LS-ADAT

Owner's Manual

Lynx
STUDIO
TECHNOLOGY

Contents

Introduction

Thank you for purchasing the LS-ADAT™! We are proud to provide you with a reliable, professional-quality product for your digital audio requirements.

This manual provides basic information to help you get started. Additional information is available via our web site and email support. Please refer to the support section at the end of this manual for support contact information.

The LS-ADAT is a 16-channel ADAT LStream™ interface that is designed for use with the LynxTWO and L22 professional audio interfaces. The devices communicate via Lynx's proprietary LStream multi-channel interface.

Before You Begin

We recommend that you read through the manual to acquire an overview of the installation procedure and use of the LS-ADAT. You should have a working knowledge of Windows and general PC concepts. Additionally, refer to the User's Guide included with your LynxTWO or L22.

Contents
Verify that you received the following in the LS-ADAT shipping carton:
- LS-ADAT card in cushioned antistatic bag
- LS-ADAT LStream cable (gray ribbon cable with two IDC connectors)
- Warranty Registration Card

Optional Equipment
The following cables are required for connection to external devices:
- TOSLINK optical cable (4), available from Lynx: Part # CBL-OPT3M - 3 meter length
- ADAT 9-pin Sync Cable, standard cable readily available

System Requirements
Verify that your computer meets or exceeds the following the system requirements specified in the LynxTWO or L22 User's Guide.

The LS-ADAT requires one expansion card position in your computer. A PCI slot **is not required**. The LS-ADAT derives all signals from the host LynxTWO/L22 card via its LStream ribbon cable.

Manual Conventions

The term "LynxTWO/L22" is a reference to either the LynxTWO or L22. Both products are compatible with the LS-ADAT.

This manual uses the following typographic conventions:
- ALL UPPER CASE text denotes the names of specific connectors.
- *Italic* text denotes emphasis or a warning.
- Phrases, such as Start > Programs > Lynx Studio Technology, use the greater than (">") sign to separate multiple menu options or icon names that are selected with a keyboard or mouse action.

Warranty Registration

We are committed to providing you with the best service possible. To help us serve you better, please be sure to register your LS-ADAT using one of the following methods:

- Fill out and mail the Warranty Registration Card included with your LS-ADAT.

- 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.

Locating the Serial Number of Your LS-ADAT
To register your LS-ADAT, 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.

Installation Procedure

The following installation procedure must be followed in the order described below in insure proper operation.

LynxTWO/L22 Driver

Verify that the driver installed for your LynxTWO/L22 is Build 049 or later. You can determine the driver version by selecting About Mixer in the Mixer menu of the LynxTWO/L22 Mixer. If you do not have the correct driver version it can be downloaded from the Lynx web site at http://www.lynxstudio.com/download.html. Refer to the Installation section of the LynxTWO or L22 User's Guide for more information related to driver installation.

LynxTWO/L22 Firmware

Verify that the version of firmware installed on your LynxTWO/L22 will support the LS-ADAT. You can determine the firmware version by selecting About Mixer in the Mixer menu of the LynxTWO/L22 Mixer. Verify the firmware version for your product is:

LynxTWO A Model: Rev 22 or later
LynxTWO B Model: Rev 8 or later
LynxTWO C Model: Rev 6 or later
L22: Rev 8 or later

If you do not have the correct firmware version installed, download the latest LynxTWO/L22 Firmware Update program http://www.lynxstudio.com/download.html. This is a self-extracting archive file.
1. Start L2UpdateXX.exe.
2. When prompted, navigate to a temporary directory to store L2Update.
3. L2Update will automatically start.
4. Click the Update button to continue.
5. Click OK when prompted and wait for the update process to complete.
6. Power down your computer. *A warm boot will not load the new firmware*.

LS-ADAT Internal Card Installation

1. With your computer powered down, install the LS-ADAT in a bracket slot adjacent to the LynxTWO/L22 as shown in the figure below. The LS-ADAT must be secured to the computer chassis with a screw.

