

UltraLite™

User's Guide for Windows

MOTU

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- Relocate or reorient the receiving antenna
- Increase the separation between the equipment and the receiver
- Plug the equipment into an outlet on a circuit different from that to which the receiver is connected

If necessary, you can consult a dealer or experienced radio/television technician for additional assistance.

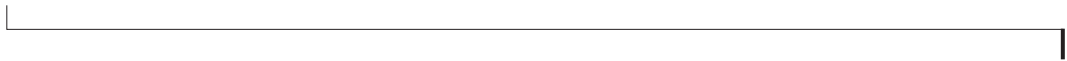
PLEASE NOTE: only equipment certified to comply with Class B (computer input/output devices, terminals, printers, etc.) should be attached to this equipment, and it must have shielded interface cables in order to comply with the Class B FCC limits on RF emissions.

WARNING: changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

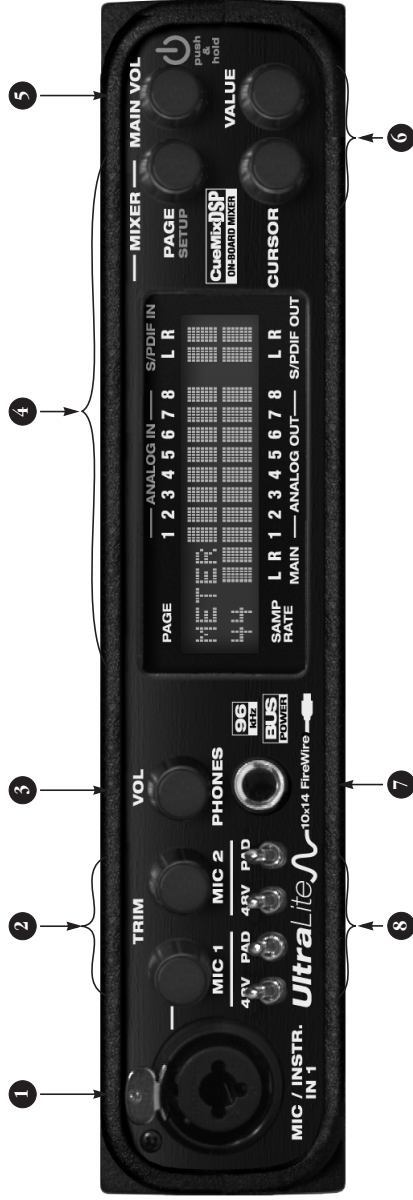


Contents

- 5 **Quick Reference: UltraLite Front Panel**
- 6 **Quick Reference: UltraLite Rear Panel**
- 7 **Quick Reference: MOTU Audio Setup**
- 9 **About the UltraLite**
- 13 **Packing List & Windows System Requirements**
- 15 **IMPORTANT! Run the UltraLite Software Installer First**
- 17 **Installing the UltraLite Hardware**
- 27 **MOTU Audio Setup**
- 31 **UltraLite Front Panel Operation**
- 37 **Cubase, Nuendo and Other ASIO Software**
- 41 **SONAR and other WDM Software**
- 47 **GigaStudio and GSIF**
- 51 **Reducing Monitoring Latency**
- 57 **MOTU CueMix Console**
- 65 **Performance Tips & Troubleshooting**

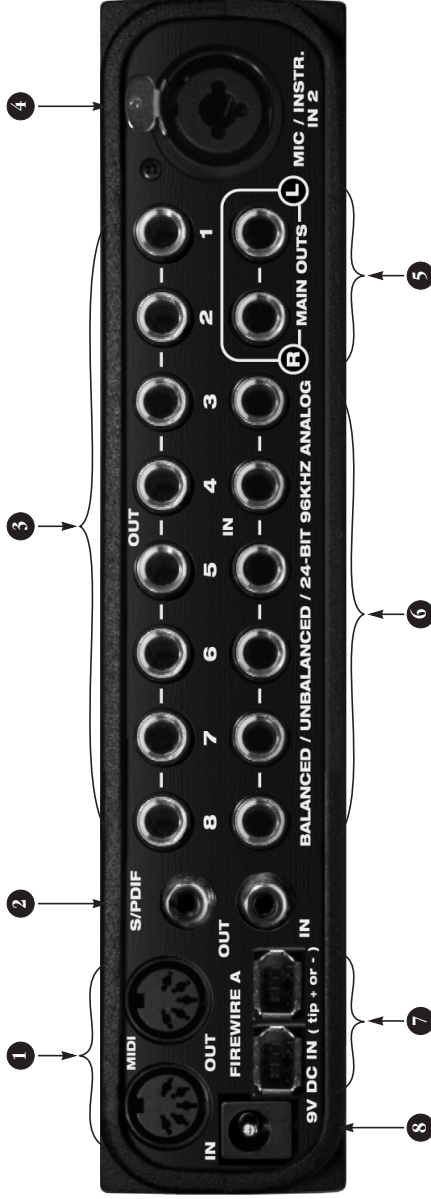


Quick Reference: UltraLite Front Panel



1. This XLR/TRS combo jack accepts either a mic cable or a cable with a quarter-inch plug. Both the low-impedance XLR jack and the high-impedance TRS jack are equipped with 24dB of front-panel trim control. The XLR (mic) input can be supplied with 48V phantom power via the Mic 1 front-panel switch. The Mic 1 three-way pad switch provides zero (down), 18dB (middle), and 36dB (up) pad settings for the XLR (mic) input as well.
2. These two Precision Digital Trim™ knobs provide 24dB of gain in 1dB increments for the front and rear panel Mic/Instrument inputs. Both have preamps so you can plug in just about anything: a microphone, a guitar, a synth, or even a +4 signal. Use the trim knob three-way pad switch and input level meter in the LCD to calibrate the input signal level.
3. Controls the headphone volume. The LCD provides visual feedback for the headphone volume setting as you turn the knob.
4. The multi-purpose backlit LCD provides metering for all of the UltraLite's inputs and outputs. It also gives you access to the UltraLite's built-in mixer and other settings. There are four independent mix busses: MIX1 through MIX4. Each mixes all inputs (or any subset you wish) to a stereo output of your choice. To edit a mix, push the PAGE knob to enter mixer mode. Use the CURSOR knob to scroll to the Mix1 setting until it flashes and then turn the VALUE knob to choose the desired mix, or push it to cycle through the four mixes. Each mix has parameters (volume, pan, etc.) for each input; choose the parameter you wish to edit by turning the PAGE knob. The LCD shows each UltraLite input (XLR/Combo, TRS, and SPDIF), along with the current mix parameter setting for each input. To change a setting, scroll to it with the CURSOR knob and change it with the VALUE knob. The labels above and below the LCD refer to all of the UltraLite's inputs and outputs (both analog and digital).
5. This knob doubles as the main volume and the power switch. The UltraLite is powered by its FireWire connection to the computer. Push this knob to turn the UltraLite on; push and hold to turn it off. It is recommended that you always power off the UltraLite before unplugging the FireWire cable.
6. Use the CURSOR and VALUE knobs to edit CueMix DSP parameters and other UltraLite settings in the LCD.
7. This is a standard quarter-inch stereo headphone jack. From the factory, its output matches the main outs on the rear panel. But it can be programmed to mirror any other output pair (digital or analog). It can even be programmed to serve as its own independent output. Use the volume knob above to control its level.
8. The 48V phantom power switches provide phantom power for condenser microphones. Down is off; up is on. The PAD switches are three-way switches: down turns off the pad; the middle position provides an 18dB pad; the up position provides a 36dB pad.

Quick Reference: UltraLite Rear Panel



1. Connect a MIDI device here using standard MIDI cables. Connect the UltraLite's MIDI OUT port to the MIDI IN port on the other device. Conversely, connect the UltraLite's MIDI IN port to the MIDI OUT port on the other device. You can connect different devices to each port, such as a controller device to the IN port and a sound module to the OUT port. You can also daisy-chain MIDI devices, but be sure to manage their MIDI channels (so that they don't receive or transmit on the same channel).
2. These jacks provide stereo, 24-bit S/PDIF digital input and output at any sample rate up to 96kHz.
3. The UltraLite's eight analog outputs are gold-plated, balanced +4dB TRS (tip/ring/sleeve) quarter-inch connectors that can also accept an unbalanced plug. They are equipped with 24-bit, 128x oversampling converters.
4. This XLR/TRS combo jack accepts either a mic cable or a cable with a quarter-inch plug. Both the low-impedance XLR jack and the high-impedance TRS jack are equipped with 24dB of front-panel trim control. The XLR (mic) input can be supplied with 48V phantom power via the Mic2 front-panel switch. The Mic2 three-way pad switch provides zero (down), 18dB (middle) and 36dB (up) pad settings for the XLR (mic) input as well.
5. These two balanced, quarter-inch jacks serve as the UltraLite's main outputs. You can connect them to a set of powered studio monitors and then control the volume from the front panel volume knob. To hear disk tracks in your audio software on these main outs, assign the disk tracks (and master fader) to these main outs (Main Out 1-2). You can also use CueMix DSP to monitor live UltraLite inputs here as well.
6. These six analog inputs (3 through 8) are gold-plated, balanced TRS (tip/ring/sleeve) quarter-inch connectors that can also accept an unbalanced plug. The front panel LCD and MOTU CueMix Console software let you adjust them for either +4dB or -10dB input signals. They have 24-bit, 64x oversampling converters. These inputs do not have microphone preamps, so they are best used for synthesizers, drum machines, effects processors, and other instruments with line level signals.
7. Connect the UltraLite to the computer here using the standard 1394 FireWire A cable provided with your UltraLite. **Important note: it is best to turn off the UltraLite when plugging in the FireWire cable, as this avoids the possibility of static discharge, which can harm the electrical components in the UltraLite or your computer.** Use the second FireWire port to daisy-chain up to four MOTU FireWire audio interfaces to a single FireWire bus. You can also connect other FireWire devices. For details, see "Connecting multiple MOTU FireWire interfaces" on page 23.
8. This jack accepts any standard 10-24V DC power supply with either tip-positive or tip-negative polarity.

Quick Reference: MOTU Audio Setup

MOTU Audio Setup

General UltraLite

Sample Rate: 96000

Clock Source: Internal

Samples Per Buffer: 1024

Enable Pedal

Pedal Down: Set

Pedal Up: Set

Enable full Wave support for legacy (MME) software. (Less efficient)

Enable Multi Channel Wave Synchronization (Recommended)

driver: 3.5.3.6

Cancel OK

Determines the clock source for your UltraLite. If you're just using the analog ins and outs, set this to 'Internal'. The other settings are for digital transfers via S/PDIF or synchronization to other audio devices.

If you have a foot switch connected to another MOTU FireWire interface, these settings let you map the foot switch to any computer keyboard key for both the up and down position. This setting does not apply to the UltraLite, which does not have a foot switch input.

Check this option if the audio software you are using with the UltraLite does not support Windows WDM drivers and instead only supports legacy MME (Wave) drivers. When checked, this option makes all of the UltraLite inputs and outputs available to legacy Wave-driver compatible audio software.

Click the tabs to access general MOTU FireWire interface settings or settings specific to the UltraLite (or other connected interface.)

Choose the sample rate for the system here.

Choosing a smaller setting here reduces the delay you may hear when listening to live input that you are running through effects plug-ins in your software. But lower settings also increase the strain on your computer. For details, see "Samples Per Buffer" on page 29.

This option should always be left on (checked). There are only a few rare cases in which you would want to turn it off. For details, refer to the MOTU tech support database at www.motu.com.

MOTU Audio Setup

General UltraLite

Main Outs Volume: Main Outs

Phones: Phones

firmware: 1.0, hardware: 1.9

Cancel

Click the UltraLite tab to access these settings.

Lets you choose what to control with the MAIN VOL knob on the front panel. You can control the stereo Main Outs on the rear panel, the S/PDIF stereo output, or analog outputs 1-6 or 1-8 for 5.1 or 7.1 surround output, respectively.

This menu lets you choose what you will hear from the headphone jack. To mirror the main outs, choose *Main Out 1-2*. Or you can mirror any other output pair. To hear the phones as their own independent output, choose *Phones 1-2*.

- Phones
- Analog 1-2
- Analog 3-4
- Analog 5-6
- Analog 7-8
- Main Outs
- SPDIF

How to access these settings

- UltraLite There are several ways to access these settings:
- From the Windows Start menu, choose Programs>MOTU>MOTU Audio Setup.
 - From within Cubase SX, go to the Device Setup window, click the *VST Audiobay* and then choose *MOTU Audio* from the menu. Then click the *MOTU Audio* list item to access the Control Panel button.
 - From within other applications, refer to their documentation.

Device Setup

MOTU Audio

ASIO Driver Name: MOTU Audio

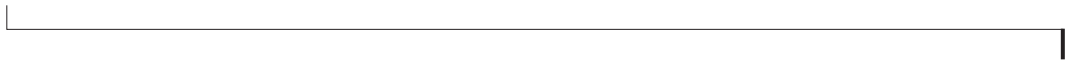
Input Latency: 12.517 ms

Output Latency: 11.633 ms

Internal Clock Source

ControlPanel

Device Setup in Cubase SX



CHAPTER 1 About the UltraLite

OVERVIEW

The UltraLite is a computer-based hard disk recording system for Mac OS X and Windows that offers 10 inputs and 14 outputs. Analog recording and playback is offered at any standard sample rate up to 96kHz. All inputs and outputs, both analog and digital, can be accessed simultaneously. The UltraLite is housed in a sturdy, compact enclosure that connects directly to a computer via a standard IEEE 1394 FireWire™ cable. The UltraLite offers the following:

- Bus-powered operation
- Two combo XLR/TRS mic/guitar inputs with preamps and 48V phantom power
- Digital Precision Trim™ preamp gain adjustment
- Six 24-bit analog TRS inputs
- Ten 24-bit analog TRS outputs
- S/PDIF digital I/O
- MIDI I/O
- Headphone jack with volume control
- Main Out volume knob
- CueMix™ DSP no-latency mixing & monitoring
- Front-panel programming
- Stand-alone mixing

With a variety of I/O formats, mic preamps and no-latency monitoring of live input, the UltraLite is a complete, portable “studio in a box” when used with a Macintosh or Windows computer. A WDM driver is included for audio applications running under Windows XP. Also included are ASIO2 and

GSIF2 drivers for multi-channel operation with any Windows audio software that supports these drivers.

THE ULTRALITE REAR PANEL

The UltraLite rear panel has the following connectors:

- Ten gold-plated, balanced +4dB quarter-inch (TRS) analog outputs (with 24-bit 96kHz converters)
- One combo XLR/TRS mic/instrument input
- Six gold-plated, balanced -10/+4 dB quarter-inch (TRS) analog inputs (with 24-bit 96kHz converters)
- RCA S/PDIF in/out
- Two 1394 FireWire jacks
- DC power jack
- MIDI IN and MIDI OUT jacks

10 inputs and 14 outputs

All UltraLite inputs and outputs can be used simultaneously, for a total of 10 inputs and 14 outputs:

Connection	Input	Output
Analog 24-bit 96kHz on bal/unbal TRS	6	10
Mic preamps 24-bit 96kHz on XLR/TRS combo	2	-
SPDIF 24-bit 96kHz digital	2	2
Headphone output	-	2
Total	10	14

All inputs and outputs are discrete and can be active simultaneously.

The headphone outputs can operate as an independent output pair, or they can mirror any other UltraLite output pair, such as the main outs.

Mic/instrument input

The two mic/instrument inputs (front panel and rear panel) are equipped with preamps and “combo” XLR/TRS jacks, which accept low-Z XLR microphone inputs or high-Z quarter-inch guitar/instruments inputs. The total gain range for these preamps, including the three-way pad and 24dB trim, is 60dB. Preamp gain and pad can be controlled from the front panel digital rotary encoders/switches or the included MOTU CueMix Console™ software.

Analog

All six quarter-inch analog inputs are equipped with 24-bit 96kHz, 64x oversampling A/D converters. All eight analog outputs have 24-bit 128x oversampling D/A converters. All audio is carried to the computer in a 24-bit data stream. All ten analog outputs and six quarter-inch inputs are on balanced TRS +4dB quarter-inch jacks. All of these jacks can also accept unbalanced plugs.

The quarter-inch analog inputs are equipped with 18dB of trim, which can be adjusted for each channel individually via the CueMix Console software application or via the front panel LCD display.

S/PDIF

The UltraLite rear panel provides RCA “coax” S/PDIF input and output.

1394 FireWire

The two 1394 FireWire jacks accept a standard IEEE 1394 FireWire cable to connect the UltraLite to a FireWire-equipped Macintosh or Windows computer. The second jack can be used to daisy chain multiple interfaces — up to four MOTU FireWire interfaces — on a single FireWire bus. It can also be used to connect other FireWire devices

without the need for a FireWire hub. The UltraLite has the ability to power itself from its FireWire connection to the computer.

MIDI I/O

The UltraLite’s standard MIDI IN and MIDI OUT jacks supply 16 channels of MIDI I/O to and from the computer via the UltraLite’s FireWire connection.

Power supply

If you do not want the UltraLite to draw power from the computer, and AC power is available, you can power the UltraLite from any standard 10-18V, 12 watt DC power supply with any polarity (tip positive or negative).

THE ULTRALITE FRONT PANEL

Mic/instrument input

The two mic/instrument inputs (front panel and rear panel) are equipped with preamps and “combo” XLR/TRS jacks, which accept low-Z XLR microphone inputs or high-Z quarter-inch guitar/instruments inputs. The total gain range for these preamps, including the three-way pad and 24dB trim, is 60dB. Preamp gain and pad can be controlled from the front panel digital rotary encoders/switches or the included MOTU CueMix Console™ software.

Phantom power

Individual 48V phantom power can be enabled for each preamp with the two front panel switches.

Three-way pad

An individual three-way pad can be enabled for each preamp with the two front panel switches. The independent three-way pad switch for each input provides zero (down), 18dB (middle) and 36dB (up) pad settings for the XLR jack. (The pad is not available on the TRS input.)

Digital Precision Trim™ rotary encoders

The two Digital Precision Trim™ detented rotary encoders provide preamp gain adjustment. When you turn these trim knobs, input gain can be adjusted in 1dB increments, and the LCD display provides active numeric feedback as the adjustment is made.

