828™
User Guide

MOTU®

SAFETY PRECAUTIONS AND ELECTRICAL REQUIREMENTS FOR THE 828 ("PRODUCT")

⚠️ CAUTION! READ THIS SAFETY GUIDE BEFORE YOU BEGIN INSTALLATION OR OPERATION. FAILURE TO COMPLY WITH SAFETY INSTRUCTIONS COULD RESULT IN BODILY INJURY OR EQUIPMENT DAMAGE.

⚡ HAZARDOUS VOLTAGES: CONTACT MAY CAUSE ELECTRIC SHOCK OR BURN. TURN OFF UNIT BEFORE SERVICING.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR OTHER MOISTURE.

CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER. NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: THIS EQUIPMENT IS NOT SUITABLE FOR USE IN LOCATIONS WHERE CHILDREN ARE LIKELY TO BE PRESENT.

WARNING: DO NOT PERMIT FINGERS TO TOUCH THE TERMINALS OF PLUGS WHEN INSTALLING OR REMOVING THE PLUG TO OR FROM THE OUTLET.

WARNING: IF NOT PROPERLY GROUNDED THE MOTU PRODUCT COULD CAUSE AN ELECTRICAL SHOCK.

The MOTU product is equipped with a three-conductor cord and grounding type plug which has a grounding prong, approved by Underwriters' Laboratories and the Canadian Standards Association. This plug requires a mating three-conductor grounded type outlet as shown in Figure A below. If the outlet you are planning to use for the MOTU product is of the two prong type, DO NOT REMOVE OR ALTER THE GROUNDING PRONG IN ANY MANNER. Use an adapter as shown below and always connect the grounding lug to a known ground. It is recommended that you have a qualified electrician replace the TWO prong outlet with a properly grounded THREE prong outlet. An adapter as illustrated below in Figure B is available for connecting plugs to two-prong receptacles. In the EU, use the supplied EU power cord and be sure that the power outlet is properly grounded (Figure C).
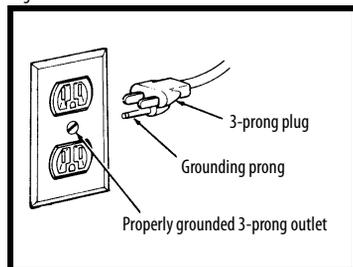
Figure A

3-prong plug
Grounding prong
Properly grounded 3-prong outlet

Figure B

Grounding lug
Screw
3-prong plug
Make sure this is connected to a known ground.
Two-prong receptacle
Adapter

Figure C

Danmark: Apparatets stikprop skal tilsluttes en stikkontakt med jord som giver forbindelse til stikproppens jord.

Suomi: Laite on liitettävä suojakoskettimilla varustettuun pistorasiaan.

Norge: Apparatet må tilkoples jordet stikkontakt.

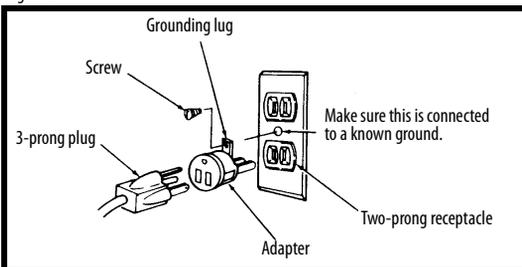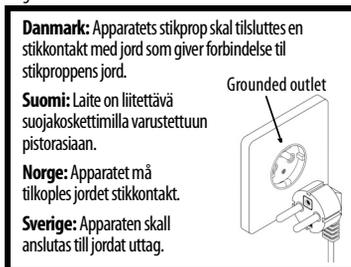**Sverige:** Apparaten skall anslutas till jordat uttag.

Grounded outlet

WARNING: THE GREEN GROUNDING LUG EXTENDING FROM THE ADAPTER MUST BE CONNECTED TO A PERMANENT GROUND SUCH AS TO A PROPERLY GROUNDED OUTLET BOX. NOT ALL OUTLET BOXES ARE PROPERLY GROUNDED.

If you are not sure that your outlet box is properly grounded, have it checked by a qualified electrician. NOTE: The adapter illustrated is for use only if you already have a properly grounded two-prong receptacle. Adapter is not allowed in Canada by the Canadian Electrical Code. Use only three wire extension cords which have three-prong grounding type plugs and three-prong receptacles which will accept the MOTU product plug.

IMPORTANT SAFEGUARDS

1. Read these instructions. All the safety and operating instructions should be read before operating the product.
2. Keep these instructions. These safety instructions and the product owner's manual should be retained for future reference.
3. Heed all warnings. All warnings on the product and in the owner's manual should be adhered to.
4. Follow all Instructions. All operating and use instructions should be followed.
5. Do not use the product near water.
6. Cleaning - Unplug the product from the computer and clean only with a dry cloth. Do not use liquid or aerosol cleaners.
7. Ventilation - Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
8. Heat - Do not install the product near any heat sources such as radiators, heat registers, stoves, or another apparatus (including an amplifier) that produces heat.
9. Overloading - Do not overload wall outlets and extension cords as this can result in a risk of fire or electrical shock.
10. Grounding - Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding-type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult and electrician for replacement of the obsolete outlet.
11. Power cord - Protect the product power cord from being walked on or pinched by items placed upon or against them. Pay particular attention to cords and plugs, convenience receptacles, and the point where they exit from the unit.
12. Power button - Install the product so that the power button can be accessed and operated at all times.
13. Disconnect - The main plug is considered to be the disconnect device for the product and shall remain readily operable.
14. Accessories - Only use attachments/accessories specified by the manufacturer.
15. Placement - Use only with the cart, stand, tripod, bracket or table specified by the manufacturer, or sold with the product. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
16. Surge protection - Unplug the product during lightning storms or when unused for long periods of time.
17. Servicing - Refer all servicing to qualified service personnel. Servicing is required when the product has been damaged in any way, such as when a power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the product, the product has been exposed to rain or moisture, does not operate normally, or has been dropped.
18. Power Sources - Refer to the manufacturer's operating instructions for power requirements. Be advised that different operating voltages may require the use of a different line cord and/or attachment plug.
19. Installation - Do not install the product in an unventilated rack, or directly above heat-producing equipment such as power amplifiers. Observe the maximum ambient operating temperature listed below.
20. Power amplifiers- Never attach audio power amplifier outputs directly to any of the unit's connectors.
21. Replacement Parts - When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original part. Unauthorized substitutions may result in fire, electric shock or other hazards.
22. Safety Check - Upon completion of any service or repairs to this MOTU product, ask the service technician to perform safety checks to determine that the product is in safe operating conditions.

The device with CLASS I construction must be connected to the mains socket with a protective earthing connection.

ENVIRONMENT, HEAT AND VENTILATION

Operating Temperature: 10°C to 40°C (50°F to 104°). The product should be situated away from heat sources or other equipment that produces heat. When installing the product in a rack or any other location, be sure there is adequate space around the product to ensure proper ventilation. Improper ventilation will cause overheating and can damage the unit.

TO REDUCE THE RISK OF ELECTRICAL SHOCK OR FIRE

Do not handle the power cord with wet hands. Do not pull on the power cord when disconnecting it from an AC wall outlet. Grasp it by the plug. Do not expose this apparatus to rain or moisture. Do not place objects containing liquids on it.

AC INPUT

100 - 240VAC ~ • 50 / 60Hz • 0.5A max

CAUTION
RISK OF ELECTRIC SHOCK
DO NOT OPEN

Contents

Part 1
Getting Started

Quick Start Guide

Thank you for purchasing an 828! Follow these easy steps to get started quickly.

MAC USERS START HERE

1 Visit *motu.com/828-start* to download and run the *MOTU Gen 5 Installer*.

2 Connect the included power cord to your 828 unit.

3 Connect the 828 to your Mac using the included USB-C cable. Alternately, if your Mac requires it, use a USB-C-to-A cable. See "A note about USB cables and adapters" on page 23.

4 Choose *Apple menu > System Preferences* and click *Sound* to choose the *828* as the input and output device.

5 Proceed to "For all users" below.

WINDOWS USERS START HERE

1 BEFORE you connect the 828 to your computer, visit *motu.com/828-start* to download and run *MOTU Gen 5 Setup*.

2 Connect the included power cord to your 828 unit.

3 Connect the 828 to your computer using the included USB-C cable. Alternately, if your computer requires it, use a USB-C-to-A cable. See "A note about USB cables and adapters" on page 23.

4 Go to the Windows Sound Control Panel and choose *828* as the default recording and playback device.

5 Proceed to "For all users" below.

FOR ALL USERS

6 As shown on the next page, connect speakers to the 828 *Main Out Left/Right*, or connect a pair of headphones to either headphone output on the front panel, so you can hear your computer's audio output.

7 You are now ready to start using your 828 interface.

8 Visit *motu.com/828-start* to register your 828, download the included software and watch brief how-to videos, including:

■ How to connect a mic, guitar, keyboard or other audio source.

■ How to use the 828 with your recording software.

■ How to get the most out of the 828.

☛ Register your 828 to gain access to all the software, virtual instruments, loops and sounds that are included with your 828 purchase. Registered users also qualify for technical support and information about software updates, so please register today!

RACK-MOUNT INSTALLATION

The 828 can be mounted in a standard 19-inch (48.26 cm) equipment rack using four standard 10-32 5/8th-inch or M6 1mm pan head rack screws. It is one rack unit (1U) high (1.75 inches, 44.45 mm) with a depth of 12.25 inches (31 cm).

A Typical 828 Setup

Mic or guitar

Mic or guitar

MIC / LINE / INSTRUMENT

828

1   2

GAIN
1   2
PAD   48V   PAD   48V

AB ON   MUTE
A   MONO
B   TALK

MENU
BACK   SELECT

MOTU

Headphones

Word clock generator/distributor

I/O expansion

Home theater

Surround speakers

Aux speakers

Main speakers

Keyboards and synths

WORD CLOCK
IN

OUT
THRU

MOTU
828

OPTICAL
OUT—B—IN   OUT—A—IN

USB3 USB2

S/PDIF
IN

OUT

MIDI
OUT   IN

FOOT
SWITCH

LINE OUT
(L)
9   7   5
(B)
(R)
10   8   6   4

MAIN OUT (A)
RIGHT   LEFT

2   1

LINE IN
(L)
9   7   5   3

(R)
10   8   6   4

SEND
MIC
INSERT
2   1

RETURN

Mac, PC or iOS device

MIDI modules

MIDI controller

Foot pedal

Studio/stage monitors

MIDI modules

Outboard processors

828 Front Panel

1. These XLR/TRS combo jacks accept a mic cable or a quarter-inch cable, balanced or unbalanced, from a guitar or line level source. Use the front panel controls (3) to adjust individual preamp gain, 48V phantom power and optional -20 dB pad for each mic input.

2. Two independent HEADPHONE OUTPUTS with volume control. As you turn the knob, the LCD provides visual feedback with a volume meter.

3. Individual MIC INPUT preamp gain, switchable 48V phantom power, and optional -20 dB pad switches for each mic input. The Precision Digital Trim™ knob provides 74 dB of preamp gain. Turn the knob to see the gain adjustments in the LCD.

4. Push AB ON to enable A/B monitor selection. Then use the A and B monitor select buttons to switch your studio's primary stereo output between two

pairs of studio monitors connected to the 828 XLR main outs and Line Out 3-4, as explained by "A/B Mode" on page 38. To enable both pairs simultaneously, push both buttons simultaneously.

5. Push MUTE to silence the Main Outs, the current Monitor Group (all channels in the group), or both pairs of A/B monitor outputs (if enabled).

6. Push MONO to sum the current main monitor stereo pair (Main Out, A or B) to mono. Push it again to return to stereo operation.

7. The 828 color LCD displays metering, device settings and menu navigation. Use the *Meter View* MENU setting to choose among several different meter arrangements. Use the MENU knob and BACK/SELECT buttons for menu navigation.

8. Turn the MENU knob to enter the LCD menu and scroll through menu options. Push SELECT to go into the sub-menus, if applicable. To choose the current setting, push SELECT. Use the BACK button to return to the previous menu level. Push BACK repeatedly to return to the main screen.

9. The large monitor knob controls the volume of both the A and B monitor output pairs, regardless of which one is currently selected. To change the relative volume between the A and B monitor outs, see "Monitor control" on page 37. This knob also supports surround monitoring. See "The Monitor Group" on page 37.

10. This is the POWER button for the unit.

11. Push SELECT (or turn the MENU knob) to enter the menus. Push SELECT to select or confirm the currently selected menu setting. Push BACK to go back one level.

12. Push BACK to go back one level in the menu. When the display is showing meters, push BACK to clear the peak indicators and clip indicators, if any.

13. Push TALK to speak to musicians located in a separate studio room or isolation booth via a connected talkback mic. See "Talkback" on page 39.

828 Rear Panel
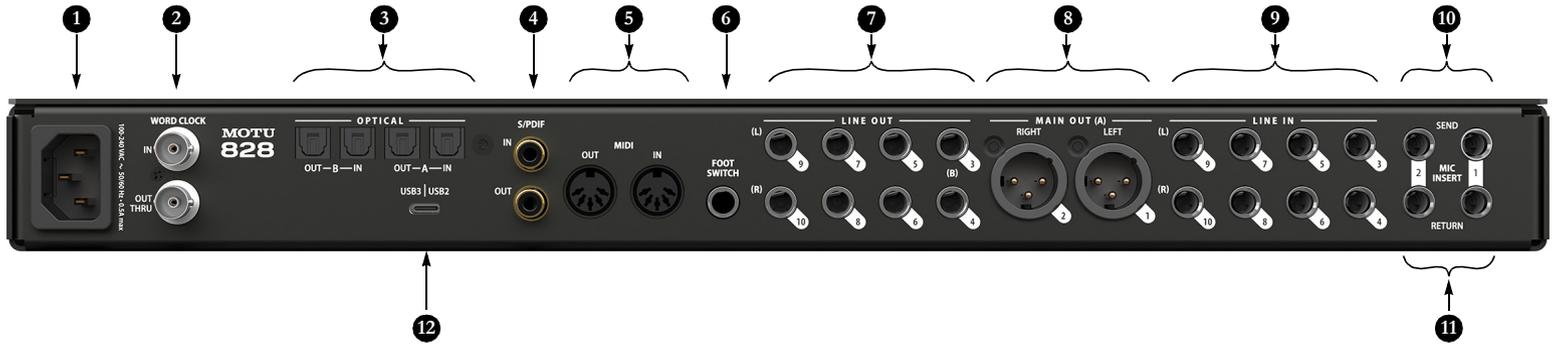
1. The 828 is equipped with a universal international power supply (100-240 VAC, 50/60 Hz, 0.5A max) with a standard IEC connector.

2. These are standard BNC WORD CLOCK jacks. Use them for a variety of applications, such as digital I/O with devices that cannot resolve to the clock supplied by their digital I/O connection with the 828. See "Syncing word clock devices" on page 31.

3. These two banks of ADAT optical "lightpipe" connectors each provide 8 channels of 24-bit ADAT optical digital I/O at 1x sample rates (44.1 or 48 kHz) and 4 channels at 2x sample rates (88.2 or 96 kHz). They are disabled at higher sample rates. Bank A can alternately operate as stereo TOSLink (optical S/PDIF) connectors. See "Optical I/O" on page 27 and "Syncing optical devices" on page 30.

   Note: you can choose independent formats for Bank A IN and OUT. For example, you could choose ADAT for the optical A IN (for eight channels of input from your digital mixer, for example) and stereo TOSLink for the optical A OUT (for a set of auxiliary speakers, for example).

4. These jacks provide stereo, 24-bit RCA (coaxial) S/PDIF digital input and output at all supported sample rates (up to 96 kHz). When connecting a source to the input, be sure to set the clock source correctly, as explained in "Syncing S/PDIF devices" on page 30.

5. Connect a MIDI device here using standard MIDI cables. Connect the 828 MIDI OUT port to the MIDI IN port on the other device. Conversely, connect the 828 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). See "Connecting additional gear with MIDI THRUs" on page 28. The 828's MIDI output can be alternately configured as a MIDI THRU port. See "MIDI Thru" on page 28.

6. Connect a standard FOOT SWITCH here for hands-free punch-in and punch-out during recording. For details about how to set this up, see item #7 in the Device tab overview (page 45).

7. The eight LINE OUT jacks are balanced, DC-coupled quarter-inch connectors that can also accept a TRS plug with the ring disconnected for unbalanced operation (see "TRS quarter-inch line inputs/outputs" on page 25 for more on this). They provide additional analog output for secondary studio monitors, surround monitoring, sub-mixes or any other desired destination. The output trim can be adjusted from the Device Tab in the CueMix 5 app. For surround monitoring, connect your surround speakers to outputs 1-6 (or 1-8) and see "The Monitor Group" on page 37.

8. These two XLR MAIN OUT jacks serve as the 828 main output pair for primary (powered) studio monitors, PA speakers or any other desired destination. You can control their volume from the front panel MONITOR knob (#9 on page 11). They also serve as monitor pair A for the 828 front panel A/B monitor switching feature (#4 on page 11). See "A/B Mode" on page 38.

   To hear audio playback from your host audio software on the MAIN OUT pair, assign audio tracks (and master fader) to these main outs. You can also use the CueMix 5 app to route live 828 inputs here as well.

