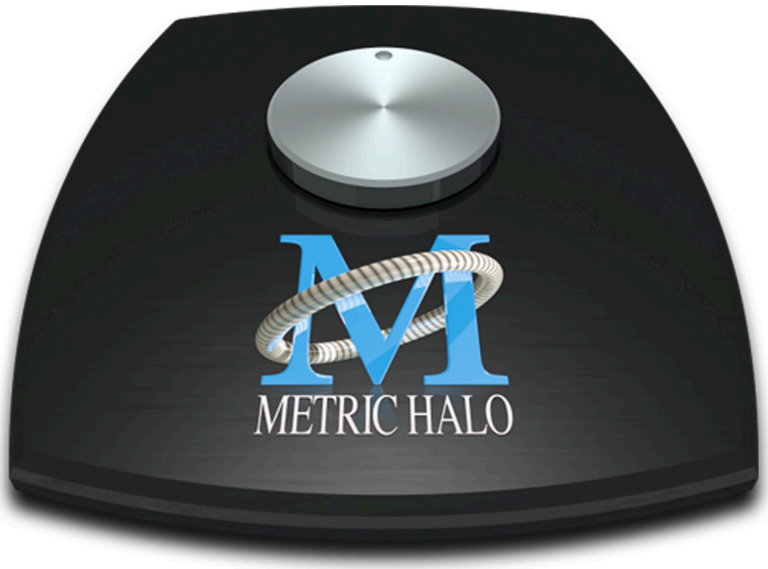


ULN-8mkIV Quick Start and Hardware Guide

ULN-8mkIV Quick Start and Hardware Guide

Metric Halo

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1. ULN-8mkIV Quick Start Guide



ULN-8mkIV

Prepare the unit for use

Unpack the ULN-8mkIV and make sure all the parts are there:

- One Mobile I/O ULN-8mkIV unit
- One IEC Power Cord appropriate for your area
- One 18-volt 60-watt world-ready external power supply
- One 12" CAT5e Ethernet Cable
- One 14' CAT5e Ethernet Cable
- One USB-A to USB-C Cable
- Two Rack Ears w/ fasteners
- Rubber feet
- Warranty/Registration Card

Welcome to your new Metric Halo ULN-8mkIV 3d! Once you're finished checking the box physically and installing the rack ears (or rubber feet), connect the power supply. Now connect your input and output cables along with your monitors and signal sources. Your monitors should be connected to Analog Out 1/2, either via a DB25 cable or the 1/4" TRS jacks. Turn the unit on using the front panel switch.

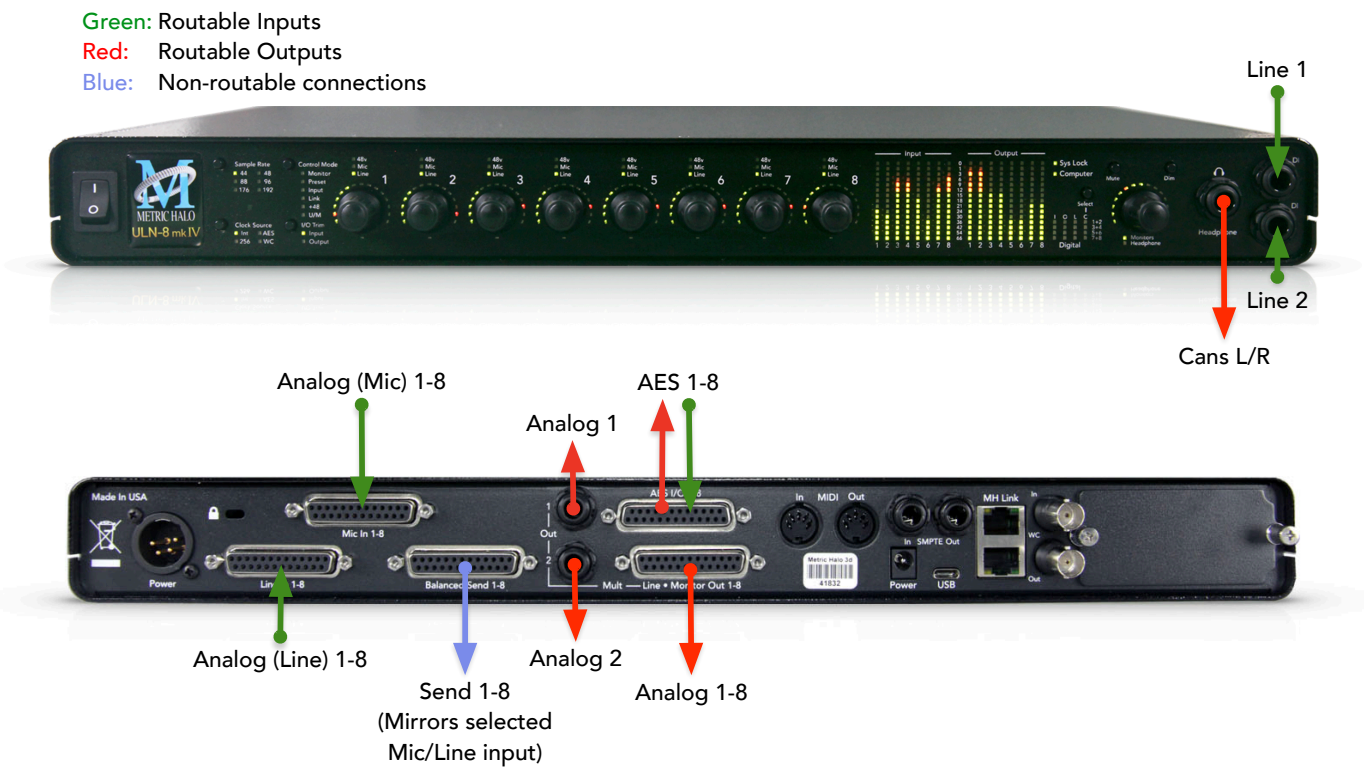
Super QuickStart!
Plug your computer into the USB-C port on the back of the ULN-8mkIV.

Select "ULN-8mkIV" as your computers' audio device.

Done.

The ULN-8mkIV will receive and send audio from/to channels 1 through 12 of your USB host device at all resolutions up to 192kHz/24 bit. Audio channels 1 and 2 of your host device will play audio out both the headphone jack and the analog channels 1 and 2 jacks and DB25 analog out on the rear panel.

Note: While this is indeed the fastest way to get audio going, it is also the most boring. Connecting your Host computer through MHLink is by far the more powerful and expansive interface (and certainly the preferred method), but rest assured the USB connection will take on a much more interesting role later in the Advanced section. Please, do read on.



ULN-8mkIV Routing

Connect the ULN-8mkIV

Install the latest MIOConsole3d installer package from: macOS MIOConsole3d installers (this will require a restart). Please see the section on software installation if you need clarification.

> **macOS Permissions**
> The MHLink Driver runs in macOS user space, so you do not need to approve a system extension, as the old kext driver required. On macOS 13 (Ventura) and later, macOS shows a notification when the driver is installed; you do not need to do anything. To confirm that the driver is enabled, open **System Settings** > **General** > **Login Items** (**Login Items & Extensions** in macOS 15 and later).
>
> The first time MIOConsole3d passes audio, macOS asks whether to let it access the "Microphone". Click **OK**: if you refuse, your recordings are filled with silence. To check it later, open **System Settings** > **Privacy & Security** > **Microphone** and make sure MIOConsole3d is turned on. Before macOS 13 (Ventura), it is in **System Preferences** > **Security & Privacy** > **Privacy** > **Microphone**.

Connect an ethernet cable between the ULN-8mkIV and an available ethernet port on your computer, then in **System Settings** > **Sound** (**System Preferences** > **Sound** before macOS 13) select "MHLink Audio" as the sound input and output.

Get familiar with the front panel

Look at the LED under the Monitor Control encoder; the "Monitor Control" LED should be illuminated. Push the encoder knob (all encoder knobs are also push buttons) to switch the volume knob between controlling your Monitor outputs or the "Headphones" (aka "Cans"). If it is yellow, push the "Dim" button. If it is red push the "Mute" button. Now that you're sure that you're looking at the Monitor Controller and that is not dimmed and unmuted, turn it down. The meters are now showing the gain value of the Monitor Controller. This will happen any time you adjust an encoder.

See the ULN/LIO-8/mkIV Front Panel Guide for the full front panel control breakdown.

Take a listen

With MHLink, you need to launch MIOConsole3d to establish the routing between MHLink and the Analog Outputs on the box. The routing is established automatically as soon as you launch MIOConsole3d.

If you connect with USB, you don't need to launch MIOConsole3d to establish the output routing; it is setup automatically by the box itself.

Note: The ULN-8mkIV default configuration is set to receive audio from channels 1 and 2 from your computer, and play audio out both the headphone jack and analog out channels 1 and 2 from the db25 and 1/4" TRS jacks on the rear panel.

Using Legacy Interfaces
If you wish to compare your new 3d interface with an older "2d" Firewire MIO interface, you can leave it connected as always and run them both at the same time.

All FireWire-based Metric Halo interfaces will operate as fully independent audio devices alongside your Metric Halo 3d Ethernet-based interfaces.