2. Connect the included 14-pin ribbon cable from connector JP1 on the LynxTWO/L22 to connector JP2 on the LS-ADAT (labeled INT LSTREAM). The connectors on the ribbon cable have polarizing tabs that insert into slots in the mating connectors. Insure that these tabs are aligned correctly. *Failure to do so may result in serious damage to the LynxTWO/L22 and LS-ADAT.*
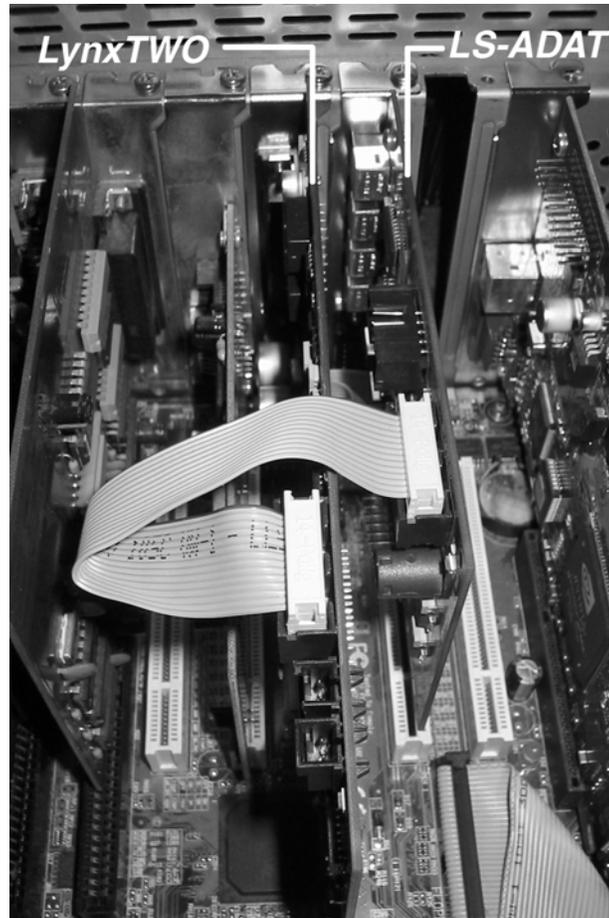
LynxTWO and LS-ADAT Installation in Computer Chassis

External Connections

The figure below depicts the layout of the LS-ADAT circuit board and its connectors.
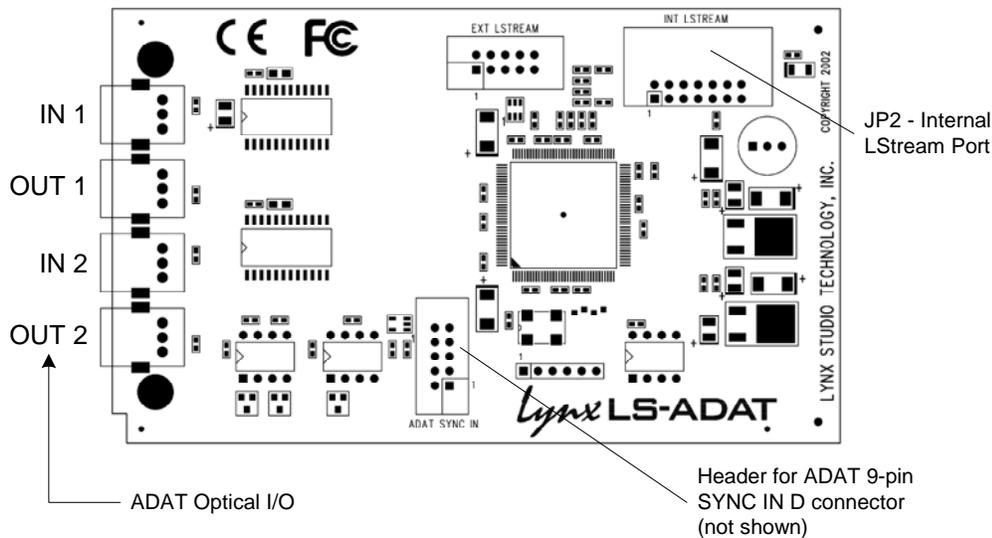
ADAT Optical Interface (lightpipe) Ports