9. These eight LINE IN jacks are balanced (TRS) quarter-inch connectors that can also accept a TS plug. Use with line level analog signals up to +21 dBu, including synthesizers, drum machines, effects processors, etc. These inputs are also equipped with the 828 Precision Digital Gain™ feature: digitally controlled analog gain that let you adjust input level in 1 dB increments from the included CueMix 5 app.

10. These two balanced quarter-inch SEND jacks supply the pre-amplified input signal from the mic/line/instrument inputs on the front panel (#1 on page 11). Use them to insert your favorite compressor, EQ, reverb or other outboard effect. Use the corresponding return jack below to return the signal to the Input 1 or 2 signal path.

11. These two balanced quarter-inch RETURN jacks re-insert the signal back into the corresponding Input 1 or 2 signal path. If nothing is plugged in to the corresponding input on the front panel (#1 on page 11), this return acts as an additional line input that is identical to the other analog inputs (9). When nothing is connected to these returns, they are automatically "normaled" to the send to receive signal directly from the preamp.

12. Connect the 828 to a computer or iOS device here using a standard USB-C cable. For details, see chapter 4, "Hardware Installation" (page 23).

About the 828

The 828 is an 28 x 32 USB audio interface with mixing, DSP effects, and very high quality A/D/A conversion at sample rates up to 192 kHz for on-the-go mobile audio recording.

Hardware-driven DSP delivers monitor mixes on all analog output pairs, with seven stereo buses and 32-bit effects processing, including EQ, compression and reverb.

The 828 can operate as an audio interface for a studio workstation (DAW), as a standalone mixer, or as an auxiliary monitor mixing system in the studio or on stage. This chapter provides a brief overview of its main features and characteristics.

Comprehensive I/O

The 828 provides a variety of analog and digital interconnects, all active simultaneously, designed to provide everything you need for a well-equipped desktop recording studio.

Connection	Input	Output
Quarter-inch analog on bal/unbal TRS	8	8
Main out on XLR	-	2
Mic/guitar inputs on combo XLR/TRS	2	-
Headphone output	-	2 x stereo
S/PDIF digital I/O on RCA	2	2
ADAT optical digital (at 44.1 or 48 kHz)†	16	16
Total	**28**	**32**

† The 828 optical connectors support the industry-standard ADAT and TOSLink optical I/O formats, which provide varying channel counts. TOSLink is available on Bank A, and ADAT is available on both banks (A and B). See "Optical I/O" on page 27 for details about optical bank operation.

All inputs and outputs are discrete. For example, using a mic input does not "steal" an input from the TRS analog I/O bank.

Universal connectivity

The 828 connects to a computer via USB, using isochronous Hi-Speed USB 2.0 (480 Mbits/s) or SuperSpeed USB 3.x (5 Gbits/s) connectivity, depending on the host computer. It is USB audio class-compliant, which means that it is iOS compatible and does not require driver installation for USB connection to macOS or iOS hosts.

Mic/guitar inputs with preamps

The two front-panel mic/line/instrument inputs are equipped with preamps and "combo" XLR/TRS jacks, which accept XLR microphone inputs or quarter-inch line/instruments inputs. Individual 48 volt phantom power and a -20 dB pad can be applied independently to each mic input. The Precision Digital Gain™ knobs on the front panel for each mic/instrument input provide up to 74 dB of gain in precise 1 dB increments.

Mic/guitar sends

Before A/D conversion, the pre-amplified signal from each front-panel mic/guitar input is routed to one of the two rear-panel quarter-inch analog sends, so that you can insert a favorite outboard EQ, compressor, amp or effects processor to the mic/guitar input signal before it is converted to digital form. The resulting output from the outboard gear can be fed back into the 828 via the corresponding return jack for the channel on the rear panel, for routing to the computer and/or inclusion in the 828es built-in monitor mixes. If

nothing is plugged in to the front panel input jack, the return jack can serve as an additional line input, identical to the other eight analog inputs.

Flexible analog I/O with Precision Digital Trim™

All quarter-inch analog inputs can accept either a balanced or unbalanced plug. The eight line inputs are equipped with digital gain, adjustable in 1 dB increments.

Equipped with renowned ESS Sabre32™ DAC technology, all analog outputs offer trim (cut), also adjustable in 1 dB increments.

All quarter-inch outputs are DC-coupled, so they can be used for control voltage (CV) output.

Independent XLR main outs

The XLR main outs are equipped with very high quality ESS Sabre32 D/A converters and serve as independent outputs for the computer or the 828 on-board mixer.

On-board DSP with mixing and processing

The 828 is equipped with a DSP engine that drives a 44 x 16 monitor mixer, which supplies each analog output pair with a unique monitor mix. Each mix can include any chosen inputs, plus computer output and the separate reverb bus. Effects include 4-band parametric EQ, compression and reverb. The included CueMix 5 app provides easy and intuitive on-screen control of everything from your computer or iOS device.

32-bit processing

The DSP engine delivers 32-bit floating point processing for virtually infinite headroom, with 64-bit double-precision processing for the EQ filters for the utmost in sound quality.

Software control

Control the 828 on-board mixing and device settings from the CueMix 5 app software running on a laptop or iOS device.

Stand-alone mixing

Connect an iOS device to the 828 for complete control of all settings on the road at rehearsals or gigs — great for live sound mixing.

ADAT digital I/O

The 828 provides two 8-channel banks of optical digital I/O. Connect outboard digital processors, digital mixers or other gear: 16 channels at 44.1/48 kHz or 8 channels at 88.2/96 kHz. Alternately, the optical Bank A ports can be independently configured to support stereo TOSLink (optical S/PDIF).

Bank A input and output operate independently, allowing you to mix and match optical formats. For example, you could receive four channels of 96 kHz S/MUX input while at the same time sending 96 kHz stereo optical S/PDIF ("TOSLink") to the output.

S/PDIF

The 828 rear panel provides S/PDIF input and output in two different formats: RCA "coax" and optical "TOSLink". The RCA jacks are dedicated to the S/PDIF format. The optical jacks can be used for either TOSLink or ADAT optical, as discussed earlier.

MIDI I/O

The 828's standard MIDI IN and MIDI OUT jacks supply 16 channels of MIDI I/O to and from the computer through its USB connection. The MIDI OUT port can be configured as a MIDI THRU port, if desired.

Word clock

The 828 supports standard word clock synchronization at any supported sample rate.

Foot switch input

The quarter-inch foot switch input accepts a standard foot switch. When you push the foot switch, the 828 triggers a programmable keystroke on the computer keyboard. For example, with

MOTU's Digital Performer audio sequencer software, the foot switch could trigger the 3 key on the numeric keypad, which toggles recording in Digital Performer. Therefore, pressing the foot switch is the same as pressing the 3 key. The CueMix 5 app lets you program any keystroke you wish.

Full-color LCD display

The 3.9-inch full-color 24-bit RGB IPS TFT LCD display has 480 x 128 pixel resolution and shows all signal activity at a glance with precise, detailed metering for all I/O. You can access many hardware settings directly from the front panel.

Two independent headphone outputs

The 828 front panel provides two independent headphone jacks with separate volume control. You can program each phone output to mirror another set of outputs or act as its own independent output with its own mix.

Control room features

Control room features include talkback with front panel TALK button and A/B monitor select, mute and sum-to-mono buttons for the main outs. Surround monitoring is also supported for both 5.1 and 7.1 surround.

Rack mount or desktop operation

The 828 is housed in a rugged steel full-rack enclosure.

Performer Lite

Performer Lite is a full-featured audio workstation software package for Mac and Windows that is available as a free download for you as an 828 owner. Visit motu.com/download to obtain your copy. Performer Lite provides multi-track MIDI and audio production, over 100 included virtual instruments, automated virtual mixing, graphic editing, music notation editing, real-time effects plug-ins with crossfades, support for many third-party audio plug-ins, sample-accurate editing and placement of audio, and more.

CHAPTER 2 Packing List and System Requirements

PACKING LIST

The 828 ships with the items listed below. If any of these items are not present in the box when you first open it, please immediately contact your dealer or MOTU.

- 828 audio interface
- USB-C-to-C cable
- IEC power cord
- Printed user guide
- Getting Started card

SYSTEM REQUIREMENTS

- Intel Core i3 Mac (including Apple silicon Macs) or PC (or AMD equivalent). Faster CPUs are recommended for best performance.
- 4GB RAM; 8 GB or more recommended.
- macOS 10.15 or later; Windows 10 or later.
- Available high-speed USB2 or USB3 port.
- A large hard drive (preferably at least 512 GB).

PLEASE REGISTER TODAY!

Please register the 828 today: visit www.motu.com/register.

As a registered user, you will be eligible to receive free bundled software, technical support and announcements about product enhancements as soon as they become available. Only registered users can receive the included free software, so please register today.

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

CHAPTER 3   Software Installation

USB AUDIO CLASS-COMPLIANT OPERATION

The 828 is a USB audio class-compliant device. This means that you can connect it to your Mac (running Mac OS 10.15 or higher) with a USB cable and use it without installing any software drivers. The computer recognizes the 828 as a USB audio device and makes its inputs and outputs available to your host audio software. Basic settings, such as the hardware's sample rate, are made in either your host software or the front-panel menu.

☛ In this scenario, the 828 provides basic audio input and output, and no software driver installation is necessary. Use the Mac's Audio MIDI Setup utility to manage the 828 audio inputs and outputs for your Mac. That said, it is best to install the software so you can take full advantage of the 828's low-latency performance and all its great features (accessed via the CueMix 5 application).

Connection to iOS devices (iPad and iPhone)

Audio-class compliant operation allows you to connect the 828 to any iOS device (via either USB-C or a standard Lightning camera connection kit adapter). The 828 then provides multi-channel audio I/O to your audio apps, and you can access all of its settings, features, and mixing with the CueMix 5 app.

SOFTWARE INSTALLATION

If you don't want to operate the 828 as a USB audio class compliant device, or if you are using Windows on a PC, install the software as follows.

1 Visit *www.motu.com/828-start* to download the latest Mac or Windows MOTU Gen 5 installer.

2 Run the installer and follow the directions it gives you.

☛ We recommend that you run the software installer *before* you connect the 828 to your computer and power it on. This ensures that all driver components are properly installed in your system.

AUDIO DRIVERS

The installer provides a USB audio driver for Mac (CoreAudio) and Windows (ASIO and Wave).

Industry-leading I/O latency performance

On macOS and Windows, the 828 driver provides exceptionally low I/O latency performance. For example, with a 32-sample buffer size, an 828 interface operating at 96 kHz produces round trip latency (RTL) performance of approximately 2 milliseconds (ms) on macOS and Windows. RTL is the measurement of the time it takes audio to pass from an analog input, through a high-performance DAW host such as Digital Performer, to an analog output.

ASIO Driver support

On Windows, to enable the 828 in your ASIO host software, choose the *MOTU Gen 5* ASIO driver, as shown in Figure 7-1 on page 58.

WDM / Wave driver support

On Windows, the MOTU Gen5 driver includes support for WDM (Wave) compatible audio software. See item #15 on page 44.

Host Buffer Size

When connected to a Windows computer, the *Host Buffer Size* menu is available in the Device tab (item #13 on page 44). This setting determines the amount of latency (delay) you may hear when live audio is patched through your Windows audio software. Smaller buffer sizes produce lower latency, with sizes of 256 samples or less producing virtually imperceptible delay. Many host applications report audio hardware I/O latency, so you can see what happens to the reported latency when making adjustments to this setting.

Be careful with very small buffer sizes, as they can cause performance issues from your host software or PC.

☛ At sea level, audio travels approximately one foot (30 cm) per millisecond. A latency of ten milliseconds is about the same as being ten feet (three meters) from an audio source.

Host Safety Offset

When connected to a Windows host, the *Host Safety Offset* menu (item #14 on page 44) also becomes available. This setting allows you to fine tune host latency. Larger offsets allow the driver more time to process audio as it transfers to and from the hardware. Lower settings produce lower latency, but if you go too low, your host software may experience performance issues. Generally speaking, 64 samples should serve as a good baseline setting. You can then experiment with lower settings from there. Be mindful, however, when reducing the safety offset, as this parameter can have a significant impact on your computer system's performance.

Sync Windows sample rate to device

Enable the *Sync Windows sample rate to device* option (item #16 on page 44) to link the 828 sample rate setting with the sample rate setting in Windows. If you change the sample rate for the 828, it will change the Windows sample rate as well, and vice versa. This option is enabled by default for best performance with many Windows audio applications. When this option is unchecked, the 828 driver performs sample rate conversion to reconcile the difference in sample rates between Windows and the 828 hardware.

CUEMIX 5 APP

CueMix 5 is an easy-to-use app for macOS, Windows and iOS that gives you complete control over all the settings in your 828 interface. For details, see chapter 6, "CueMix 5" (page 41).

PERFORMER LITE WORKSTATION SOFTWARE

Performer Lite is an easy to use audio workstation software package for macOS and Windows that lets you record, edit, mix, process, bounce and master multi-track recording projects. Advanced features include over 100 included virtual instruments, real-time effects processing, recording, and much more.

To obtain Performer Lite, visit motu.com to register your MOTU audio interface, download Performer Lite and activate it on your computer.

Figure 3-1: Performer Lite.

WORKING WITH HOST AUDIO SOFTWARE

For further information about using the 828 with host audio software, see chapter 7, "Working with Host Audio Software" (page 57).

MIDI I/O ON WINDOWS

On Windows, the *MOTU Gen 5 Installer* provides a USB MIDI driver for the 828. This driver allows you to access the 828's MIDI input and output ports through its USB connection to the computer. The ports are published in Windows and are available to all MIDI software.

MIDI I/O SETUP ON THE MAC

Core MIDI is the "under-the-hood" component of macOS that handles MIDI services for MIDI hardware and software. Core MIDI provides many universal MIDI system management features, including MIDI communication between your 828 interface and all Core MIDI compatible software.

Audio MIDI Setup is a utility included with macOS that allows you to configure your 828 interface for use with all Core MIDI compatible applications. Audio MIDI Setup provides:

■ A "virtual" studio on your Mac that graphically represents your MIDI hardware setup and that is shared by all Core MIDI-compatible applications

■ A simple, intuitive list of your MIDI devices whenever you need it in any Core MIDI-compatible application

Launching Audio MIDI Setup

1 Make sure your 828 interface is connected (a USB connection is required) and turned on.

2 Launch the Audio MIDI Setup utility.

This can usually be found in /Applications/ Utilities. If it has been moved, just search for *Audio MIDI Setup*.

3 Confirm that the MIDI interface is present in the *MIDI Studio* window in Audio MIDI Setup. If the interface does not appear, or if it is grayed out, check your USB cable connections and click *Rescan MIDI*.

Connecting MIDI devices to the 828

Once your 828 interface appears in Audio MIDI Setup, you are ready to add devices, indicate how they are connected, and identify properties they may have for particular purposes. This information is shared with all Core MIDI compatible applications.

To add a device in Audio MIDI Setup:

1 Click *Add Device*.

2 Drag on its *MIDI* port input and output arrows, as shown below, to draw connections to the 828 that match its physical connection.

☛ Do not use the *COM* port for MIDI I/O. It is reserved for future use.
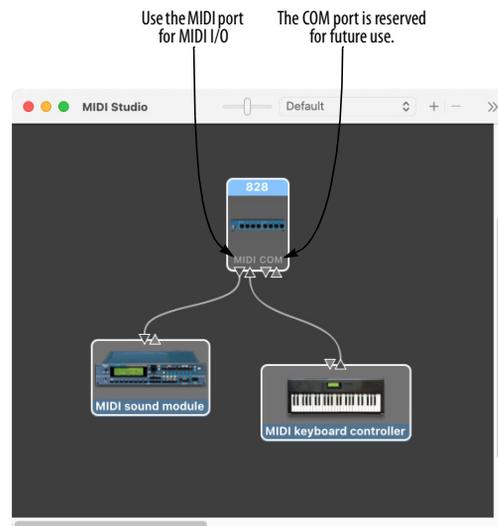
Figure 3-2: Connecting devices to the 828. In this example, a controller keyboard is connected to the 828's MIDI IN, and a sound module is connected to the 828 MIDI OUT.

3 Double-click the device to make settings, such as input and output channels, that further describe the device.
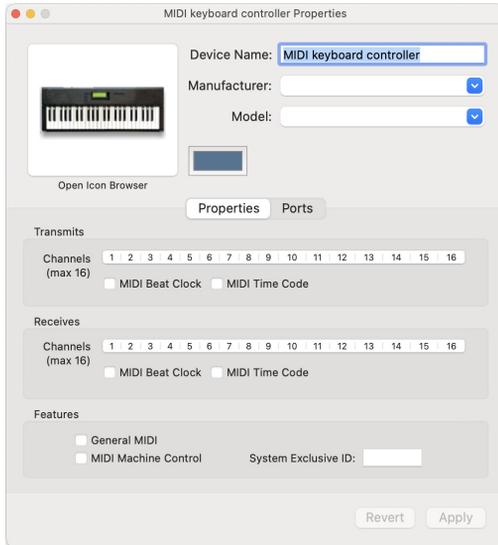
Figure 3-3: Device settings.

4 Repeat the above steps for each MIDI device connected to the interface.

5 When you are finished, quit Audio MIDI Setup.

Your configuration is automatically saved as the default configuration, and it is shared with all Core MIDI-compatible applications.