MIOConsole3d



MIOConsole3d ULN-8mkIV default view

MIOConsole3d Default Window Layout

At first launch of MIOConsole3d with your ULN-8mkIV you will be presented with the default layout shown above.

There are a few important things to look at here so let's take a few minutes to familiarize ourselves with the interface/GUI.

First of all, if the Mixer window takes up too much room or appears too small on your screen, select Mixer/Mixer UI Scale from the menu bar and adjust the visual scale of the mixer surface. Note that scaling does not change the size of all of the Mixer strip elements - the fader/meters section remains elastic and will shrink or stretch as other Mixer elements are resized, added or removed. Try selecting the 85% scale setting so you can see what it does.

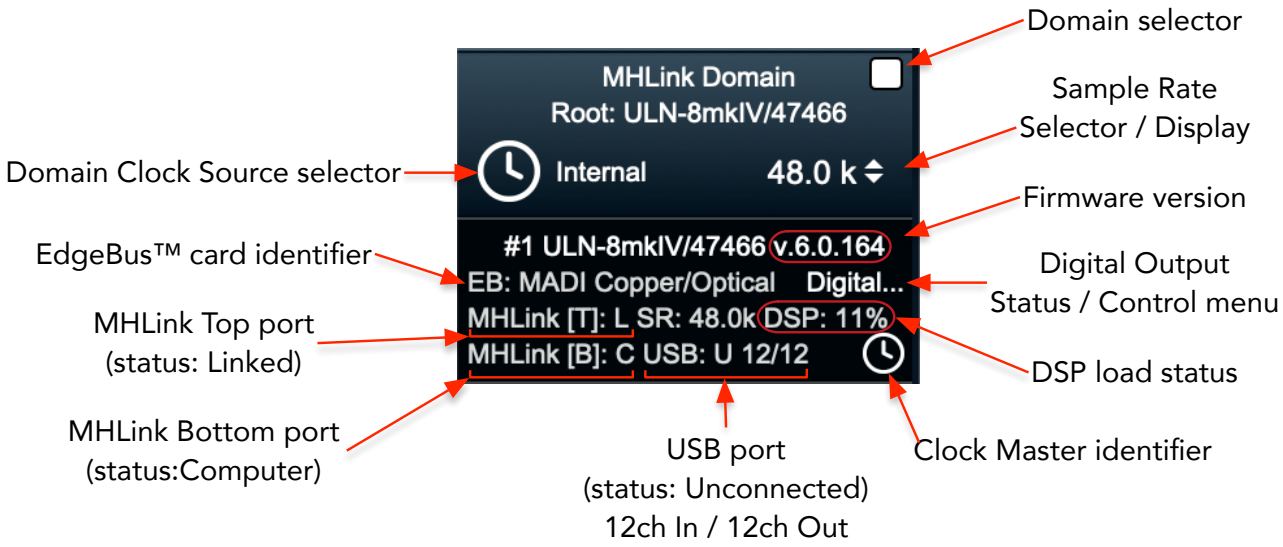
Now resize the Mixer window by grabbing the window corner (or any of the edges) so you can see how the mixer elements react.

You can also change the width of mixer strips (wider strips are helpful to better see 8-channel surround meters) and show or hide any mixer strip UI element. We will explore these features in more detail below.

As you have probably noticed as you check things out in the MIOConsole3d, most elements in the Mixer, Monitor Controller and Cue Controls windows have mouse-over pop-up hints which display expanded details for the button beneath.

The regular mixer surface button labels will often be abbreviated to save space, but the mouse-overs will display all the details of each control setting. This is an especially important feature as you add more boxes to your system domain.

1. In the upper left side of the main mixer window you see the System Status Pane.



ULN-8mkIV System and Unit Status display

The System Status Pane displays critical information for every 3d MH device visible to your computer.

The Status Pane header lists the current MIOConsole version and MHLink Driver version. When the version number turns orange, there is a new version available: click to download and install.

The MHLink Domain "Root" box (your ULN-8mkIV connected directly to the host computer) is listed next and also occupies the #1 spot in the **Unit Status Display** directly below. Click the sample rate indicator to the right select your system sample rate, and the clock icon to the left to set your clock source (currently defaulted to "Internal").

Below the ULN-8mkIV icon is the box ID label and current firmware version. As with the Console and Driver displays in the Status Pane header, when the firmware version turns orange, click to download and install the new version.

Click on the **"Digital..."** label (circled in red below the firmware version) to open the **Digital I/O Status** window for this box.

You'll see a pop-up with that device's type and serial number, with Clock Input Lock status for each of the built-in rear panel AES channel pairs.

This window will also identify any digital audio ports present on an EdgeBus™ (abbreviated "EB") I/O card installed in the rear panel expansion slot, with Output Mode settings appropriate to each digital port format. See the Digital I/O Status / Control Menu section for details.

Other status info shown the example above - the MHLink Top port is Connected, MHLink Bottom port is Unconnected and the USB port is Unconnected. We can also see that the sample rate on the DSP card is 48K, the current DSP load is 10%, and the small clock icon in the lower right indicates that this box is the Clock Master for the domain.

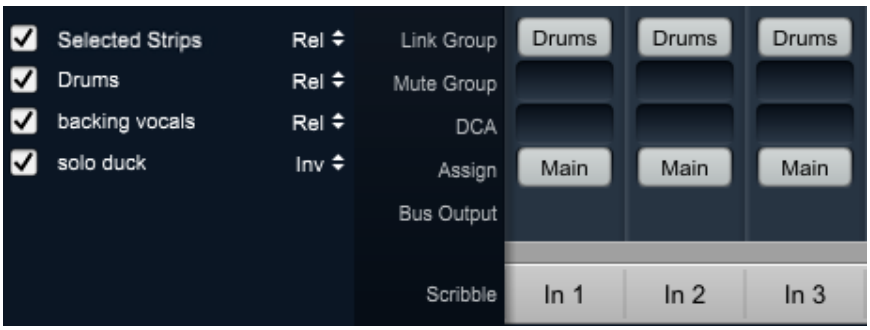
Each 3d box in your domain will have a similar Unit Status Display.

2. Directly below the Unit Status Displays is a currently empty field for Mute Groups controls, which we will get more into later.

3. The Link Groups section, including "Selected Strips", is at the bottom. With "Selected Strips" checked, shift- or command-click to select a few random faders in the mixer. You now have a "Selected Strips" link group of just those selected faders.

   With the "Rel" (as in "Relative") setting selected, it behaves just as one would expect - move one fader and the rest follow.

   Now click "Rel" and select "Inv" (for "Inverse"). In this mode moving one fader causes the other faders in the group to move in the opposite direction.



Link Groups example

   Any Link Groups you create will be listed below "Selected Strips" in this section and can be assigned using the Link Groups selectors in each mixer strip (as illustrated in the example above). Saved Link Groups have additional operational modes, which will be detailed in the dedicated Link Groups section of the manual.

   The visibility of the System Status and Link Groups section of the 3d Console interface can be toggled with the " [" key (or the "Mixer > Show System Status Pane" menu command).

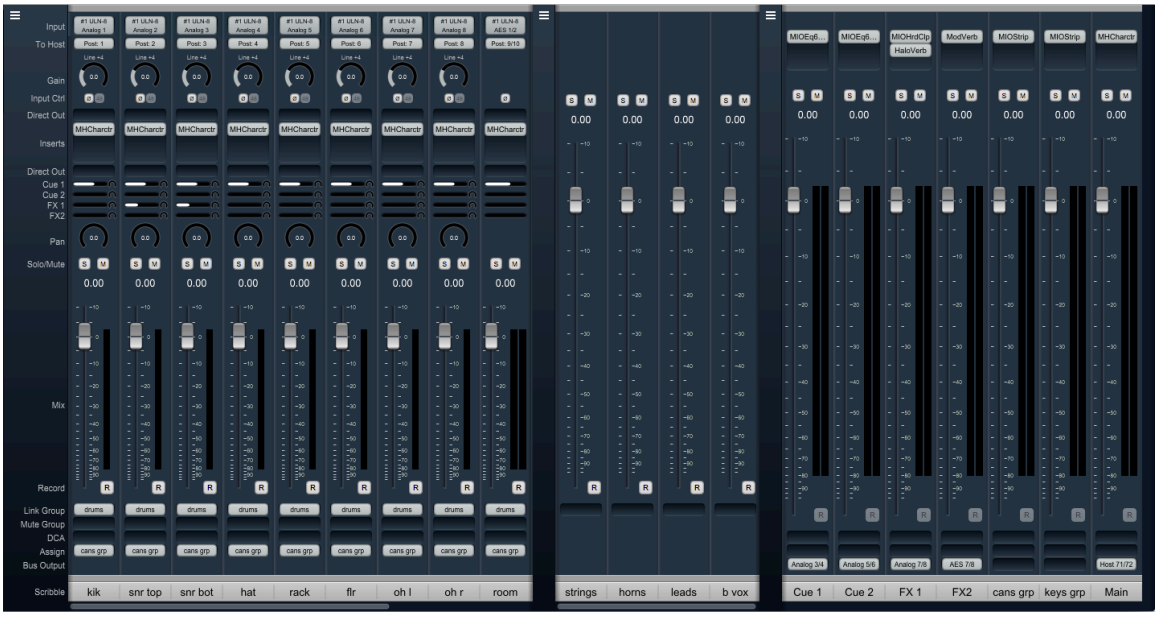
4. To the right of the System Status Pane is the primary default Mixer window.