The LS-ADAT provides two ADAT optical inputs and outputs. They are labeled on the mounting bracket and in the figure above. The ADAT channels corresponding to each port are as follows:

IN 1   ADAT input channels 1-8
OUT 1   ADAT output channels 1-8
IN 2   ADAT input channels 9-16
OUT 2   ADAT output channels 9-16

Connect the LS-ADAT to ADAT devices in your system using standard ADAT compatible fiber optic cables. Refer to the "Optional Equipment" section at the beginning of this manual for part numbers of cables available from Lynx.

ADAT Sync In Port

The LS-ADAT provides an ADAT Sync In port labeled "SYNC IN" on the mounting bracket. (The actual connector is not shown in the figure above). This port is used to interface to ADAT equipment with a compatible Sync Out port for synchronization.

Connect this port to the Sync Out port of an external device using a 9-pin ADAT Sync Cable.

LynxTWO / L22 Mixer Controls

The LStream page of the LynxTWO/L22 Mixer contains controls for installed LStream interface cards. With the LS-ADAT installed, ADAT-specific controls are displayed as shown below. The description for each control is included for reference.

	Device ID	LStream device identification
	Output Select	Controls routing of the eight upper and lower digital outputs from the host card to LStream channels.
	Clock Source	Controls selection of the clock source for the LS-ADAT.
	Position	Time code frame address decoded from ADAT SYNC IN port. The frame rate is 30 fps.
	Cue Point Enable	Enables sample accurate time code synchronization starting at the time code address specified in the Cue Point box.
	Cue Point	Text box for entry of time code Cue Point frame.

All LStream controls are described in detail later in this manual.

LStream Interface to the Host LynxTWO/L22

The LS-ADAT communicates with the host card through Lynx's proprietary LStream interface. LStream is a high-speed TDM serial interface that supports up to 16 channels of bi-directional 24-bit audio data with synchronization and control information.

The individual channels of the LStream interface are integrated into the host card's on-board digital mixer. This allows LStream data, in this case ADAT data, to be freely routed and mixed with the host card's analog and digital audio I/O. Currently, the architecture of LynxTWO/L22 digital mixer supports a maximum of 16 input and 16 output channels that can assigned as needed to the available physical I/O's. Controlling the digital mixer requires an understanding of the LynxTWO/L22 Mixer application. Please refer to the User's Guide included with the product you own for further details.

The number of channels supported on one LStream connection varies with sample rate as follows:

Sample Rate	Speed	Number of LStream Channels
44.1/48 kHz	Single	16
88.2/96 kHz	Double	8
176.4/192 kHz	Quad	4

It just so happens that the LStream channel capacity meets the requirements for handling the high sample rate S/MUX features of the LS-ADAT. This will be discussed in more detail later.

LS-ADAT Output Routing

As shown below and in the Outputs page of the LynxTWO/L22 Mixer application, 16 output channels are available from the digital mixer. Output channels 1-8 are wired to the analog outputs, AES digital output, loopback registers, *and* to both LStream ports. Channels 9-16 are wired only to LStream output channels. This connection scheme allows any (or all) of the digital mixer's output channels to be routed to the outputs of the LS-ADAT via the LStream interface. Please note, that the signals sent to host card's analog and digital outputs will be mimicked on the corresponding LS-ADAT channels if mixer outputs 1-8 are routed to the LS-ADAT.