Hardware Installation

USB AUDIO INTERFACE SETUP

Computer

HI-SPEED | SUPER-SPEED
USB   USB-C to USB-C cable or
       USB-C to USB-A cable
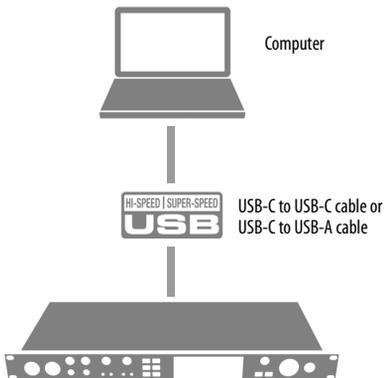
Use this setup if you want to use the 828 as a USB audio interface for a computer.

■ Use the included USB-C-to-C or a high-quality (USB-IF certified) USB-C-to-A cable.

■ Connect to any USB port (USB 2.0 or 3.0) on your computer.

■ See "USB audio class-compliant operation" on page 19.

■ For Mac or iOS operation, no driver installation is necessary.

iOS SETUP (USB-C)
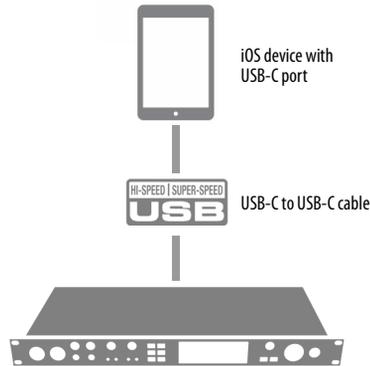
iOS device with
USB-C port

HI-SPEED | SUPER-SPEED
USB   USB-C to USB-C cable

Use the 828 as an iOS audio interface, or control it from your iOS device.

■ Use this setup for iOS devices with a USB-C port.

■ Connect the 828 directly to the iOS device with the included USB-C-to-C cable.

A NOTE ABOUT USB CABLES AND ADAPTERS

The USB C-to-C cable supplied with your 828 is USB-IF certified and rated for USB3 operation at 5 Gbp/s. If your computer doesn't have a USB-C port, use a USB C-to-A cable. For best performance and reliability, a high-quality USB-IF certified cable is recommended.

☛ USB-C-to-A plug adapters with a male USB-A plug and a female USB-C port (designed to accept the host-side of the C-to-C cable) should not be used, as they are not compliant with USB-IF standards.

This type of USB A-to-C adapter is not recommend.

iOS SETUP (LIGHTNING)
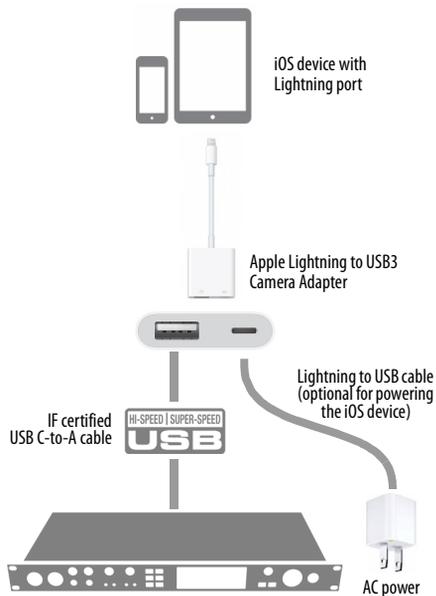
iOS device with Lightning port

Apple Lightning to USB3 Camera Adapter

Lightning to USB cable (optional for powering the iOS device)

IF certified USB C-to-A cable

HI-SPEED | SUPER-SPEED
USB

AC power

Use the 828 as an iOS audio interface, or control it from your iOS device.

■ Use this setup for iOS devices with a Lightning port.

■ For iOS devices with a Lightning port, an Apple Lightning to USB3 Camera Adapter is required (sold separately), as shown above.

A TYPICAL 828 SETUP

See the diagram on page 10 for an example of typical connections to the 828. The following sections provide important information for achieving best results for each type of connection.

AUDIO CONNECTIONS

Here are a few things to keep in mind as you are making audio connections to your 828 interface.

Mic/line/instrument inputs with preamps

Connect a microphone to the front-panel XLR/ quarter-inch combo jack with a standard XLR mic cable. Connect a guitar or line level input with balanced or unbalanced cable with a quarter-inch plug. Adjust the level with the gain knob for either type of input.

☛ If you need to connect a +4 dBu (line level) signal to inputs 1 or 2, use the mic inserts (see "Mic inserts" on page 25), which provide a signal path that matches the line inputs. If you need to use the front panel input for some reason, be sure to engage the -20 dB pad.

48V phantom power

If you are connecting a condenser microphone or another device that requires phantom power, engage the corresponding front-panel phantom power button.

Preamp gain

The 828 preamps provides 74 dB of gain. Use the front panel gain knobs to adjust gain as needed for each input. The front-panel screen provides visual feedback as you turn the knob. Preamp gain is digitally controlled, so you can make fine-tuned adjustments in 1dB increments. You can also adjust preamp gain in the CueMix 5 app. See "Home tab" on page 42.

-20 dB pad

Each mic input (XLR jack) is equipped with a -20 dB pad button, to accommodate input signals that could overdrive the input. The pad button

Figure 4-1: 828 front panel

HARDWARE INSTALLATION

does not affect the quarter-inch input of the combo jack, which supports line level signals up to +20 dBu balanced and +18 dBu unbalanced.

Combo jack summary
Use these guidelines for 48V phantom power, pad and gain settings on the two combo input jacks:

Input	48V	Pad	Gain
Condenser mic	On	Off	As needed
Dynamic mic	Off	Off	As needed
Guitar	Off	n/a	As needed
-10 dBv line level via TRS*	Off	n/a	As needed
-10 dBv line level via XLR*	Off	As needed	As needed
+4 dBv line level via XLR*	Off	On	As needed
+4 dBv line level via TRS*	Off	n/a	As needed

See the next section below for an alternative way to connect line level signals to inputs 1 and 2 using the insert returns.

Mic inserts
Each mic input (1 and 2) is equipped with a send/return loop for inserting outboard gear into the input's signal path. The SEND jack provides the pre-amplified mic input signal (or the signal from the input's TRS jack). Connect the SEND jack to your outboard compressor or other processor, and then connect the output from the processor to the input's RETURN jack to re-insert the signal into the input's signal path.

If nothing is plugged in to the input, the RETURN jack acts as an additional line input that is identical to the other analog inputs (described below).

When nothing is connected to the returns, they are automatically "normaled" to the send to receive signal directly from the preamp.

Mic insert gain staging
The 828 mic inputs provide 74 dB of signal gain. The first 54 dB of gain occur before the insert point, while the final 20 dB occur after. Accordingly, when a plug is inserted into the insert RETURN jack, CueMix 5 provides two separate gain knobs, as shown below.
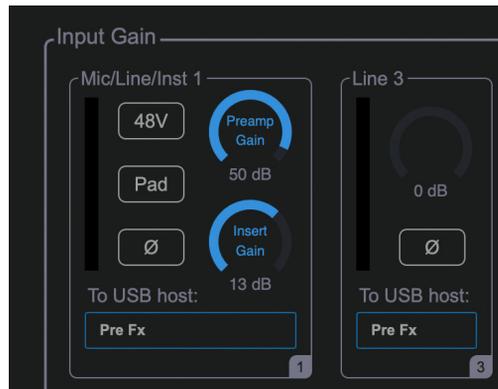
Figure 4-3: 54 dB of gain occurs before the insert point, while 20 dB occurs after. Together, they provide up to 74 dB of gain.

☛ The channel's 20 dB pad is applied before the insert point, while Phase Invert is applied after.

TRS quarter-inch line inputs/outputs
Quarter-inch line inputs and outputs are balanced (TRS) connectors. The inputs can also accept an unbalanced (TS) plug. The outputs are DC-coupled, so they can be used for control voltage (CV) output.

Monitor Pair A

Monitor Pair B

Figure 4-2: 828 back panel

☞ Quarter-inch line outputs are not cross-coupled. Therefore, when connecting them to an unbalanced input, use a TRS plug with the ring disconnected. Not floating the negative terminal will short it to the sleeve ground and cause distortion.

Various settings for the line inputs and outputs, such as gain, trim, phase invert, etc. can be accessed in the CueMix 5 app. See "Input tab" on page 45 and "Output tab" on page 46.

Main outs

Like all I/O on the 828, the XLR 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 primary (powered) studio monitors, but they can be used as regular outputs for any purpose. With adjustable Precision Digital Trim™, they support a wide range of industry-standard reference levels. Main out volume is controlled by turning the large knob on the front panel. The level of the main outputs can be independently trimmed. See "Output tab" on page 46. From an audio signal standpoint, these XLR outputs perform identically to the quarter-inch line outputs (via a different type of connector).

Analog I/O calibration

All analog inputs and outputs can be calibrated to support a variety of standards, including EBU-R68, SMPTE RP-155, +4dBu, -10dBv, 2vRMS and 1vRMS.

The line inputs are equipped with +0 to +20 dB of digital gain, adjustable in 1 dB steps.

The line outputs, main outs and headphone outs are equipped with a range of digital trim from 0 to -99 dB, adjustable in 1 dB steps.

Trim and gain controls can be accessed in the CueMix 5 app. See "Input tab" on page 45 and "Output tab" on page 46.

Monitor A/B outputs

The XLR Main Outs serve as monitor pair A. If you have a secondary pair of studio monitors, connect them to Line Outs 3-4 as monitor pair B, as shown in Figure 4-2. See "A/B Mode" on page 38.

Pre/Post Fx switch for line inputs

Each analog input provides EQ and compression. The mic/line/inst inputs include gating. These effects can be applied to the input as needed (items #1 and 2 on page 49). The *To USB Host* menu for each line input (item #4 on page 45) lets you choose whether to send the input signal to your host software with or without these hardware effects applied to the signal. If you want to record the signal dry, *without* the effects applied to it, choose *Pre Fx*. If you want to record the signal *with* the effects applied, choose *Post Fx*.

☞ Once the signal is recorded in your DAW with th *Post Fx* option, the effects cannot be removed from the signal.

Guitar re-amping

Re-amping allows you to record an amplified guitar signal but then change the amp tone later, after recording. This is accomplished by splitting the dry DI guitar signal during recording and separately recording the dry signal (with no amplification) on one track and the mic'd amplifier signal simultaneously on a separate track. You can then choose to use the original recorded amp tone, or you can mute that track and experiment with applying different amp tones to the dry track, either with amp (and pedal) plug-ins or by sending the output of the dry track back to your guitar amp, pedals and other tone gear.
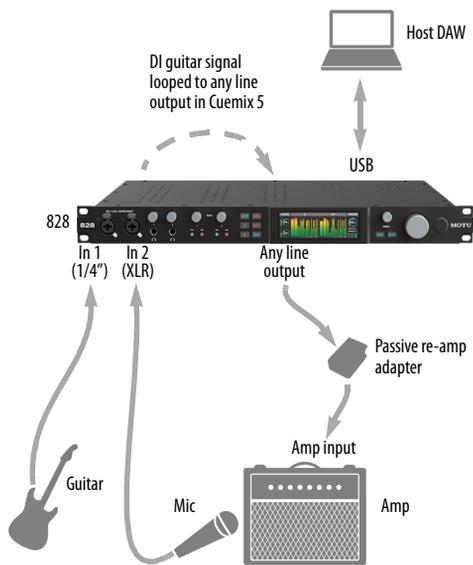
Host DAW

DI guitar signal looped to any line output in Cuemix 5

USB

828

In 1 (1/4") In 2 (XLR)   Any line output

Passive re-amp adapter

Amp input

Guitar

Mic

Amp

Figure 4-4: Recording guitar for re-amping.

Connections for re-amping

Figure 4-4 shows the connections needed for re-amping. Connect your guitar directly to the quarter-inch jack of Input 1. This is your DI (direct input). The quarter-inch jack has the proper impedance to accept a guitar signal. Mic your amplifier and connect the mic to Input 2. Connect any line output to your amp. Note that you may need a re-amp adapter with ground lift and transformer isolation, as shown, to remove noise (hum). You can also add pedals or other effects processors to the chain, as usual (after the adapter).

Recording for re-amping

For recording, set up your host DAW software to record Inputs 1 and 2 on separate tracks. Be sure that Patch Thru is disabled for these tracks in your DAW. In CueMix 5, go to the mix for the amp output and bring up the fader for Input 1 in the mixer (item #3 on page 47). (Be sure to keep all other faders all the way down). Pan Input 1 hard left or right as needed (depending on which output in the pair you are using for the amp output), or set up the mix as a mono mix (item #13

on page 50). You should now hear your guitar through the amp and you're ready to record. There is no latency because the signal is being looped directly from input to output in the 828 mixer hardware (without the computer).

Re-amping after recording

To experiment with different guitar tones after recording, send the dry guitar signal to the same line output to feed it into a different amp, foot pedals or other favorite tone gear. Or apply amp and pedal plug-ins to the dry guitar track.

Optical I/O

The 828 provides two banks of ADAT optical ("lightpipe") connectors. Each bank provides an input and output connector. Together, they provide 16 channels of ADAT optical digital I/O at 44.1 or 48 kHz, or 8 channels of SMUX optical at 2x sample rates (88.2 or 96 kHz).

☛ The optical ports are disabled when the interface is operating at a 176.4 or 192 kHz.

TOSLink (optical S/PDIF)

Alternately, the Bank A optical ports can be configured for stereo TOSLink (optical S/PDIF) in the CueMix 5 app (item #5 on page 45 for input and item #10 on page page 46 for output). The optical IN and OUT banks can be configured independently.

Choosing a source for the optical output

By default, the audio signal from the optical output comes from your host software (over USB) from any tracks you've assigned to the output. Alternately, you can choose other sources, such as the line inputs or one of the 828's mix buses. For further information, see items #8 and 10 on page 46.

Choosing a clock source for optical connections

When connecting an *optical* device, make sure that its digital audio clock is phase-locked (in sync with) the 828, as explained in "Synchronization" on page 29 and "Syncing optical devices" on page 30.

S/PDIF I/O

The 828 provides S/PDIF digital audio input and output on the RCA jacks provided (item #4 on page 12). Be sure to review the digital audio clocking issues, as explained in "Syncing S/PDIF devices" on page 30.

☞ The S/PDIF ports are disabled when the interface is operating at a 176.4 or 192 kHz.

Choosing a source for the S/PDIF output

By default, the audio signal from the S/PDIF output comes from your host software (over USB) from any tracks you've assigned to the output. Alternately, you can choose one of the 828's mix buses. For further information, see items #7 on page 46.

MIDI CONNECTIONS

Connect your MIDI device's MIDI IN jack to the 828 MIDI OUT jack (Connection A below). Conversely, connect the MIDI device's MIDI OUT jack to the 828 MIDI IN jack (Connection B).
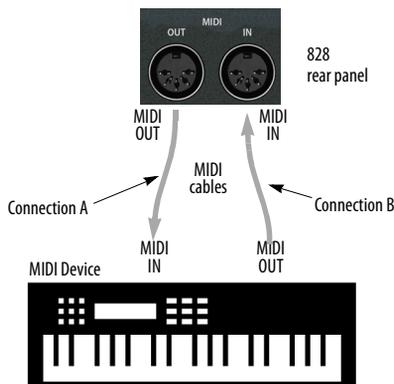
Figure 4-5: Connecting a MIDI device to the 828.

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 4-5. 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 THRUs

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 828 to the MIDI IN on the additional device as shown below in Figure 4-6. The two devices then share the 828 MIDI OUT port. This means that they share the same set of 16 MIDI channels, too, so try to do this with devices that listen to only one MIDI channel (such as effects modules), which makes it easier to avoid MIDI channel conflicts.

Figure 4-6: Connecting additional devices with MIDI THRU ports

MIDI Thru

The 828 MIDI OUT port can be configured as a MIDI THRU port. To do so, use the *MIDI Thru* setting in the CueMix 5 Device tab (item #7 on page 43). This can also be enabled from the front panel menu.

Figure 4-7: The MIDI OUT port can be configured as a MIDI THRU port

FOOT SWITCH CONNECTION

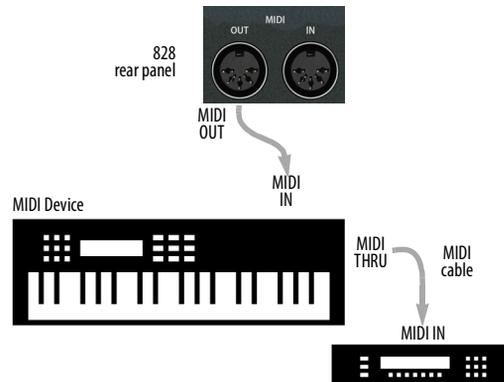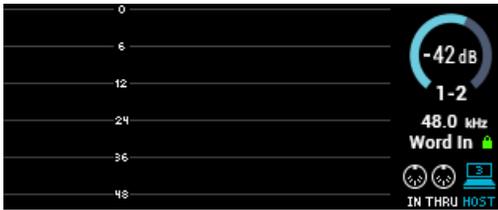If you would like to use a foot switch with your 828, connect it to the FOOT SWITCH jack. See item #7 in the Device tab overview (page 45) for information about how to program the foot switch to trigger any computer keystroke you wish.

The foot switch input is USB class compliant. This allows it to trigger keystrokes on iOS devices (such as an iPad). Note, however, that you'll need a physical keyboard to program the keystrokes, either with an Apple Magic Keyboard or with a computer. But once programmed, you can use the footswitch to trigger the keystrokes on an iPad (or iPhone).