Headphone output and main volume control

The UltraLite front panel includes a quarter-inch stereo headphone output jack and volume knob. The LCD display provides feedback. The MAIN VOL knob can be used to control the volume of the main out jacks on the rear panel. It can alternately be configured to control the S/PDIF outputs or TRS analog outputs 1-6 or 1-8 for 5.1 or 7.1 surround.

CueMix™ DSP no-latency on-board mixing

The CueMix DSP section of the front-panel provides access to the UltraLite's on-board mixing features, as well as global system settings. Together, these features provide complete stand-alone operation, without a computer. The UltraLite can mix all inputs to any output pair, and up to four such mixes can be independently programmed and simultaneously operated.

Backlit LCD display

Any UltraLite setting can be accessed directly from the front panel using the four rotary encoders and the 2x16 backlit LCD display. CueMix DSP settings such as input gain, panning, input level trim, phase invert, stereo pair grouping, mix output assignment and others are quickly accessed, clearly marked and easy to adjust. Sixteen presets can be created, saved, recalled and duplicated.

The LCD also provides activity metering for all UltraLite inputs and outputs.

16-BIT AND 24-BIT RECORDING

The UltraLite system handles all data with a 24-bit signal path, regardless of the I/O format. You can record and play back 16-bit or 24-bit audio files at any supported sample rate via any of the UltraLite's analog or digital inputs and outputs. 24-bit audio files can be recorded with any compatible host application that supports 24-bit recording.

HOST AUDIO SOFTWARE

The UltraLite system ships with a standard WDM Windows driver that allows you to record, edit, play back and mix your UltraLite projects using your favorite Windows audio software.

The UltraLite also includes ASIO2 and GSIF2 drivers for multi-channel compatibility with any audio application that supports these drivers.

A COMPUTER-BASED SYSTEM

Regardless of what software you use with the UltraLite, the host computer determines the number of tracks the software can record and play simultaneously, as well as the amount of real-time effects processing you can apply to your mix. A faster computer with more RAM and faster hard drives will allow more simultaneous tracks and real-time effects than a slower computer with less RAM and slower hard drives. Today's fastest computers can typically play as many as 72 tracks or more.

CHAPTER 2 **Packing List & Windows System Requirements**

PACKING LIST

The UltraLite ships with the items listed below. If any of these items are not present in your UltraLite box when you first open it, please immediately contact your dealer or MOTU.

- One UltraLite I/O rack unit
- One set of removable rack ears
- One 1394 “FireWire” cable
- One UltraLite Mac/Windows manual
- One AudioDesk Manual
- One cross-platform CD-ROM
- Product registration card

WINDOWS SYSTEM REQUIREMENTS

The UltraLite system requires the following Windows system:

- A 1 GHz Pentium-based PC compatible or faster equipped with at least one FireWire port
- A Pentium III processor or faster is recommended
- At least 256 MB (megabytes) of RAM (512 MB or more is recommended)
- Windows XP
- A large hard drive (preferably at least 20 GB)

PLEASE REGISTER TODAY!

Please register your UltraLite today. There are two ways to register.

- Visit www.motu.com to register online

OR

- Fill out and mail the included product registration card

As a registered user, you will be eligible to receive on-line technical support email and announcements about product enhancements as soon as they become available. Only registered users receive these special update notices, so please, complete and mail this registration card!

Thank you for taking the time to register your new MOTU products!

IMPORTANT! Run the UltraLite Software Installer First

OVERVIEW

- Install the UltraLite software first!..... 15
- Installing the UltraLite software 15
- MOTU Audio Setup 16
- ASIO MOTU Audio Driver 16
- The MOTU Audio WDM driver 16
- MOTU GSIF FireWire driver 16
- MOTU MIDI Driver 16
- MOTU CueMix Console 16

INSTALL THE ULTRALITE SOFTWARE FIRST!

Before you connect the UltraLite audio interface to your computer and turn it on, insert the UltraLite software CD and run the UltraLite Software Installer. This ensures that all the UltraLite components are properly installed in your system.

If Windows asks you to locate the drivers

If you've already connected the UltraLite to your computer and switched it on, Windows probably issued an alert notifying you that the UltraLite requires drivers, followed by another window asking you to locate the drivers on disk. If this happens:

- 1 Cancel the driver search.
- 2 Switch off the UltraLite.
- 3 Run the UltraLite Software Installer as instructed in the next section.

INSTALLING THE ULTRALITE SOFTWARE

To install the UltraLite software, insert the MOTU Audio CD-ROM and follow the directions it gives you on your computer screen. The UltraLite ships with the following software and drivers for Windows XP:

Software component	Purpose
MOTU Audio Setup	Provides access to all of the settings in the UltraLite hardware.
MOTU CueMix Console	Gives you complete control over the UltraLite's CueMix DSP feature, which provides no-latency monitoring of live inputs.
MOTU ASIO Driver	Allows Cubase or other ASIO-compliant software to do multi-channel input and output with the UltraLite. Only required if you are using Cubase or another ASIO-dependent program.
MOTU WDM Driver	Allows any WDM-driver compatible audio software to do multichannel input and output with the UltraLite.
MOTU GSIF Driver	Allows you to use your UltraLite with Tascam GigaStudio.
MOTU MIDI Driver	Provides MIDI input and output via the UltraLite MIDI ports.

MOTU AUDIO SETUP

MOTU Audio Setup (available in the Start menu) gives you access to all of the settings in the UltraLite, such as the clock source and sample rate. For complete details, see chapter 5, “MOTU Audio Setup” (page 27).

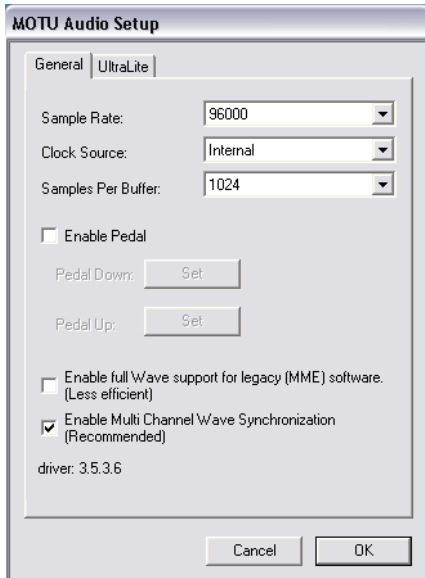


Figure 3-1: MOTU Audio Setup gives you access to all of the settings in the UltraLite hardware.

ASIO MOTU AUDIO DRIVER

ASIO stands for *Audio Streaming Input and Output*. The ASIO MOTU FireWire driver allows UltraLite to provide multi-channel input and output for Steinberg’s Cubase SX and Nuendo software, or any other audio application that supports ASIO drivers.

The ASIO MOTU FireWire driver is only required if you are using Cubase SX, Nuendo, or another audio program that relies on the ASIO driver to support multi-channel I/O with the UltraLite.

The ASIO MOTU FireWire driver is installed by the UltraLite Software Installer and properly registered with Windows, so you don’t need to be concerned about its installation or location.

For details about using Cubase and Nuendo with the UltraLite, see chapter 7, “Cubase, Nuendo and Other ASIO Software” (page 37).

THE MOTU AUDIO WDM DRIVER

The MOTU Audio WDM driver provides standard multi-channel input and output for audio applications running under Windows XP. See chapter 8, “SONAR and other WDM Software” (page 41) for details.

The MOTU Audio installer CD installs the MOTU Audio WDM driver into Windows for you.

MOTU GSIF FIREWIRE DRIVER

The MOTU GSIF FireWire Driver allows you to access the UltraLite as an audio interface for Tascam GigaStudio and related products. The GSIF driver features low-latency multi-channel performance.

MOTU MIDI DRIVER

This driver allows you to access the UltraLite’s MIDI input and output ports. The ports are published in Windows and are available to all MIDI software.

MOTU CUEMIX CONSOLE

This program provides a mixing console that gives you control over the UltraLite’s no-latency CueMix DSP features. For details, see chapter 11, “MOTU CueMix Console” (page 57).

CHAPTER 4 Installing the UltraLite Hardware

OVERVIEW

Here's an overview for installing the UltraLite:

Important note before you begin! 17

Take these precautions to prevent damage to your computer, the UltraLite and other equipment.

Connect the UltraLite interface 18

Connect the UltraLite to the computer.

Connect audio inputs and outputs 18

Make analog and digital connections as desired.

Connect MIDI gear 19

Connect a controller, synth or control surface.

Power options 20

Choose from among several convenient options.

A typical UltraLite setup 22

An example setup for computer-based mixing/FX.

Connecting and syncing S/PDIF devices 23

Connect a DAT deck, effects processor or other device with digital I/O, but be sure to make the correct clock source settings.

Connecting multiple MOTU FireWire interfaces 23

Connect additional UltraLites or other audio interfaces.

IMPORTANT NOTE BEFORE YOU BEGIN!

Before you begin installing the UltraLite (or any bus-powered device), take these important precautionary measures to avoid damaging the sensitive electrical components in your computer, the UltraLite or other devices being connected:

- Turn off the computer.
- Turn off the UltraLite (push and hold the MAIN VOL knob).
- Turn off the power of any other devices.
- Touch the metal casing of the UltraLite to discharge any static electricity that you may be carrying just before the installation.

After you have made all of the necessary connections, as described in this chapter, turn on the devices in this sequence:

1. Turn on the computer.
2. Turn on the UltraLite.
3. Turn on other devices connected to the UltraLite.

CONNECT THE ULTRALITE INTERFACE

- 1 Make sure your computer and the UltraLite are switched off.
- 2 Plug one end of the UltraLite FireWire cable (included) into the FireWire socket on the computer as shown below in Figure 4-1.
- 3 Plug the other end of the FireWire cable into the UltraLite I/O as shown below in Figure 4-1.

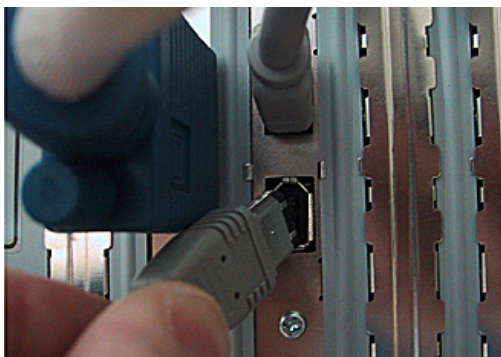


Figure 4-1: Connecting the UltraLite to the computer.

CONNECT AUDIO INPUTS AND OUTPUTS

The UltraLite audio interface has the following audio input and output connectors:

- 10 balanced quarter-inch analog outputs
- 6 balanced quarter-inch analog inputs
- 2 XLR/quarter-inch “combo” analog inputs with preamps
- 1 pair of RCA S/PDIF in and out

Here are a few things you should keep in mind as you are making these connections to other devices.

Mic/instrument inputs

Connect a microphone, guitar, instrument or other analog input to the XLR/TRS combo jack with either a standard mic cable or a cable with a balanced quarter-inch plug.

Phantom power

If you are connecting a condenser microphone or other device that requires phantom power, move the 48V phantom power switch on the front panel to the up position (enabled).

Trim

Both the low-impedance XLR jack and the high-impedance TRS jack are equipped with 24dB of trim control. Use the digital trim knobs on the front panel to adjust the input level as needed for each input. The LCD provides visual feedback as you turn the trim knob. The UltraLite's input trims are digital controlled, so they allow you to make fine-tuned adjustments in precise 1dB increments. You can also adjust trim in the MOTU CueMix Console software. See “Input trim” on page 60.

Three-way pad

The XLR jack is equipped with a three-way pad, so “hot” signals are best connected via an XLR cable so that you can use the pad switch. Since the pad is not available on the TRS jack, hot signals connected via the TRS jack will probably overdrive

the input. The independent three-way pad switch for each input provides zero (down), 18dB (middle) and 36dB (up) pad settings for the XLR jack. When combined with the 24dB digital trim, the full gain range is 60dB. This is the difference between the minimum (trim at zero + pad at 36dB) and maximum (trim at 24dB + pad at zero) gain settings.

Combo jack summary

Use these general guidelines for the 48V phantom power, pad and trim settings on the two combo input jacks:

Input	48V	Pad	Trim
Condenser mic	On	As needed	As needed
Dynamic mic	Off	As needed	As needed
Guitar	Off	n/a	As needed
-10dB Line level via TRS	Off	n/a	As needed
-10dB Line level via XLR	Off	36dB	+12dB
+4dB line level (XLR only)	Off	36dB	Zero

Quarter-inch analog

The quarter-inch analog inputs (3-8) and outputs (1-8 plus main out) are balanced TRS connectors that can also accept an unbalanced plug.

The outputs are all referenced to +4dBu.

The reference level for the inputs can be adjusted over an 18dB range with the same general trim guidelines as shown earlier for the mic/instrument inputs. Trims for each input (or input pair) can be adjusted from the MOTU CueMix Console or the front panel. To learn how to adjust trim from CueMix Console, see “Input trim and phase invert” on page 59. To learn how to adjust trim from the front panel, see “PAGE” on page 35.

Separate main outs

The main outputs operate as an independent pair (they don’t share signal with any other output pair). In a standard studio configuration, the main outs are intended for a pair of studio monitors, but they can also be used as regular outputs for any purpose. Their reference level is +4dB. Main out volume is controlled by the MAIN VOL knob on the front panel, although this knob can be configured to control other outputs instead.

S/PDIF

If you make a S/PDIF digital audio connection to another device, be sure to review the digital audio clocking issues, as explained in “Connecting and syncing S/PDIF devices” on page 23.

The UltraLite on-board mixer also supplies 12dB of digital trim for the S/PDIF input pair, which can be adjusted from CueMix Console or the front panel. To learn how to adjust S/PDIF input trim from CueMix Console, see “Input trim and phase invert” on page 59. To learn how to do it from the front panel, see “PAGE” on page 35.

CONNECT MIDI GEAR

Connect your MIDI device’s MIDI IN jack to the UltraLite’s MIDI OUT jack (Connection A below). Conversely, connect the MIDI device’s MIDI OUT jack to the UltraLite’s MIDI IN jack (Connection B).

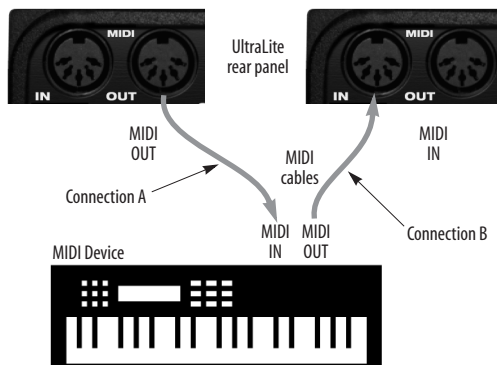


Figure 4-2: Connecting a MIDI device to the UltraLite.

One-way MIDI connections

MIDI devices that do not receive MIDI data, such as a dedicated keyboard controller, guitar controller, or drum pad, only need Connection B shown in Figure 4-2. Similarly, devices that never send data, such as a sound module, only need Connection A. Make both connections for any device that needs to both send and receive MIDI data.

Connecting additional gear with MIDI THRU

If you need to connect several pieces of MIDI gear, run a MIDI cable from the MIDI THRU of a device already connected to the UltraLite to the MIDI IN on the additional device as shown below in Figure 4-3. The two devices then share the UltraLite's MIDI OUT port. This means that they share the same set of 16 MIDI channels, too, so try to do this with devices that receive on only one MIDI channel (such as effects modules) so their receive channels don't conflict with one another.

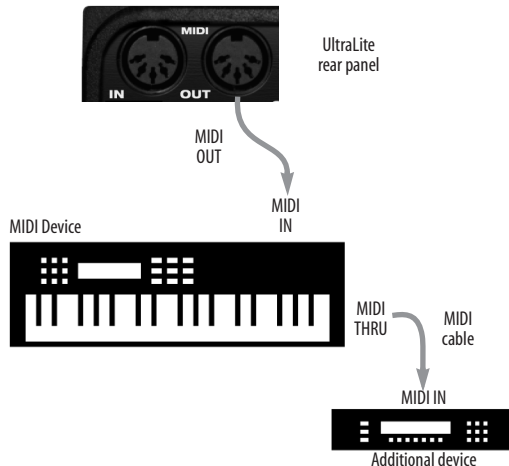


Figure 4-3: Connecting additional devices with MIDI THRU ports.

POWER OPTIONS

The UltraLite can draw power from two possible sources: the computer (via FireWire) or a DC power supply.

Bus power requirements

The UltraLite draws all the power it needs from the FireWire bus connection to the computer. However, the FireWire connection to the computer must meet all of the requirements discussed below.

6-pin FireWire connectors

The UltraLite can only draw power over the FireWire bus from a 6-pin to 6-pin cable, or a 6-pin to 9-pin (FireWire B) cable. It cannot draw power from a FireWire cable with a 4-pin connector, as shown below:

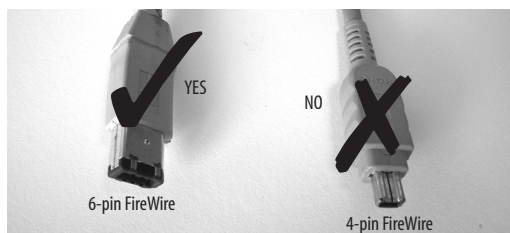


Figure 4-4: 4-pin FireWire connectors cannot be used for bus power.

When operating under bus power, daisy-chaining is not recommended

The UltraLite can be daisy-chained with other FireWire devices from a single FireWire connection to the computer. However, if the UltraLite is operating under bus power, this is not recommended. If you need to daisy chain the UltraLite with other devices on the same FireWire bus, power the UltraLite with a DC power supply (or battery). The other devices on the chain should also have their own power supply. In general, bus-powered FireWire devices should not be daisy-chained.

FireWire adapter products must be powered

If you are using a FireWire adapter (a third-party product that supplies one or more FireWire ports to your computer), it must have direct access to a power supply:

- **PCI FireWire cards** — If you plan to connect the UltraLite to a PCI card and run the UltraLite under bus power, the PCI card must have a direct

connection to the power supply harness inside your computer. This is the same power supply harness to which you connect internal hard drives, CD/DVD drives, etc.