   There are three "Mix Panes" available to help organize your mixer. Each Mix Pane can show any combination of Input strips, Bus strips (Main, Aux and Group) or DCA strips. Mixer strip layouts (i.e.: which mix desk strip controls are shown) are configured independently for each Mixer Pane, and are controlled from the "hamburger menu" icon in the upper left corner of each Mix Pane. This lets you set up the strips in one Mix Pane for tracking and the same channel strips in another pane for mixing. Additionally, each Mix Pane has its own independent scroll bar.

   In the default view, only Mix Pane 1 is set up and visible - Mix Panes 2 and 3 are currently unconfigured and are accessible by the two "Hamburger Menus" at the far top right of the Mixer window.

   Click on the Mix Pane 1 hamburger menu and uncheck "Show Input Strips" - that hides the Input strips in Mix Pane 1. Now bring them back, and select "Configure Channel Strip Elements...". This sub-window let's you show or hide any of the control elements for the strips within that Mix Pane.

   Click on the Show/Hide box for each of the Strip elements so you can see what happens. This feature allows you optimize your Mixer layout for whatever workflow you may require.



ULN-8mkIV Mixer Panes example

In the example above we have Input strips in Mix Pane 1, DCA strips in Mix Pane 2 and Cue/Effects Aux buses, submix Groups and the Main master bus in Mix Pane 3. As you add Input strips, Aux buses, Group buses and DCA strips to your mixer, tweaking the strip layout across the three Mixer Panes helps you maximize the efficiency of your control surface while conserving valuable screen space.

5. In the upper right of the default layout is the Monitor Controller. This is a separate resizable window from the main Mixer window which can also be set to "float" so it is always visible on your display. Across the top of the Monitor Controller is the Monitor Source selector, showing the Main master bus and the four Aux buses from your default Mixer layout.

   All Monitor Controller Sources and Outputs are completely user-configurable - these are just the default settings.



Monitor Controller

Below the Source selection buttons is the speaker and volume level control/display.

The new 3d Monitor Controller is a vast upgrade to previous versions with its own dedicated DSP processing path and supports all channel configurations from Mono through Dolby Atmos™ 9.2.6.

There is a wealth of knowledge in the Monitor Controller section on how to set up and use the Monitor Controller.

The Monitor Controller window can be hidden by toggling the " m " key. Hold the Option key to engage scroll wheel/two finger scroll control of Monitor Level control. Option-Click returns controls to the default setting.

6. Below the Monitor Controller is the Cue Controls window. This window will expand downwards as you add more Cue Sends.

   You can think of Cues as named sends to physical outputs; they provide advanced routing controls to allow you feed them with the MC source, dedicated buses (for cue mixes) and with a talkback or listen back signal.

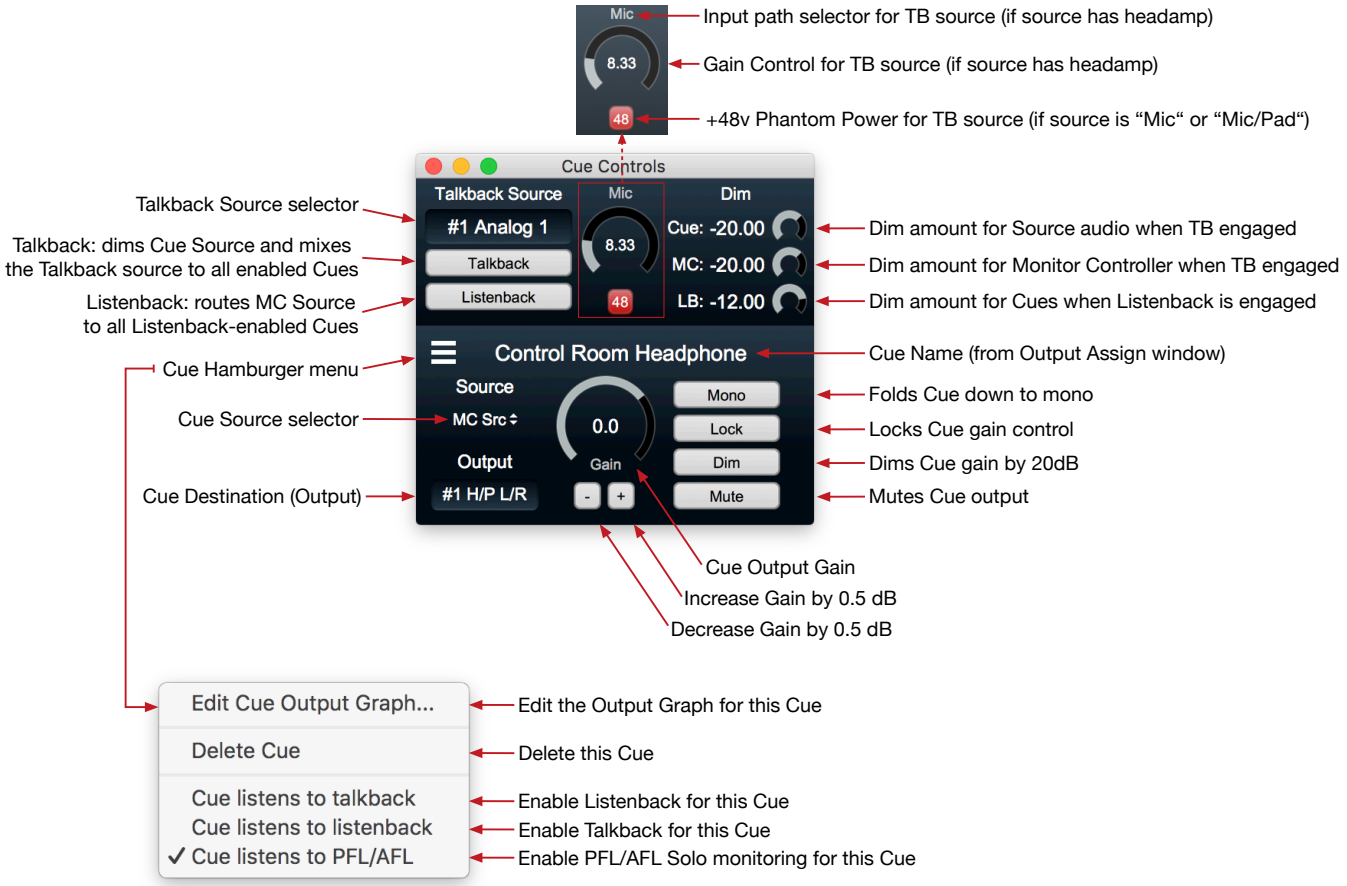
   The Cues give you top level control of the physical output level for each Cue. The controllable routing logic allows you to easily control the source and level of the signals routed to the cues which allows you to use them as a monitoring console for live monitoring and/or as part of a send system for bus output routing.

   By default, there will be one Cue that mults the selected input in the MC and routes to the Headphones of the root box. This mults the selected MC source to both the Monitor output and headphones. You can think of this Cue as your Control Room headphones.

   The Talkback Source at the top of this window can be set to any mono audio input. "Listenback" sends the currently selected Monitor Controller source to all Cue Sends when selected. Multiple independent Cues Sends are fully supported.

   A logical place to start would be to name the first two Aux mix buses "Cue 1" and "Cue 2", then add more Cue and effects mix buses as you build up your session; this allows you to provide independent monitor mixes to performers during tracking.

   Probably the most straightforward application of Cue Sends in an MHLink domain would be have an MHLink box at each musicians' station with one Cue mix output assigned to the headphone jack of each box. That way each person has direct monitoring and their own independent volume control knob with plenty of inputs for their mics and instruments, and it all still appears to the DAW as a single audio device.