SYNCHRONIZATION

If you connect devices digitally to the 828, or if you need to synchronize the 828 with an outside time reference such as word clock, you must pay careful attention to the synchronization connections and clock source issues discussed in the next few sections.

Do you need to sync?

If you will be using only the 828's analog inputs and outputs (and none of its digital I/O), and you don't need to resolve your system to external word clock, you don't need to make any sync connections. You can skip this section.

Situations that require synchronization

There are two general cases in which you will need to resolve the 828 with other devices:

- Synchronizing with other digital audio devices so that their digital audio clocks are *phase-locked* (as shown in Figure 4-8)

- Resolving the 828 to an external clock source

Synchronization is critical for clean digital I/O

Synchronization is critical in any audio system, but it is especially important when you are transferring audio between digital audio devices. Your success in using the digital I/O features on the 828 depends almost entirely on proper synchronization. The following sections guide you through several recommended scenarios.

Be sure to choose a digital audio clock master

When you transfer digital audio between two devices, their audio clocks must be in phase with one another — or *phase-locked*. Otherwise, you'll hear clicks, pops, and distortion in the audio — or perhaps no audio at all.
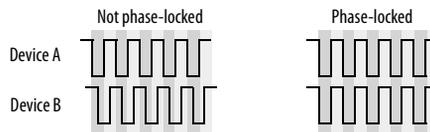
Figure 4-8: When transferring audio, two devices must have phase-locked audio clocks to prevent clicks, pops or other artifacts.

There are two ways to achieve phase lock: slave one device to the other, or slave both devices to a third master clock. If you have three or more digital audio devices, you need to slave them all to a single master audio clock.
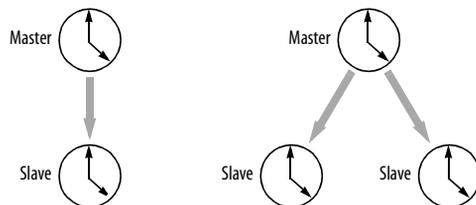
Figure 4-9: To keep the 828 phased-locked with other digital audio devices connected to it, choose a clock master.

Also remember that audio phase lock can be achieved independently of timecode (location). For example, one device can be the timecode master while another is the audio clock master, but only one device can be the audio clock master. If you set things up with this rule in mind, you'll have trouble-free audio transfers with your MOTU hardware.

SYNCING S/PDIF DEVICES

The 828 provides RCA S/PDIF digital input and output. Your 828 and the other S/PDIF device will sync to each other by way of the S/PDIF connection itself for click-free digital transfers. One device is the master, and the other device is the slave.

Syncing the 828 to its S/PDIF input

When you transfer audio from the S/PDIF device into the 828, choose *S/PDIF* as the clock source (item #3 on page 43) to resolve the 828 to its S/PDIF input, as shown in Figure 4-10.
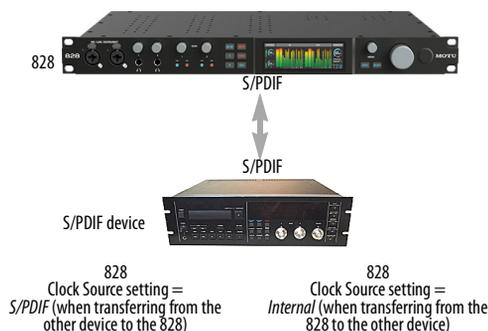

Figure 4-10: The setup for synchronizing a S/PDIF device with the 828. Sync is achieved via the digital I/O connection itself.

Syncing another S/PDIF device to the 828

When transferring audio from the 828 to another S/PDIF device, set the 828 clock mode (item #3 on page 43) to any source other than S/PDIF. Doing so makes the 828 the clock master. When the other device records (or receives) S/PDIF audio (from the 828), it will simply synchronize to the clock provided by the 828 S/PDIF signal.

SYNCING OPTICAL DEVICES

There are several ways to sync an optical device with the 828:

A. Resolve the other device to the 828

B. Resolve the 828 to the other device

C. Resolve both devices to a word clock source

For A, choose *Internal* as the clock mode in the Device tab (item #3 on page 43). Then configure the other device to resolve to its optical input. Alternately, the MOTU interface could be resolved to any other external clock source besides *Optical*.

For B, choose *Optical* as the clock mode (item #3 on page 43), and configure the other device to resolve to its own internal clock.

For C, choose *Word Clock* as the clock mode for the 828 (item #3 on page 43), and resolve the other device to its word clock input.

Using word clock to resolve optical devices

If the optical device has word clock connectors on it, you can use them to synchronize the device with the 828. See the next section, "Syncing word clock devices".

SYNCING WORD CLOCK DEVICES

The word clock connectors on the 828 allow you to synchronize it with a wide variety of other word clock-equipped devices.

For standard word clock sync, you need to choose an audio clock master (as explained in "Be sure to choose a digital audio clock master" on page 29). In the simplest case, you have two devices and one is the word clock master and the other is the slave as shown below in Figure 4-11 and Figure 4-12.

Figure 4-11: Slaving another digital audio device to the 828 via word clock. For the 828 clock source, choose Internal (or any source other than Word Clock, as daisy-chaining word clock is not recommended).

Figure 4-12: Slaving the 828 to word clock. For the 828 clock source, choose 'Word Clock In'.

The 828 word clock input provides proper 75 ohm termination, but only when the BNC jack is configured to operate as a word clock output. Alternately, the word clock output can be configured as a word clock thru, which connects the input clock signal directly to the output, *with no termination on the input*. See the "Daisy-chaining word clock" below.

Resolving to a word clock signal that matches the 828 base clock rate

The 828 can resolve to a word clock signal running at an even multiple of the current system clock setting (the *base clock rate*). For example, the 828 could be running at 96 kHz while resolving to a 48 kHz word clock signal from another device. Similarly, the 828 could run at 88.2 kHz and resolve to 44.1 kHz word clock signal. Conversely, the 828 could run at 48 kHz and resolve to a 96 kHz word clock signal. However, if the 828 is running at 96 kHz, it cannot resolve to a word clock signal running at 44.1 kHz.

In summary, the word clock signal must be one of the following:

- the same as the current 828 clock rate

- 2x or 4x the current 828 clock rate

- half or quarter of the current 828 clock rate

Daisy-chaining word clock

If necessary, you can daisy-chain several word clock devices together. When doing so, connect WORD CLOCK OUT from the first (master) device to the WORD CLOCK IN on the second device. Then connect its WORD CLOCK THRU port to the next device's WORD CLOCK IN port, and so on. If the 828 is in the middle of the chain, use its WORD CLOCK OUT port and change its operation from OUT to THRU (using item #7 on page 43 or from the front panel menu). If the 828 is the first device in the chain (to generate word clock for the other devices), do not enable WORD CLOCK THRU mode.

Make sure that the last device in the word clock chain has 75 ohm termination on its input.

If you have more than four word clock devices that you need to synchronize, try to avoid chaining their word clock connections. Instead, use a word clock distribution device of some kind.

Part 2
Using the 828

Front Panel Operation

The front panel provides access to preamp settings, two headphone outputs with independent volume, and the 828's control room features. The high-resolution LCD screen displays level meters for all inputs and outputs, status information and activity indicators for MIDI I/O. Basic device settings and status information can be accessed in the LCD using the MENU knob and SELECT/BACK buttons.

LEVEL METERS

In its default state when the unit is first powered on, the LCD screen displays level meter activity for all audio inputs and outputs (Figure 5-2).
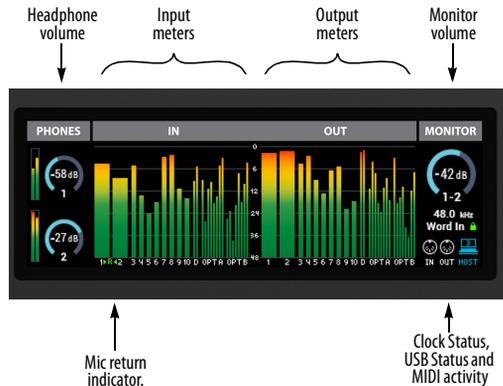
Figure 5-2: The front panel LCD.

Clock Status

The Clock Status section of the screen (Figure 5-2) displays the *Sample Rate* at which the unit is currently operating, and the current *Clock Source* setting (item #3 in the Devices tab on page 43). The Sample Rate and Clock Source settings can also be found (and changed) in the front panel screen menu. They can also be changed in the Device tab of CueMix 5.

Figure 5-1: The 828 front panel.

The Lock icon

When the 828 has successfully resolved to the current clock source, the *Lock* icon (Figure 5-2) turns *green*. When the 828 has not yet successfully locked to the current clock source for some reason, the lock icon turns *red*. Check the *Clock Source* setting (item #3 on page 43), cable connections, etc.

USB Status

The *Host* icon (Figure 5-2) indicates the status of the USB connection to the computer. *Blue* indicates a successful connection to the host; the number indicates the format of the USB connection (USB2 or USB3). When the icon turns *yellow*, this indicates that USB connectivity has not yet been establish for some reason.

MIDI Activity

The *MIDI Activity* indicators (Figure 5-2) flash green when MIDI data is sent from or received by the 828 MIDI jacks. The MIDI OUT jack becomes THRU when MIDI thru is enabled (page 28).

Mic return indicator

The *mic return* indicators (Figure 5-2) appear when a cable is connected to the RETURN input on the rear panel. Accordingly, the level meter indicates the level of the signal being received on the RETURN input.

Meter views

Several alternative meter views are available, such as *All meters* and *Analog I/O only*. These can be chosen from the MENU (see the next section).

All meters
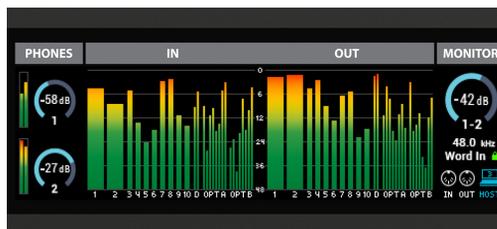
Analog I/O only

Analog I/O only

Figure 5-3: Meter views.

MENU NAVIGATION

Turn the MENU knob or push the SELECT button to access the menu, which provides settings and status information. Turn the MENU knob to scroll through the menu settings.

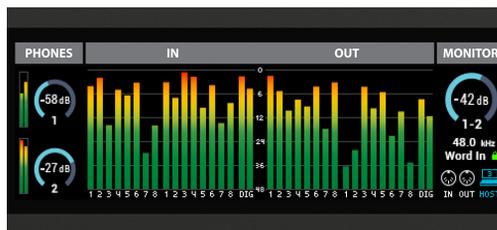Push SELECT to enter the selected sub-menu or to select the currently highlighted parameter. Push BACK to go to the parent menu.

To exit the menu entirely, push BACK repeatedly until the menu disappears from the display.

Menu setting	What it does
Sample Rate	Sets the sample rate for the device.
Clock Source	Sets the digital audio clock source for the device. See "Synchronization" on page 29.
Word Clock	Lets you configure the Word Clock OUT port as either OUT or THRU. See "Syncing word clock devices" on page 31.
Optical Expander Mode	Puts the unit into Optical Expander mode. See chapter 8, "Optical Expander Mode" (page 63).
Optical A Format	Specifies ADAT or TOSLink. See "Optical I/O" on page 27.
Headphone 1 Source	Lets you choose the source signal for the Headphone 1 output.
Headphone 2 Source	Lets you choose the source signal for the Headphone 2 output.
S/PDIF Out Source	Lets you choose the source signal for the S/PDIF output.
MIDI Thru	When enabled, MIDI data passes directly from the MIDI input to the MIDI output when the 828 is disconnected from USB (running standalone). See "MIDI Thru" on page 28.
Meter View	Lets you choose a desired metering configuration, such as *All Meters*, *Analog I/O Only*, etc.
Meter Settings	Lets you set the peak/hold time for the meters.
Display	Provides timeout options for the display (after 30 seconds, 30 minutes or off). When timed out, the screen goes dark.
About	Displays the device name, serial number, and firmware version for the device.
Reset	Restores factory default settings.

HEADPHONE VOLUME

Turn the headphone volume knobs to adjust their volume. The LCD indicates the current level (on a scale from -∞ to 0) and provides feedback during adjustment.

PREAMP CONTROLS

Use the 48V and PAD buttons to engage or disengage these features for each mic input. Turn the preamp GAIN knob to adjust the preamp gain in 1 dB increments. The LCD indicates the current level (from 0 to +74 dB) and provides feedback during adjustment.

CHANNEL FOCUS

When turning a knob to adjust volume or input gain, the screen shows a focused version of the channel meters (while other meters dim). A few seconds after you stop turning the knob, the screen returns to normal. To temporarily suspend the focus timeout, press the front panel SELECT button while focused. The focused metering will remain on screen until you press the BACK button to dismiss it.

MONITOR CONTROL

Turn the large volume knob (to the right of the LCD) to adjust the Monitor volume. From the factory, this knob controls the level of Main Outs 1-2 (and Line Outs 3-4 when operating in A/B mode). If you add additional outputs to the Monitor group (see below), this volume knob controls the output level of all of them.

THE MONITOR GROUP

The 828 *Monitor Group* allows you to add additional analog outputs to be controlled as a group by the main volume knob and MUTE button on the front panel (and their corresponding controls in the Home tab and Output tab in CueMix 5). For example, you could group Outputs 1-6 or 1-8 to control a 5.1 or 7.1 surround system, respectively. Choose the desired outputs in the *Monitor Group* section in the

CueMix 5 Output tab, as shown below in Figure 5-4. After doing so, the main volume knob and MUTE button (on both the front panel and in the CueMix 5 Home and Output tabs) affect all of them. The MONO button sums only Main Outs 1-2 when additional channels are included in the Monitor Group.

Figure 5-4: The Monitor Group. In this example, outputs 3-6 have been added to Main Out 1-2 for monitor control of a 5.1 surround system.

Main Out 1-2 are always part of the Monitor Group, so they cannot be enabled or disabled like the other analog channels.

Figure 5-5: When A/B Mode is enabled, the Monitor Group controls both pairs of A and B outputs (Main Out 1-2 and Line Out 3-4, respectively). See "A/B Mode" below.

Use the trim controls in the CueMix 5 Output tab to trim Monitor Group outputs relative to each other.

MUTE AND MONO
Push MUTE (Figure 5-6) to temporarily silence all outputs currently included in the Monitor Group (Figure 5-4).

Push MONO (Figure 5-6) to temporarily sum the Main Out 1-2 pair (or the A/B monitor pairs, if enabled) to mono. When summing to mono, the left and right channels are mixed together and the resulting mono audio stream is sent to both outputs of the stereo pair. The resulting mono signal is also attenuated by 3 dB to maintain the same overall loudness of the original stereo image.

If the Monitor Group currently has additional channels included in the group (beyond Main Out 1-2), the MONO button affects only Main Out 1-2. It does not affect any of the other Monitor Group outputs.

A/B MODE
The 828 front panel provides controls for the primary and secondary monitors in your studio, labeled A and B, respectively (Figure 5-6).

These controls are also available in the CueMix 5 Home tab (page 42) and Output tab (page 46), so you can control them from your laptop, tablet or smartphone.

Figure 5-6: A/B Mode and Monitor controls on the front panel.

Output connections for Monitor A and B
Monitor pair A should be connected to the XLR Main Outs 1-2 and monitor pair B to Line Outs 3-4.

Enabling A/B monitor mode
To enable or disable A/B monitor mode, press the AB ON button. When enabled, the output channels in monitor group A and B share the same audio signal (assigned to the channels in group A).

Monitor A/B select
To select a monitor pair and mute the other pair, press A or B (Figure 5-6). Press both buttons at the same time to hear both sets of monitors simultaneously.

A/B volume control and separate trim

Control the volume of both Monitor A and B pairs with the large volume knob (to the right of the LCD). This knob controls both pairs. To adjust their volume relative to one another, use their trim controls in the Output tab (item #6 on page 46).

TALKBACK

Talkback allows an engineer in the control room to temporarily dim or mute all audio and talk to musicians during a recording session. Talkback requires a microphones located in the control room, near the engineer.

Mic effects

Figure 5-7: talkback settings can be found in the CueMix 5 Home tab.

Talkback setup

To set up talkback:

1 Plug in a microphone to the 828 Mic input 1 or 2. Enable 48V phantom power, if it is a condenser mic.

2 In CueMix 5's Home tab, choose the mic input from the Source menu.

3 In the Destinations menu, check the outputs you wish to send the talkback signal to.

4 Adjust the Talkback settings as explained below.

Talkback settings

Talkback has the following settings (Figure 5-7).

Talk

Press and hold the *Talk* button (Figure 5-7) to engage the talkback mic. This is the same as pressing the TALK button on the front panel of the 828 (item #13 on page 11).

Latch

When *Latch* is engaged (Figure 5-7), the Talk button remains engaged when you click it, until you click it again to disengage, so you don't have to hold it down while speaking. This setting also affects the TALK button on the front panel of the 828 (item #13 on page 11).

Level

The Talkback *Level* setting controls the volume of the talkback signal, as an additional gain stage after the talkback mic preamp gain and pad.

Dim

If you are feeding a monitor mix to the musicians on the same Aux bus as your talkback mic, use the *Dim* knob (Figure 5-7) to control how much the monitor mix will be attenuated when talkback is engaged. This gives you control over the relative volume between the talkback mic signal and all other audio on the mix bus. To control overall volume of everything, use the bus fader.

