enforceable only by the original retail purchaser. To be protected by this warranty, the purchaser must complete and return the enclosed warranty card within 14 days of purchase.

During the warranty period Lynx shall, at its sole and absolute option, either repair or replace free of charge any product that proves to be defective on inspection by Lynx or its authorized service representative. In all cases disputes concerning this warranty shall be resolved as prescribed by law.

To obtain warranty service, the purchaser must first call or write Lynx at the address and telephone number printed below to obtain a Return Authorization Number and instructions concerning where to return the unit for service. All inquiries must be accompanied by a description of the problem. All authorized returns must be sent to Lynx or an authorized Lynx repair facility postage prepaid insured and properly packaged. Proof of purchase must be presented in the form of a bill of sale, canceled check or some other positive proof that the product is within the warranty period. Lynx reserves the right to update any unit returned for repair. Lynx reserves the right to change or improve design of the product at any time without prior notice.

This warranty does not cover claims for damage due to abuse, neglect, alteration or attempted repair by unauthorized personnel, and is limited to failures arising during normal use that are due to defects in material or workmanship in the product.

ANY IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE LENGTH OF THIS LIMITED WARRANTY. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

IN NO EVENT WILL LYNX BE LIABLE FOR INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES RESULTING FROM THE BREACH OF ANY EXPRESS OR IMPLIED WARRANTY, INCLUDING, AMONG OTHER THINGS, DAMAGE TO PROPERTY, DAMAGE BASED ON INCONVENIENCE OR ON LOSS OF USE OF THE PRODUCT, AND, TO THE EXTENT PERMITTED BY LAW, DAMAGES FOR PERSONAL INJURY. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state.

This warranty only applies to products sold in the United States of America or Canada. The terms of this warranty and any obligations of Lynx under this warranty shall apply only within the country of sale. Without limiting the foregoing, repairs under this warranty shall be made only by a duly authorized Lynx service representative in the country of sale. For warranty information in all other countries please refer to your local distributor.

Your warranty will be in effect and you will receive warranty information ONLY IF YOU REGISTER YOUR AES16 as described in the "Warranty Registration" section.

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