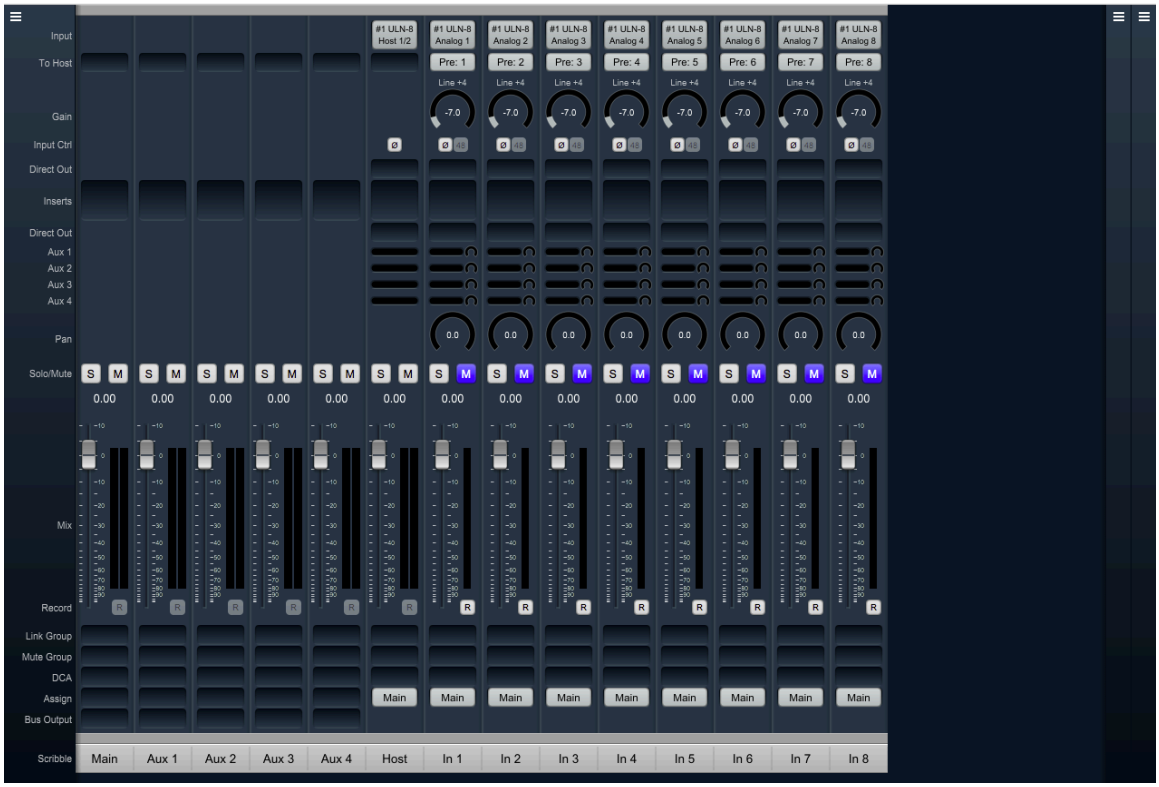


Cue Controller

To add a Cue, hit the “p” key, or go to the Monitor menu and select “Add Cue Controller”. You can delete a Cue from its hamburger menu. The Cue Controls can be hidden by toggling the “c” key. Hold the Option key to engage scroll wheel control of Talkback and Cue Level controls. Option-Click returns controls to the default setting.

Check out the Cue Controller section for more details.

The Mixer window



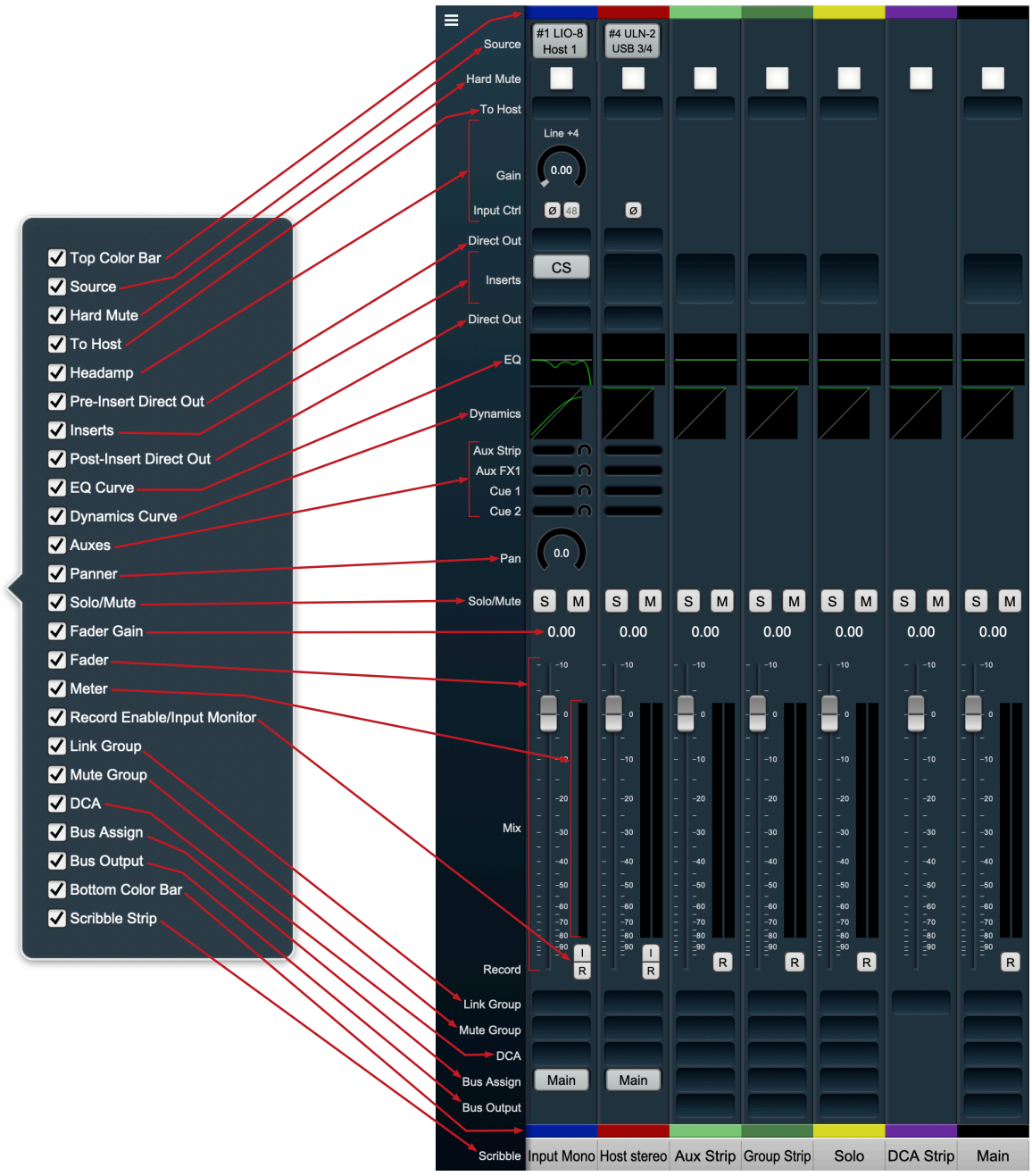
Mixer Window

The Mixer window presents you with the primary mixer interface to the ULN-8mkIV.

Moving from left to right, the default Mixer surface has a stereo "Main" bus, stereo Aux buses 1 through 4, and nine Input channel strips. The first input strip is the "Host", which is a stereo mixer input routed from channels 1 and 2 of your host computer (ie.: channels 1 and 2 from your DAW). The remaining eight input strips are all mono, and are routed from the hardware analog inputs from your ULN-8mkIV.

Let's look at the input strips first.

Input Strips



Mixer Strip elements exposed

At the top of every input strip is the Input Source selector. Click on it to see the Input Source Selector window. Within the Input Source Selector window you can choose the type of inputs you want to select from, show all the inputs from all boxes in the domain or only one box, how many channels you want your new input strip(s) to include, and how many strips you want to create (or modify) with Cascade.

"Hard Mute" is a kill switch at the source of the desk strip designed for live sound applications. "Hard Mute" is hidden and disabled by default.

Analog inputs get a head amp where you can select the input path type, invert signal phase, toggle phantom power and set input gain.

Below the input selector is the "To Host" menu. This lets you set pre- and/or post-insert return paths directly to your Host computer. Since the 3d MIOConsole3d mixer is designed to support hundreds of hardware and Host computer i/o channels, "To Host" is optimized for fast setup of large mixer layouts, and will automatically assign the *next available Host return channel.*

Below the head amp is the pre-insert Direct Out. The Direct Outs can send signal to any physical analog or digital output, as well as provide additional returns back to the Host computer.[1]

Below the Pre-insert Direct Out are the Inserts slots. Here you can insert plugins, route to sends (additional buses), add hardware I/O inserts, call up macros (previously-saved DSP processors) and instantiate custom DSP graphs. The Inserts section expands as you add more processors up to a maximum of ten per strip. To delete an insert, open the Insert selection window and select "None". *Note:* For users upgrading from earlier MIO versions, "Character" has been moved to the Inserts section.

Below the Inserts section is a Post-insert Direct Out. Any signal routed from this Direct Out includes all of your insert processing.

Aux send controls appear below the post-Direct Out. Each Aux has a send level control and (where appropriate) a panner to the bus on each strip.

Aux buses can be named in the "Configure Mixer" window or by double-clicking the scribble field at the bottom of the Aux return strip.

For more precise control of the send levels to an Aux bus, click the name of the Aux bus in the strip legend to the left of the mixer pane. A dot will mark the selected bus name, the gray fader knobs in the main mixer surface will become yellow, and the Aux mix will move onto the main surface.

So, yellow faders in your mixer means you are looking at and controlling an Aux mix, not your main mix. Click the dotted Aux name in the legend again to return to the main mix desk. *Hint:* Aux buses are also used for Cue mix sends.