Mic effects

Click the *Mic effects* thumbnails (Figure 5-7) for quick access to the EQ, compressor and gate effects for the mic input you are using for talkback. These are the same settings found in the mix tabs for that mic input (items #1 and 2 on page 49).

POWER BUTTON

Push the power button to turn the unit on or off.

CueMix 5

CueMix 5 gives you complete control of all the settings in the 828. It is a standard software application installed on your Mac or PC when you run the MOTU Gen 5 installer or setup app. It can be found in the Applications folder (Mac) or Start menu under MOTU (Windows).

CueMix 5 is also available as an iOS app.

RUN THE INSTALLER, GET THE APP
Visit *motu.com/828-start* to get the latest MOTU Gen 5 installer or setup and run it on your computer. Visit the Apple App Store to install the CueMix 5 app on your iOS device.

☛ Look for updated PDF versions of this user guide at the link above, which may document new features and updates to CueMix 5.

MAKE HARDWARE CONNECTIONS
Before running CueMix 5, be sure that the 828 is successfully connected to your device and powered on, and described in chapter 4, "Hardware Installation" (page 23).

HOME TAB
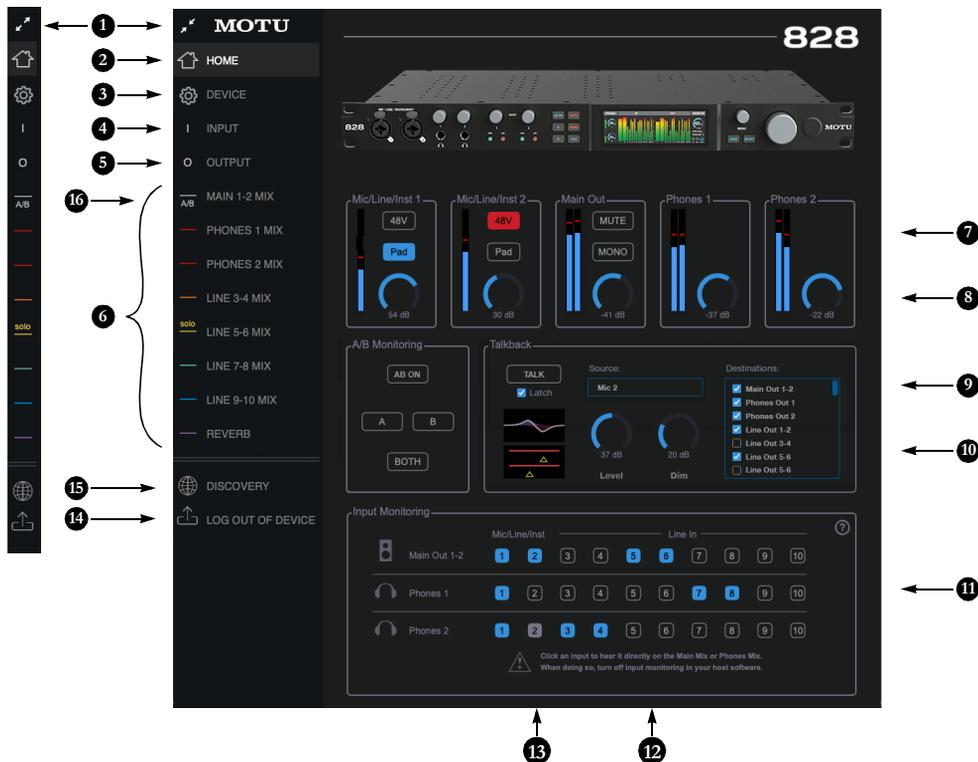
1. Expands and collapses the sidebar.

2. This is the *Home* tab, which provides quick access to basic settings.

3. The *Device* tab provides basic hardware settings, such as the Sample Rate and Clock Source. See "Device tab" on page 43.

4. The *Input tab* provides settings for the 828's physical inputs, such as gain levels for the line inputs. See "Input tab" on page 45.

5. The *Output tab* provides settings for the 828's physical outputs, such as trim levels for the line outputs. See "Output tab" on page 46.

6. The *Mix* tabs give you access to the on-board mixing and effects. The 828 is a capable 44 x 16 monitor mixer. Each analog output pair gets its own independent mix consisting of all inputs, computer audio and the reverb bus. See "Mix tabs" on page 47.

7. The *Mic/Line/Inst 1-2* panels give you software control of the settings for those two front panel inputs. You

can turn on 48V phantom power if you have a condenser mic connected to the input, or engage the -20 dB pad for line level signals. You can also adjust the preamp gain here. These are the same as the controls on the front panel of the unit.

8. Control the unit's *Main Out* volume and *Phones 1/2* volume here. These are the same as the controls on the front panel of the unit.

9. *A/B Monitoring* lets you connect two sets of speakers and then check your mixes on each pair by toggling between your A speakers and B speakers. These are the same controls as on the front panel. See See "A/B Mode" on page 38.

10. The *Talkback* section provides controls for setting up and controlling the 828's talkback features. The Talk button here is the same as the button on the front panel of the unit. See See "Talkback" on page 39.

11. The *Input Monitoring* section lets you quickly patch the analog inputs directly to the *Main Outs 1-2* or

Headphones 1/2. This is near-zero latency monitoring because the computer (USB) is not involved. To hear an input on the Main Outs, click its button in the top row; to hear it on Headphone 1 or Headphone 2, click its button in the appropriate row.

If you use this hardware-based monitoring, be sure to turn off the input monitoring feature in your host software. Otherwise, both the 828 *and* your host software will send the input signal to the output and the signal will be doubled, which can cause phasing and/or cancellation problems (bad sound). Consult your software documentation for details.

12. Here, *Line Inputs 5-6* have been routed to the main outs. More specifically, by clicking these buttons, their faders in the *Main 1-2 Mix* tab have been set to unity gain and mute has been turned off (if it was on). You can further adjust the input's volume or other settings in its channel strip in the *Main 1-2 Mix* tab.

13. Here, the *Mic/Line/Inst 2* input has been routed to *Phones 2*. However, the button is gray because the *Mic 2* channel fader has been lowered (from unity gain) in the *Phones 1-2 Mix* tab. The gray color alerts you that it is no longer being monitored at full scale, or that other channel settings may have been modified (pan or mute).

14. If you have password-protected your 828 for security purposes while operating the device on a network, you can log out of the device to prevent unauthorized access from the computer on which you were logged in. See "Discovery tab" on page 55.

15. The *Discovery* tab lets you manage access to connected devices and devices on the network. See "Discovery tab" on page 55. On iOS, swipe from the left edge of your screen to access the Discovery tab.

16. The *AB* here indicates that AB monitoring is enabled for the Main Mix. If a mix shows *SOLO*, it indicates that there are soloed channels in the mix.

DEVICE TAB
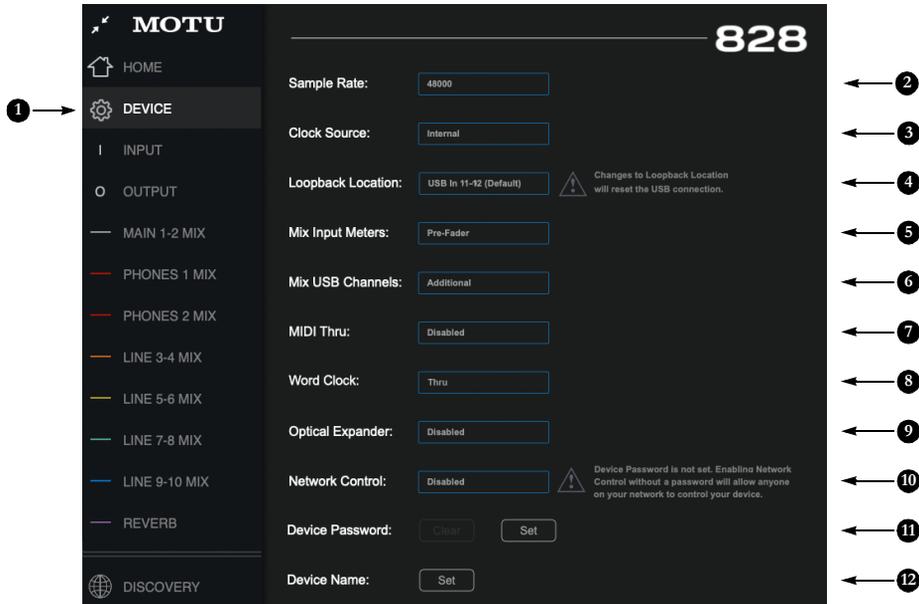
1. This is the *Device* tab, which provides basic hardware settings, such as the Sample Rate and Clock Source.

2. Choose the desired *Sample Rate*. Make sure your host audio software is set to the same rate.

3. Choose the *Clock Source*. Your MOTU device will resolve its digital clock to this master source. Set the clock source to *Internal*, unless you have other devices connected to the optical or S/PDIF inputs. If so, see "Optical I/O" on page 27 and "S/PDIF I/O" on page 28. If you are resolving the 828 to an external word clock source, choose *Word Clock*. See "Syncing word clock devices" on page 31.

4. Choose the *Loopback Location* here. This setting determines the position of the loopback channels in the input channel list. See "Loopback location" on page 61.

5. The *Mix Input Meters* in the mix tabs can show level before or after the channel fader setting. See "Mix input meters" on page 54.

6. Each mix (Main 1-2 mix, Phones 1 mix, Phones 2 mix, etc.) includes USB channels coming from the host computer (from your DAW or other audio software) so that you can mix computer output with the 828's physical inputs. By default, each mix includes the Main 1-2 USB channels, plus the USB channels going to the mix itself (such as the Line 3-4 for the Line 3-4 mix). The *Mix USB Channels* setting lets you add *additional* USB channels to each mix, which appear as additional channel strips in each mix tab. See "Mix USB Channels" on page 54.

7. When *MIDI Thru* is enabled, MIDI data received on the MIDI input is patched directly to the MIDI output. See "MIDI Thru" on page 28.

8. The Word Clock output on the your MOTU interface can operate as an OUT or a THRU. When Word Clock *Thru* is enabled, 75 ohm termination on the input is lifted and the word clock signal received on the input is patched directly to the Word Clock Output. See "Daisy-chaining word clock" on page 31.

9. If you wish to use the 828 as an optical expander for another optical-equipped device (such as another interface or digital mixer), enable *Optical Expander* mode. See chapter 8, "Optical Expander Mode" (page 63).

10. The 828 can be controlled from any device on the same network that the host computer is connected to. Use the *Network Control* setting to control whether the 828 is available to the network or not. See "Discovery tab" on page 55.

11. Use the *Device Password* to protect the 828 when using it on a network. The password is saved in a secure form on the host computer and in the device itself. See "Discovery tab" on page 55.

12. You can give your 828 a unique *Device Name*, which appears in the Discovery tab, which allows you to manage multiple devices that are connected or available on the network.

    See the next page for more...
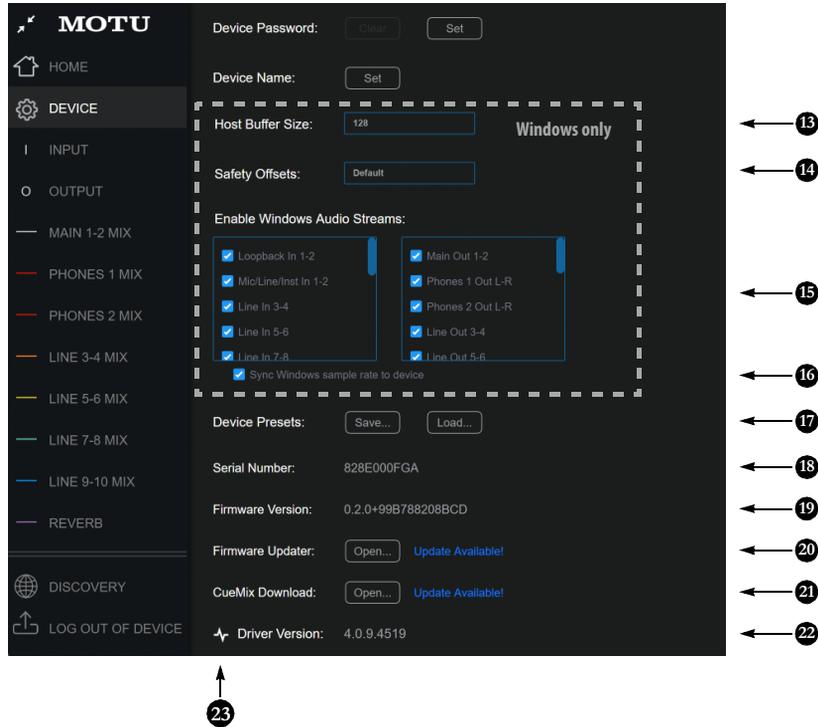
13. (Windows only) Choose the desired *Host Buffer Size*. Smaller values reduce latency but increase your computer's CPU load. See "Host Buffer Size" on page 20.

14. (Windows only) Use the *Safety Offsets* setting to fine tune host buffer latency. See "Host Safety Offset" on page 20.

15. (Windows only) The 828 supports Windows built-in audio. Choose the *Audio Streams* you wish to use with your Windows audio applications that use built-in audio. These settings do not affect the ASIO driver channels.

16. Enable the *Sync Windows sample rate to device* option to link this sample rate setting with the sample rate setting in Windows. If you change the sample rate here, it will change the Windows sample rate as well, and vice versa. This option is checked by default for best performance with most Windows audio applications. See "Sync Windows sample rate to device" on page 20.

17. A *Device Preset* is a 'snapshot' of all the settings in the 828, including all the mixes and all the settings in the CueMix 5 tabs (Home, Device, Input and Output). Use the *Save...* button to save your favorite device configurations for tracking, live gigs, rehearsals, etc. You can then restore them at any time with the *Load...* button.

18. Displays the *Serial Number* of your 828 unit.

19. Displays the *Firmware Version* currently installed in your 828 unit.

20. If you wish to update the firmware version in your 828, click *Open...* to launch the firmware updater app.

21. If you wish to download the latest version of CueMix 5, click *Open...*

22. Displays the *Driver Version* currently installed on your computer for the 828.

23. (Windows only) Click this icon to open a diagnostics window for troubleshooting purposes. This can be helpful when contacting MOTU Tech Support to diagnose issues.
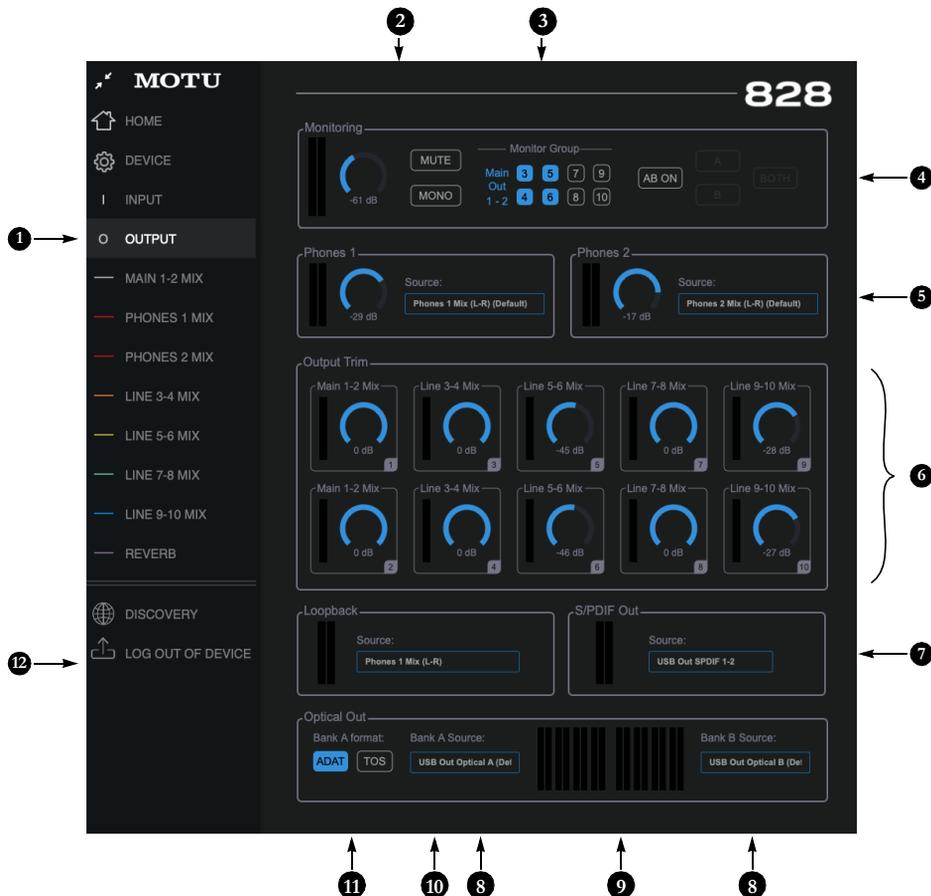
INPUT TAB

1. This is the *Input* tab, which provides access to settings for the 828 analog and digital inputs.

2. These channel settings for the *Mic/Line/Inst* inputs are the same as those shown in the Home tab (item #7 on page 42) and on the front panel of the 828, including preamp gain, 48V phantom power and -20 dB pad.

3. Each line input can be digitally boosted up to + 20 dB. This allows the inputs to easily accommodate +4 dB and -10 dB reference levels. Each input also includes a *Phase Invert* button.