■ **PCMCIA slot adapters** — If you plan to connect the UltraLite to a PC card FireWire adapter (inserted in the PC card slot in your laptop), it must provide a 6-pin connection and it must also have its own power supply. Most commonly, these types of products have a DC power adapter. As you can see, however, this situation does not allow for remote battery operation, as the PC card adapter requires AC.

Examples of bus- powered operation

Here are a few typical examples of bus-powered UltraLite operation:

Bus power from a desktop computer

Your desktop computer is running off of its usual AC power connection, and the UltraLite draws power from the FireWire cable connected to the computer. There are no limits to running time.

Bus power from an AC-powered laptop

This scenario is identical to the desktop situation described above: the laptop is powered by AC, the UltraLite is powered via the FireWire bus and there are no limits to running time.

Bus power from a battery-powered laptop

The laptop is being powered by its own battery, and the UltraLite is being powered by its FireWire connection to the computer. So the laptop battery is supplying power to both the laptop and the UltraLite. This is the most compact and portable operating scenario. Running time is determined by the capacity of the laptop battery. For extended recording sessions, bring extra, fully charged laptop batteries.

DC power supply

If you do not want the UltraLite to draw power from the computer, and AC power is available, you can power the UltraLite from any standard 8-18 volt, 12 watt DC power supply with any polarity (tip positive or negative), and amperage as shown below.

Voltage	Amperage
9 volts	1.33 amps
12 volts	1 amp
18 volts	0.66 amps

Bus power versus DC power

When you connect a DC power supply, the UltraLite could draw power from either FireWire or the DC power supply. So which source does it use? The answer is: the source that is currently supplying the greatest voltage. But in practice, it doesn't really matter because the only situation in which you need to be concerned about the UltraLite's power draw is when you are operating it with a battery-powered laptop. And in this situation, the only available power is from FireWire. In all other situations, the computer has its own power, so it doesn't matter if the UltraLite is drawing power from FireWire or not.

Turning off the UltraLite

To turn on the UltraLite, push the MAIN VOL knob. To turn it off, push *and hold* the MAIN VOL knob. When the UltraLite is turned off, it is really in a sort of "sleep" mode, where it still draws just enough power to detect the power switch (a digital encoder) when the UltraLite is turned back on. But the amount of power that the UltraLite draws when it is turned off is so small that it has very little practical impact. If you are running a laptop under battery power, and you are in a situation where you are not using the UltraLite and you need every last bit of laptop battery power, unplug the UltraLite entirely from the computer.

A TYPICAL ULTRALITE SETUP

Here is a typical UltraLite studio setup. This rig can be operated without an external mixer. All mixing and processing can be done in the computer with audio software. During recording, you can use the UltraLite's CueMix™ DSP no-latency monitoring

to listen to what you are recording via the main outs, headphone outs, or any other output pair. You can control monitoring either from the front panel or from the included MOTU CueMix Console software.

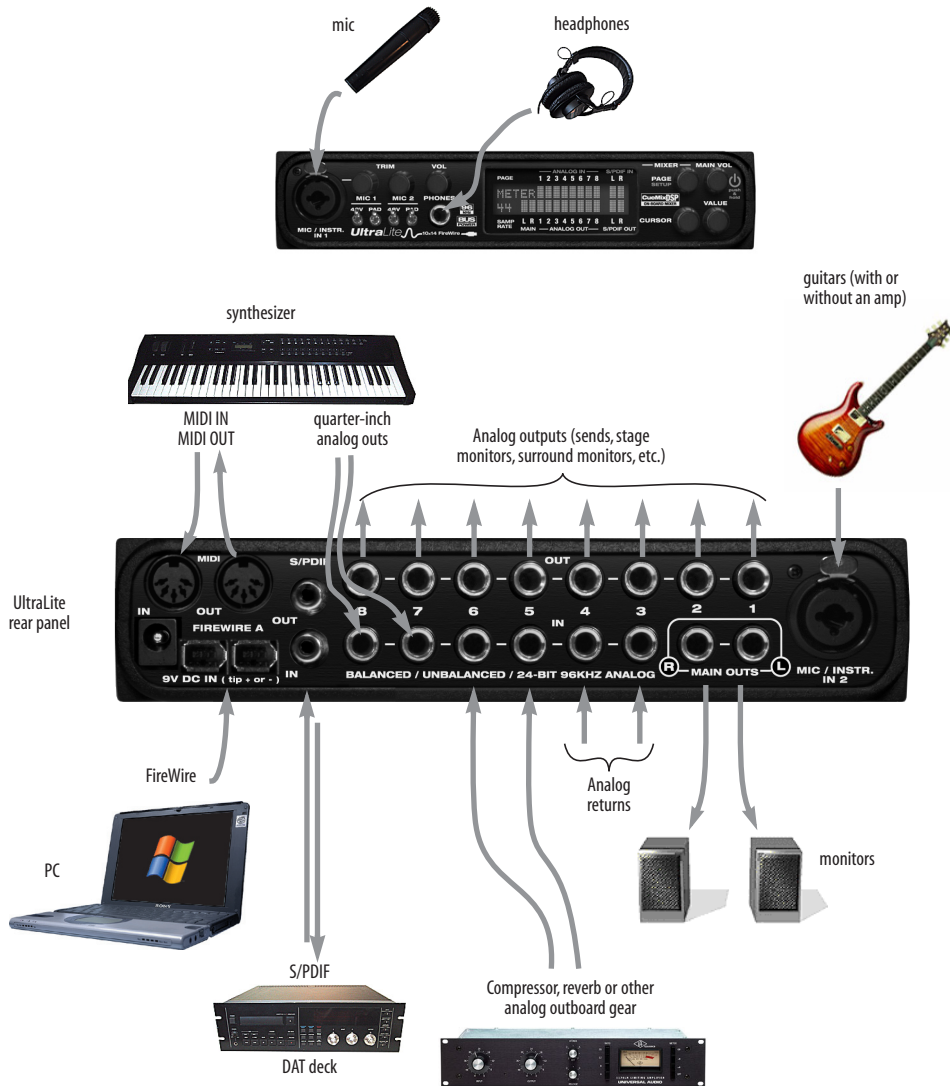


Figure 4-5: A typical UltraLite studio setup.

CONNECTING AND SYNCING S/PDIF DEVICES

DAT decks and other devices with S/PDIF digital I/O will sync to the UltraLite in via the S/PDIF connection itself. Just connect it to the UltraLite via the S/PDIF connectors. When the device records a digital audio signal (from the UltraLite), it will simply synchronize to the clock provided by the digital audio input.

On the other hand, when you transfer audio from the S/PDIF device into the UltraLite, you'll have to slave the UltraLite to its S/PDIF input.

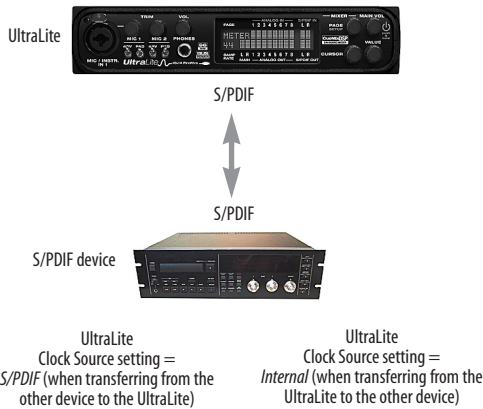


Figure 4-6: The setup for synchronizing a S/PDIF device with the UltraLite. Sync is achieved via the digital I/O connection itself. In this case, you have to choose S/PDIF as the UltraLite's clock source when recording from the other device.

CONNECTING MULTIPLE MOTU FIREWIRE INTERFACES

You can daisy-chain up to four MOTU FireWire interfaces on a single FireWire bus, with the restrictions described in the following sections. Most computers have only one built-in FireWire bus (even if it supplies multiple FireWire sockets). Connect them as follows:

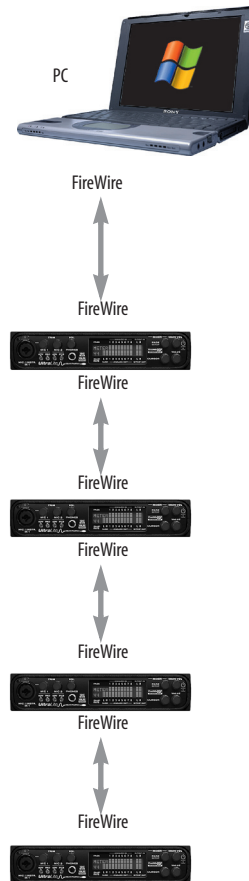


Figure 4-7: Connecting multiple UltraLite's (or other MOTU Audio interfaces) to a computer.

Multiple interfaces cannot be bus-powered

Do not run the UltraLite under bus power when connecting it with other devices to the same FireWire bus. See “Power options” and “Bus power requirements” on page 20.

Multiple interfaces in MOTU Audio Setup

MOTU Audio Setup displays the settings for one interface at a time. To view the settings for an interface, click its tab as shown below in Figure 4-8.

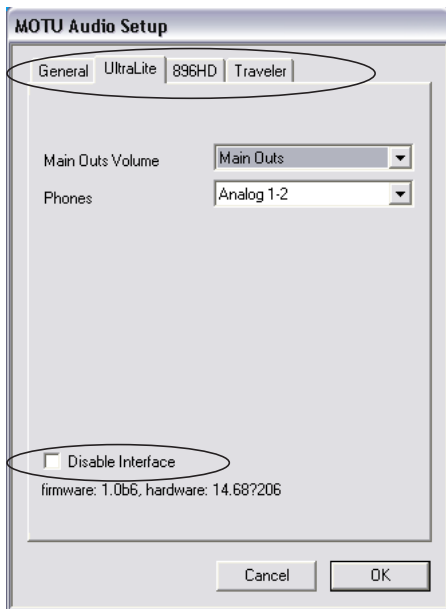


Figure 4-8: To view the settings for an interface, click its tab.

Synchronizing multiple interfaces

All connected MOTU FireWire interfaces get their clock from whatever you choose from the *Clock Source* menu in the *General* tab in MOTU Audio Setup. When you connect multiple MOTU FireWire interfaces, all of their respective sync sources are displayed in the menu as shown below in Figure 4-9.

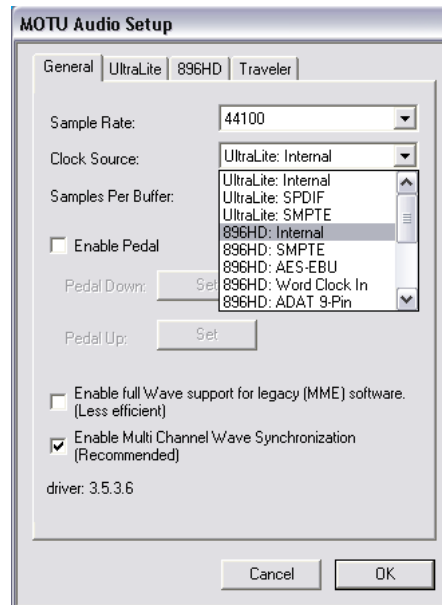


Figure 4-9: All MOTU FireWire audio interfaces get their clock from a single master sync source on any connected UltraLite (or other MOTU FireWire interface). After you choose a source from this menu, the entire system, including all connected UltraLites, synchronizes to it.

Each FireWire interface in the system gets its clock from the computer (unless it is the master clock itself).

Connecting other MOTU FireWire interfaces

You can add an original MOTU 828 to the end of a FireWire daisy chain (because the 828 has only one FireWire port), or you can mix and match multiple 828's with other MOTU FireWire interfaces using a standard FireWire hub. You can also add 828mkII's or 896HD's, which have two FireWire ports convenient for daisy-chaining. Up to four interfaces can be combined on one FireWire bus.

Operating multiple FireWire interfaces at high sample rates

Four MOTU FireWire interfaces can operate at 44.1 or 48kHz on a single FireWire bus. At the 2x sample rates (88.2 or 96kHz), you can operate no more than three FireWire interfaces on a single FireWire bus.

Adding additional interfaces with a second FireWire bus

Third-party FireWire bus expansion products in the form of a cardbus (“PC card”) adaptor or PCI card allow you to add a second FireWire bus to your computer. It may be possible to add additional MOTU FireWire interfaces connected to such a third-party product, depending on the performance of the product and the performance of your host computer.

Managing the IDs of multiple interfaces

Multiple UltraLite interfaces are identified by number (#1, #2, #3, etc.) Interfaces are ID’d (given a number) by the order in which they are first powered up after being connected. This information is stored in the MOTU Audio preferences file. Once ID’d, they retain the same number regardless of the order in which they are powered up. You can disable an interface at any time with the *Disable interface* option shown in Figure 4-8 on page 24. Doing so frees up the FireWire bandwidth required by the interface without turning it off. Switching off an interface accomplishes the same thing. To get MOTU Audio Setup to forget about an interface entirely, you’ll see a *Forget* button in MOTU Audio Setup. Just click the *Forget* button and MOTU Audio Setup will no longer consider the interface to be present but off line (turned off).

CHAPTER 5 MOTU Audio Setup

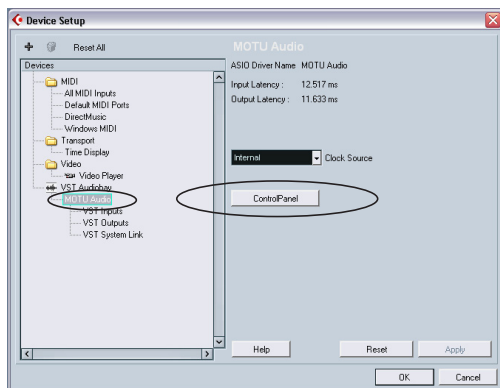
OVERVIEW

Accessing the UltraLite settings.....	27
'General' tab Settings	28
Sample Rate	28
Clock Source	28
Samples Per Buffer.....	29
Enable Pedal	30
Wave support for legacy (MME) software.....	30
'UltraLite' tab settings.....	30
Phones.....	30
Main Outs Volume	30

ACCESSING THE ULTRALITE SETTINGS

There are several ways to access MOTU Audio Setup settings:

- From the Windows Start menu, choose *Programs>MOTU>MOTU Audio Setup*
- In Cubase SX or Nuendo, open the Device Setup window, click *VST Audiobay* and choose *MOTU Audio* from the *Master ASIO Driver* menu. Then click the *MOTU Audio* item in the list and click the *Control Panel* button as shown below.



- From within other ASIO-compatible programs, refer to their documentation.

- From the front panel LCD (see chapter 6, “UltraLite Front Panel Operation” (page 31)).

General tab settings

The General tab provides settings that apply globally to all connected MOTU FireWire interfaces.

UltraLite tab settings

The UltraLite tab provides settings that apply to a specific UltraLite interface. If you have several UltraLites (or other MOTU FireWire audio interfaces) connected, you’ll see a separate tab for each one.

'GENERAL' TAB SETTINGS

Sample Rate

Choose the desired *Sample Rate* for recording and playback. The UltraLite can operate at 44.1 (the standard rate for compact disc audio), 48, 88.2 or 96 kHz. If you have a S/PDIF device connected to the UltraLite, make sure that it matches the UltraLite's sample rate.

☞ Mismatched sample rates cause distortion and crackling. If you hear this sort of thing, check the sample rate settings in your hardware and here in MOTU Audio Setup.

Clock Source

The *Clock Source* determines the digital audio clock that the UltraLite will use as its time base. The following sections briefly discuss each clock source setting.

Internal

Use the *Internal* setting when you want the UltraLite to operate under its own digital audio clock. For example, you may be in a situation where all you are doing is playing tracks off hard disk in your digital audio software on the computer. In a situation like this, you most often don't need to reference an external clock of any kind.

Another example is transferring a mix to DAT. You can operate the UltraLite system on its internal clock, and then slave the DAT deck to the UltraLite via the S/PDIF connection (usually DAT decks slave to their S/PDIF input when you choose the S/PDIF input as their record source).

If you would like help determining if this is the proper clock setting for your situation, see "Connecting and syncing S/PDIF devices" on page 23.

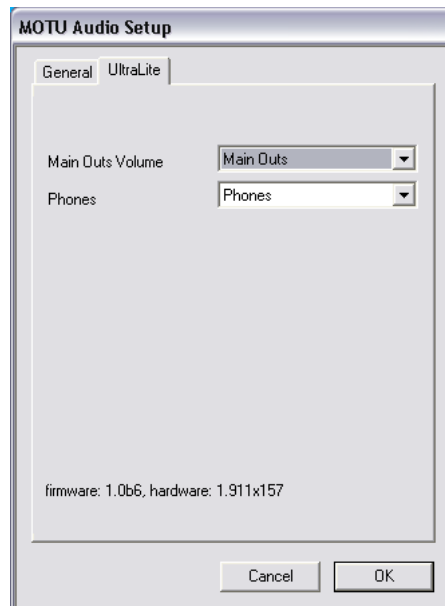
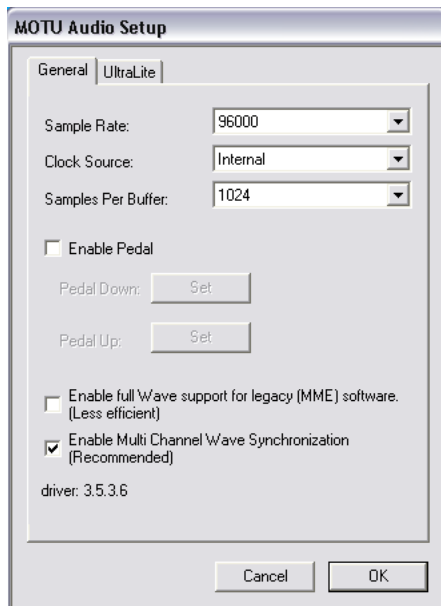


Figure 5-1: MOTU Audio Setup gives you access to all of the settings in the UltraLite hardware.

S/PDIF

The *S/PDIF* clock source setting refers to the S/PDIF RCA input jack on the UltraLite. This setting allows the UltraLite to slave to another S/PDIF device.