Panners are next. The panner type configures automatically to match the channel width of the strip to the bus that it is assigned to:

- There are no pan controls on a channel assigned to a mono bus.
- Mono input channels will have a pan knob when assigned to stereo or LCR buses.
- Mono input channels assigned to LCRS through 7.1 buses will have joysticks. Right-clicking on the joystick will allow you to hard assign the input channel to a specific output channel, i.e. Center, Left, etc.
- Multichannel inputs (stereo and above) have no pan control, and are direct routed to the matching channels in the bus.

The fader/meters section dynamically expands and contracts based on the size of the Mixer window and the number of control elements currently visible in the strip. The number of meters will always reflect the number of channels handled in the strip. Meters display "pre-fader" by default, and can be set to read "post-fader" signal in the MIOConsole3d Mixer menu.

All input and bus strips have Solo, Mute and Record Enable buttons.

[1] *Hint regarding Direct Outs:* Use Direct Outs whenever you need to route to a specific-numbered return channel to the Host. "To Host" is designed to automate the addition of many channelstrips in a single step and is sometimes just not the right tool for the job. Using Direct Outs (often coupled with 'Selected Strips' groups and Cascade) to route your Host returns allows you to precisely target specific channels or groups of channels from the MIOConsole3d mixer to your DAW.

Please note that 'Record Enable' is active only if there is audio routed from that strip back to the Host computer either via "To Host" or a Direct Out (the audio you want to record must be routed back to the Host or the Host computer has no way to record it to the hard drive).

Below the fader/meters section are controls for managing assignments for Link Groups, Mute Groups and DCA groups, with Bus Assign selectors (all currently defaulted to the Main bus) as the bottom controls on the input strip. The Assign control is for routing that strip the Main bus and/or any available Group bus.

At the very top and bottom of each strip is a color band (default color: gray) for differentiating strips at a glance. Click on a color band to open the color selector. Setting the color of a strip will apply to multiple strips at once based on either a 'Selected Strips' group or the assigned link group. (Note: Strip colors can be applied to the entire strip as a preference.)

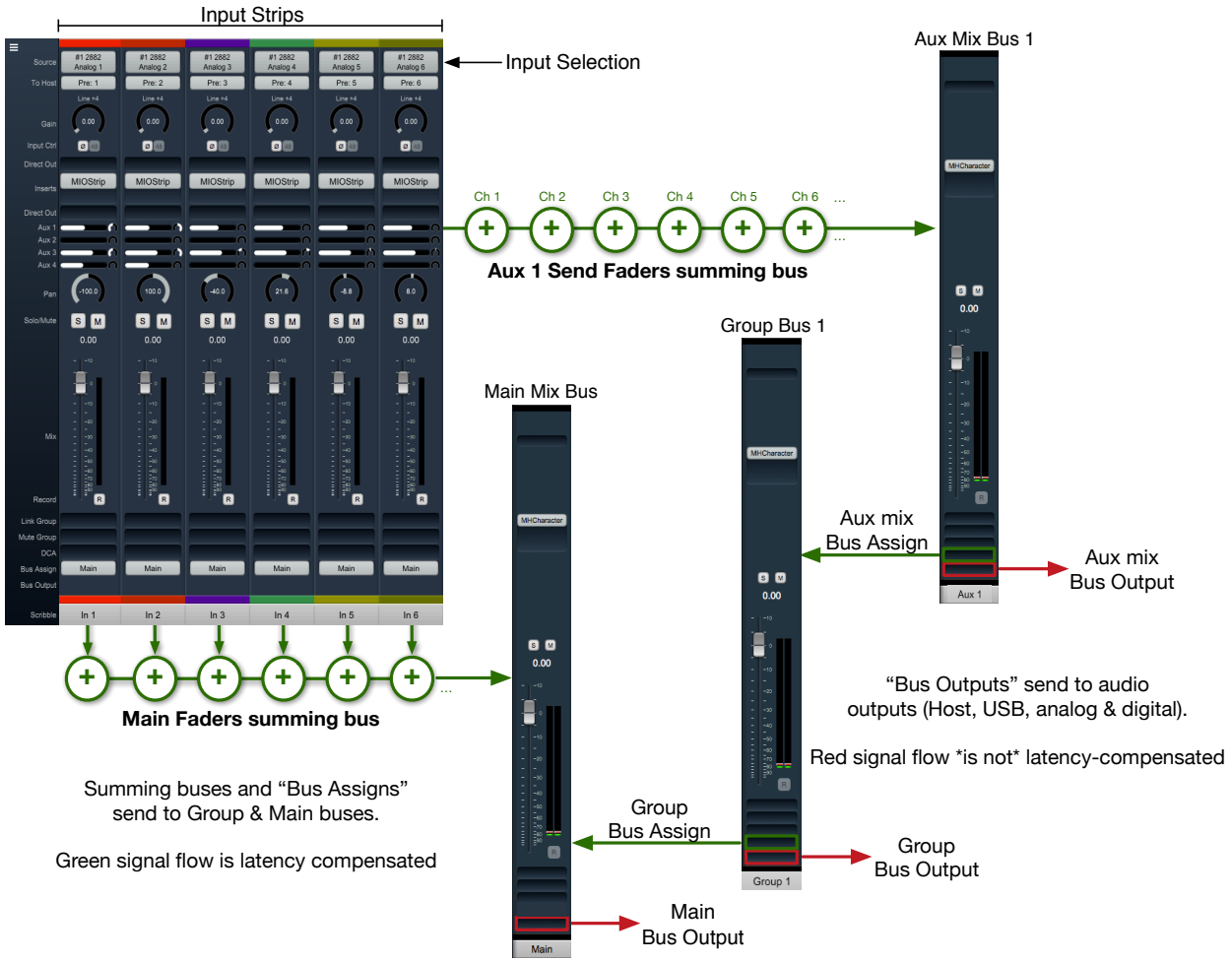
See the Input Strip Details section of the MIOConsole3d overview for more information.

Bus Strips

In the default mixer configuration you have the one stereo Main "master" bus and four Aux bus return strips. These bus strips all have To Host (post-fader only), Inserts, Solo, Mute, Record Enable, Link Group, Mute Group, DCA, and Assign control elements which all work just like the Input strips.

Aux, Group and Main buses have an additional routing selector below "Assign" on the strip called "Bus Output". Use Bus Output to route bus strip outputs to any hardware port or as additional post-fader return routes to the Host computer.

There are two other types of buses which are not shown in the default mixer, but are shown in the "Mixer Strip elements exposed" graphic: Group buses and the Solo bus. The Solo bus appears when a PFL or AFL Solo mode is chosen in "Configure Mixer" (default is Solo-In-Place). Group buses are also created in "Configure Mixer". We will get into more detail on MIOConsole3d busing architecture later but the general flow is:

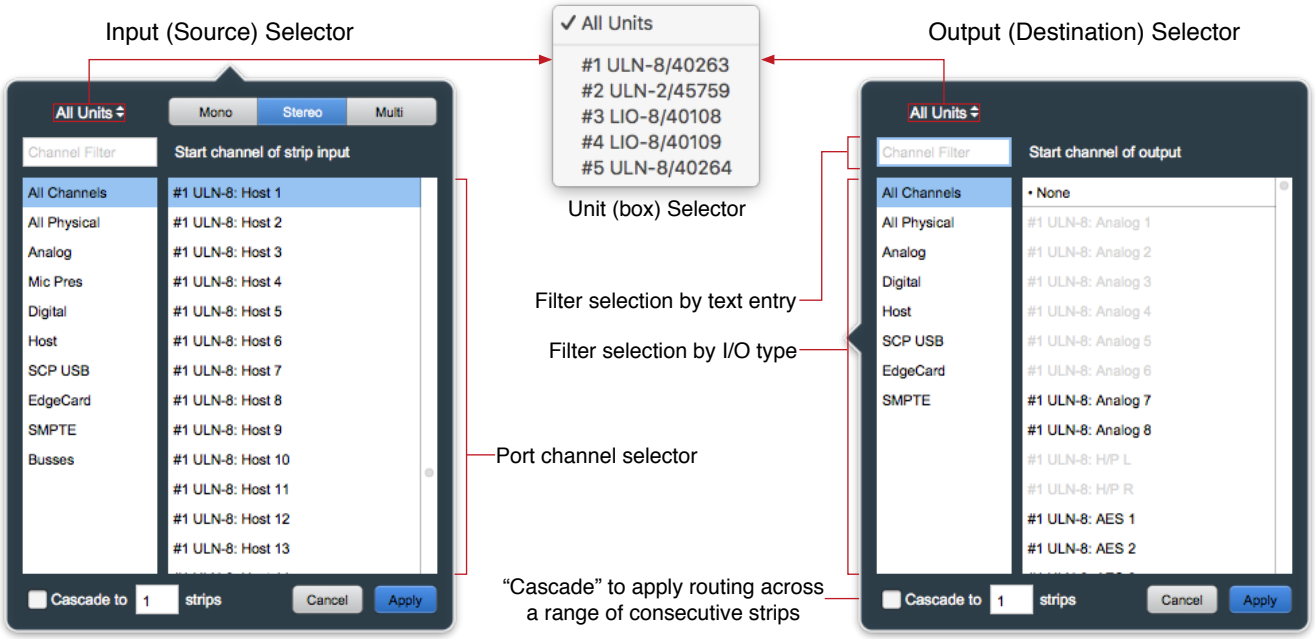


Basic 3d Mixer signal flow

- External audio sources enter the 3d mixer through Input strips. Input strips can send to any output, bus or both. Input strips are internally latency-compensated from their input through their assigned output bus.
- Aux buses include their own fader, pan and mute for each Input strip independently of the Main mix bus. Aux buses are for building a completely independent mix and can be used for effect sends (to be returned to a Group or Main mix bus), or for independent cue mixes (to be routed out to the world). Aux buses are internally latency-compensated when assigned to Group buses or the Main mix bus.
- Group buses are sub-mix buses. All the buses assigned to an input strip (Main + any groups) all share the same fader, mute, and pan settings. Group buses can be routed to hardware ports out to the world, to other Group buses, or the Main mix. Routing through Group buses within the mixer will be internally latency compensated.