4. In the Mix tabs (page 47), each analog input channel strip provides EQ and compression. The mic/line/inst inputs include gating. These effects can be applied to the input as needed (items #1 and 2 on page 49). This *To USB Host* menu for each line input lets you choose whether to send the input signal to your host software with or without these hardware effects applied to the signal. If you want to record the signal dry, *without* the effects applied to it, choose *Pre Fx*. If you want to record the signal *with* the effects applied, choose *Post Fx*. Please note: once the signal is recorded in your DAW with th *Post Fx* option, the effects cannot be removed from the signal.

5. Configure the *Optical Input format* for Bank A for either 8-channel ADAT or stereo TOSLink. At 88.2 or 96 kHz, the ADAT setting supports 4-channel SMUX format. Note that you can choose a different format for the optical IN and OUT ports. See "Optical I/O" on page 27.

6. Meters are provided here for the two Optical Input banks, for convenience.

7. Enable the *Foot Switch* input here (7a). Note that when you enable the foot switch, the USB connection to the computer is briefly reset so that the foot switch input can register as a keyboard device to trigger keystrokes on your computer. You may also see a dialog box on your computer asking you to confirm the addition of a new keyboard.

   In each text box (7b), type the keystroke you wish to trigger from your foot pedal. Hit the backspace key to clear the text box.

8. *S/PDIF Input* level meters are provided here for convenience.

OUTPUT TAB

1. This is the *Output* tab, which provides settings for the 828's analog and digital outputs.

2. These monitor controls (main volume, MUTE and SOLO) are the same as the controls on the front panel of the 828 and in the Home tab (item #8 on page 42).

3. The *Monitor Group* determines which outputs are controlled by the *Main Out* volume knob on the 828's front panel (item #9 on page 11), plus the Main Volume controls in the Home tab (item #8 on page 42) and here in the Output tab. For example, if your studio has a pair of main monitors, plus a sub-woofer connected to Line Out 3, you could click the Line Out 3 button to add it to the main volume controls. If you have 5.1 or 7.1 surround monitoring, you can add the surround channels to the monitor group to be able to

control the volume of all surround outputs simultaneously with the Main Volume knob. Please note: the *Main Out 1-2* pair is always part of the Main Volume Group.

4. *A/B Monitoring* lets you connect two sets of speakers and then check your mixes on each pair by toggling between your A speakers and B speakers. These are the same controls as on the front panel. See "A/B Mode" on page 38.

5. Meters and volume controls for the two *Headphone* outputs. These are the same as the PHONES 1 and 2 volume control on the front panel. You can also choose among many possible sources for each headphone output.

6. All analog outs can be *trimmed* (in the DAC) from zero to -∞ dB. This can be useful for speaker calibration

or other situations where you need a fixed amount of level adjustment for a particular output (or output pair).

7. By default the *Source* for the RCA S/PDIF output is set to USB channels from your host audio software, as shown in the menu. Alternately, you can send any 828 monitor mix to the RCA S/PDIF output.

8. The *Source* menus let you choose the source for each Optical Output bank. By default, the source is set to USB channels from your host audio software, as shown above in the menus. However, if you would like to use the 828 as an ADAT optical expander, the menus provide a number of options for routing analog input channels to the optical outputs. Doing so patches the line inputs directly to the outputs.

9. Meters are provided here for the two Optical Input banks, for convenience.

10. When the Optical Out format is TOSLink (TOS), the *Bank A Source* menu lets you send any 828 monitor mix (or any analog input pair) to the optical output.

11. Configure the *Bank A format* for either 8-channel ADAT or stereo TOSLink. At 88.2 or 96 kHz, the ADAT setting supports 4-channel SMUX format. Note that you can choose a different format for the IN and OUT. See "Optical I/O" on page 27.

12. Choose the *Loopback Source* here. This is the signal that will be returned to the computer on the Loopback channels. See "Loopback" on page 61.

MIX TABS
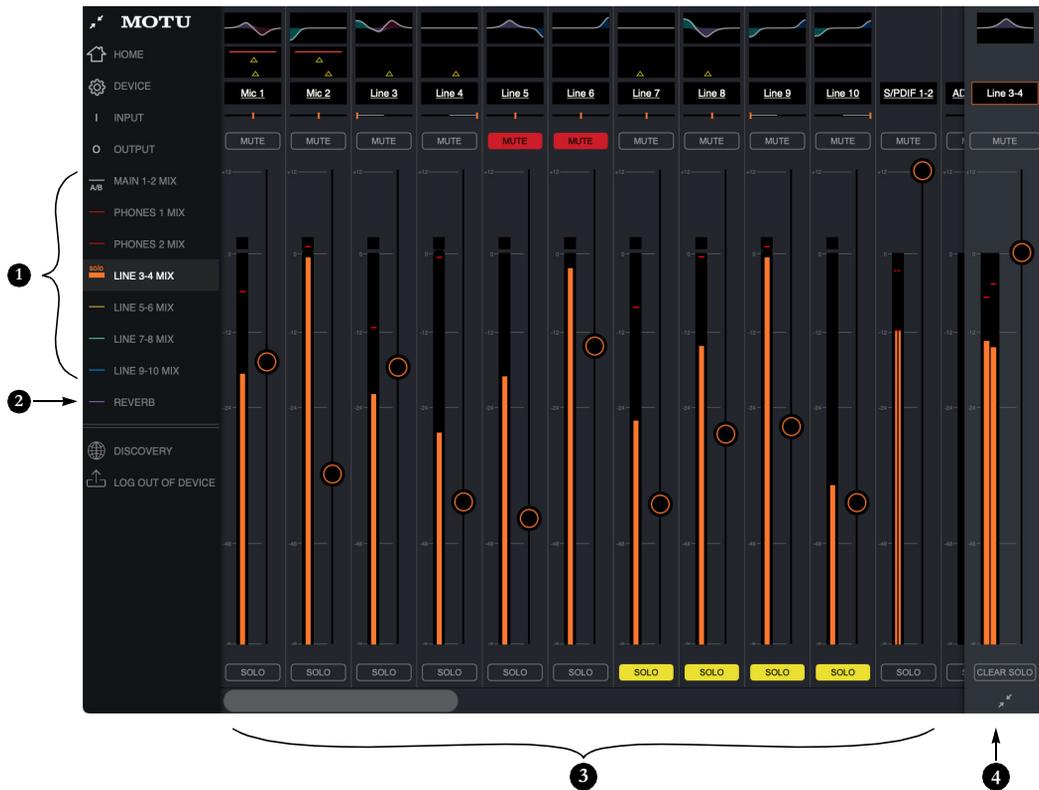
1. The *Mix tabs* provide an independent monitor mix for each analog output pair. Click a Mix's tab to access the channels for that mix. Then, just bring up the faders for any inputs (3) you wish to hear on that output.

   For example, for a studio session, you could set up a primary mix for the Main Outs 1-2 going to the control room that consists of live signals from the 828's inputs (from the musicians), plus playback from the computer. You could then create a completely different mix for Analog Outs 1-2, 3-4, 5-6, etc. for feeding headphone monitor mixes for the musicians.

   All mixes except Main 1-2, Headphones 1/2, and Reverb can be configured as two individual mono, mixes (instead of a stereo pair). See item #13 on page 50.

2. The *Reverb* tab lets you apply the 828's built-in reverb to any input signal: just bring up the fader for that input. To hear the reverb mix on an output, switch to the mix tab for that output and bring up the *Reverb* channel fader. Use the fader to control how much of the reverb mix you wish to hear.

3. Available inputs for each mix bus include:
   - The 828's analog, optical and S/PDIF inputs
   - Any computer audio being sent to the Main Out 1-2 output pair (available as a channel)
   - Any computer audio being sent to the mix's output pair, Line Out 3-4 in this example (available as a channel)
   - The reverb mix (2)
   - (Optional) Additional computer audio channels being sent to other output pairs. See "Mix USB Channels" on page 54.

4. This is the *Master Fader* for the current mix, which in this example is the *Line Out 3-4* mix. It controls the overall volume for the mix. It is always visible and pinned to the right side of the window, although you can collapse the strip using the widget at the bottom of the strip. Use the *Clear Solo* button to clear all solos in the mix. When one or more channels are soloed in a mix, the word "SOLO" appears next to the mix name in the sidebar on the left to alert you that channels are soloed in the mix (and therefore other channels are muted).

47

MIX INPUTS
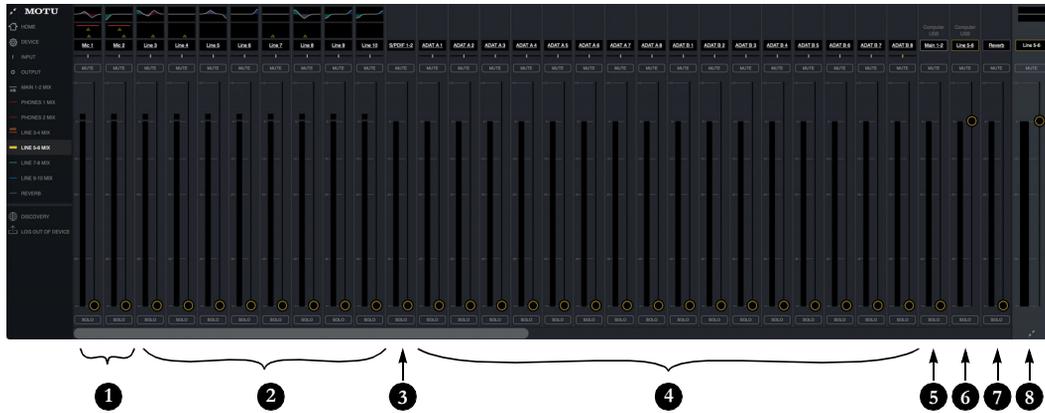
Each mix has the inputs shown here, with a few variations depending on the mix. To hear the input in the mix, just bring up its fader.

1. Each mix can include the signal from the 828's two front-panel *mic/line/ instrument* inputs.

2. These are the eight *line inputs* on the rear panel of the 828. All mixes include these channels.

3. To hear the *RCA S/PDIF input*, bring up this fader. All mixes include the S/PDIF channel.

4. These inputs represent the 828's *optical input* channels for the two banks (A and B). If *ADAT* is chosen as the optical format for Bank A (item

#5 on page 45), then you'll see eight channels of ADAT input for Bank A at 1x sample rates (or four channels at 2x rates). If *TOSLink* is chosen as Bank A's optical format, you'll see a single stereo channel strip instead of the eight shown here. Bank B is always 8 channels only (or 4 channels at 2x sample rates). All mixes include the optical channels.

5. On the *Main 1-2* channel (Computer USB), you'll hear the audio you're playing back from your host audio software, assigned to the 828's Main 1-2 outputs. This channel lets you include computer audio in your mix. This channel is available in all mixes.

NOTE: if you want the headphone output to mirror the main outs, go to the *Phones 1-2* mix and bring up the *Main1-2* fader and mute the *Phones 1-2* channel.

6. This *Computer USB* channel changes, depending on which mix you are viewing. It represents any computer audio being sent to the mix's output pair from host audio software (over USB). In this example, we are viewing the *Line 5-6 mix*, so this channel represents signal being sent to line outputs 5-6 from host audio software over USB. By default, this fader is set to full scale so that you'll always hear any computer audio being sent to the mix's output.

7. This channel is the *Reverb mix* (item #2 on page 47). When you bring up this fader, you'll hear the entire reverb mix. To adjust the amount of reverb on individual signals, go to the Reverb mix tab and make the individual adjustments there. All mixes include the Reverb channel, except the Reverb mix itself.

8. This is the master fader for the mix (item #4 on page 47).

9. The *Mix USB Channels* menu (item #5 on page 43) lets you add additional USB channels from the computer. See "Mix USB Channels" on page 54.

INPUT CHANNEL STRIP
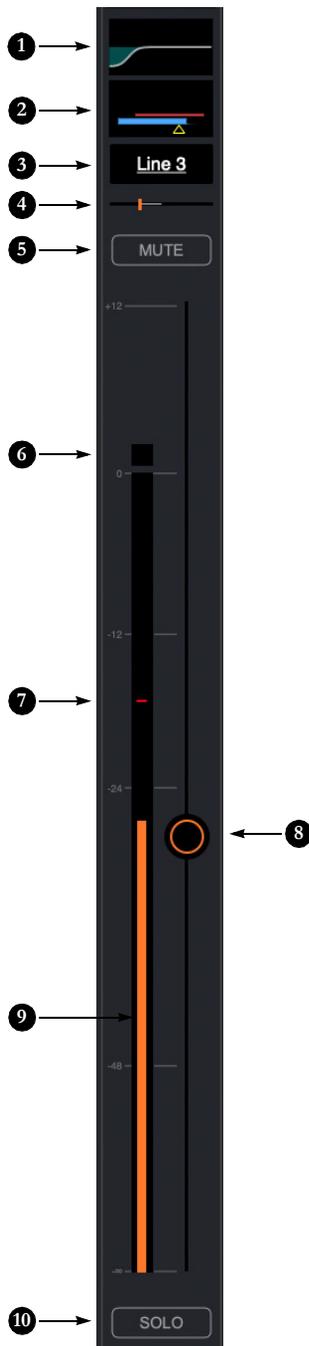
1. Click this EQ thumbnail to access the parametric EQ and other channel settings. EQ is only available on analog inputs and mix bus master faders. See "Multi-band parametric EQ" on page 51.

2. Click this thumbnail to access the *Gate*, *Compressor* and other channel settings. Compression is only available on analog inputs. See "Compressor" on page 52. The Gate is only available on mic/line/inst inputs. See "Gate" on page 52.

3. Click the channel name to access the channel settings, where you can rename the channel and make other channel settings.

4. Panning for mono inputs (such as a mic input). Stereo inputs (such as S/PDIF) do not have a pan control.

5. Channel mute.

6. Clip indicator.

7. The peak/hold indicator shows where the signal has recently peaked.

8. Use the channel fader to control the input level. Double-click to return to -∞.

9. By default, the level meter displays the signal level before the fader (pre-fader), but they can be changed to post-fader, if desired. See "Mix input meters" on page 54.

10. Channel solo. When you solo a channel, it mutes all other inputs on the bus (as is customary in a traditional "solo-in-place" model on a mixing console. In other words, there is no separate solo bus.)

CHANNEL SETTINGS
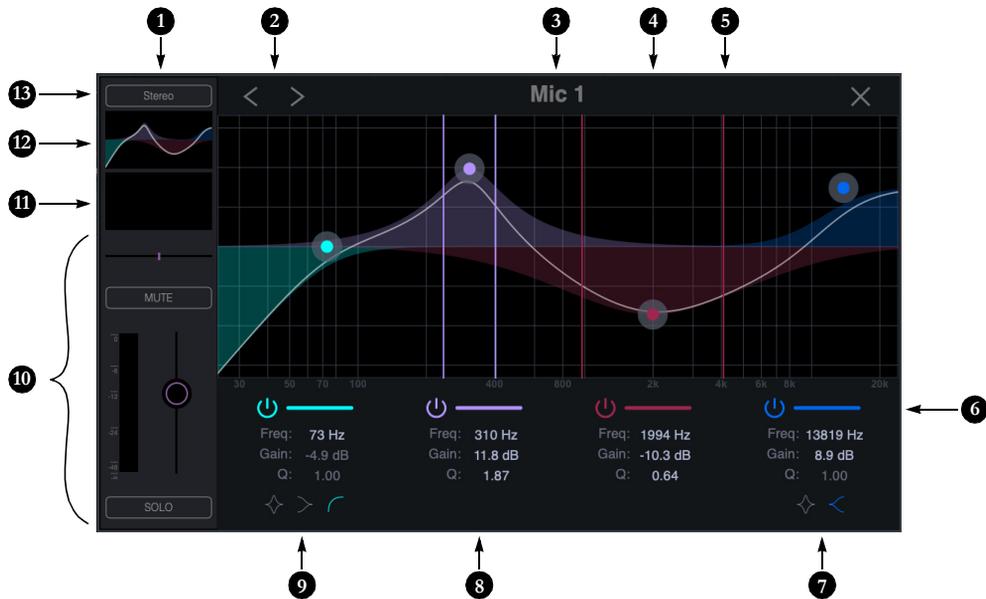
Click any of the items at the top of a channel strip (items #1, 2 or 3 on page 49) to access the Channel Settings shown here.

1. The *Channel Settings Sidebar* displays basic settings for the channel.

2. The *Next/Previous Channel* buttons display the settings for adjacent channels in the mix.

3. Click the *Channel Name* to rename the channel.

4. Drag the *Frequency/Gain* handle for an EQ band to change the frequency and/or gain for the band.

5. Drag the *Q (bandwidth)* handles for an EQ band to change them. The handles are color-coded to match the color of their respective EQ band.

6. *Enables* (or disables) the EQ band.

7. Click the *Notch/Shelf* switch to toggle the filter type.

8. Click filter settings to edit them directly. See "Multi-band parametric EQ" on page 51.

9. Click the *Notch/Shelf/Low-cut* button to change the filter type.

10. *Basic channel settings* (gain, pan, solo, mute and level meter) are shown here for convenience.

11. Click to access the *Compressor* and *Gate*.

12. Click to access the *Parametric EQ* settings.

13. The *Stereo Link* button links or unlinks the channel to an adjacent channel for stereo pairing.

14. The Gate processor is available on Mic inputs 1 and 2 only. See "Gate" on page 52.

15. The Compressor is available on all analog inputs. See "Compressor" on page 52.

MIXER EFFECTS

The EQ, compressor, gate and reverb processor in the 828 are available when operating the unit at 1x and 2x samples rates. At 4x sample rates (176.4 or 192 kHz), the following effects are disabled:

- All input effects

- Reverb

However, all mix bus EQ's (including Phones) remain enabled during 4x operation.