Use this setting whenever you are recording input from a DAT deck or other S/PDIF device into the UltraLite. It is not necessary in the opposite direction (when you are transferring from the UltraLite to the DAT machine).

For further details about this setting, see “Connecting and syncing S/PDIF devices” on page 23.

Samples Per Buffer

The *Samples Per Buffer* setting lets you reduce the delay you hear when patching live audio through your audio software. For example, you might have a live microphone input that you would like to run through a reverb plug-in that you are running in your host audio software. When doing so, you may hear or feel some “sponginess” (delay) between the source and the processed signal. If so, don’t worry. This effect only affects what you hear: it is not present in what is actually recorded.

You can use *Samples Per Buffer* setting to reduce this monitoring delay—and even make it completely inaudible.

☛ If you don’t need to process an incoming live signal with software plug-ins, you can monitor the signal with no delay at all using MOTU CueMix Console, which routes the signal directly to your speakers via hardware. For details, see chapter 11, “MOTU CueMix Console” (page 57).

Adjusting the *Samples Per Buffer* setting impacts the following things:

- The strain on your computer’s CPU

- The delay you hear when routing a live signal through your host audio software plug-ins
- How responsive the transport controls are in your software

This setting presents you with a trade-off between the processing power of your computer and the delay of live audio as it is being processed by plug-ins. If you reduce the *Samples Per Buffer*, you reduce patch thru latency, but significantly increase the overall processing load on your computer, leaving less CPU bandwidth for things like real-time effects processing. On the other hand, if you increase the *Samples Per Buffer*, you reduce the load on your computer, freeing up bandwidth for effects, mixing and other real-time operations. But don’t set the *Samples Per Buffer* too low, or it may cause distortion in your audio.

If you don’t process live inputs with software plug-ins, leave this setting at its default value of 1024 samples. If you do, try settings of 256 samples or less, if your computer seems to be able to handle them. If your host audio software has a processor meter, check it. If it starts getting maxed out, or if the computer seems sluggish, raise the *Samples Per Buffer* until performance returns to normal.

If you are at a point in your recording project where you are not currently working with live, patched-thru material (e.g. you’re not recording vocals), or if you have a way of externally monitoring input, choose a higher *Samples Per Buffer* setting. Depending on your computer’s CPU speed, you might find that settings in the middle work best.

The *Samples Per Buffer* setting also impacts how quickly your audio software will respond when you begin playback, although not by amounts that are very noticeable. Lowering the *Samples Per Buffer* will make your software respond faster; raising the *Samples Per Buffer* will make it a little bit slower, but barely enough to notice.

Monitoring live inputs without plug-in effects
As mentioned earlier, CueMix Console allows you to monitor dry, unprocessed live inputs with no delay at all. For complete details, see chapter 10, “Reducing Monitoring Latency” (page 51).

Enable Pedal

This setting applies to other MOTU FireWire audio interfaces, but it does not apply to the UltraLite.

Wave support for legacy (MME) software

Windows only exposes the first two channels of a multi-channel WDM audio stream to applications which use the legacy (MME) multimedia interface. The *Enable full Wave support for legacy (MME) software (less efficient)* option forces the UltraLite multimedia driver to expose all channels as stereo pairs, providing full MME support.

If your host audio software does *not* directly support WDM audio and instead only supports legacy MME drivers, use this option to access multiple UltraLite input and output channels.

If your host audio software *does* directly support WDM audio, leave this option unchecked for optimal performance.

This option is only available when the multimedia driver has been installed, and it defaults to being not checked.

‘ULTRALITE’ TAB SETTINGS

Phones

The *Phones* setting lets you choose what you will hear from the headphone jack. Choose *Main Out 1-2* if you’d like the headphone output to match the main outs. Choose *Phones 1-2* if you would like the headphones to serve as their own independent output, which you can access as an independent output destination in your host audio software and as an output destination for the four on-board CueMix DSP mix busses.

Main Outs Volume

The Main Outs Volume setting lets you choose what to control with the MAIN VOL knob on the front panel of the UltraLite. Choose *Main Outs* to control the stereo main outs on the rear panel. Choose *S/PDIF* to control the S/PDIF stereo output. For surround setups, choose *5.1* to control analog outputs 1-6 or choose *7.1* to control analog outputs 1-8.

CHAPTER 6 UltraLite Front Panel Operation

OVERVIEW

The UltraLite offers complete front-panel programming via six rotary encoders and a 2x16 backlit LCD display. All UltraLite settings can be accessed via these front-panel controls.

- Push-button rotary encoders 31
- Multi-function LCD display 31
- MAIN VOLUME..... 32
- POWER SWITCH 32
- Page/SETUP 32
- MIXER..... 34
- PAGE..... 35
- CURSOR / VALUE..... 35
- Stand-alone operation..... 35

PUSH-BUTTON ROTARY ENCODERS

All of the knobs shown in Figure 6-1 are push-button digital rotary encoders. In many cases, you can either push the knob or turn it to make a setting or toggle the LCD display (depending on the encoder and setting).

MULTI-FUNCTION LCD DISPLAY

The LCD provides access to the many UltraLite settings, as well as visual feedback of the current parameter being modified.

Setup mode

In setup mode, the LCD displays basic settings, such as clock source, headphone output assignment and so on. These settings are covered in detail later in “Page/SETUP” on page 32.

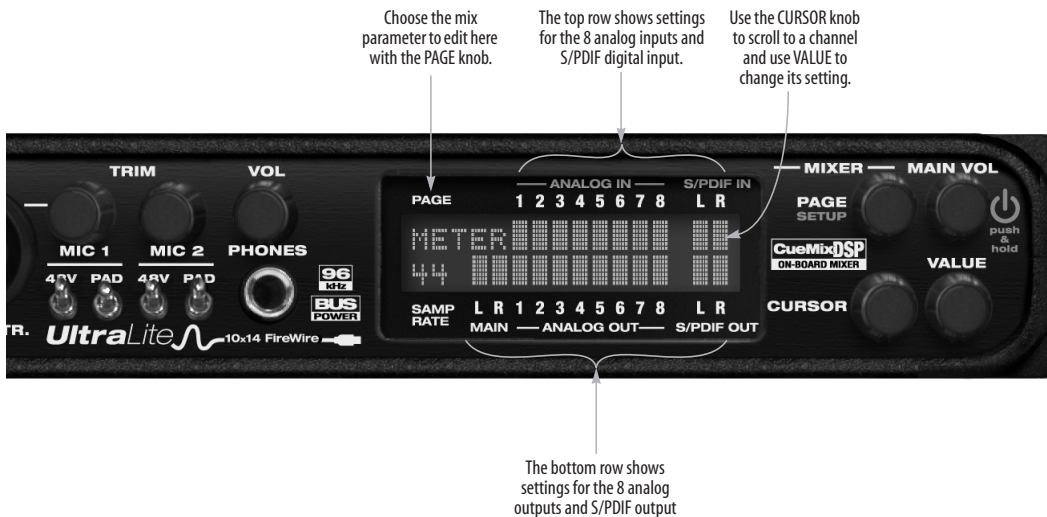


Figure 6-1: The UltraLite front panel controls.



Figure 6-2: In setup mode, the LCD displays a setup parameter in the top row of the LCD and the current setting in the bottom row.

Mixer mode

In mixer mode, the LCD displays the settings for the current UltraLite mix being shown in the display, as demonstrated in Figure 6-1 on page 31.

Parameter “zooming”

For many settings, the LCD temporarily “zooms in” to display a long-throw meter and alpha-numeric display to give you precise, real-time feedback as you adjust the setting. For example, if you change the headphone volume, the LCD will display a level meter and gain reduction reading that updates as you turn the volume knob. After a brief time-out, the display returns to its previous state before you turned the volume knob. The time-out period can be adjusted, as explained later in the section called “Fader View Time”.



Figure 6-3: For many settings, the LCD “zooms in” on the setting as you adjust it.

MAIN VOLUME

Turning the MAIN VOL knob lets you control the volume of the rear-panel main outs. It can also be programmed to provide master volume control over S/PDIF output, or 5.1 and 7.1 surround output via analog outputs 1-6 or 1-8, respectively. See “Main Volume Assign” on page 33.

As explained in the previous section, the LCD provides detailed feedback as you turn the knob. To view the current setting without changing it, just push the knob (without turning it).

POWER SWITCH

Push the MAIN VOL knob to switch on the UltraLite. Push in and hold the MAIN VOL knob to turn it off.

PAGE/SETUP

Press the PAGE/SETUP knob to toggle between mixer mode and setup mode.

In mixer mode, the PAGE, CURSOR and VALUE knobs let you adjust the on-board mixing features. See “MIXER” on page 34.

In setup mode, turn PAGE to choose a setting and turn VALUE to adjust it. Press the VALUE knob to make the change to a setting. The CURSOR knob is also used to adjust some of the settings. The setup mode settings are briefly explained below.

Clock source

This sets the global clock source for the UltraLite and is the same as the *Clock Source* setting in MOTU Audio Setup as explained in “Clock Source” on page 28. If the UltraLite is currently connected to a computer, this setting cannot be changed from the front-panel LCD. It must be changed in MOTU Audio Setup instead. Or, you can disconnect the UltraLite from the computer to change the Clock Source from the front panel.

If the UltraLite is not currently connected to the computer, there are four sample rates available for the Internal clock setting (in kHz): Internal 44.1 (the standard rate for audio CDs), Internal 48, Internal 88.2 and Internal 96.

Fader View Time

The *Fader View Time* option lets you control the length of time that an adjusted parameter remains displayed in the LCD before the LCD returns to its previous state. For example, when you turn the MAIN VOL knob to adjust the main volume, you'll see a long-throw horizontal fader in the LCD, along with a numeric display of the current gain reduction. After you stop turning the knob, this fader remains displayed in the LCD for a moment before the LCD returns to its previous state. The Fader View Time option lets you control how long the adjusted parameter remains on the LCD after the knob stops turning.

Bus output

The *Bus Output* setting lets you choose the UltraLite output pair for each of the four CueMix DSP mix busses. Turn the CURSOR knob to choose a bus. Turn the VALUE knob to choose an output for the current bus. Push the VALUE knob to select the output. The output stops flashing to confirm that it has been selected.

Bus mute

The *Bus Mute* setting mutes and unmutes the current bus output. Use the CURSOR knob to choose the mix. Push the VALUE knob to mute or unmute the bus.

Phones Assign

The *Phones Assign* setting lets you choose what you hear on the headphone output. This is the same as the *Phones* setting in MOTU Audio Setup as explained in “Phones” on page 30.

Main Volume Assign

The *Main Volume Assign* setting lets you choose what to control with the MAIN VOL knob. The choices are: *Main Outs*, *5.1 (Analog 1-6)*, *7.1 (Analog 1-8)* and *SPDIF Out*. This is the same as the *Main Out Volume* setting in MOTU Audio Setup, as explained in “Main Outs Volume” on page 30.

Init Current Mix

The *Init Current Mix* setting lets you reset the current mix (or all four mixes). Use the CURSOR knob to choose the mix. All inputs get reset to unity gain (0 dB), pan center, etc.

Copy Bus Mix

Copy Bus Mix lets you copy all of the settings for the currently displayed mix. Turn the CURSOR knob to choose a mix. Push the VALUE knob to copy it. You can then paste the settings to another mix as explained below. The word *Done* appears briefly to confirm that the mix settings have been successfully copied.

Paste Bus Mix

After you copy mix settings (explained above), *Paste Bus Mix* lets you paste the copied mix settings to another mix. Turn the CURSOR knob to choose a mix. Push VALUE to paste. The word *Done* appears briefly to confirm the paste. The following mix parameter are included in the paste operation: Gain, Pan, Solo, Mute, Trim and stereo pairing. The following mix parameters are not pasted: Bus output, Bus mute and Bus gain.

Save/Name Preset

The *Save/Name Preset* setting lets you name and save up to sixteen separate UltraLite presets. A preset holds all of the current CueMix DSP mix settings for all four mix busses. Setup parameters

are not included. The name can have up to 12 characters. Here is a summary of how to name and save a preset:

To do this:	Do this:
To change the currently flashing character	Turn the CURSOR knob.
To jump to capital letters, lower case letters, numbers or symbols	Turn the VALUE knob.
To save the preset.	Push VALUE. If you are asked to replace existing preset, push VALUE again to replace it, or turn it to select a different preset.

Load preset

After you've saved one or more presets, *Load Preset* lets you recall them. Turn the VALUE knob to choose a preset. Push VALUE to load it. The word *Loaded* appears briefly to confirm the operation.

All Notes Off

The *All Notes Off* setting sends a MIDI *All Notes Off* message, as well as a MIDI note-off message for every note on every MIDI channel. This stops any stuck notes that are currently playing. Push VALUE to initiate the All Notes Off operation.

Factory Defaults

The *Factory Defaults* setting restores the UltraLite factory settings. Before you can attempt this operation, you must first quit all Windows audio applications and all MOTU consoles (MOTU Audio Setup, MOTU CueMix Console, etc.) Once you have done so, push VALUE to initiate the operation, and then when the LCD asks "Are you sure?", push VALUE to execute it. If any of the above-mentioned applications are still running, the LCD will alert you with the message saying that the UltraLite is in use by the CPU. Quit all audio software applications and consoles and then try again.

MIXER

The UltraLite on-board CueMix DSP mixer provides four stereo mix busses, named MIX1, MIX2, MIX3 and MIX4, respectively. Each mix bus (also referred to as a "mix") independently mixes all inputs (or any subset of your choosing) down to one UltraLite output pair of your choosing. For example, you could assign MIX1 to the main outs, MIX2 to analog outputs 1-2 and MIX3 to the headphone outs. You can then independently assign any input to any mix. An input can even be included in two or more mixes simultaneously at different input levels.

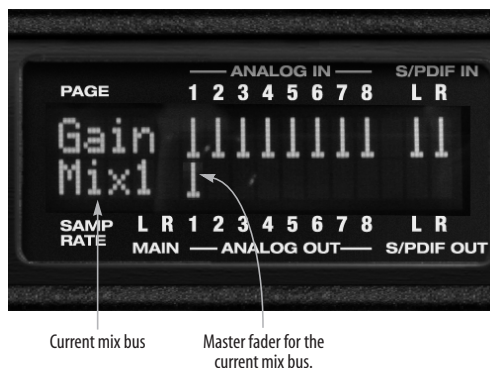


Figure 6-4: In mixer mode, the LCD displays the mix settings for the mix bus currently being displayed in the LCD.

Choosing a mix bus

When the LCD display is in mixer mode, use the CURSOR knob to scroll to the current mix bus (Figure 6-4) and then turn the VALUE knob to choose the desired mix bus, or push the VALUE knob repeatedly to cycle through the four mix buses.

Bus master fader

To change the output level for the current mix, use the CURSOR knob to scroll to the fader displayed just to the right of the mix bus name (Figure 6-4) and then use the VALUE knob to adjust it.

PAGE

When the LCD display is in mixer mode, the PAGE knob cycles through the mix parameters listed below. Use the CURSOR knob to scroll to a particular channel (until it flashes) and use the VALUE knob to change its setting:

Mix parameter	Range	Comments
Gain	OFF, -84 to 0 dB	Each channel displays a small fader. Push the VALUE knob to toggle between OFF and unity gain (0dB).
Pan	-64 to +64 Zero = pan center	Push the VALUE knob to jump to pan center. Stereo pairs (explained below) are panned hard left/right by default.
Solo	“s” or blank	Push the VALUE knob to toggle between soloed (S) and not soloed (blank), or turn the knob to toggle.
Mute	“m” or blank	Push the VALUE knob to toggle between muted (m) and unmuted (blank), or turn the knob to toggle.
Trim	zero to +24dB for inputs 1-2 zero to +18dB for inputs 3-8 zero to +12dB for S/PDIF	This setting applies universally across ALL mix busses for each input or input pair. Push the VALUE knob to toggle between the minimum and maximum setting. For the Mic inputs (1-2), 24dB of gain is provided, and this trim setting can also be adjusted with the dedicated front panel trim knobs for the two mic inputs. For analog (TRS) inputs 3-8, 18dB of gain is provided. For the S/PDIF input pair, 12 dB of gain is provided.
Inv (Phase invert)	“i” or blank	This setting applies universally across ALL mix busses for analog inputs 1-8. Push the VALUE knob to toggle between phase-inverted (i) and not phase-inverted (blank), or turn the knob to toggle.
Pair	“[]” or blank	This setting applies universally across ALL mixes. Push the VALUE knob to toggle a stereo input pair between separate mono inputs (blank) or a stereo pair (“[]”). Or turn the knob to toggle. When a pair of inputs are linked, all of their mix settings become linked (gain, solo, etc.) except for pan. When the pair is first created, pan is set to hard left and hard right, but the channels can then be further modified independently. When a pair is unlinked, the channels are set to pan-center.

Mix parameters that apply across all mixes

The last three mix settings (Trim, Phase Invert, and Stereo Pair) apply across all mixes because they have to do with the nature of the input itself. For example, if you have an input that requires +10dB of boost, then you’ll want the boost to apply to all mixes.

Working with stereo pairs

When you group a pair of inputs as a stereo pair, all of their mix settings become linked, and whenever you scroll to either channel, both channels will flash to indicate that they will operate as a linked stereo pair. Note that when a pair is first created, pan is set to hard left and hard right, but the channels can then be further modified independently. When a pair is unlinked, the channels are set to pan-center.

CURSOR / VALUE

When the LCD display is in mixer mode, the CURSOR knob scrolls left and right over the 10 inputs displayed in the LCD. The current input flashes. The VALUE knob changes the current mix parameter for the currently flashing input. In some cases, such as Gain and Pan, the LCD will “zoom” to the enlarged horizontal fader while you adjust it with the VALUE knob. After you stop adjusting, the LCD will return to the mixer display.

STAND-ALONE OPERATION

All settings, including all mix settings and global settings, are saved in the UltraLite’s memory, and they remain in effect even when the UltraLite is not connected to a computer. This allows you to use the UltraLite as a stand-alone 8-bus mixer. You can make adjustments to any setting at any time from the front panel.