The fact that the buses are latency compensated means that you can sum channels to any of the buses, and if you assign one bus to another bus the shared signals will be time-aligned and will not introduce any phasing. You can utilize this to do parallel compression on submix buses or sum in a reverb bus that includes a dry component.

Routing



Input source and Output destination routing selectors

Since 3d/MHLink domains are completely dynamic (in that you can add or remove boxes live, and up to 100m between...) the Input and Output routing selector UIs both offer filter-by-box, filter-by-port-type and text-entry search tools to help manage the madness. Use the "Unit Selector" when you know which box you need when they are in different locations, select by the port type when the boxes are clustered in a rack, or combine search filters at will. Text-entry searches are dynamic - type "tos" and you are presented with every TOSLINK port visible in the domain.

In the above graphic, note that some of the output ports in the Output selector on the right are greyed-out and unavailable. In the case shown, those ports are occupied as a 5.1 Monitor Controller output and a stereo Cue send, both to the ULN-8mkIV root box #1. Automatic direct mults to outputs are not currently supported in MIOConsole3d, but you can always use a Group or Aux bus to accomplish the same thing.

Two things to be aware of when routing in the 3d mixer:

- Routing from a bus output to an Input strip is allowed, but as mentioned in the previous section, will not be automagically latency-compensated.
- Since routing search filters can be combined, typing "tos" to find a TOSLINK port while the "Analog" port type filter is selected will return zero results (because, after all, TOSLINK is a digital port). Best practice is to select "All Channels" or "All Physical" (which includes all regular analog and digital hardware ports, but not Host computer and SCP USB ports) when searching by text.

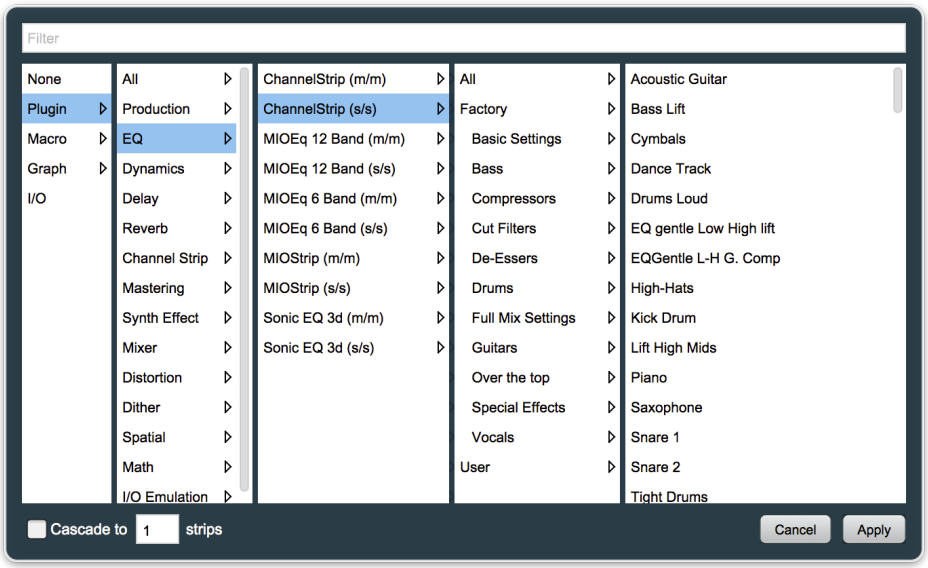
> For more information regarding configuration and routing of ADAT/TOSLINK, MADI and USB ports see the Digital I/O Status / Control Menu and USB Port Status and Configuration sections of the main manual.

Using the Mixer

You should now be in a good position to integrate the ULN-8mkIV with your audio workstation. First, make sure "Main" is selected as the Monitor Controller source. To play it safe (if you haven't already done so),

reduce the Monitor Controller level from its default "0.0" and bring it up after the music starts. Select "MHLink Audio" (or, if you are connecting via USB, "ULN-8mkIV") as your audio interface in your DAW's hardware configuration. To play from your DAW, send your DAW's signal to outputs 1/2 and it will also come into the ULN-8mkIV on the Host 1/2 strip. Hit "Play" in your DAW and enjoy.

Now that you have some tunes going, you might feel like messing around with some insert processes and see what this thing can really do. To get started, go to your Host input strip and click in an Insert slot. The dialog that appears list categories for "Plugin", "Macro", "Graph" and "I/O".



Mixer Strip Insert: Plug-in selector

- Plugin: Includes the 3d-native MH Production Bundle , Sonic EQ 3d and many very useful processor "building blocks". Click the *MH Production Bundle* link above to learn about sharing presets between your Metric Halo AU/VST plug-ins and the 3d DSP versions.
- Macro: Most are essentially presets of more complex process chains in a DSP Graph. Feel free to use these as a starting point to create your own personal custom signal processors. The Reverb macros can not be represented as modules in a normal graph, and can not be modified as-is.
- Graph: A graph is a "DSP playground" where you can build your own signal processing chains and save them for later recall. The MIOConsole3d Graph is arguably the most powerful audio hardware DSP environment available to the public. Creative users have built custom stereo to 5.1 spatial upmix processors, analog tape noise reduction, and multi-layered FOH speaker array time delay and acoustic correction tools, to name just a very few. Graphs can be very simple - just build a quick little tool to do some one-off task not gracefully handled by a packaged plug-in… Graphs are especially spectacular for creating new types of parallel processors because no matter how complex the processing it is all fully internally latency-compensated.
- I/O: A basic signal path insert-within-an-insert, if you will. From within any strip, send to any hardware output or the Host computer and return from any hardware input or the Host. I/O is very useful for an extra Direct Out, as a sidechain source, or for mults to secondary systems (external backup recorder, video truck feed...), etc.

  Note: Since an I/O send/return insert sends audio to external systems outside the mixer DSP and back, I/O loops can not be automatically latency-compensated.

As a reminder, all of the mixing, gain control and processing which is shown and accessed through the MIOConsole3d is operating solely in the box(es) and not on the computer, even though the user interface

for the 3d Mixer is controlled from the computer display. This is an important distinction to keep in mind so you can properly manage your sessions and take best advantage of the strengths of both the DAW and the 3d hardware.

Now let's walk through adding the ULN-8mkIV's eight AES channels into the MIOConsole3d mixer and your DAW. This procedure works with any kind of input from any box in the domain.

First hit command-shift-A to create a new input strip. In the routing window that pops up, select "Digital" from the filter list on the left (to show only the digital inputs), select "AES 1", type "8" in the Cascade box at the bottom of the routing window and hit Apply (or Return or Enter).

With these few clicks, you have instructed the Mixer to create eight new input strips assigned starting at AES Input 1 (i.e.: AES inputs 1-8).

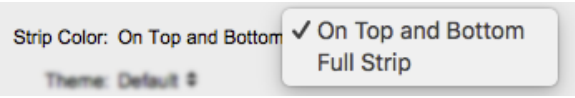
The Mixer defaults to automatically assign routes to the Host computer for each strip, starting with the next available To Host channel... so, since the eight analog input strips are already using To Host routes 1-8, these new strips will use To Host channels 9-16.

Now, go back to your DAW, create eight new input strips in your DAW mixer and assign them to input 9-16. You have built a virtual patchbay routing audio between your DAW and the ULN-8mkIV. You can route pre- and post-insert Direct Outs, Aux buses, Group buses and the Main bus back to the Host DAW in the same way.

To disable any route, just open the routing window and select "None" at the very top of the strip inputs list, or mouse over the strip inputs button and click the "X" to delete that route and free it up for another task.

Mixer Strip Color Bars

Clicking on the Color Bar at the top or bottom brings up a macOS color selector, from which you may choose a color for that Mixer strip. In the Appearance pane of the MIOConsole3d Preferences you may select whether to color the entire mixer strip or just the top and bottom color bars.

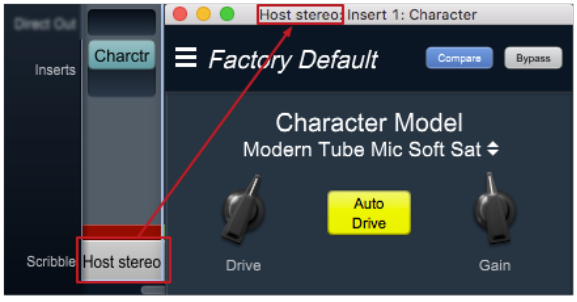


Console3d Prefs: Appearance: Strip Color configurator

The Bottom and Top Color Bars mirror each other, so what applies to one applies to the other. You may show or hide the opt or bottom color bars independently with "Configure Mixer Strip Controls...".