LynxTWO A Model Output Section

LS-ADAT Output Section
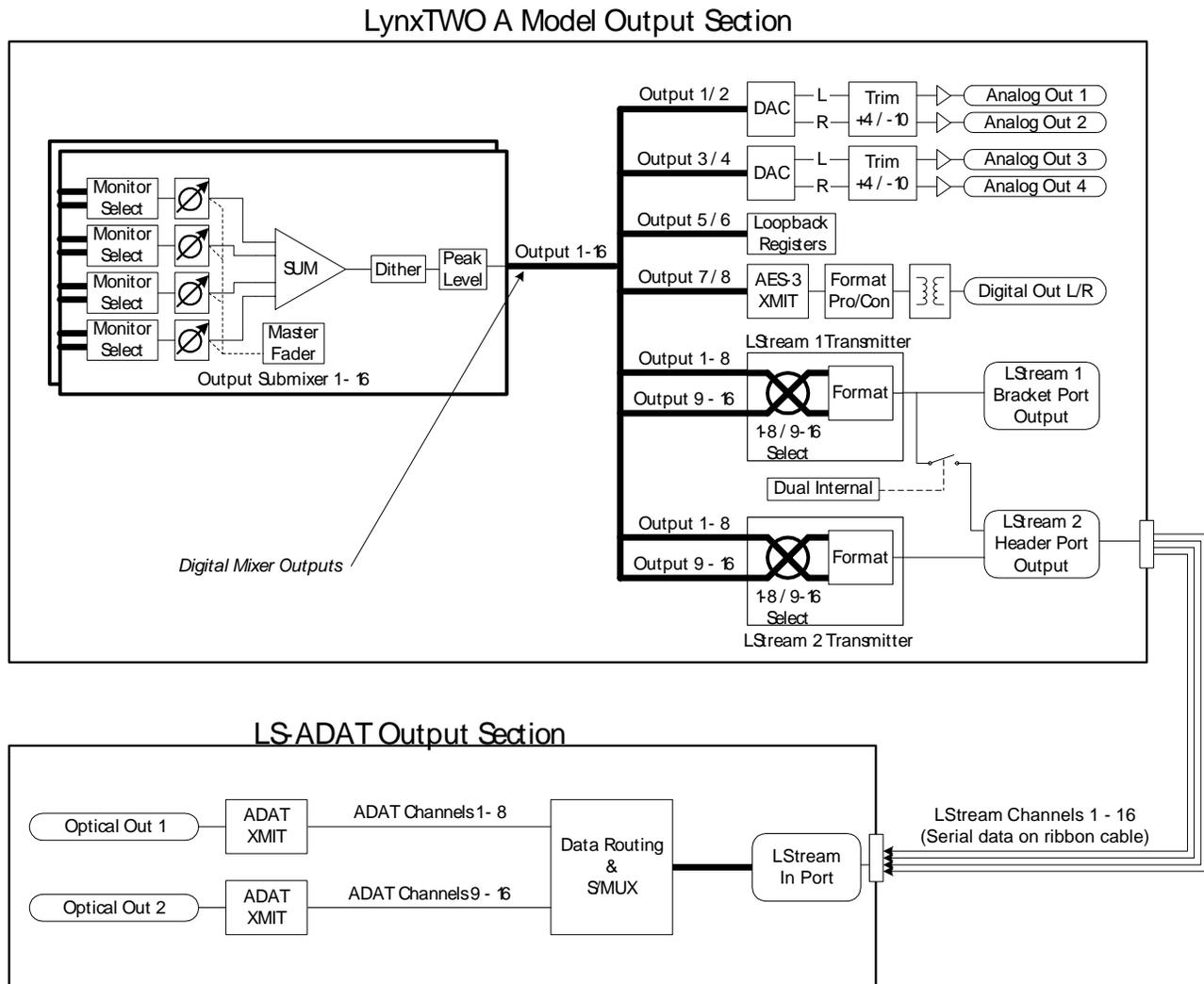
Output Channel Source Selection

As shown in the diagram, each digital mixer output channel is derived from a four-input submixer. The inputs to the submixer are recording and playback signals that can be selected using the Output Monitor Source select buttons. These buttons reside in the Outputs page of the LynxTWO/L22 Mixer just above the faders for each output channel. Choose up to four sources for each output. The mute button (labeled M) next to each Output Monitor Source button must be in the "out" position in order for the signal to be heard.