CHAPTER 7 Cubase, Nuendo and Other ASIO Software

OVERVIEW

The UltraLite includes an ASIO driver that provides multi-channel I/O with Steinberg’s Cubase family of digital audio sequencers, including Cubase SX and Nuendo.

What is ASIO?	37
Preparation	37
Run MOTU Audio Setup	37
Choosing the MOTU ASIO driver	38
ASIO Direct monitoring	39
Other System dialog settings	39
Viewing and managing UltraLite inputs	39
Viewing and managing UltraLite outputs	40
Changing UltraLite settings	40
Processing live inputs with plug-ins	40
MIDI I/O via the UltraLite MIDI ports	40
24-bit operation	40
Monitoring system performance	40

WHAT IS ASIO?

ASIO is an acronym for *Audio Streaming Input and Output*. The MOTU ASIO driver allows the UltraLite to provide multi-channel audio input and output for any audio application that supports ASIO drivers.

Attention: Other software users

The UltraLite ASIO driver also provides multi-channel I/O with any ASIO-compatible audio software. Cubase is used for the examples in this chapter. However, the basic procedures are the same and can be easily applied to any ASIO-compatible software. Just follow the general descriptions at the beginning of each main section in this chapter. Consult your software documentation for details about each topic, if necessary.

If your audio software doesn’t support ASIO

If your host audio software does not support ASIO, but instead supports WDM (or legacy Wave) audio drivers, refer to the next chapter.

PREPARATION

To make sure that everything is ready for Cubase, install Cubase first (if you haven’t already done so), and then see these chapters before proceeding:

- chapter 3, “IMPORTANT! Run the UltraLite Software Installer First” (page 15)
- chapter 4, “Installing the UltraLite Hardware” (page 17).

RUN MOTU AUDIO SETUP

Before you run Cubase, launch MOTU Audio Setup to configure your UltraLite hardware. MOTU Audio Setup lets you configure your audio interface. For complete details, see chapter 5, “MOTU Audio Setup” (page 27). The following sections provide a brief explanation of each UltraLite setting for use with Cubase.

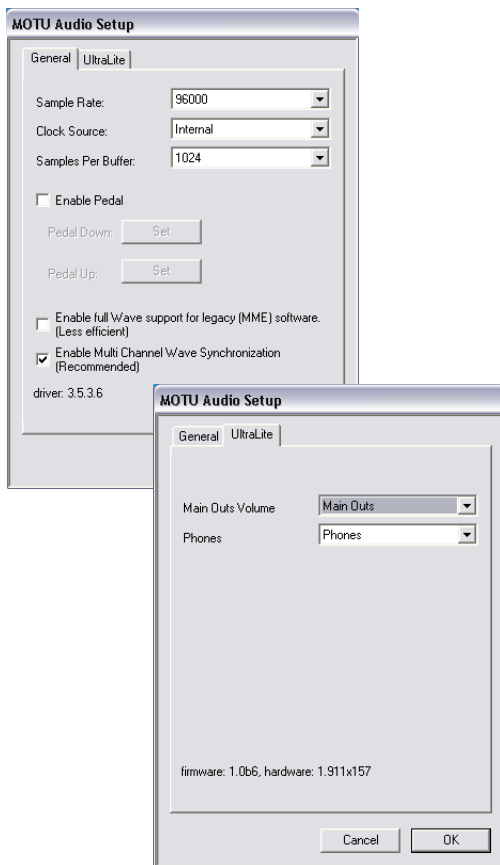


Figure 7-1: MOTU Audio Setup gives you access to all of the settings in the UltraLite hardware, including the clock source, sample rate and headphone output assignment.

Sample rate

Choose the desired overall sample rate for the UltraLite system and Cubase. Newly recorded audio in Cubase will have this sample rate.

Clock Source

This setting is very important because it determines which audio clock the UltraLite will follow.

If you do not have any digital audio connections to your UltraLite (you are using the analog inputs and outputs only), choose *Internal*.

If you have a S/PDIF digital audio device connected to the UltraLite, or if you are not sure about the clock source of your setup, be sure to read “Connecting and syncing S/PDIF devices” on page 23 and “Clock Source” on page 28.

Samples Per Buffer

The *Samples Per Buffer* setting can be used to reduce the delay — or *monitoring latency* — that you hear when live audio is patched through your UltraLite hardware and Cubase. For example, you might have MIDI instruments, samplers, microphones, and so on connected to the analog inputs of the UltraLite. If so, you will often be mixing their live input with audio material recorded in Cubase. See chapter 10, “Reducing Monitoring Latency” (page 51) for complete details.

Phones

This UltraLite setting lets you choose what you’ll hear from the headphone jack. For example, if you choose *Main Out 1-2*, the headphones will duplicate the main outs. Or you can choose any other output pair. If you choose *Phones*, this setting makes the headphone jack serve as its own independent output pair. As a result, you’ll see *Phones 1-2* as an additional audio destination in Cubase’s audio output menus.

CHOOSING THE MOTU ASIO DRIVER

Once you’ve made the preparations described so far in this chapter, you’re ready to run your audio software and enable the MOTU ASIO driver. Check the audio system or audio hardware configuration window in your software. There will be a menu there that lets you choose among various ASIO drivers that may be in your system. Choose the MOTU ASIO driver from this menu.

Nuendo, Cubase SX and V-Stack

To activate the UltraLite driver in Nuendo, Cubase SX or V-Stack, go to the Device Setup window, click *VST Audiobay* and choose *MOTU Audio* from

the *Master ASIO Driver* menu as shown below. Make the other settings in the dialog as need for your system and synchronization scenario.

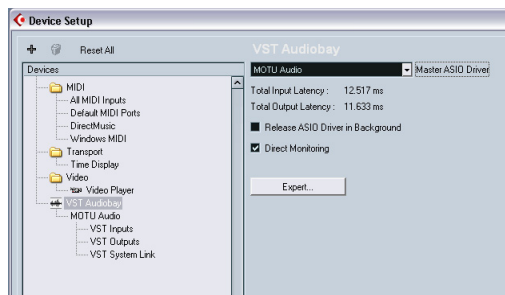


Figure 7-2: Activating the UltraLite FireWire ASIO driver in Nuendo and Cubase.

ASIO DIRECT MONITORING

The *Direct Monitoring* option (Figure 7-2) allows you to monitor inputs directly in the UltraLite hardware with no drain on your computer and near zero latency. When you enable this option, Cubase uses the UltraLite’s CueMix DSP monitoring features whenever you use Cubase’s monitoring features. For further information, see “Controlling CueMix DSP from within Cubase or Nuendo” on page 55.

OTHER SYSTEM DIALOG SETTINGS

Consult your Cubase or Nuendo documentation for details about the rest of the settings in this dialog.

VIEWING AND MANAGING ULTRALITE INPUTS

Once you’ve chosen the MOTU Audio driver in the Audio System dialog as explained earlier, click *VST Inputs* beneath the *MOTU Audio* item (Figure 7-3). The list on the right displays inputs supplied by the UltraLite, as well as any other connected MOTU FireWire audio interfaces. If the list does not match what you expect to see, click the *Reset* button.

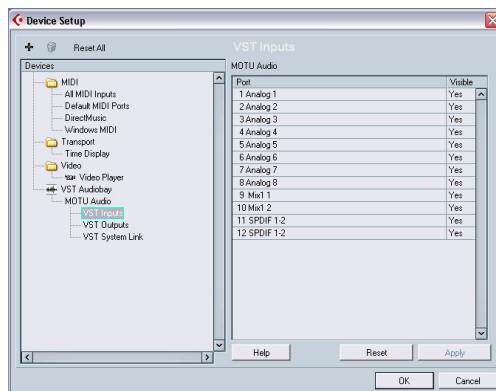


Figure 7-3: Creating UltraLite inputs in Nuendo or Cubase SX.

The “Mix1 1-2” input

In the Cubase Inputs list, you’ll see an UltraLite input called *Mix1 1-2*. This input source delivers the output of CueMix DSP “MIX1” (the first mix bus of the four on-board no-latency monitor mixes in the UltraLite) back to your computer. This input serves, for example, as a convenient way for you to record the UltraLite’s MIX1 monitor mix back into Cubase (for reference and archiving purposes). Further, if you are sending audio from Cubase to the same output pair as MIX1, you can choose to either include or exclude the audio from the computer in the stream being sent back to Cubase. For details on how to do this, see “Mix1 Return Includes Computer” on page 63.

⚠ Warning: the Mix1 1-2 input can cause feedback loops! DO NOT assign this input to a track that shares the same UltraLite output pair as MIX1.

VIEWING AND MANAGING ULTRALITE OUTPUTS

To view and manage UltraLite outputs, click *VST Outputs* beneath the *MOTU Audio* item (Figure 7-4).

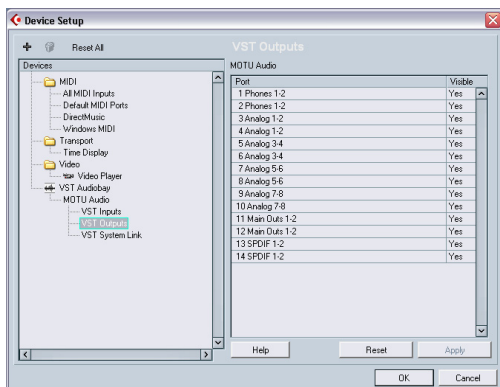


Figure 7-4: Working with UltraLite outputs in Nuendo or Cubase.

The “Phones 1-2” output

If you’ve chosen to treat the UltraLite headphones as an independent output, you’ll see *Phones 1-2* as an UltraLite output destination. Audio tracks assigned to this output pair will be heard on the headphone jack only. For further explanation, see “Phones” on page 38.

CHANGING ULTRALITE SETTINGS

To change the UltraLite settings at any time, go to the Device Setup window in Nuendo or Cubase SX and click the ASIO Control Panel button, as shown in Figure 7-2 on page 39. Be sure to click the Reset button (as shown in Figure 7-3 and Figure 7-4) after making any changes.

PROCESSING LIVE INPUTS WITH PLUG-INS

If you patch a live input (such as MIDI synthesizer) through a VST plug-in effect in Cubase, you might hear a slight delay. There are several ways to reduce this delay. For details, see chapter 10, “Reducing Monitoring Latency” (page 51).

MIDI I/O VIA THE ULTRALITE MIDI PORTS

Once you’ve run the UltraLite’s software installer as explained in “Installing the UltraLite software” on page 15, the UltraLite MIDI ports will appear as an input source and output destination in the MIDI input and output menus of your ASIO-compatible host software.

24-BIT OPERATION

Your UltraLite hardware fully supports Cubase and Nuendo’s 24-bit recording capabilities. Simply enable 24-bit operation as instructed in your Cubase or Nuendo manual. The UltraLite always supplies a 24-bit data stream, and when you enable 24-bit operation in Cubase or Nuendo, it simply uses all 24-bits supplied by the UltraLite hardware.

MONITORING SYSTEM PERFORMANCE

Keep the VST Performance window open to keep tabs on the load on your CPU and disk buffers. If the meters get too high, you can reduce the load by reducing the number of inputs and outputs you are working with. Use MOTU Audio Setup to uncheck input check boxes and set output source menus to *None*.

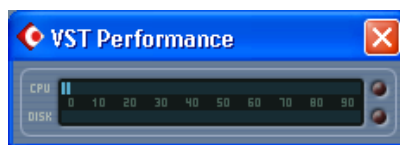


Figure 7-5: Keep the Audio Performance window open to keep tabs on your computer’s processing power and hard disk performance.

CHAPTER 8 SONAR and other WDM Software

OVERVIEW

The UltraLite WDM driver provides standard multi-channel input and output for WDM-compatible audio software running under Windows XP.

WDM and Wave driver compatibility.....	41
Installing the MOTU Audio WDM driver.....	41
Enabling Wave (MME) compatibility	41
Making settings in MOTU Audio Setup	42
Enabling the MOTU Audio WDM driver	43
Working with UltraLite inputs and outputs	44
Changing UltraLite settings.....	44
Reducing delay when monitoring live inputs	44
Synchronization	45
MIDI I/O via the UltraLite MIDI ports	45
24-bit operation	45

WDM AND WAVE DRIVER COMPATIBILITY

WDM is an acronym for *Windows Driver Model*. The MOTU WDM Driver allows the UltraLite to provide multi-channel audio input and output for any audio application that supports WDM audio drivers.

Attention: Cakewalk users

Cakewalk SONAR is used for the WDM driver setup examples in this chapter.

Attention: other software users


SONAR and Sound Forge are used for the WDM driver setup examples in this chapter. However, the basic procedures are the same and can be easily applied to any WDM-compatible software. Consult your software documentation for details, if necessary.

INSTALLING THE MOTU AUDIO WDM DRIVER

The MOTU Audio Installer CD installs the MOTU WDM driver into Windows for you. That's pretty much all the preparation you need. See chapter 3, "IMPORTANT! Run the UltraLite Software Installer First" (page 15).

ENABLING WAVE (MME) COMPATIBILITY

If your host audio software does not yet support Windows WDM drivers, enable Wave driver compatibility in the MOTU WDM Driver so that all of the UltraLite's inputs and outputs show up in your software. For details, see "Wave support for legacy (MME) software" on page 30.

 If your host audio software *does* support WDM audio drivers, *don't* enable Wave driver compatibility.

MAKING SETTINGS IN MOTU AUDIO SETUP

Before you run your audio software, launch MOTU Audio Setup to configure your UltraLite hardware. MOTU Audio Setup lets you choose the audio clock source, sample rate, buffer size and other hardware settings. For details, see chapter 5, “MOTU Audio Setup” (page 27). The following sections provide a brief explanation of each UltraLite setting for use with SONAR.

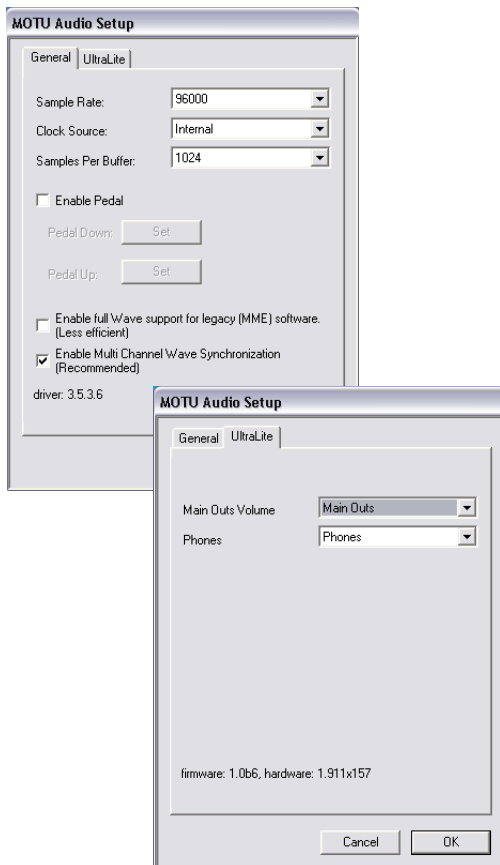


Figure 8-1: MOTU Audio Setup gives you access to all of the settings in the UltraLite hardware, including the clock source, sample rate and headphone output assignment.

Sample rate

Choose the desired overall sample rate for the UltraLite system and SONAR. Newly recorded audio in SONAR will have this sample rate.

Clock Source

This setting is very important because it determines which audio clock the UltraLite will follow.

If you do not have any digital audio connections to your UltraLite (you are using the analog inputs and outputs only), and you will not be slaving SONAR to external SMPTE time code, choose *Internal*.

If you have a S/PDIF digital audio device connected to the UltraLite, or if you are not sure about the clock source of your setup, be sure to read “Connecting and syncing S/PDIF devices” on page 23 and “Clock Source” on page 28.

Samples Per Buffer

The *Samples Per Buffer* setting can be used to reduce the delay — or *monitoring latency* — that you hear when live audio is patched through your UltraLite hardware and SONAR. For example, you might have MIDI instruments, samplers, microphones, and so on connected to the analog inputs of the UltraLite. If so, you will often be mixing their live input with audio material recorded in SONAR. See chapter 10, “Reducing Monitoring Latency” (page 51) for complete details.

Phones

This UltraLite setting lets you choose what you’ll hear from the headphone jack. For example, if you choose *Main Out 1-2*, the headphones will duplicate the main outs. Or you can choose any other output pair. If you choose *Phones*, this setting makes the headphone jack serve as its own independent output pair. As a result, you’ll see *Phones 1-2* as an additional audio destination in SONAR’s audio output menus.

ENABLING THE MOTU AUDIO WDM DRIVER

Once you've made the preparations described so far in this chapter, you're ready to run your audio software and enable the MOTU Audio WDM driver. Check the audio system or audio hardware configuration window in your software.

Enabling the MOTU Audio WDM driver in SONAR

To activate the MOTU Audio WDM driver in SONAR:

- 1 Choose *Audio* from the Options menu.
- 2 Click the *Drivers* tab.
- 3 Highlight the UltraLite inputs and outputs that you wish to use and unhighlight the ones you don't as shown in Figure 8-2.

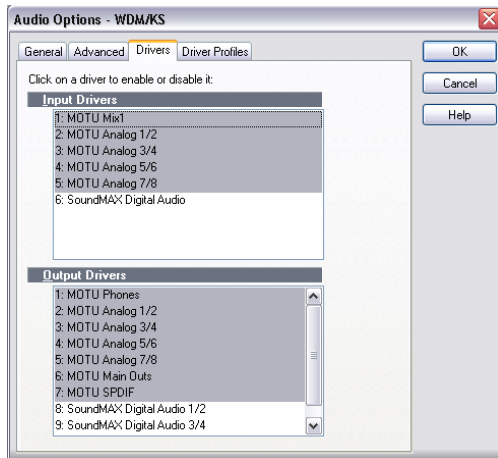


Figure 8-2: Activating the MOTU Audio WDM driver in SONAR by highlighting UltraLite inputs and outputs.