DSP-driven mixing and effects

The 828 effects are driven by a powerful DSP that delivers 32-bit floating point precision and plenty of bandwidth for no-latency processing. Effects can be applied when operating as an audio interface or as a stand-alone mixer.

Advantages over host-based mixing and processing

The hardware mixer in the 828 provides several advantages over mixing and processing in your host audio software:

- No buffer latency. The DSP-mixer provides the same near-zero latency throughput performance as a conventional digital mixer. Effects processing doesn't impact your computer's CPU.

- DSP mixing and routing can be maintained independently of individual software applications or projects.

- Monitoring is maintained during computer related disruptions (such as switching from one DAW project to another, for example).

- DSP-driven mixing can function without the computer, allowing the 828 to operate as a portable, stand-alone mixer with effects.

Accessing mixer effects

To access the EQ, compressor or gate for a channel, click its thumbnail at the top of the channel strip (item #1, 2 or 3 on page 49).

MULTI-BAND PARAMETRIC EQ

Analog input channels (items #1 and 2 on page 48) provide four bands of center-frequency parametric EQ filtering as shown on page 50. The High and Low bands include shelf filtering options. Master faders provide three bands of parametric EQ.

Enabling EQ bands

Each band has an *enable/disable* button (item #6 on page 50), allowing you to enable as few or as many bands as needed.

EQ filter controls

The EQ filters have three controls (item #8 on page 50):

Control	unit	range
Frequency	Hertz	20 to 20,000
Gain	dB	-20.00 to +20.00
Q (bandwidth)	n/a	0.45 to 10.0

Click a value to edit it numerically. Or drag its corresponding control handle in the graph above. Controls for each EQ band are color-coded.

EQ filter characteristics

EQ is one of the most widely used processing tools and can be applied to many different situations, from minor corrective tasks to creative tone sculpting. The multi-band EQ has been designed to be flexible enough to cover a broad range of applications. By adjusting Gain and Bandwidth together, you can emulate the smooth and musical character of classic analog EQ circuits.

Filter types

The Low and High bands offer a shelf option that is similar to those found in most conventional parametric EQs. The Low band also provides an additional low-cut filter option to filter out low frequencies below the frequency setting.

GATE

Mic/line/inst channels 1-2 (item 1 on page 48) provide a *Gate* (Figure 6-1).
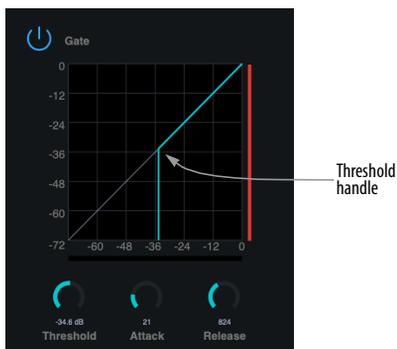

Figure 6-1: The Gate.

To access the gate, click the compressor/gate thumbnail (item #2 on page 49).

The gate silences the signal when the input signal's level drops below the *Threshold*.

The rate at which the gate responds, (opens to let signal through) is determined by the *Attack* parameter. With a short Attack time, the gate will open as soon as the signal crosses the Threshold; with longer Attack times, the gate will gradually open, much like a fade-in.

When the input level falls back below the Threshold, the time it takes for the gate to close (how quickly the signal is attenuated), is determined by the *Release* parameter. Short Release times will close the gate quickly, abruptly attenuating your signal, versus longer release times, which will gradually attenuate your signal, like a natural fade-out.

COMPRESSOR

All analog input channels (items 1 and 2 on page 48) provide a *Compressor* (Figure 6-2).
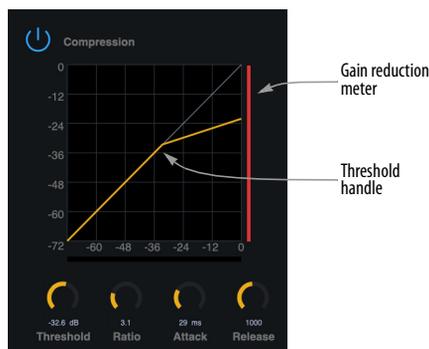
Figure 6-2: The Compressor.

To access the compressor, click the compressor/gate thumbnail (item #2 on page 49).

The *Compressor* lowers the level of the input when amplitude of the signal is above the Threshold. The amount of attenuation is determined by the *Ratio* and the input level. For example, if the input is 6 dB above the *Threshold* and the Ratio is 3:1, the compressor will attenuate the signal to 2 dB above the Threshold. When the input level goes above the threshold, the attenuation is added gradually to reduce distortion. The rate at which the attenuation is added is determined by the *Attack* parameter. Likewise, when the input level falls below the Threshold, the attenuation is removed gradually. The rate at which the attenuation is removed is determined by the *Release* parameter. Long Release times may cause the audio to drop out briefly when a soft passage follows a loud passage. Short Release times may cause the attenuation to "pump", a term used to describe the sound of the compressor when the average input level quickly fluctuates above and below the Threshold. These issues can be addressed by adjusting the parameters. The *Gain reduction meter* (Figure 6-2) displays the attenuation applied by the compressor.

REVERB

To access the reverb settings: go to the Reverb bus tab (item #2 on page 47) and then click the thumbnail at the top of the reverb bus fader, as shown below.
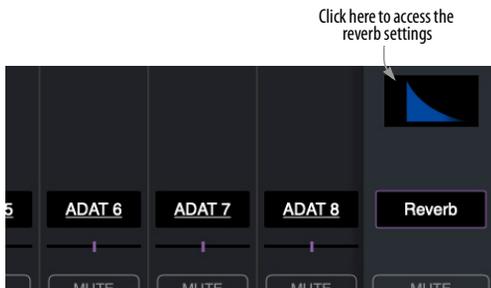
Figure 6-3: Accessing the Reverb processor.

Reverb settings

The Reverb processor (Figure 6-4) provides *Small*, *Medium* and *Large* room sizes, along with *Pre-Delay* (see below), *Damping*, *Decay* (length) and *Width* (stereo image) controls, which you can adjust with the handles on the graph or the settings below.

Predelay

Predelay is the amount of time before the acoustic energy from the source returns to the listener, after reflecting off the surfaces of the listening space. The very first reflections helps you perceive information about the listening space, (size, distance, surface type, etc.) In large rooms, it takes a while (on the order of milliseconds) before the first reflections return to the listener. Predelay is useful for adding clarity, as it delays these reflections, before the onset of full reverberation. For example, with pre-delay added to vocals, the reflections won't start until after the initial sound of a word has been sung.

Routing inputs and groups to the reverb processor

The reverb processor is a single, independent unit that provides stereo reverb. Use the channels in the Reverb mix tab (item #2 on page 47) to route input signals to it. All incoming signals to the reverb processor are mixed and processed together. The resulting stereo output from the reverb can then be added into any other mix bus with the Reverb channel strip (item #7 on page 48).

Figure 6-4: The reverb processor.

MIX INPUT METERS

The *Mix Input Meters* menu (item #5 on page 43) offers two settings: *Pre-fader* or *Post-fader*. This setting lets you choose whether the input meters in CueMix 5 display levels before or after the signal passes through the fader's gain stage.

☞ Post-fader metering is calculated as the Post-FX send level, plus the fader value. Therefore, if the pre-fader signal goes above zero dBFS, the resulting post-fader meter value will not include the magnitude of the signal above zero dBFS.

MIX USB CHANNELS

The *Mix USB Channels* menu (item #5 on page 43) offers two settings: *Default* or *Additional*.

Default

Each mix (Main 1-2 mix, Phones 1 mix, Phones 2 mix, etc.) includes USB channels coming from the host computer (from your DAW or other audio software) so that you can mix computer output with the 828's physical inputs. With the *Default* setting chosen, each mix includes the Main 1-2 USB channels, plus the USB channels going to the mix itself (such as the Line 5-6 for the Line 5-6 mix). See items #5 and 6 on page 48.

Additional

The *Mix USB Channels* setting lets you add *Additional* USB channels to each mix, which appear as additional channel strips in each mix tab, as shown by item #9 on page 48. This allows you to include multi-channel output from your host software as part of the mix, with independent mix control for each USB channel pair (volume, pan, effects, etc.)

SAVING AND RECALLING DEVICE PRESETS

Use the *Save* and *Load* buttons in the CueMix 5 Device tab (item #17 on page 44) to save and recall 828 device presets to your computer hard drive. A preset saves the entire state of the 828 interface, including all device settings, mixes and effects settings.

THE CUEMIX 5 IOS APP

CueMix 5 is also available as an app for iOS and allows you to control the 828 from your iOS device. Simply download it from the App Store. Also see "iOS setup (USB-C)" on page 23 and "iOS setup (Lightning)" on page 24.

DISCOVERY TAB
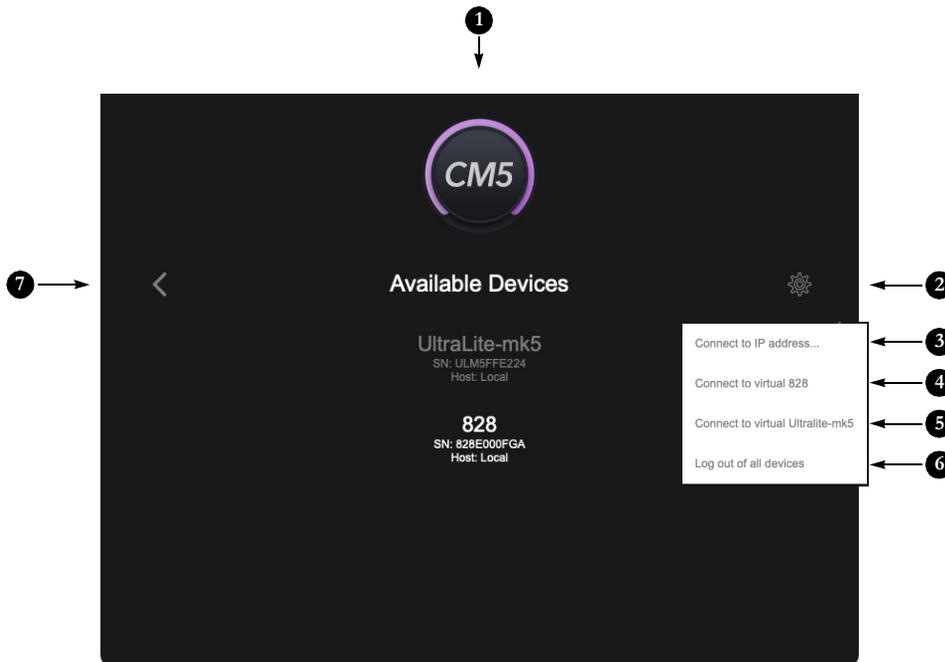
Click *Discovery* in the CueMix 5 side bar (item #15 on page 42) to access the Discovery tab, which allows you to access any available MOTU Gen 5 devices (such as the UltraLite-mk5 and 828) connected to your host computer, or any MOTU Gen 5 devices on your local area network (LAN) via Ethernet or Wi-Fi.

1. The *Available Devices* list displays Any MOTU devices that are connected to the computer you are running CueMix 5 on, or any devices connected to a computer on the same Ethernet/Wi-Fi network. Click any device in the list to view its settings in CueMix 5. CueMix can only access one device at a time, so use this tab to switch between multiple devices, if you have them. You can freely switch devices at any time. Note that if any of the devices are password-protected (see

below), you do not need to log out to switch to another device. You can stay logged in while switching to and from a password-protected device.

IMPORTANT NOTE: if you are using your MOTU Gen 5 device with a computer that is on a network, security can be an issue. You can assign a password to your 828 hardware to prevent unauthorized access to its settings. You can also control whether it is visible on the network, and you can give it a name for easy identification. See items 10, 11 and 12 on page 43.

ALSO NOTE: to access a MOTU device connected to another computer on the network, CueMix 5 must be installed on the computer.

2. This menu provides access to the menu items shown below.

3. *Connect to IP address* lets you connect directly to a MOTU device by entering its IP address on the network. You can then view all of its settings in the other CueMix 5 tabs.

4. *Connect to virtual 828* lets you work with CueMix 5 off line, when no 828 hardware is accessible or available (i.e. there is no 828 present in the list of available devices). You can look at all CueMix 5 settings and create and save presets off line. You can then load presets into the hardware, once it is back on line.

5. *Connect to virtual UltraLite-mk5* is the same as above for the 828: it lets you work with CueMix 5 settings for the UltraLite-mk5 when the hardware is off line.

6. If you have password-protected multiple MOTU Gen 5 devices for security purposes while operating them on a network, choose *Log out of all devices* to prevent unauthorized access from the computer on which you were logged in. To log out of an individual device, switch to that device and use *Log out of Device* (item #14 on page 42).

7. Click this *Back button* to return to the other CueMix 5 tabs for the currently selected device.

CHAPTER 7   Working with Host Audio Software

The 828 provides multi-channel audio input and output for Core Audio compatible audio applications on the Mac and ASIO or Wave compatible applications on Windows, including MOTU's Digital Performer and Performer Lite, Apple's Logic Pro and GarageBand, and other third-party software applications such as Ableton Live, Avid Pro Tools, Cockos Reaper, Propellerhead Reason, Steinberg Cubase and Nuendo, PreSonus Studio One, Bitwig, and others.

Performer Lite is available as a free download for 828 owners from their motu.com account page. For complete information about all of Performer Lite's powerful workstation features, refer to the *Performer Lite User Guide.pdf* found in the Help menu of the Performer Lite application.

Digital Performer, MOTU's state-of-the-art digital audio workstation software, is available separately; for details about upgrading from Performer Lite to Digital Performer, talk to your authorized MOTU dealer or visit motu.com.

PREPARATION

Install your host audio software first if you haven't already done so, and complete these chapters before proceeding:

■ chapter 3, "Software Installation" (page 19)

■ chapter 4, "Hardware Installation" (page 23)

RUN THE CUEMIX 5 APP

Before you run your host audio software, launch CueMix 5 to configure your MOTU hardware.

Sample Rate

Choose the desired sample rate for the 828 (item #2 in the Devices tab on page 43) and your host audio software. Make sure the sample rates for the hardware and software match. Newly recorded audio will have this sample rate.

☛ Optical and S/PDIF channels are disabled when the interface is operating at a 176.4 or 192 kHz.

Clock Mode

The *Clock Source* setting (item #3 in the Devices tab on page 43) is important because it determines the master digital audio clock for your system.

If you do not have any digital audio connections to your MOTU device (you are using the analog inputs and outputs only), and you will not be resolving your host software to optical or another external clock source, choose *Internal*.

If you have devices connected to the optical ports, see "Choosing a clock source for optical connections" on page 28.

If you have devices connected to the S/PDIF ports, see "S/PDIF I/O" on page 28.

If you are resolving your system to word clock, see "Syncing word clock devices" on page 31.

CHOOSE THE 828

Once you've made the preparations described so far in this chapter, you're ready to run your host audio software and choose the 828 as your audio interface ("soundcard").

For macOS audio software

For audio software running under macOS, go to the menu item or preference where you choose the audio device (Core Audio driver) you wish to use, and then select the 828 by name.

For Windows audio software

For audio software running under Windows, go to the menu item or preference where you choose the ASIO driver you wish to use, and then choose *MOTU 828*. If your host audio software doesn't support ASIO, choose the *828* Wave driver instead.
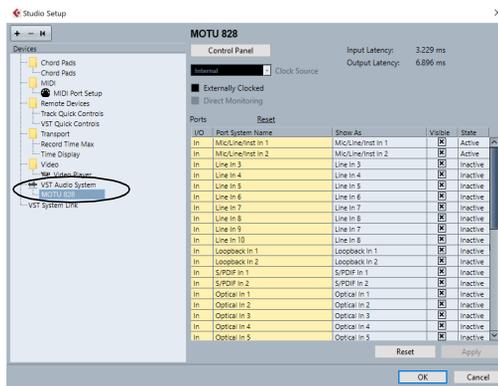
Figure 7-1: Choosing the MOTU Pro Audio ASIO driver in Cubase.

Where to go in popular audio hosts

Here is the location for this setting in various popular audio software host applications:

Host software	Location for choosing the 828
Digital Performer and Performer Lite	Setup menu > Configure Audio System > Configure Hardware Driver
Pro Tools	Setup menu > Playback Engine or Current Engine
Logic Pro	Preferences > Audio tab > Devices tab > Core Audio tab
Garage Band	Garage Band menu > Preferences > Audio/MIDI > Audio Output/Input menus
Cubase and Nuendo	Device Setup > Devices list > VST Audio System menu
Live	Preferences > Audio tab
Reason	Preferences > Audio preferences
Reaper	Preferences > Audio prefs > Devices

Other audio software

Consult your software's manual for further information.

REDUCING MONITORING LATENCY

Monitoring latency is a slight delay caused by running an input signal through your host audio software and back out. For example, you might hear it when you drive a live guitar input signal through an amp modeling 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 input on the 828, passes through the interface hardware into the computer, through your host audio software, and then back out to an output.

Monitoring through the 828

If you don't need to process a live input with plug-ins, the easiest way to avoid monitoring latency is to disable your DAW's live monitoring feature and instead use the digital mixer in the 828 to route the input directly to your outputs. For

details, see "Mix tabs" on page 47. The mixer in the 828 even provides zero latency effects processing (EQ, compression and reverb), which can be applied to the signal.