LStream Output Channel Group Mapping

The mapping of the digital mixer's output channels to LStream channels can be controlled to accommodate specific I/O configuration requirements. The Output Select control (labeled "1-8/9-16 Select" in the diagram above) allows the destination of the upper eight and lower eight mixer output channels to be altered. This feature is particularly useful for re-routing output channels 1 – 8, which are hardwired to the host card's analog and digital outputs and to the LStream ports.

The Output Select control on the LStream page of the LynxTWO/L22 Mixer has two settings:

9-16/1-8 Maps mixer output channels 9-16 to LStream output channels 1-8 *AND* maps mixer output channels 1-8 to LStream output channels 9-16 (this is the default setting).

1-8/9-16 Maps mixer output channels 1-8 to LStream output channels 1-8 *AND* maps mixer output channels 9-16 to LStream output channels 9-16.

Typically, the default setting is easiest to work with if you are using only the first eight channels of the LS-ADAT. If you are using all 16 channels of the LS-ADAT at 48 kHz it may be easier to use the 1-8/9-16 option. In this case, the numbering of the output channels of the LynxTWO/L22 mixer corresponds to the LS-ADAT output channel numbering.

Please note that this section pertains to the mapping of LStream channels, and not to LS-ADAT output channels. As will be discussed in a later section there is not always a one-to-one correspondence between LStream channels and LS-ADAT I/O channels.

LS-ADAT Input Routing

As shown below, the ADAT data from the LS-ADAT is routed into the digital mixer of the host card via the LStream 2 Header port. This data can be routed to the record bus using the Input Source Select function within each Input Submixer.

LynxTWO A Model Input Section

LS-ADAT Input Section
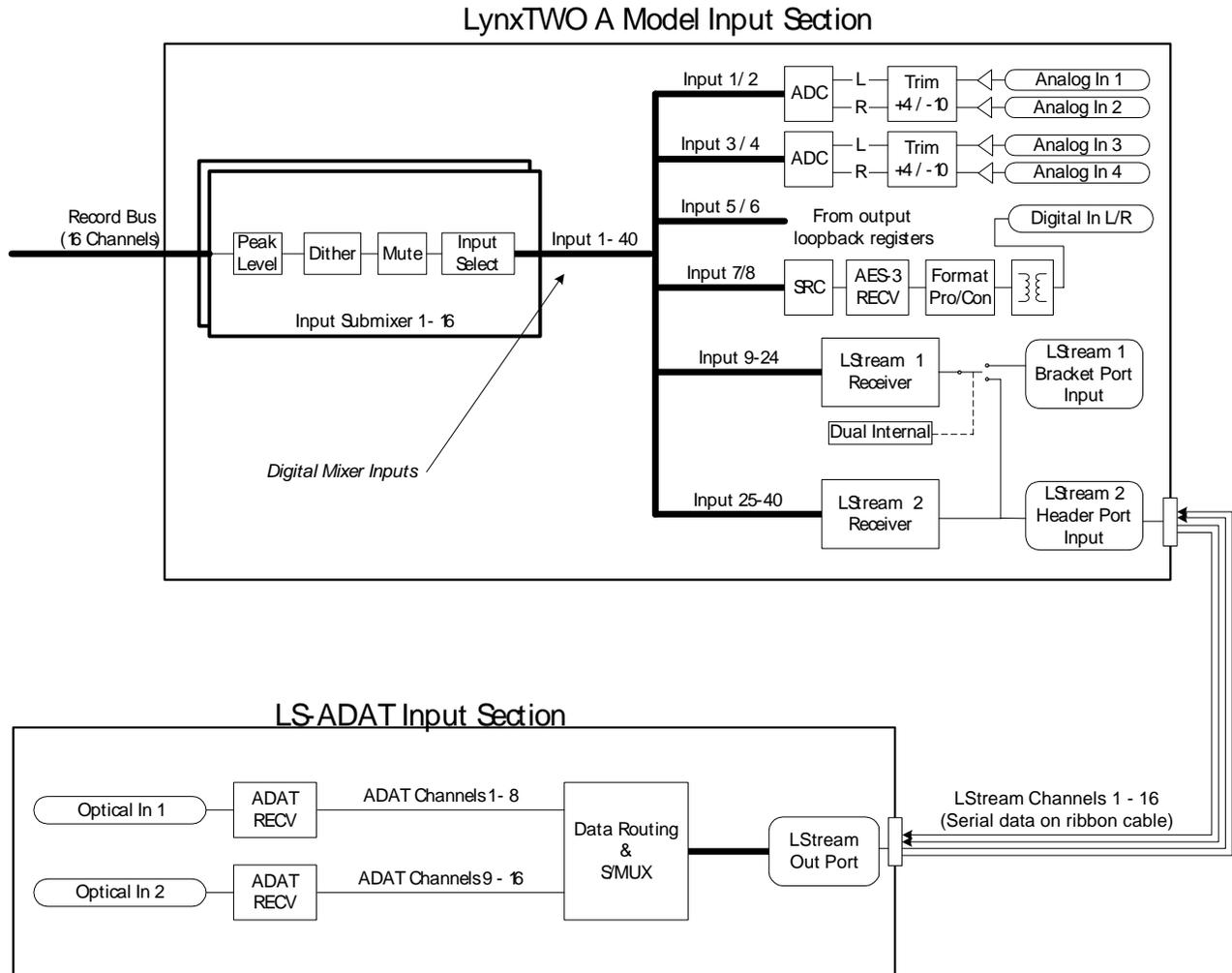
The Input Source Selection buttons on the Record/Play page of the LynxTWO/L22 Mixer provide access to the input select function. These buttons are located just above the meters for each input channel.