Enabling the MOTU ASIO driver in SONAR

As an alternative to the UltraLite's WDM driver, you can use the UltraLite's ASIO driver. Note, however, that you can only use one audio interface at a time under ASIO. Go to the Advanced tab and choose *ASIO* from the *Driver Mode* menu:

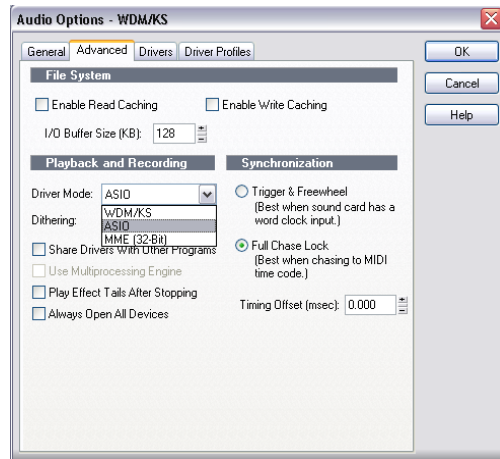


Figure 8-3: Enabling the ASIO driver instead of the WDM driver.

Other audio settings in SONAR

There are a few other settings in SONAR that impact UltraLite operation:

- 1 In the Audio Options window, click the *General* tab.
- 2 Choose an UltraLite input and output for recording and playback timing as shown below in Figure 8-4. It doesn't matter which input or output you choose.

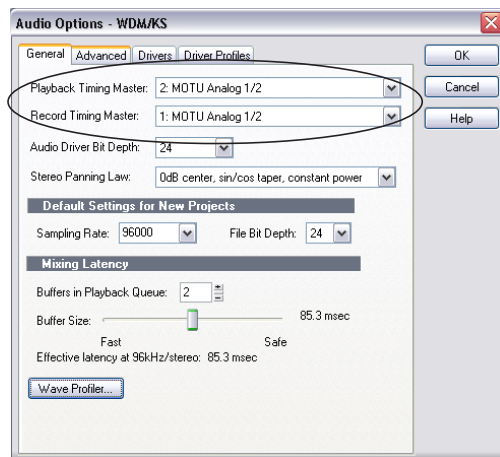


Figure 8-4: Make sure you have chosen an UltraLite input and output for the playback and recording timing master settings.

3 In the General tab, click the Wave Profiler button and run the Wave Profiler.

This process chooses the optimum settings for the UltraLite hardware.

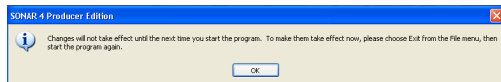


Figure 8-5: Running the Wave Profiler in Cakewalk's SONAR.

Enabling the MOTU Audio WDM driver in Sound Forge

To activate the MOTU Audio WDM driver in Sound Forge, go to the Preferences window, click the *Audio* tab, and then choose *MOTU Audio* from the *Audio device type* menu as shown below.

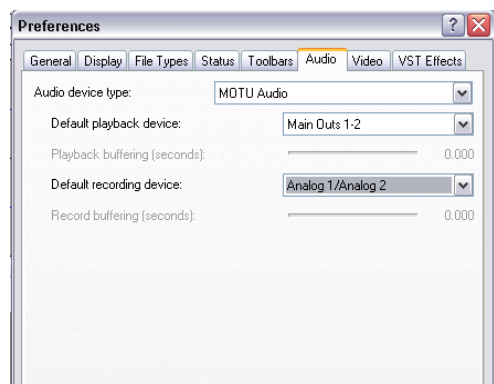


Figure 8-6: Enabling the UltraLite driver in Sound Forge.

WORKING WITH ULTRALITE INPUTS AND OUTPUTS

Once you've enabled the UltraLite inputs and output, UltraLite audio inputs and outputs will appear in your host software's input/output menus, and you can set them up and use them as any standard audio input and output.

The "Mix1 1" input

In your host software's audio input list, you'll see an UltraLite input called *Mix1 1-2*. This input source delivers the output of CueMix DSP "MIX1" (the first mix bus of the four on-board no-latency

monitor mixes in the UltraLite) back to your computer. This input serves, for example, as a convenient way for you to record the UltraLite's MIX1 monitor mix back into the computer (for reference and archiving purposes). Further, if you are sending audio from the computer to the same output pair as MIX1, you can choose to either include or exclude the audio from the computer in the stream being sent back to your host software. For details on how to do this, see "Mix1 Return Includes Computer" on page 63.

⚠ Warning: the Mix1 1-2 input can cause feedback loops! DO NOT assign this input to a track that shares the same UltraLite output pair as MIX1.

The "Phones 1-2" output

If you've chosen to treat the UltraLite headphones as an independent output, you'll see *Phones 1-2* as an UltraLite output destination. Audio tracks assigned to this output pair will be heard on the headphone jack only. For further explanation, see "Phones" on page 30.

CHANGING ULTRALITE SETTINGS

You can change the UltraLite settings at any time by accessing MOTU Audio Setup.

REDUCING DELAY WHEN MONITORING LIVE INPUTS

If you have live audio inputs connected to the UltraLite, such as MIDI synthesizers, samplers, microphones or other live instruments, you might hear a slight delay when their audio is being monitored through your UltraLite hardware and your host audio program. There are several ways to reduce — and eliminate — this audible monitoring delay. For details, see chapter 10, "Reducing Monitoring Latency" (page 51).

SYNCHRONIZATION

If you have a device connected to the UltraLite S/PDIF digital input, you need to be concerned with the synchronization of the UltraLite's digital audio clock with other device connected to it. For details, see “Connecting and syncing S/PDIF devices” on page 23.

MIDI I/O VIA THE ULTRALITE MIDI PORTS

Once you've run the UltraLite software installer as explained in “Installing the UltraLite software” on page 15, the UltraLite MIDI ports will appear as a MIDI input source and output destination in your WDM-compatible software's MIDI input and output menus.

24-BIT OPERATION

Your UltraLite hardware fully supports 24-bit recording in any audio software that supports it. Simply enable 24-bit operation as instructed by the software. The UltraLite system always supplies the software with a 24-bit data stream, and when you enable 24-bit operation, it simply uses all 24-bits supplied by the UltraLite hardware.

CHAPTER 9 GigaStudio and GSIF

OVERVIEW

The UltraLite includes a GSIF driver that provides multi-channel I/O with Tascam's GigaStudio family of virtual sampler products.

What is GSIF?	47
Preparation	47
Run MOTU Audio Setup	47
Choosing the MOTU GSIF driver	48
Enabling UltraLite outputs & inputs	48
Changing UltraLite settings.....	49
MIDI I/O via the UltraLite MIDI ports	49
24-bit operation	49

WHAT IS GSIF?

GSIF is an acronym for *Giga Sampler Interface*. The MOTU Audio driver allows the UltraLite to provide multi-channel audio input and output for the Tascam GigaStudio family of products.

PREPARATION

Install GigaStudio first (if you haven't already done so), and then see these chapters before proceeding:

- chapter 3, "IMPORTANT! Run the UltraLite Software Installer First" (page 15)
- chapter 4, "Installing the UltraLite Hardware" (page 17).

RUN MOTU AUDIO SETUP

Before you run GigaStudio, launch MOTU Audio Setup to configure your UltraLite hardware. MOTU Audio Setup lets you configure your audio interface. For complete details, see chapter 5, "MOTU Audio Setup" (page 27).

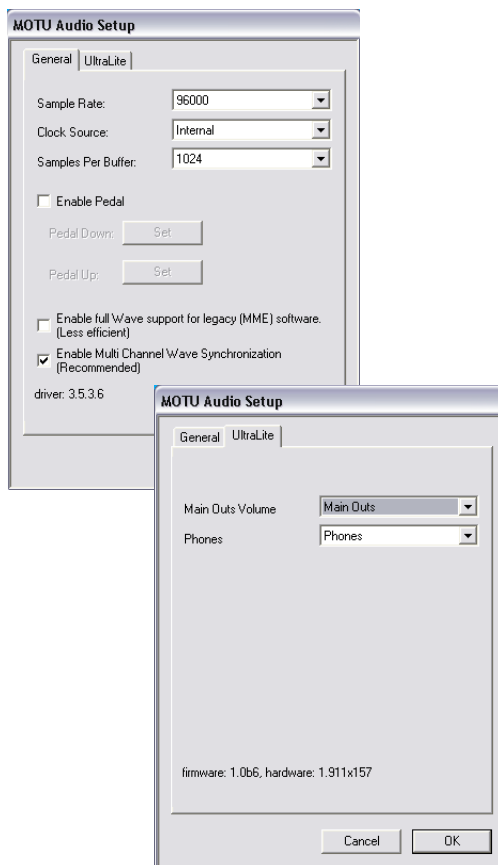


Figure 9-1: MOTU Audio Setup gives you access to all of the settings in the UltraLite hardware, including the clock source, sample rate and headphone output assignment.

Sample rate

Choose the desired overall sample rate for the UltraLite system and GigaStudio. This should match the sample rate at which you intend to operate GigaStudio.

Clock Source

This setting is very important because it determines which audio clock the UltraLite will follow.

If you do not have any digital audio connections to your UltraLite (you are using the analog inputs and outputs only), choose *Internal*.

If you have a S/PDIF digital audio device connected to the UltraLite, or if you are not sure about the clock source of your setup, be sure to read “Connecting and syncing S/PDIF devices” on page 23 and “Clock Source” on page 28.

Samples Per Buffer

The *Samples Per Buffer* setting can be used to reduce the delay — or *latency* — that you hear when playing GigaStudio from your MIDI controller or MIDI sequencer. In general, you have better timing accuracy with lower buffer settings, but the trade-off is that lower buffer settings require the computer that is running GigaStudio (with the UltraLite) to work harder. So in general, you want to keep the buffer size a low as possible while still maintaining the performance you need from GigaStudio.

Phones

This UltraLite setting lets you choose what you’ll hear from the headphone jack. For example, if you choose *Main Out 1-2*, the headphones will duplicate the main outs. Or you can choose any other output pair. If you choose *Phones*, this setting makes the headphone jack serve as its own independent output pair. As a result, you’ll see *Phones 1-2* as an additional audio destination in GigaStudio’s audio output menus.

CHOOSING THE MOTU GSIF DRIVER

Once you’ve made the preparations described so far in this chapter, you’re ready to run GigaStudio and enable the MOTU GSIF driver. To activate the UltraLite GSIF driver, go to the File menu, choose System Settings and click the *Hardware* tab. In the *Hardware Adapter* section, choose *MOTU Audio* from the menu.

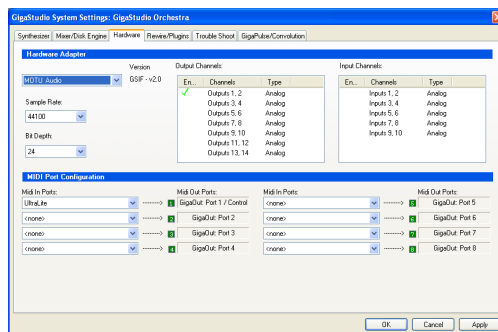


Figure 9-2: Activating the UltraLite GSIF driver in GigaStudio.

ENABLING ULTRALITE OUTPUTS & INPUTS

To enable UltraLite inputs and outputs for use with GigaStudio, click in the *Enable* column to put a check mark next to each input and output you wish to use. Here is how you can identify each input and output. Inputs are always listed in the same order as follows:


Input	Number of Channels	List position	Comment
Mix1 1-2	2	1-2	See “The “Mix1 1-2” input” on page 49
Analog	6	3-8	-
S/PDIF	2	9-10	-

Outputs are listed in this order:

Output	Channels	List position
Phones	2	1-2
Analog	8	3-10
Main	2	11-12
S/PDIF	2	13-14

The “Mix1 1-2” input

In the GigaStudio Inputs list, you’ll see an UltraLite input called *Mix1 1-2*. This input source delivers the output of CueMix DSP “MIX1” (the first mix bus of the four on-board no-latency monitor mixes in the UltraLite) back to your computer. This input serves, for example, as a convenient way for you to record the UltraLite’s MIX1 monitor mix back into Cubase (for reference and archiving purposes). Further, if you are sending audio from Cubase to the same output pair as MIX1, you can choose to either include or exclude the audio from the computer in the stream being sent back to Cubase. For details on how to do this, see “Mix1 Return Includes Computer” on page 63.

 Warning: the Mix1 1-2 input can cause feedback loops! DO NOT assign this input to a track that shares the same UltraLite output pair as MIX1.

MIDI I/O VIA THE ULTRALITE MIDI PORTS

Use the *MIDI Port Configuration* section (Figure 9-2) as instructed in your GigaStudio manual to use the UltraLite’s MIDI ports with GigaStudio.

CHANGING ULTRALITE SETTINGS

To change the UltraLite settings at any time, run MOTU Audio Setup (Figure 9-1 on page 47).

24-BIT OPERATION

Your UltraLite hardware fully supports GigaStudio 24-bit operation. Simply enable 24-bit operation in the Hardware Adapter section (Figure 9-2). The UltraLite always supplies a 24-bit data stream, and when you enable 24-bit operation, it simply uses all 24-bits supplied by the UltraLite hardware.

CHAPTER 10 Reducing Monitoring Latency

OVERVIEW

Monitoring latency is that slight delay you hear when you run an input signal through your host audio software. For example, you might hear it when you drive a live mic input signal through a reverb plug-in running in your audio sequencer.

This delay is caused by the amount of time it takes for audio to make the entire round trip through your computer, from when it first enters an UltraLite input, passes through the UltraLite hardware into the computer, through your host audio software, and then back out to an UltraLite output.

If you don't need to process a live input with plug-ins, the easiest way to avoid monitoring latency is to use the UltraLite's CueMix DSP feature to patch the input directly to your monitor outs via the UltraLite audio hardware. This is just like bussing inputs to outputs in a digital mixer. For details, see "CueMix DSP hardware monitoring" on page 54.

If you *do* need to process a live input with plug-ins, or if you are playing virtual instruments live through your UltraLite audio hardware, you can significantly reduce latency — and even make it completely inaudible, regardless of what host audio application software you use. This chapter explains how.

It is important to note that monitoring delay has no effect on when audio data is recorded to disk or played back from disk. Actual recording and playback is extremely precise.

Monitoring live input.....	52
Adjusting the audio I/O buffer	53
Lower latency versus higher CPU overhead	54
Transport responsiveness	54
Effects processing and automated mixing	54
CueMix DSP hardware monitoring	54
Two methods for controlling CueMix DSP	54
Using MOTU CueMix Console	55
Controlling CueMix DSP from your audio software ..	55

MONITORING LIVE INPUT

There are two ways to monitor live audio input with an UltraLite: 1) through the computer or 2) via CueMix™ DSP hardware monitoring.

Figure 10-1 below shows method 1, which allows you to add effects processing such as reverb and guitar amp effects via plug-ins in your audio software. See the next section, “Adjusting the audio I/O buffer” for details about how to reduce — and possibly eliminate — the audible monitoring delay that the computer introduces.

Figure 10-2 on page 53 shows how to use CueMix™ DSP hardware-based monitoring, which lets you hear what you are recording with no monitoring delay and no computer-based effects processing. (You can add effects later, after you’ve recorded the live input as a disk track.) See “CueMix DSP hardware monitoring” later in this chapter for

details on how to use CueMix DSP with your audio software, or with the included MOTU CueMix Console software.

If the material you are recording is suitable, there is a third way to monitor live input: use both methods (Figure 10-1 and Figure 10-2) at the same time. For example, you could route vocals to both the computer (for a bit of reverb) and mix that processed signal on the main outs with dry vocals from CueMix DSP.

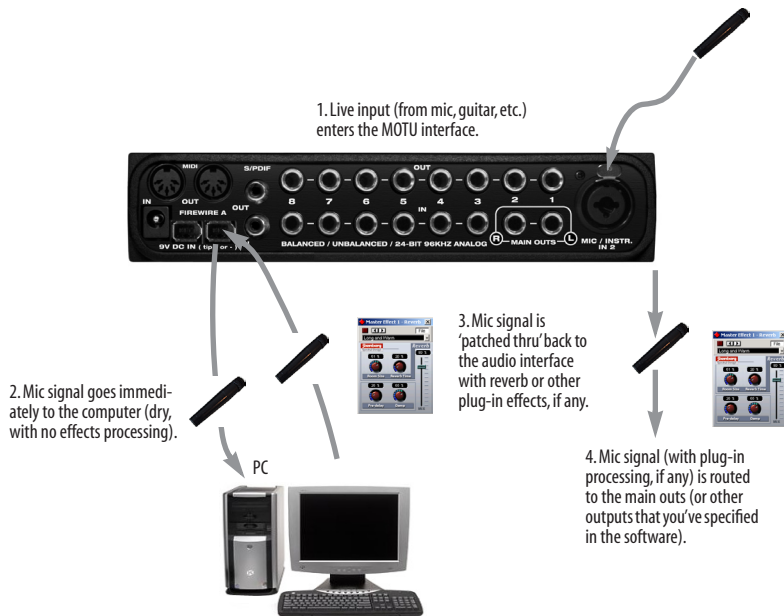


Figure 10-1: There are two ways to monitor live audio inputs with an UltraLite: 1) through the computer or 2) via CueMix™ DSP hardware monitoring. This diagram shows method 1 (through the computer). When using this method, use your host software's buffer setting to reduce the slight delay you hear when monitoring the live input, but don't lower it too much, or your computer might get sluggish.

ADJUSTING THE AUDIO I/O BUFFER

A *buffer* is a small amount of computer memory used to hold data. For audio interfaces like the UltraLite, buffers are used for the process of transferring audio data in and out of the computer. The size of the buffers determines how much delay you hear when monitoring live inputs through your audio software: larger buffers produce more delay; smaller buffers produce less.

Buffer size adjustment is made in MOTU Audio Setup, as shown in Figure 10-3 via the *Samples Per Buffer* setting.