Direct hardware playthrough / Direct ASIO monitoring

When managing your live monitor mix through the 828 mixer, remember to disable your DAW's live monitoring features, so that you won't hear record-enabled tracks in your DAW. Also note that the 828 does not support *Direct Hardware Playthrough* in Digital Performer, or the *Direct ASIO Monitoring* feature (or similar) offered and other DAWs, which lets you control no-latency hardware monitoring from within the host application. Instead, you can use the CueMix 5 app mixer ("Mix tabs" on page 47) to set up these monitor mixes manually.

If you don't require any effects processing on the input signal (no reverb or compression, for example), all this takes is one click on a fader to route the input being recorded to the output you are using for monitoring.

If you are recording a mono input that you'd like to monitor in stereo, or if you need to apply effects to the monitored signal, you can use the 828 mixer for that, too. Use the mix tabs and reverb mix (page 47) to apply effects as desired, and perhaps include other channels to the mix.

Monitoring through your host audio software

If you *do* need to process a live input with host software plug-ins, or if you are playing virtual instruments live through your MOTU audio hardware, you can significantly reduce latency by adjusting the audio buffer setting in your host audio software, as explained in the next section.

☛ It is important to note that monitoring delay has no effect on the recording, or playback, of audio data from disk. The actual recording and playback is extremely precise, it is only the monitoring of your live input signal which may be delayed.

Adjusting your host software audio buffer

Buffers are small bundles of audio data. The 828 "speaks" to your computer in buffers, rather than one sample at a time. The size of these buffers determine how much delay you hear when monitoring live inputs through your audio software: larger buffers produce more delay; smaller buffers produce less.

Adjusting buffer size on macOS

Under macOS, audio I/O buffer size is handled by the host audio application (not by the 828 Core Audio driver). Most audio software applications provide an adjustable audio buffer setting that lets you control the amount of delay you'll hear when monitoring live inputs or processing them with software plug-ins. Here are a few examples.
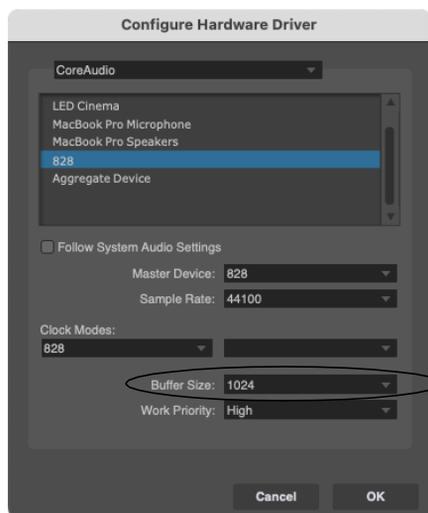
Figure 7-2: In Digital Performer and Performer Lite, choose Setup menu> Configure Audio System> Configure Hardware Driver to open the dialog shown above and access the Buffer Size setting.

Figure 7-3: In Cubase or Nuendo, choose Devices menu > Device Setup. Select your interface (828), then click the Control Panel button to access the window above and the Buffer Size setting.
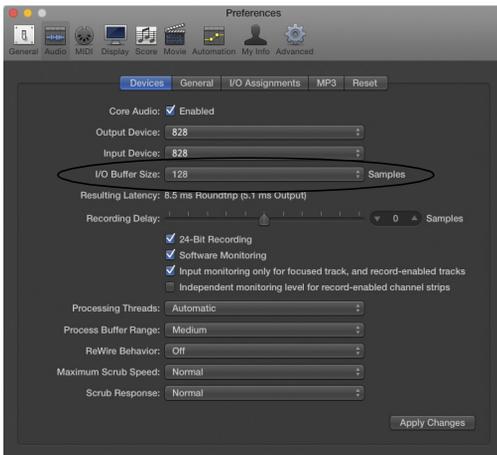
Figure 7-4: In Logic Pro, go to the Audio Driver preferences to access the Buffer Size option shown above.

Adjusting buffer size on Windows
On Windows, the buffer size is adjusted in the CueMix 5 app Device tab (items #13 and 14 in the Devices tab on page 44).

Lower latency versus higher CPU overhead
Buffer size has a large impact on the following:

- Monitoring latency

- The load on your computer's CPU

- Responsiveness of transport controls and effect knobs in Performer Lite, Digital Performer or other audio software.

- Real-time virtual instrument latency.

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 monitoring 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.
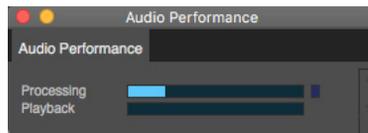
Figure 7-5: When adjusting the buffer size to reduce monitoring latency, watch the 'processor' meter in Digital Performer's Performance Monitor. If you hear distortion, or if the Performance meter is peaking, try raising the buffer size.

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.

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.

LOOPBACK

Use the *Loopback In 1-2* input channels provided by the 828 audio driver to send USB audio output from your computer – or any 828 mix – back to the computer.

Choose the desired source from the *Loopback Source* menu (item #12 on page 46).

The loopback channels return the chosen signal back to the computer so that you can capture the signal in your host software, stream it to the web or broadcast it with podcasting software.

Loopback location

The *Loopback Location* setting (item #4 on page 43, and below in Figure 7-6) determines the placement of the loopback channels within the list of input channels available in your host audio software. There are two choices, as shown below.
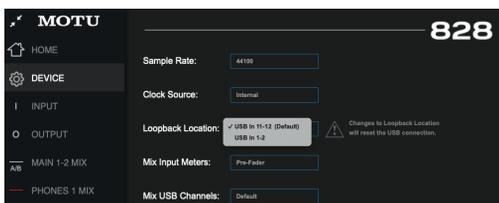
Figure 7-6: Loopback location.

The default location is *USB In 11-12*, which is just after the ten analog input channels. Alternately, you could choose *USB In 1-2* (the first two channels in the list).

If your host audio software presents all 828 input channels in its UI (wherever input channels are displayed), then this setting is mostly comes down to personal preference. However, some host audio

applications don't provide a way to choose from among several input channel pairs, or they can only present a few choices for input channels. This can especially be true for video-conferencing or podcasting-related applications, for which the loopback feature is crucial. In cases like these, choosing the *USB In 1-2* option guarantees that the host software has access to the loopback channels because they are the first channels in the list, which may be the only two channels that the software can access.

Mixing loopback with live inputs and disk tracks

If you need to mix the loopback channels with live inputs, do the following:

1 Choose a mix from the *Loopback Source* menu (item #12 on page 46).

2 Go to the mix tab for that mix (item #1 on page 47) and bring up the fader(s) for the *computer USB* channels you want to hear.

3 Bring up the faders for any live inputs you want to add to the mix. When you do so, their signal is mixed with the computer USB channels.

☞ Remember, be careful! When monitoring loopback channels and live inputs, your host software can cause loud feedback loops. Be sure to disable the monitoring of loopback tracks to avoid feedback.

CHAPTER 8   Optical Expander Mode

OVERVIEW

The 828 has the ability to function as an optical expansion interface. You can connect it to other optical-equipped devices to route the 828's analog inputs and outputs to and from the other device. Up to 16 channels are supported at 1x sample rates (44.1 or 48 kHz) and 8 channels at 2x rates (88.2 or 96 kHz).

☞ Optical Expander mode supports the ADAT format for both Bank A and B. TOSLink is not available in Optical Expander mode.

MAKING CONNECTIONS

To route the 828's analog inputs to the other device, connect the 828 Optical OUT A port to the other device's Optical IN port. If the other device has a 2nd bank of optical, connect the 828's Optical OUT B to the other device's 2nd Optical IN bank.

to route audio from the other device to the 828's analog outputs, connect the other device's Optical OUT to the 828's Optical IN A port. Similarly, if the other device as a 2nd bank of optical, connect it's 2nd Optical OUT bank to the 828's Optical IN B port.

ENABLING OPTICAL EXPANDER MODE

You can enable Optical Expander mode using the front panel LCD menu or the CueMix 5 device tab.
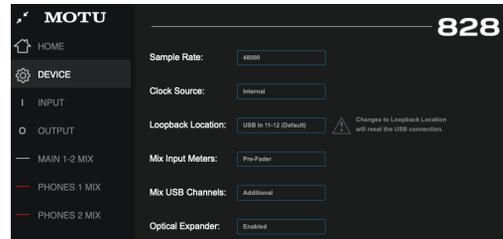
Figure 8-1: Enabling Optical Expander mode.

SETTING THE SAMPLE RATE

Be sure that the sample rate setting (item #2 on page 43) for the 828 matches the sample rate of the other device. At the 1x sample rates (44.1 and 48 kHz), each optical bank provides 8 channels. At the 2x rates (88.2 and 96 kHz), each bank provides 4 channels.

SETTING THE CLOCK SOURCE

In Optical Expander Mode, the 828 transfers digital audio channels over it's optical connections. It is therefore crucial to make sure that the clocks in the two devices are properly resolved. See the following sections for further information:

■ "Synchronization" on page 29

■ "Syncing optical devices" on page 30

CHANNEL MAPPING AT 1X

At 1x sample rates, the 828's two optical banks are mapped as follows:

Optical Input	Destination
Bank A Inputs 1-8	Analog Outputs 1-8
Bank B Inputs 1-2	Analog Outputs 9-10
See note below*	Headphone 1
See note below*	Headphone 2
See note below*	S/PDIF Out 1-2

*Use the Source menus in the Output tab (page 46) for the S/PDIF output and headphone outputs to choose any desired source for each. These settings can also be accessed in the front panel.

Source	Optical Output
Analog Inputs 1-8	Bank A Outputs 1-8
Analog Inputs 9-10	Bank B Outputs 1-2
S/PDIF In 1-2	Bank B Outputs 3-4

CHANNEL MAPPING AT 2X

At 2x sample rates, the 828's two optical banks are mapped as follows:

Optical Input	Destination
Bank A Inputs 1-4	Analog Outputs 1-4
Bank B Inputs 1-4	Analog Outputs 5-8

Source	Optical Output
Analog Inputs 1-4	Bank A Outputs 1-4
Analog Inputs 5-8	Bank B Outputs 1-4

Part 3

Appendices

Troubleshooting

My 828 isn't showing up in Audio MIDI Setup on my Mac.
Due to the updated architecture of macOS Catalina (10.15) and above, the system extensions for all newly-installed third-party software will automatically be blocked from running. If your 828 is not showing up in Audio MIDI Setup, CueMix 5 or your DAW, you might need to enable the driver in your System Preferences. To do so, first download and install the very latest installer for your 828. After restarting, open System Preferences. Select Security & Privacy. In the General section, click the Allow button. The Allow button will disappear 30 minutes after installation. If the button has disappeared, run the installer for the MOTU driver again.

I have absolutely no audio input or output happening to or from my 828. Why?
Make sure that the unit has a stable sample rate (the *lock icon* in the front panel displays will flash red if the clock hasn't settled yet). Try setting the unit's clock source to *Internal* if you can't sync to any external clock sources. Check that audio is working with Internal sync, and if so, then work on establishing a stable external clock.

I can't hear computer audio output through my 828.
In the Sound panel of System Preferences, the 828 should be selected as the output device.

How do I monitor live 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 mixer in the 828. Please see "Monitoring through the 828" on page 58.

How do I control monitoring latency?
See "Reducing monitoring latency" on page 58.

How do I factory reset my device?
Push SELECT or turn the MENU knob to enter the main menu. Navigate to *RESET* and tap the SELECT button three times to reset.

I hear clicks and pops under optical or S/PDIF sync.
Many problems result from incorrect sync settings. See "Synchronization" on page 29. Whenever there is any unexpected noise or distortion, suspect digital clocking issues.

Clicks and pops due to hard drive problems...
If you have checked your clock settings and you are still getting clicks and pops in your audio, you may have a drive related problem. Set your Clock Source to *Internal* and try recording just using the analog inputs and outputs on the 828. 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 or there are other drive-related issues.

Connecting or powering gear during operation...
It is not recommended that you connect/ disconnect, or power cycle connected devices while recording or playing back audio. Doing so may cause a brief glitch in the audio.

CUSTOMER SUPPORT
We are happy to provide complimentary customer support to our registered users. If you haven't already done so, please take a moment to register online at MOTU.com. Doing so entitles you to technical support and notices about new products and software updates.

TECHNICAL SUPPORT

If you are unable, with your dealer's help, to solve problems you encounter with your MOTU device, you may contact our technical support department in one of the following ways at motu.com/support:

■ Live Chat: You can connect directly with a technician Monday through Friday between 10 AM and 5 PM Eastern Time.

■ Schedule a call: You can schedule a callback time to speak with a technician by phone Monday through Friday between 1 PM - 5 PM Eastern time.

■ Support ticket: You can submit an online support ticket (TechLink) at any time, 24 hours a day, 7 days a week. A technician will get back to you in 1-2 business days.

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

■ The serial number of your MOTU device. This is printed on a label placed on the bottom of the unit and on the side of the box. You must be able to supply this number to receive technical support.

■ 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.

■ The pages in the manual that refer to the features or operation of your MOTU Device or Performer Lite with which you are having trouble.

■ The version of your computer's operating system.

We're not able to solve every problem immediately, but a quick TechLink or chat may yield a suggestion for a problem which you might otherwise spend hours trying to track down.

If you have features or ideas you would like to see implemented, we'd like to hear from you. Please write to the Development Team, MOTU Inc., 1280 Massachusetts Avenue, Cambridge, MA 02138, or use our online suggestion box at www.motu.com/ suggestions.

APPENDIX B   Audio Specifications

MIC in

Connector Type	Combo-style, XLR / TRS	Pin 2 hot, tip hot

XLR

Impedance load	2.8 k ohm	
Pad	-20 dB, Switchable per channel	
Phantom power	+48V, switchable per channel	DIN 45596 / IEC 61938-P48
EIN	-129 dBu	A-weighted, 20-20k, 150 ohm
Dynamic Range	118 dB	A-weighted
THD+N	-114 dB	1kHz, -1dBu, 0dB gain, unweighted
Frequency Response	+0.05 / -0.1 dB, 26 Hz-20 kHz	Ref. 1 kHz
Max Level In with Pad	+21.5 dBu	
Max Level In without Pad	0.5 dBu	
Gain range	0 to +74 dB in 1 dB steps	

TRS

Description	Balanced or single ended	Suitable for line or instrument (guitar)
Impedance Load	1 meg ohm 2 meg ohm	unbalanced balanced
Pad	None	
Phantom power	None	
Dynamic Range	115 dB	A-weighted
THD+N	-109 dB	1kHz, 17 dBu, 0dB gain, unweighted
Frequency Response	+0.05/-.6 dB, 40-20kHz	Ref. 1 kHz
Max Level	+20 dBu Differential, 18dBu Single-ended	Balanced; +18 dBu unbalanced
Gain range	0 to +74 dB in 1 dB steps	

Line In

Connector Type	1/4" Female, TRS	Balanced/unbalanced, Tip hot
Specification	Complies with EBU-R68 / SMPTE RP-155	
Impedance Load	20 k ohm	balanced
Dynamic Range	120 dB	A-weighted
THD+N	-114 dB	1kHz, 20dBu, 0dB Trim, unweighted
Frequency Response	±0.05 dB, 20 Hz-20 kHz	Ref. 1 kHz
Max Level In	+21 dBu	
Gain Range	0 to +20 dB	Digitally controlled in 1 dB steps

Line Out

Connector Type	1/4" Female, TRS	Balanced, tip hot
Output Impedance	220 ohm	Per leg
Dynamic Range	125 dB	A-weighted
THD+N	-114 dB	-1 dBFS, Unweighted, 1 kHz
Frequency Response	+0.01/-0.15 dB, 20 Hz-20 kHz	Ref. 1 kHz
Max Level Out	+21 dBu	
Trim Range	0 to -∞ (-127)	Digitally controlled in 1 dB steps

Phones

Connector Type	1/4" Female, TRS Stereo	Tip Left, Ring Right
Output Impedance	< 1 ohm	
Dynamic Range	118 dB	
THD+N	-110 dB	Unweighted, -1 dBFs, 1 kHz
Frequency Response	+0.01/-0.1 dB, 22 Hz-20 kHz	Ref. 1 kHz
Trim Range	0 to -99 dB, plus mute	0 to -99 dB in 1 dB steps
Max output	14.4 dBu	Unloaded

S/PDIF

Connector Type	RCA	
Input Termination	75 ohm	
Lock Range	44.1k/48k, +/- 0.5%	1x, 2x
Input Voltage Range	0.2 - 0.6 V	
Output Drive	0.5 Vp	
Specification	IEC-958/60968-3	

Word Clock In/Out/Thru

Specification	AES-11 2009 Annex B	
Connector Type	BNC	
Termination	75 ohm (in/out)	THRU is unterminated
Lock Range	44.1 kHz / 48kHz, +- 0.5%	x1/x2/x4
Input	1 vpp to 3 v p-p (with termination)	AC coupled
Output	5.0 vpp, (2.5 v p-p terminated)	DC coupled
Jitter	complies with AES3-4-2009	< 0.025 UI

Power Supply

Connector Type	IEC 3-conductor receptacle	For AC mains connection
Configuration	Internal, Universal	
Power Input	100 V to 240 V, 50 Hz or 60 Hz	
Power Usage	0.5A	

APPENDIX B: AUDIO SPECIFICATIONS

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