When these buttons are clicked, a menu containing the 40 possible input sources will be displayed. To access channels from the internal version of the LS-ADAT, choose sources from **LStream 2 In 1** through **LStream 2 In 16.**

Each Input Source is routed to either the left or right channel of a record device. The record device number is located under the meters, e.g., Record 1, Record 2. When setting up for recording in an audio editing application, these devices numbers are used to specify the recording source.

ADAT Channel Mapping and S/MUX

This section describes the mapping of LStream channels to LS-ADAT channels. This mapping varies with sample rate since S/MUX is required to support sample rates above the standard ADAT sample rate of 48 kHz.

At 44.1 kHz and 48 kHz there is a one-for-one correspondence between LStream channels and LS-ADAT channels. All 16 input and output channels are available.

At sample rates above 48 kHz, the signal channel capacity (and the number of required LStream channels) is reduced since S/MUX utilizes multiple ADAT channels for each signal channel. Refer to the following table.

88.1/96 kHz Sample Rate		176.4/192 kHz Sample Rate	
LStream Channel	ADAT Channel	LStream Channel	ADAT Channel
1	1-2	1	1-4
2	3-4	2	5-8
3	5-6	3	9-12
4	7-8	4	13-16
5	9-10	16 – 5	**NOT VALID**
6	11-12		
7	13-14		
8	15-16		
16-9	**NOT VALID**		

S/MUX is enabled on demand, based on the sample rate currently selected for recording or playback. As such, the mapping of channels will change when the sample rate changes. The user must be keenly aware of this "automatic" re-mapping to avoid mixing and routing problems.

Clock Synchronization

The ADAT Clock control on the LStream page of the LynxTWO/L22 Mixer provides LS-ADAT clock source selection as follows:

Clock Source Selection	Action
Slave	LS-ADAT clock is slaved to the host card system clock source. The system clock source is selected on the Adapter page of the Mixer.
Optical In 1	The word clock derived from optical IN 1 port is the clock source for the LS-ADAT and host card.
Optical In 2	The word clock derived from optical IN 2 port is the clock source for the LS-ADAT and host card.
Sync In	The word clock derived from optical SYNC IN port is the clock source for the LS-ADAT and host card.

Important: If a clock source other than Slave is used, the LynxTWO/L22 clock source must also be set to **LStream 2** in the Adapter page of the Mixer.