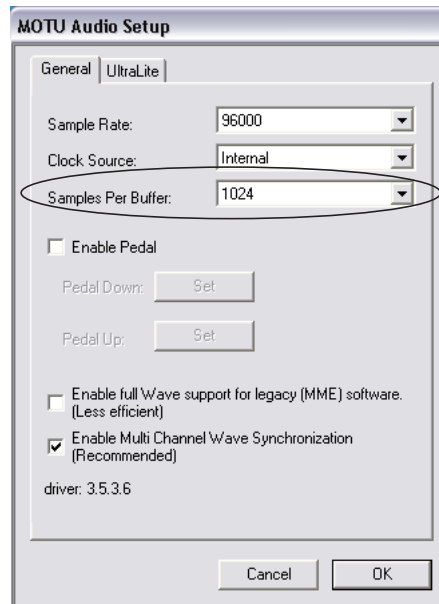


Figure 10-3: Lowering the 'Samples Per Buffer' setting in MOTU Audio Setup reduces patch thru latency. But doing so increases the processing load on your computer, so keep an eye on the Performance Monitor in your host audio software.

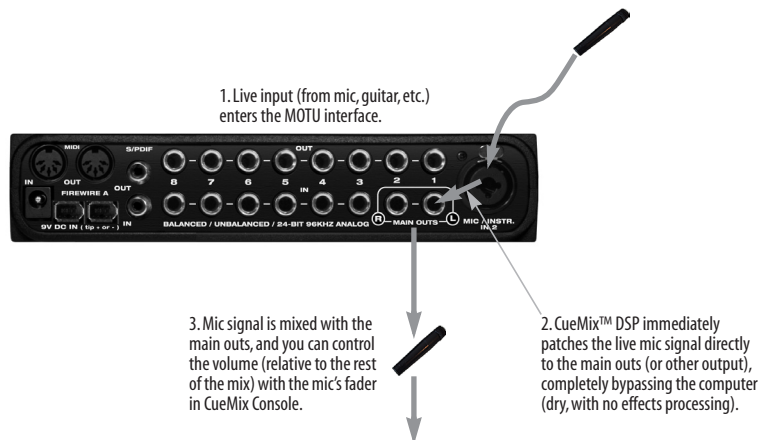


Figure 10-2: This diagram shows the signal flow when using CueMix™ DSP no-latency monitoring. Notice that this method does not allow you to process the live input with plug-ins in your audio software while it is being monitored. You can, however, add effects later — after recording the live input as a disk track. CueMix™ DSP lets you hear what you are recording with no delay and no computer-based effects.

Lower latency versus higher CPU overhead

The buffer setting has a large impact on the following things:

- Patch thru latency
- The load on your computer's CPU
- Possible distortion at the smallest settings
- How responsive the transport controls are in your audio software

The buffer setting presents you with a trade-off between the processing power of your computer and the delay of live audio as it is being patched through your software. If you reduce the size, you reduce patch thru latency, but significantly increase the overall processing load on your computer, leaving less CPU bandwidth for things like real-time effects processing. On the other hand, if you increase the buffer size, you reduce the load on your computer, freeing up bandwidth for effects, mixing and other real-time operations.

If you are at a point in your recording project where you are not currently working with live, patched-thru material (e.g. you're not recording vocals), or if you have a way of externally processing inputs, choose a higher buffer size. Depending on your computer's CPU speed, you might find that settings in the middle work best (256 to 1024).

Transport responsiveness

Buffer size also impacts how quickly your audio software will respond when you begin playback, although not by amounts that are very noticeable. Lowering the buffer size will make your software respond faster; raising the buffer size will make it a little bit slower, but barely enough to notice.

Effects processing and automated mixing

Reducing latency with the buffer size setting has another benefit: it lets you route live inputs through the real-time effects processing and mix automation of your audio software.

CUEMIX DSP HARDWARE MONITORING

The UltraLite has a more direct method of patching audio through the system. This method is called *CueMix DSP*. When enabled, CueMix activates hardware patch-thru in the UltraLite itself. CueMix DSP has two important benefits:

- First, it completely eliminates the patch thru delay (reducing it to a small number of samples — about the same amount as one of today's digital mixers).
- Secondly, CueMix DSP imposes no strain on the computer.

The trade-off, however, is that CueMix DSP bypasses your host audio software. Instead, live audio inputs are patched directly through to outputs in the UltraLite itself and are mixed with disk tracks playing back from your audio software. This means that you cannot apply plug-ins, mix automation, or other real-time effects that your audio software provides. But for inputs that don't need these types of features, CueMix DSP is the way to go.

On the other hand, if you really need to use the mixing and processing provided by your audio software, you should not use CueMix DSP. Instead, reduce latency with the buffer setting (as explained earlier in this chapter).

TWO METHODS FOR CONTROLLING CUEMIX DSP

There are two ways to control CueMix DSP:

- With MOTU CueMix Console
- From within your host audio software (if it supports direct hardware monitoring)

You can even use both methods simultaneously.

Using MOTU CueMix Console

If your host audio software does not support direct hardware monitoring, you run MOTU CueMix Console side-by-side with your audio software and manage your monitor mix in CueMix Console.

CueMix Console allows you to create up to four separate UltraLite monitor mixes, or any other desired routing configurations. These routings are independent of your host audio software. For complete details, see chapter 11, “MOTU CueMix Console” (page 57).

Controlling CueMix DSP from your audio software

Some ASIO-compatible audio applications, such as Cubase and Nuendo, allow you to control CueMix DSP monitoring from within the application (without the need to use CueMix Console). In most cases, this support consists of patching an UltraLite input directly to an output when you record-arm a track. Exactly how this is handled depends on the application.

CueMix DSP routings that are made via host applications are made “under the hood”, which means that you won’t see them in CueMix Console. However, CueMix DSP connections made inside your host audio software dovetail with any other mixes you’ve set up in CueMix Console. For

example, if your host application routes audio to an output pair that is already being used in CueMix Console for an entirely separate mix bus, both audio streams will simply be merged to the output.

Follow the directions below in the section that applies to you.

Controlling CueMix DSP from within Cubase or Nuendo

To turn on CueMix in Cubase SX or Nuendo, enable the Direct Monitoring check box in the Device Setup window (Figure 7-2 on page 39).

Other ASIO 2.0-compatible host software

If your ASIO-compatible host audio software supports ASIO’s direct monitoring feature, consult your software documentation to learn how to enable this feature. Once enabled, it should work similarly as described for Cubase (as explained in the previous section).

Using CueMix DSP with WDM- or Wave-compatible software

Run CueMix Console (chapter 11, “MOTU CueMix Console” (page 57)) and use it to route live inputs directly to outputs, control their volume and panning, etc. If necessary, you can save your CueMix Console setup with your project file.

CHAPTER 11 MOTU CueMix Console

OVERVIEW

MOTU CueMix Console provides access to the flexible on-board mixing features of the UltraLite. CueMix lets you route any combination of inputs to any stereo output pair. These mixes can be set up entirely independently of your host audio software. CueMix allows you to set up four completely independent mix configurations with the UltraLite. You can also save and load mix configurations.

CueMix Console can be used independently of host audio software, or together with it. CueMix mixing dovetails with the direct monitoring (hardware patch thru) features of your host audio software, allowing you to seamlessly mix in both environments.

- Advantages of CueMix monitoring..... 58
- CueMix Console installation..... 58
- Cuemix Console basic operation 58
- Working with a mix 58
- Shortcuts..... 59
- Copying & pasting (duplicating) entire mixes 59
- Message center 59
- Input trim and phase invert 59
- Saving and loading presets 60
- Saving and loading presets to/from disk 60
- Talkback and listenback..... 60
- Peak Hold Time..... 62
- Mix1 Return Includes Computer 63
- Phones menu 63
- Control Surfaces menu..... 63

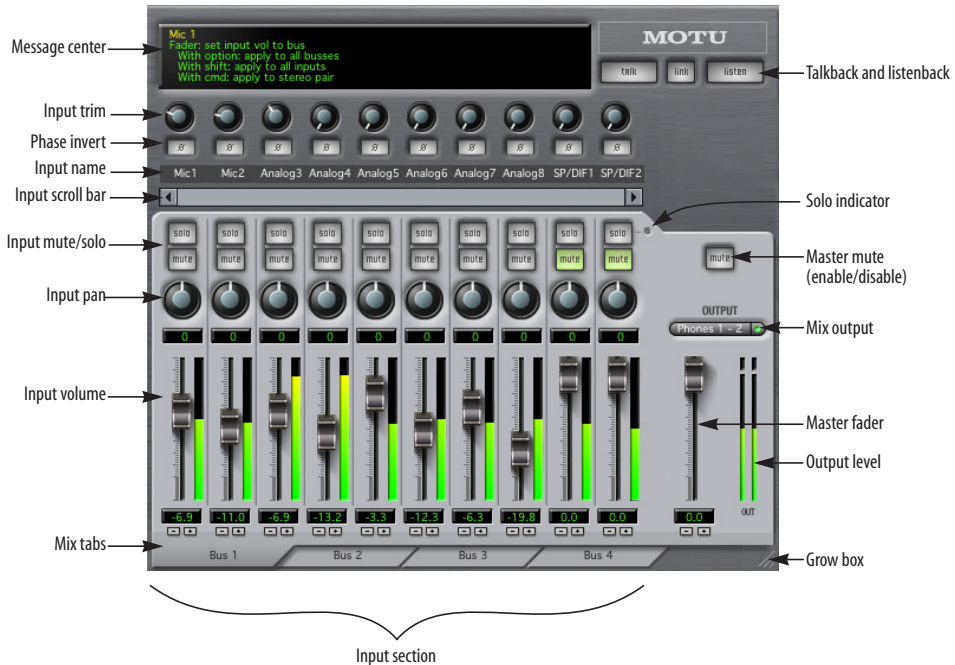


Figure 11-1: CueMix Console is a virtual mixer that gives you control over the UltraLite's on-board mixing features.

ADVANTAGES OF CUEMIX MONITORING

CueMix Console provides several major advantages over monitoring live inputs through your host audio software:

- CueMix has no buffer latency. Thanks to the UltraLite's DSP chip, CueMix provides the same throughput performance as a digital mixer.
- CueMix imposes absolutely no processor drain on the computer's CPU.
- CueMix routing can be maintained independently of individual software applications or projects.
- CueMix routing can operate without the computer, allowing the UltraLite to operate as a portable, stand-alone mixer.

CueMix Console does not provide effects processing. For information about using your audio software's native plug-ins together with CueMix, see chapter 10, "Reducing Monitoring Latency" (page 51).

CUEMIX CONSOLE INSTALLATION

CueMix Console is installed with the rest of your UltraLite software.

CUEMIX CONSOLE BASIC OPERATION

CueMix console is simple to operate, once you understand these basic concepts.

Four mixes

CueMix provides four separate mixes: Mix1, Mix2, Mix3 and Mix4. Each mix can have any number of inputs mixed down to any UltraLite output pair that you choose. For example, Mix1 could go to the headphones, Mix2 could go to the main outs, Mix3 could go to a piece of outboard gear connected to analog outputs 7-8, etc.

Many inputs to one output pair

It might be useful to think of each mix as some number of inputs all mixed down to a stereo output pair. CueMix Console lets you choose which inputs to include in the mix, and it lets you specify the level and pan for each input being fed into the mix.

Viewing one mix at a time

CueMix Console displays one mix at a time. To select which mix you are viewing, click its tab at the bottom of the window, as shown in Figure 11-1. The mix name appears in the tab. Double-click the name to change it.

Each mix is completely independent

Each mix has its own settings. Settings in one mix will not affect another. For example, if an input is used in one mix, it will still be available in other mixes. In addition, inputs can have a different volume, pan, mute and solo setting in each mix.

Some channel settings apply across all mixes

The settings at the top of the CueMix Console window (above the channel section) apply to all mixes. These settings include the *Input Trim* and *Phase Invert* for each input (Figure 11-1 on page 57).

Widening the CueMix Console window

To view more input faders at once, drag the right-hand edge of the window to the right.

WORKING WITH A MIX

Each mix has the following components:

- A stereo output with master fader
- Name
- Master mute (to enable/disable the entire mix)
- Any number of mono or stereo inputs
- Pan, volume, mute and solo for each input

These elements are visually grouped together in the lightly shaded area in the lower half of the CueMix Console window.

Viewing a mix

To view a mix, click its tab at the bottom of the window, as shown in Figure 11-1. The mix name appears in the tab.

Naming a mix

Double-click the mix name in the tab.

Master mute

The master mute button (Figure 11-1) temporarily disables (silences) the mix.

Master fader

The master fader (Figure 11-1) controls the overall level of the mix (its volume on its stereo output). Use the individual input faders to the left to control individual input levels.

Output level meters

The OUT level meters show you the output for the mix's physical output, which may include audio from your host audio software. The clip indicators clear themselves after a few seconds.

Input section

The channel strips to the left of the master fader represent each input in your UltraLite. Use the input scroll bar to view additional inputs.

Input mute/solo

To add an input to a mix, or remove it, click its MUTE button. To solo it, use its SOLO button. To toggle these buttons for a stereo pair, hold down the control key while clicking either channel. The Solo indicator LED (Figure 11-1) lights up when any input is soloed (including inputs that may currently be scrolled off-screen).

Input volume and pan

Use the input fader and pan knob (Figure 11-1) to adjust these settings for the input in the mix. Again, all settings within the gray-shaded channel strip area belong to the mix currently being viewed. Note that an input can have different settings in different mixes.

To adjust the volume or panning for a stereo input pair, hold down the control key while dragging the fader or knob for either the left or right input.

SHORTCUTS

Hold down the following modifier keys as shortcuts:

Shortcut	Result
Shift key	Applies your action to all inputs in the mix.
Control key	Applies your action to the stereo input pair
space bar	Applies your action to all busses
Double-click	Returns the control to its default value (pan center, unity gain, etc.)

COPYING & PASTING (DUPLICATING) ENTIRE MIXES

To copy and paste the settings from one mix to another:

- 1 Select the source mix (Figure 11-1) and choose Copy from the file menu (or press control-C).
- 2 Choose the destination mix and choose Paste from the file menu (or press control-V).

MESSAGE CENTER

The Message Center displays fly-over help for items in the CueMix Console window. It also displays messages regarding the overall operation of the UltraLite.

INPUT TRIM AND PHASE INVERT

The input trim and phase invert settings at the very top of the CueMix Console window (Figure 11-1) affect each input globally, across all mixes and for

audio being routed to the computer. For example, if you phase invert an input, your host software will receive the inverted signal for that input as well.

Input trim

The input trim range is 24dB on the two mic inputs (Analog 1-2). For all other inputs (TRS analog and S/PDIF), the trim range is 18dB. This is the same trim setting as can be made from the front panel, as explained in “PAGE” on page 35.

Phase invert

All inputs, both analog and digital, can be phase inverted. This setting (Figure 11-1). This is the same phase invert setting as can be made from the front panel, as explained in “PAGE” on page 35.

MIX1 RETURN INCLUDES COMPUTER

The *Mix1 return includes computer output* item in the CueMix Console File menu refers to the *Mix1* bus that the 828mkII driver provides as an input to host audio software. This input source delivers the output of CueMix DSP “MIX1” (the first mix bus of the four on-board no-latency monitor mixes in the 828mkII) back to your computer. This input serves, for example, as a convenient way for you to record the 828mkII’s MIX1 monitor mix back into your host audio software (for reference and archiving purposes).

When the *Mix1 return includes computer* menu item is checked, any audio being sent from your audio software on the computer to the same output as Mix1 will be included in the Mix1 return bus. When it is unchecked, computer output is excluded.

This menu item is essentially a pre/post switch for the computer audio insert to the stream of audio going to Mix1’s 828mkII output pair (and also back to the computer).

PHONES MENU

The Phones menu allows you to choose what you will hear on the headphone output, just like the Phones setting MOTU Audio Setup. However, this menu provides one extra option that is exclusive to CueMix Console: *Follow Active Mix*. This menu item, when checked, causes the headphone output to mirror the output of the current mix being viewed in CueMix Console. For example, if you are currently viewing Mix3 (the Mix3 tab is active), the headphones will mirror the Mix3 output (whatever it is assigned to).

SAVING AND LOADING PRESETS

As explained earlier in “Save/Name Preset” on page 33, the UltraLite can store up to 16 presets in its on-board memory. A preset includes all CueMix DSP settings for all four mix busses, but it excludes global settings like clock source and sample rate.

The Load Preset and Save Preset commands in the CueMix Console File menu let you name, save and load presets in the UltraLite.

SAVING AND LOADING PRESETS TO/FROM DISK

The *Save* and *Load* commands in the CueMix Console File menu allow you to save UltraLite presets to and from your hard drive. This allows you to save an unlimited number of UltraLite presets on disk. (Use the *Load Preset* and *Save Preset* commands to get presets from — and save them to — the UltraLite itself.) Click the Save button to save the current configuration; click the Load button to open an existing configuration that you have previously saved on disk.

TALKBACK AND LISTENBACK

CueMix Console provides *Talkback* and *Listenback* buttons. Talkback allows an engineer in the control room to temporarily dim all audio and talk to musicians in the live room. Conversely, Listenback allows musicians to talk to the control room.

Hardware setup

Figure 11-2 below shows a typical hardware setup for Talkback and Listenback. For Talkback, set up a dedicated mic in your control room and connect it to a mic input on your MOTU Audio interface. For Listenback, set up a dedicated listenback mic in the live room for the musicians and connect it to another mic input. For talkback output, set up a headphone distribution amp or set of speakers in the live room, and connect it to a pair of outputs. For example, you might connect a headphone distribution amp to analog outputs 7-8 on your MOTU FireWire audio interface, as demonstrated below in Figure 11-2 on page 61.

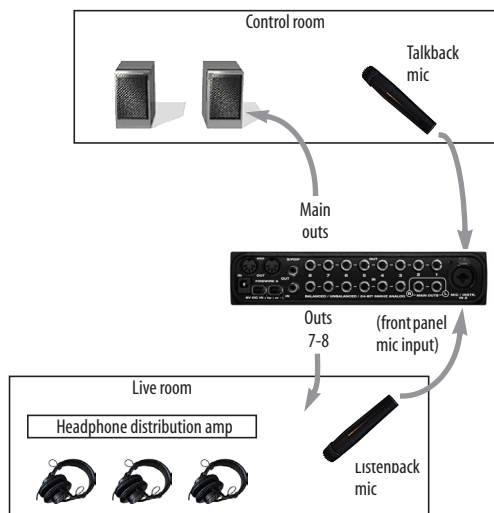


Figure 11-2: Typical hardware setup for Talkback and Listenback.