Scribble Strip

Double-click the text field at the bottom of any strip to enter the strips name. The name you enter in the Scribble Strip will be propagated throughout the 3d user interface wherever a Mixer Strip name is found, including plug-in headers, Link Group, Mute Group, DCA and Bus Assign selection windows.

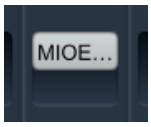


Scribble Strip name to Mixer strip Insert header

Scribble Strip names are also used to name sound files recorded in the Record Panel.

Mixer strip Insert controls

Once you have selected a plug-in, it will be listed in the assigned insert slot:



Inserted MIOEQ6 Plug-in (as shown in Mixer strip)

Plug-in names will generally appear abbreviated in order to save space ("MIOEQ6" is shown above).

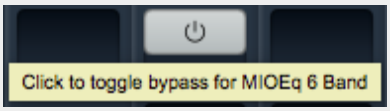
When you move the mouse over an inserted plug-in, the Insert label will change to show three control icons. The tooltips for each of these controls have been exposed in the example graphic below.



Inserted plug-in controls

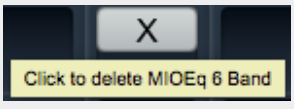
- The "On / Off" switch icon on the left is the plug-in Bypass. When Bypassed, the Insert button will turn yellow.
- Clicking the "..." icon in the middle opens the inserted plug-in editor UI. When the plug-in editor is open/visible, the Insert button will turn blue.
- Clicking the "up/down" arrows icon at the right opens the Insert selector window, where you may select a replacement plug-in, or navigate to directly open a different saved preset without having to open the plug-in editor UI.

Insert Control modifier key shortcuts



"⌘-click" / <Command>-click to Bypass Insert

<Command>-click the Insert button to Bypass the Insert.



<Control-Option-Command>-click to Delete Insert

Use "^⌥⌘-click" / <Control-Option-Command>-click to delete an Insert directly from the Mixer desk.

Quick Copy/Paste Plug-ins

Option-click-drag any plug-in instance from one Insert slot to another anywhere in the Mixer to clone that Plug-in to the new location. Plug-in instances will automatically adapt to the channel width of the target Insert as necessary

"Sweeping" controls

Toggle buttons on consecutive strips in the 3d Mixer desk can be switched in a single move by a click-hold-sweep gesture.



"Sweep" to toggle multiple buttons in one gesture

To try it, click on a Solo button, and while holding the mouse button down, drag the cursor to the right or left across the adjacent Solo buttons.

The move works with Polarity Invert, Solo, Mute and Record Enable buttons.

The ULN-8mkIV and surround

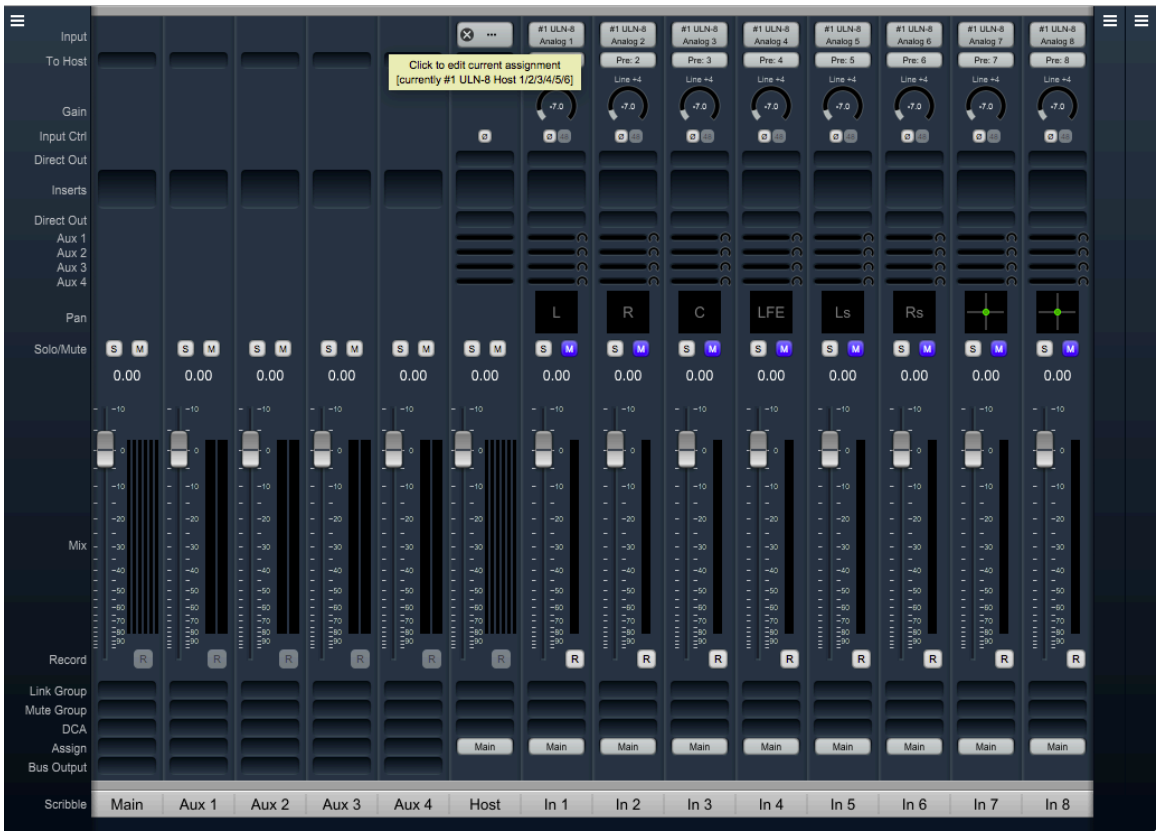
If you are working in surround, it's easy to configure the ULN-8mkIV for surround processing and monitoring. Let's take a minute to walk through the process:

First, go to the Mixer menu and select "Configure Mixer" (cmd-shift-C). This window is the main setup page for your Mixer layout. The Main Mix configuration is set at the top - it is currently set to "Stereo". If you click on the Main Mix selector, you can change it from "Stereo" to whatever width you need.

Let's say you're working in 5.1. Select "5.1 SMPTE/ITU" and hit OK… Voila! Your Main bus is six channels wide and all the mono input channels now have joysticks instead of pan knobs.

Your Host input strip is still bringing your DAW in on just two channels, so let's fix that too. Go to the top of the "Host" input strip and click on the input assignment pulldown. At the top of this window you have the choice of a mono, stereo or a multi-channel strip. Select "Multi" and click "Apply".

Your Host strip is automatically set to match the Main bus configuration of your mixer: in this case 5.1 SMPTE/ITU. Now your audio will come into the ULN-8mkIV in SMPTE surround format as positioned by your host on channels 1 through 6.



Surround Mixer

Your surround mixer should look pretty similar to this. You can right-click (or ctl-click) the panner on the first six mono input strips to hard-assign each strip to a particular speaker channel as is shown on the example above.

Note especially the mouse-over pop-up at the top of the Host desk strip. Ordinarily the text "#1 ULN-8mkIV Host 1/2/3/4/5/6" would be too small to read, so in the interest of saving screen real estate these mouse-overs come in very handy.

If you can afford the space, use the "Mixer - Set Mixer Strips Width" menu to adjust your mixer desk strips' width to taste.

Surround Monitoring Setup

In order to monitor in surround, you need to create a 5.1 output in the Monitor Controller. Go to the "Monitor" menu and select "Add Monitor Output" to get the setup box. You'll see that the "Name" field is already selected, so go ahead and type "5.1" to name the monitor output.

The "Type" selector to the right of this window is where you choose your new Monitor Controller output configuration: Select "5.1 SMPTE/ITU".

To set up 5.1 Monitor Controller outputs, click the Left channel selector (currently set to "None") in the "Destinations" field. The routing box should appear as in the figure below.

If your speaker channels are all in ITU order, you can just double-click "ULN-8mkIV Analog 1" to automatically cascade L, R, C, LFE, Ls, Rs to channels 1, 2, 3, 4, 5 and 6 respectively. Otherwise de-select "Cascade" at the bottom of this window and assign each speaker output individually.

Click "Apply" to route the speaker assignments. Note that you can apply individual level trim and delay for each speaker from this menu, should you desire.

Click "Add" to confirm and establish the new Monitor Controller Output parameters and finish up. You can return to the Monitor Controller Output configuration screen any time by right-clicking the MC output selector, or going to the Monitor menu and selecting "Edit Current Monitor Output".



Monitor Controller speaker assignment

Unleash the DSP

The ULN-8mkIV is based on the 3d processing engine and includes a very powerful arsenal of high-precision audio processing tools. All plug-ins and processors work in any channel configuration and include full parameter save and recall with lots of factory presets to get you started.