To insure glitch-free recording and playback using an external ADAT device, the LS-ADAT, host LynxTWO/L22, and external ADAT must run synchronously from a common clock source. There are only two scenarios to consider that satisfy this requirement:

1. The LynxTWO/L22 host card is the clock master. The LS-ADAT and external ADAT device must run in clock slave mode. This case includes host card synchronization to external clocks such as word clocks and composite video.
2. An external ADAT device is the clock master. The LS-ADAT clock source must be derived from either of the optical inputs or ADAT sync input and the host card clock source must be set to LStream 2.

Due to the high-jitter observed on clocks generated by ADAT recorders, we recommend that the **Slave** clock source be used if possible. This choice utilizes the LynxTWO/L22 low-jitter sample clock for all ADAT clocking. To run in this mode, the clock source of ADAT recorder must be set to slave to its digital input (DIG IN) and either of the LS-ADAT's optical outputs must be connect to the ADAT's optical input.

Select a clock source other than Slave if your system configuration does not allow the ADAT device to run in clock slave mode or you wish to slave the LS-ADAT to an external device.

Synchronization with the ADAT Sync In Port

The LS-ADAT incorporates an ADAT compatible 9-pin Sync In port for synchronization to external ADAT devices. The signals received on this port include ADAT system exclusive MIDI messages for transport control functions, time code, and word clock. Most importantly, the received time code data provides the mechanism for enabling sample-accurate transfers of audio data to and from an external ADAT device.

The ADAT Sync In port feeds time code control logic on the LS-ADAT that provides two methods of sample-accurate synchronization. In systems using ASIO compatible audio applications, the LS-ADAT utilizes Steinberg's ASIO Positioning Protocol for synchronization to ADAT time code. Alternatively, synchronization using the LS-ADAT's Cue Point capability initiates recording or playback with sample period resolution. The LS-ADAT also translates received time code to MTC for general compatibility with many applications

ADAT synchronization requires the connection of a 9-pin cable from the Sync Out port of an external ADAT device to the LS-ADAT Sync In Port.

ASIO Positioning Protocol Synchronization

ASIO specifies a sample count value for each audio data buffer to control sample position during record or playback. When an ASIO application is running, the LS-ADAT will properly generate the sample count for every buffer based on time code received from the SYNC IN port.

ASIO synchronization can be utilized in any ASIO compatible application that supports ASIO Positioning Protocol. We have tested this with both Steinberg Nuendo and Cubase SX.

To enable ASIO Positioning Protocol in Nuendo and Cubase SX:

1. From the Transport menu select Sync Setup. In the Synchronization Setup dialog box, select ASIO Positioning Protocol under Timecode Source.

2. From the Transport menu enable Sync Online.

With Positioning Protocol enabled, the ASIO application position cursor will track the time code position of the external ADAT device with sample accuracy. Refer to documentation included with your audio editing software for more information regarding ASIO synchronization.

Cue Point Synchronization

The Cue Point synchronization method relies on dedicated hardware in the LS-ADAT to detect a match between a specified SMPTE frame address (the Cue Point) and time code data received on the Sync In Port. When a match is detected, recording or playback is initiated in hardware, thus avoiding delays inherent in software sync techniques.

This sync method can be used with most applications without altering settings within the applications. The application is unaware that Cue Point is enabled.

To perform Cue Point sync:
1. Connect an ADAT machine to the Sync In Port of the LS-ADAT. Rewind the tape to a point at least 5 seconds before the desired start position.
2. Start the audio application and determine the SMPTE frame address at which you would like to start recording/playback. The frame must be referenced to a frame rate of 30 fps.
3. Launch the LynxTWO/L22 Mixer.
4. Insert the frame address from step 2 into the Cue Point text box on the LStream page. It must be entered in hh:mm:ss:ff format exactly.
5. Check the Cue Point Enable box by clicking on it.
6. Start recording or playback normally in the audio application. At this point data will not be transferred to /from the LynxTWO/L22. The application will be in a "paused stated" waiting for a buffer transfer.
7. Press play on the ADAT recorder.
8. When the LS-ADAT receives the time code matching the Cue Point, it will initiate data buffer transfers and in turn normal recording or playback activity will start in the audio application.