CueMix Console setup

To set up Talkback and/or Listenback in CueMix Console, choose *File menu > Talkback settings > Configure Talkback/Listenback* to open the window shown in Figure 11-3:

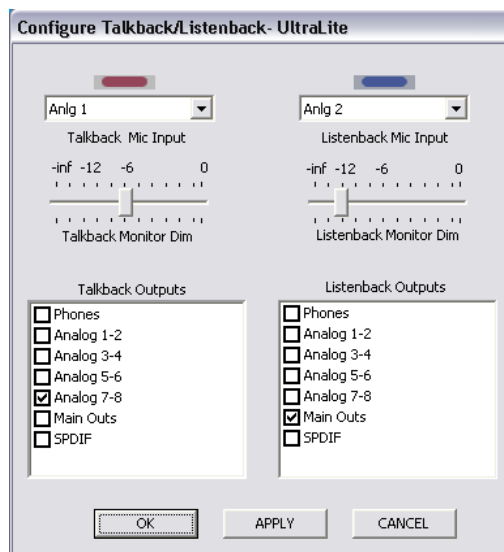


Figure 11-3: Configuring Talkback and Listenback.

Talkback / Listenback Mic Input

Choose the audio input to which your Talkback and/or Listenback mic is connected. These inputs are labeled with a purple and blue swatch, respectively, just above the channel fader.

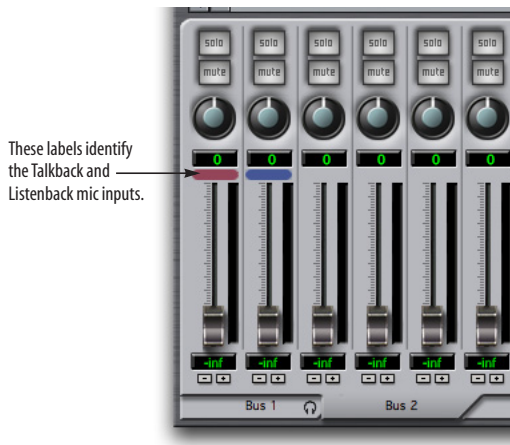


Figure 11-4: The purple label identifies the Talkback mic input; the blue label indicates the Listenback mic. Use the input fader to control the mic volume.

Talkback / Listenback Monitor Dim

Choose the amount of attenuation you would like to apply to all other audio signals (besides the talkback volume) when Talkback and/or Listenback is engaged. To completely silence all other audio, move the slider all the way to the left (-Inf).

Talk / Listen signal routing

As shown in Figure 11-3, check the boxes next to the outputs on which you'd like to hear the Talkback mic and/or Listenback mic. For example, to hear the Talkback mic on the headphones in the live room, check the *Analog 7-8* check box in the *Talk* column as demonstrated in Figure 11-3. To hear the Listenback mic on the main monitors in the control room, check the *Main Out 1-2* check box in the *Listen* column, also demonstrated in Figure 11-3.

Engaging/disengaging Talkback and Listenback

To engage Talk back or Listenback, press on the Talk or Listen buttons and then release to disengage. Talkback and/or Listenback is engaged for as long as you hold down the mouse button. Option-click to make the buttons “sticky” (stay engaged until you click them again — so you don't have to hold down the mouse). If you would like to engage both Talkback and Listenback at the same time, enable the *Link* button.



Figure 11-5: The Talkback and Listenback buttons.

Controlling Talkback and Listenback volume

To control the volume of the Talkback and/or Listenback mics, adjust their input fader in CueMix Console. This fader controls the volume of the input, regardless of which bus mix is being displayed in the CueMix Console window. In other words, once an input has been designated as a Talkback or Listenback input, its fader becomes global for all CueMix buses.

PEAK HOLD TIME

The input level meters in the UltraLite LCD display support peak/hold metering, where the meter segment for the highest level recently measured on the input remains illuminated for a brief period of time while the rest of the LEDs below it remain fully dynamic. The *Peak Hold Time* sub-menu (File menu) lets you control how long the level meters in the LCD remain illuminated before going dark again.

MIX1 RETURN INCLUDES COMPUTER

The *Mix1 return includes computer* item in the CueMix Console File menu refers to the *Mix1* bus that the UltraLite driver provides as an input to host audio software. This input source delivers the output of CueMix DSP “MIX1” (the first mix bus of the four on-board no-latency monitor mixes in the UltraLite) back to your computer. This input serves, for example, as a convenient way for you to record the UltraLite’s MIX1 monitor mix back into your host audio software (for reference and archiving purposes).

When the *Mix1 return includes computer* menu item is checked, any audio being sent from your audio software on the computer to the same output as Mix1 will be included in the Mix1 return bus. When it is unchecked, computer output is excluded.

This menu item is essentially a pre/post switch for the computer audio insert to the stream of audio going to Mix1’s UltraLite output pair (and also back to the computer).

PHONES MENU

The Phones menu allows you to choose what you will hear on the headphone output, just like the Phones setting in MOTU Audio Setup. However, this menu provides one extra option that is exclusive to CueMix Console: *Follow Active Mix*. This menu item, when checked, causes the headphone output to mirror the output of the current mix being viewed in CueMix Console. For example, if you are currently viewing Mix3 (the Mix3 tab is active), the headphones will mirror the Mix3 output (whatever it is assigned to).

CONTROL SURFACES MENU

CueMix Console can be controlled from an automated control surface such as the Mackie Control™. Use the commands in the *Control Surfaces* menu to enable and configure this feature.

Application follows control surface

When checked, the *Application follows control surface* menu command makes the CueMix Console window scroll to the channel you are currently adjusting with the control surface, if the channel is not visible when you begin adjusting it. The same is true for the bus tabs: if you adjust a control in a bus that is not currently being displayed, CueMix Console will jump to the appropriate tab to display the control you are adjusting.

Share surfaces with other applications

When the *Share surfaces with other applications* menu command is checked, CueMix Console releases the control surface when you switch to another application. This allows you to control your other software with the control surface. Here’s a simple way to understand this mode: the control surface will always control the front-most application. Just bring the desired application to the front (make it the active application), and your control surface will control it. When you’d like to make changes to CueMix Console from the control surface, just bring CueMix Console to the front (make it the active application).

When this menu item is unchecked, your control surface will affect CueMix Console all the time, even when CueMix Console is not the front-most application. In addition, you will not be able to control other host audio software with the control surface at any time (because CueMix Console retains control over it at all times). This mode is useful when you do not need to use the control surface with any other software.

Mackie Control Surfaces

CueMix Console includes support for the following control surface products:

- Mackie Control™
- Mackie HUI™
- Mackie Baby HUI™

Use the sub-menu commands in the *Mackie Control Surfaces* menu item to turn on and configure control surface support, as described briefly below.

Enabled

Check this menu item to turn on control surface operation of CueMix Console. Uncheck it to turn off control surface support.

Configure...

Choose this menu item to configure your control surface product. Launch the on-line help for specific, detailed instructions for configuring CueMix Console for operation with your control surface product.

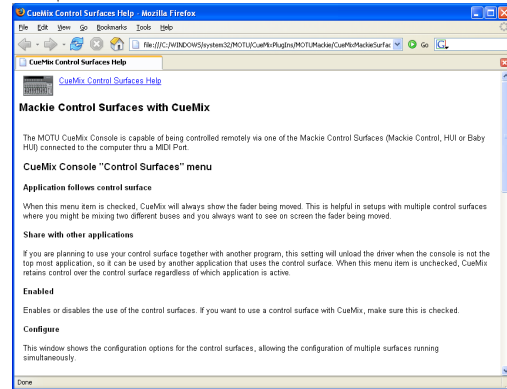
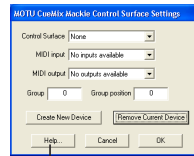


Figure 11-6: Refer to the extensive on-line help for details about configuring CueMix Console for operation with your control surface product.

CHAPTER 12 Performance Tips & Troubleshooting

Things seems like they are working fine, but the UltraLite then just drops off line, and the computer can't see it anymore on the FireWire bus.

This is a common symptom when the problem is that the UltraLite is not getting enough power. Check the power source for the UltraLite. Make sure that the power connection meets the requirements outlined in “Bus power requirements” on page 20.

Why does the start sound not play through the UltraLite?

The UltraLite will only playback audio at a sampling rate of 44.1, 48, 88.2 or 96kHz.

The computer freezes when it starts up

If the computer is unable to boot up, it may be a conflict with the WDM Driver. As soon as the computer boots up, Windows will try and initialize the WDM Driver. If this fails, your computer will hang. To determine if the WDM Driver is the problem, boot up in Safe Mode or remove the MOTU Audio software with the Add/Remove Programs Control Panel then restart. Reinstall the UltraLite software and choose only to install the MOTU ASIO driver, not the WDM Driver. Restart again.

'New hardware detected' window

If you connect your UltraLite before running the UltraLite Software Installer CD, Windows will prompt you that new hardware has been detected. Cancel this, and run the UltraLite Software Installer, rather than allowing Windows to locate the drivers.

UltraLite inputs and outputs are not available in SONAR

Make sure that the inputs and/or outputs that you want to use are enabled in SONAR.

Sound Forge and 'Smooth Scroll'

If the Smooth Scroll option under the Options menu is turned on, you may experience clicks and pops or other anomalies in the audio playback. This gets worse as you zoom in more to the waveform while playing. For the best quality playback, turn this option off.

Clicks and pops due to hard drive problems

If you have checked your clock settings sync cable connections and you are still getting clicks and pops in your audio, you may have a drive related problem. Set the UltraLite Clock Source to Internal and try recording just using the analog inputs and outputs of the UltraLite. If you encounter the same artifacts you may want try using another drive in your computer. Clicks and pops can also occur when the drive is severely fragmented, the disk drivers are outdated, or if you are using a SCSI accelerator that is not optimally configured for working with audio.

Connecting or powering gear during operation

It is not recommended that you connect/disconnect, or power on/off devices connected to the UltraLite while recording or playing back audio. Doing so may cause a brief glitch in the audio.

Monitoring - how do I monitor inputs?

Please refer to the documentation for the audio application that you are using. If your application does not support input monitoring, you will need to use the UltraLite's hardware-based CueMix DSP monitoring feature. Please see chapter 10, “Reducing Monitoring Latency” (page 51).

CUSTOMER SUPPORT

We are happy to provide customer support to our registered users. If you haven't already done so, please complete the registration card included with your UltraLite. When we receive your card, you'll be placed on our mailing list for software updates and information about new products.

REPLACING DISKS

If your UltraLite installer CD becomes damaged and fails to provide you with fresh, working copies of the program, our Customer Support Department will be glad to replace it. You can request a replacement disc by calling our business office at (617) 576-2760 and asking for customer service.

TECHNICAL SUPPORT

If you are unable, with your dealer's help, to solve problems you encounter with the UltraLite system, you may contact our technical support department in one of the following ways:

- Tech support hotline: (617) 576-3066 (Monday through Friday, 9 am to 6 pm EST)
- Tech support 24-hour fax line: (617) 354-3068
- Tech support email: techsupport@motu.com
- Web site: www.motu.com

Please provide the following information to help us solve your problem as quickly as possible:

- The serial number of the UltraLite system. This is printed on a sticker placed on the bottom of the UltraLite rack unit. You must be able to supply this number to receive technical support.
- Software version numbers for the audio software you are using, the MOTU Audio WDM Driver, MOTU ASIO driver, etc.
- A brief explanation of the problem, including the exact sequence of actions which cause it, and the contents of any error messages which appear on the screen.

- +4dB analog input 19
- 10dB analog input 19
- 1394 connector 6, 10, 18
- 24-bit
 - 3rd party software 45
 - recording 11
- 48V phantom power 5
- 4-pin FireWire 20
- 5.1 (Analog 1-6) 33
- 6-pin FireWire 20
- 7.1 (Analog 1-8) 33
- 828
 - connecting to UltraLite 24
- 896HD
 - connecting to UltraLite 24

A

- Activity meters 11
- All Notes Off 34
- Analog inputs/outputs 6
 - making connections to 19
 - overview 10
- Analog meters 11
- Application follows control surface 63
- ASIO 11, 15, 16, 37
- Audio
 - bit resolution 28
- Audio Setup software 27

B

- Balanced analog 19
- Buffer Size 29, 53
- Bus Mute 33
- Bus Output 33
- Bus power 20
 - examples 21
 - requirements 20

C

- Clock source 7, 28
 - front panel 32
- Combo jacks 5, 6
- Condenser mic input 5, 19
- Configure interface 24
- Connecting multiple UltraLites 23
- Control surface support 63
- Controller
 - connecting 20
- Converters 6
- Copy bus mix 33
- Cubase 11, 27
 - clock source 38
 - Device setup 7
 - enabling the UltraLite ASIO driver 43
 - sample rate 38
- CueMix Console 54, 57
 - Application follows control surface 63
 - Input Trim 60
 - Listenback explained 60
 - listenback settings 61
 - Mackie control surfaces 64
 - Peak Hold Time 62

- Phase Invert 60
- Share surfaces with other applications 63
 - talkback settings 60, 61
- CueMix DSP 54
 - Mixer 31
 - output jacks 19
 - overview 11
- CURSOR knob 5, 32, 35
- Customer service contact info 66
- Customer support 66

D

- Daisy-chaining 20, 23, 24
- DAT
 - connecting 22, 23
- DC power supply 21
- Delay (latency) 51
- Digital Precision Trim 11
- Disable interface option 25
- Disable option 25
- Disk
 - getting a replacement 66
- Dynamic mic 19

E

- Enable
 - full Wave support for legacy (MME) software 7
 - Multi Channel Wave Synchronization 7
- Enable Pedal 7, 30
- Expansion 23

F

- Factory Defaults 34
- Fader View Time 33
- Feedback loops 39, 44, 49
- FireWire 10
 - 6-pin vs. 4-pin 20
 - additional busses 25
 - connecting 18
 - connector 6
 - PC card adapters 21
 - PCI cards 20
- Follow Active Mix 60, 63
- Forget button 25
- Front panel 31
 - LCD display 11

G

- Gain 35
- General tab 27
- GigaStudio 47
 - clock source 47
 - sample rate 47
- GSIF driver 11, 15, 16, 47
- Guitar
 - connecting 19, 22

H

- Headphone jack 5, 11
- Headphones
 - connecting 22

- controlling output 7, 30

I

- Init Current Mix 33
- Input trim 35, 60
- Inputs
 - analog 6
 - S/PDIF 6
- Installation
 - hardware 17
 - software 15
- Internal (sync setting) 28
- Inv (Phase Invert) 35, 60

K

- Keyboard controller
 - connecting 20

L

- Laptop operation 21
- Latency 29, 38, 42, 48, 51, 53, 54
 - w/3rd party software 44
- LCD display 5, 11, 31
- Listenback
 - explained 60
- Load Preset 34, 60

M

- Mackie control surfaces 64
- Main outs
 - jacks 6
 - making connections to 19
 - volume control 5, 11
- Main Outs Volume setting 7, 30, 32, 33
- MAIN VOL knob 5, 32
- Main volume 5, 11
- Main Volume Assign 33
- Metering 11
- Mic/instrument inputs 5, 6, 18
 - connecting 22
 - overview 10
 - phantom power 5
- MIDI
 - connections 19
 - jacks 6
 - overview 10
 - Windows driver installation 16
- MIX BUS knob 34
- Mix1 1-2
 - Cubase 39, 44
 - GigaStudio 49
- Mix1 return includes computer 60, 63
- Monitoring 52
 - thru main outs 19
 - w/3rd party software 44
- MOTU
 - Audio Setup software 27
 - Audio System
 - bit resolution 28
- MOTU Audio
 - ASIO driver 16
- Multiple interfaces 23
- Mute 35

N

- Nuendo 11, 27
 - clock source 38
 - Device setup 7
 - sample rate 38

O

- Optimization 54
- Outputs
 - analog 6

P

- Packing list 13
- Pad 5, 10, 18
- PAGE knob 32, 35
- Pair 35
- Pan 35
- Paste Bus Mix 33
- Patch thru
 - latency 29, 54
- PCI
 - FireWire adapters 25
- PCMCIA adapters 25
- Peak Hold Time 62
- Performance 54
- Phantom power 5, 10, 18, 19
- Phase Invert 35, 60
- Phones 5, 7, 11, 30
 - Cubase 38
 - GigaStudio 48
 - Nuendo 38
 - SONAR 42
- Phones 1-2
 - Cubase 40, 44
- Phones Assign 33
- Phones menu 60, 63
- Polarity 21
- Power supply 21
 - jack 6
- Power switch 5, 21, 32

R

- Registration 13

S

- S/PDIF 6, 10
 - clock source setting 29
 - connection 19
 - meters 11
 - sync 23
 - volume control 7, 30, 32, 33
- Sample rate 7, 28
- Samplers
 - connecting 22
- Samples Per Buffer 29, 53
- Samples per buffer 7, 29, 38, 42, 48
- Save Preset 60
- Save/Name Preset 33
- Share surfaces with other applications 63
- Software installation 15
- Solo 35
- SONAR 11
 - clock source 42
 - sample rate 42
- Sony
 - Sound Forge 44
- Sound Forge 44
- Sound module
 - connecting 20
- SPDIF Out setting 33
- Stand-alone operation 31, 35
- Studio setup (example) 22
- Surround
 - volume control 32
- Surround volume control 7, 30, 33
- Synchronization
 - multiple interfaces 24
- Synths
 - connecting 22
- System requirements
 - minimum 13

- recommended computer 11, 13

T

- Talkback
 - explained 60
 - settings 61
- Tech support contact info 66
- Technical support 66
- Tip positive/negative 21
- Traveler
 - connecting to UltraLite 24
- Trim 18, 35, 60
- Troubleshooting
 - feedback loop 39, 44, 49
- TRS connectors 19
- TRS/XLR jacks 5, 6

U

- UltraLite
 - connecting multiple interfaces 24
 - expansion 23
 - installing 17
 - power switch 32
 - rear panel overview 9
 - software installation 15
 - summary of features 9
 - tab 27
- Unbalanced analog 19

V

- VALUE knob 35
- Volume
 - headphone 11

W

- Wave driver 16, 41

X

- XLR/TRS jacks 5, 6