Cue Point Synchronization in Cool Edit Pro

The Sample Accurate Sync function in Cool Edit Pro (available from Syntrillium) interfaces with the LS-ADAT's Cue Point capability to provide a simplified synchronization setup. This feature eliminates the requirement of manually inserting a Cue Point frame address and selecting Cue Point Enable in the LStream page of the mixer. Refer to following instructions:

1. Connect an ADAT machine to the Sync In Port of the LS-ADAT. Rewind the tape to a point at least 5 seconds before the desired start position.
2. Select Multitrack View in Cool Edit Pro (CEP) from the View menu.
3. Set the position cursor in CEP to the desired start position in the audio file.
4. From the Options menu select Sample Accurate Sync
5. Start playback in Cool Edit Pro
6. Press play on the ADAT recorder.
7. When the LS-ADAT receives the time code matching the cursor position, it will initiate data buffer transfers and in turn start normal recording or playback in the CEP.

Specifications

ADAT OPTICAL I/O	
Number / Type	Two inputs and two outputs, compatible with Alesis ADAT Type I and Type II Optical Digital Interface Protocol, up to 24-bit data
Channels	16 @ 44.1kHz 48 kHz sample rates 8 @ 88.2 kHz and 96 kHz sample rates, S/MUX enabled 4 @ 176.4 kHz and 192 kHz sample rates, SMUX enabled
Input Receiver	Fast-locking phase-locked loop with 30 kHz to 55 kHz lock range

ADAT SYNCHRONIZATION I/O	
Number / Type	One 9-pin Sync In port compatible with Alesis Synchronization Protocol
Signals	Time code (sample count), word clock, and MIDI control data
Sample Accurate Methods	ASIO Positioning Protocol and hardware-based SMPTE frame address matching logic (Cue Point).
MTC	Time code to MTC conversion
MIDI	MIDI port transfers serial input control data

CLOCK SYNCHRONIZATION	
Clock Sources	Host card (LynxTWO or L22), Optical In 1, Optical In 2, ADAT Sync In
Modes	Master mode: utilizes LynxTWO or L22 low-jitter sample clock to drive external ADAT devices Slave mode: word clock derived from external ADAT device

ARCHITECTURE	
Core	FPGA-based core. Support for field upgrades of firmware.
Audio Devices	Host Card is visible to applications as eight stereo record devices corresponding to ADAT optical inputs 1 – 16 and eight stereo play devices corresponding to ADAT optical outputs 1 – 16.
Routing/Mixing	Integrates with host card's digital mixer to allow independent routing of ADAT I/O with host card analog and digital I/O.

CONNECTIONS	
I/O Ports	(4) Bracket-mounted TOSLINK connectors. (1) 9-pin female D-sub connector.
Other	LStream interface headers

GENERAL	
Host Interface	Lynx proprietary LStream™ Interface: 24.5 Mbps bi-directional
Requirements	One available bracket position (PCI slot not required), Host card: LynxTWO or L22
Size	3.0" H X 5.0" W X 0.75" D
EMI Certifications	FCC and CE
Shipping Weight	2 pounds

Support

We are devoted to making your experience with LS-ADAT trouble-free and productive.
If you have questions or comments regarding the operation of your LS-ADAT please check the
Troubleshooting topics on the Support section of the Lynx web site at:

http://www.lynxstudio.com/support.html

If you are unable to find information about your problem please email us at:

support@lynxstudio.com

In your email message include the following information:
• The serial number of your LS-ADAT and the serial number of your LynxTWO/L22.
• 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 Holidays. Please be sure to have the above information available
before calling.

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 no agree to the terms of the Agreement, DO NOT OPEN the anti-static bag containing the LS-ADAT board. Promptly return the unopened package and all other items using the original packaging to the location of purchase.

Limited Warranty

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 LS-ADAT as described in the "Warranty Registration" section.

Lynx Studio Technology, LS-ADAT and the LS-ADAT Logo are trademarks of Lynx Studio Technology, Inc. All other product or company names are the trademarks or registered trademarks of their respective owners.

LS-ADAT™ Owner's Manual, printed 7/29/2004