There are two ways to access the DSP:

- You can insert processes directly in the mixer strip inserts; this works well for standalone processes like eq, compressors, etc.
- Insert a graph. This lets you chain plugins together, use them in parallel, and create custom processors with routing configurations that would be very difficult (or impossible) with other platforms.

  Graphs are also available in the Monitor Controller and Cue Controller signal path. High-precision room EQ/acoustic correction, custom crossovers and bass management with none of the expense, inconvenience or limitations imposed by running such processes in outboard gear or a DAW monitor bus.

You should definitely check out the following processes:

- MIOStrip: Gating, EQ and compression powerhouse. Very clean, very transparent - put it up against any precision digital mastering hardware and be just a little stunned. Mix it with some Character for a tracking console vibe.
- Character and MHCharacter: The sound of different analog circuits and devices available on any input, output or bus. Both have manual and automatic drive and gain. Character is something of a late 80's/90's animal with an extra lo-fi bite. MHCharacter is geared more towards higher precision, warmth and detail enhancement.
- Haloverb: Great sounding reverb, doesn't use any CPU from your host. What's not to love?
- Transient Control: Super fast, super clean initial strike control.

You should read the DSP Implementation section to learn more about how to work with DSP, and the DSP documentation details the over 100 plug-ins available in the 3d DSP engine.

This should get you started with the ULN-8mkIV!

Additional Resources

The ULN-8mkIV is an exceptionally deep product, and there are many features, applications and workflows to discover. We have published a series of technical notes and tutorial movies that go in depth about the Mobile I/Oplatform. Please take a look at them to learn more about the ULN-8mkIV: https://mhsecure.com/metric_halo/support/tutorials.html

2. ULN-8mkIV Users Guide

ULN-8mkIV Overview



ULN-8mkIV

What it is

The ULN-8mkIV is a portable, archival–quality, modular multi-format audio converter, interface, and processor for professional audio applications. The ULN-8mkIV is equipped with eight balanced mic inputs, eight balanced line inputs, eight channels of AES digital I/O, eight balanced sends and eight balanced analog outputs, as well as wordclock in/out, MIDI in/out, SMPTE in/out.

Host computer connection and box daisy-chaining are provided by two MHLink Gigabit Ethernet ports, each of which support 128 channels of bidirectional audio at 192khz/32 bit data rate. A UAC2 class-compliant USB-C connection is available as an alternative computer interface.

All inputs and outputs are capable of 24-bit/192kHz operation.

What it has

- Improved Sound Quality at all sample rates - Warm, open, even more detailed and musical (more soul)
- Full 32 bit/192kHz transport via MHLink
- 44.1, 48, 88.2, 96, 176.4, 192kHz Sampling Rates
- 8 channels of 24 bit A/D converters
- 10 channels of 24 bit D/A converters
- Single-sample a/d and d/a converter latencies
- 8 Balanced Microphone Inputs with switchable phantom power – DB25
- 8 Balanced Line Inputs – DB25
- 8 Balanced line level Sends – DB25
- 8 Balanced Analog Outputs – DB25, channels 1 and 2 multed on 1/4" TRS
- Integrated hardware relay mutes for analog outputs (no more power on/off noises)
- Analog I/O loops through converter stages tightly calibrated to unity gain
- 8 channels of AES I/O, single wire for 44.1-192KHz operation - DB25
- 2 channels of audiophile-grade DI available on the front panel - 1/4" TRS
- Front panel headphone output with highest-grade discrete D/A and amplification - 1/4" TRS
- Word Clock 1x on 75ohm terminated BNC

- SMPTE I/O on 1/4" TRS
- MIDI I/O on 5-pin DIN
- MH EdgeBus programmable and pluggable audio expansion slot.
- Enhanced processing power with massive hardware memory. All 3d hardware includes over a hundred DSP plug-ins and the unique Metric Halo Graph environment within the 3d mixer.
- Reduced Power Consumption (uses 35-40% less power than the previous generation ULN-8)
- Reduced heat generation (runs much cooler, allowing for tighter racking configurations without fans)
- 128 input x 64 bus (at all sample rates) multi-box unified zero-latency mixer
- 1024 x 1024 internal audio routing matrix (per box)
- Front Panel Metering for Analog Inputs and Outputs on 15 segment multicolor LEDs
- Front Panel multicolor LEDs for AES I/O: Signal Present, Lock and Clock Status
- 9 detented Front Panel encoders
- Full console metering of every channel and mix bus
- Total recall of every console parameter
- Portable Capabilities – Battery Powerable
- Rack Mount Kit

Options (can be installed before or after purchase)

- Metric Halo Edge Card expansion modules
  Click here for more information on the available Edge Card configurations

What you need to use it

- Computer:
  - For MHLink: any Apple Silicon Mac, or any Intel Mac running macOS 10.11.6 or later, with a dedicated Gigabit Ethernet port. MHLink connection through IP switches and routers is not supported.
  - For USB audio: any computer, tablet or phone that supports USB UAC2 class audio. See USB UAC2 Class Audio Port Compatibility in the User's Guide.
  - Cat 5e or better cable (with all 8 conductors). Cat 6 or better recommended for MHLink runs over 75 meters.
- Gigabit Ethernet adapters supported for MHLink:
  - The Sonnet Thunderbolt AVB Adapter, a bus-powered Thunderbolt Gigabit Ethernet adapter.

    If you still have Apple's Thunderbolt to Gigabit Ethernet Adapter, you can keep using it: Apple no longer sells it, but it is still a recommended adapter. On a Mac with USB-C Thunderbolt ports, connect it through Apple's Thunderbolt 3 (USB-C) to Thunderbolt 2 Adapter.
  - PCIe Gigabit Ethernet Adapter
  - Third-party Thunderbolt Gigabit Ethernet Adapter (e.g. as part of a dock)

  USB-based Gigabit Ethernet adapters are not supported for MHLink.

- Software: all Core Audio compliant software is compatible with both MHLink and USB audio, including:
  - Cubase
  - Digital Performer
  - GarageBand
  - iTunes
  - Live
  - Logic
  - Nuendo
  - Pro Tools
  - Studio One
  - Reaper
  - MixBus / Ardour
  - and hundreds more…

What comes with it

Your ULN-8mkIV package contains the following items:

- One ULN-8mkIV unit:



ULN-8mkIV Unit

- One IEC Power Cord appropriate for your area
- One 18-volt 48-watt world-ready external power supply
- One 12" CAT-5e Gigabit Ethernet Cable
- One 14' CAT-5e Gigabit Ethernet Cable
- Two Rack Ears w/ fasteners
- Jumpers for internal configuration
- Warranty/Registration Card

If any of these items are missing from your package when you open it, please contact Metric Halo or your dealer immediately for assistance.

Using the ULN-8mkIV Hardware

ULN-8mkIV Front Panel



ULN-8mkIV Front Panel

The front panel provides ULN-8mkIV system control and status at a glance:

- Power switch for rear 4 pin XLR connector (jumper defeatable)
- Sample Rate (nominal 44.1, 48, 88.2, 96, 176.4 or 192KHz)
  - The Sample Rate is determined from the currently selected clock source so it will accurately indicate the current sample rate, even when the clock source is being provided by an external device.
- Clock source:
  - Internal indicates that the system is internally clocked
  - Wordclock indicates that system is being clocked from the wordclock input
  - Digital In indicates that the system is being clocked from the selected digital input
- Encoders - Eight detented encoder knobs for multipurpose control, with push-switches.
- Control Mode — Indicates what parameters the encoders are modifying:
  - Monitor - Select the Monitor Controller input or output
  - Preset - Recall one of the eight stored system configurations
  - Input - Step through the available input sources
  - Link - Link multiple input and output encoders for stereo or multichannel use
  - +48 - Enable phantom power, per channel
  - U/M - User mode (for future expansion)
- I/O Trim — Indicates whether you are modifying input or output channel gain.
- Input Status - Indicates mic input, line input or mic s/r by channel.
- 15-segment metering for the 8 analog inputs and outputs using multicolor LEDs, which also display gain values during encoder use. The meters are fast PPM peak reading meters with auto-resetting peak holds.
- SysLock — Indicates that the system clock recovery circuit is properly locked to the selected clock source. If this light is not illuminated, the ULN-8mkIV will not be locked to a clock and will revert to its failsafe internal clock source. Even if the Locked light is not illuminated, the actual sample rate will still be indicated on the front panel display.
- Computer — Indicates that the ULN-8mkIV has been successfully connected to either a USB or MHLink Gigabit Ethernet connection to the Host computer. (Labeled as **Firewire** on older upgraded units)

- Signal present indicators for AES input and output, as well as digital lock and cable select button and indicators.
- Monitor Control Section:
  - The Mute and Dim buttons provide instant access to simple level control for the selected Monitor path or headphone output. The Mute button provides a quick, tactile “panic switch” which mutes the monitors or front panel headphone output in case of accidental feedback loops and other audio unpleasantries. The Dim button attenuates the selected path by 20 dB.
  - The Monitor Control encoder provides front panel adjustment for your audio. By pressing the encoder, it can toggle between affecting the Monitor Control section or Headphones. There are two multicolor LEDs below the encoder that indicate which path the encoder is modifying as well as mute and dim status.

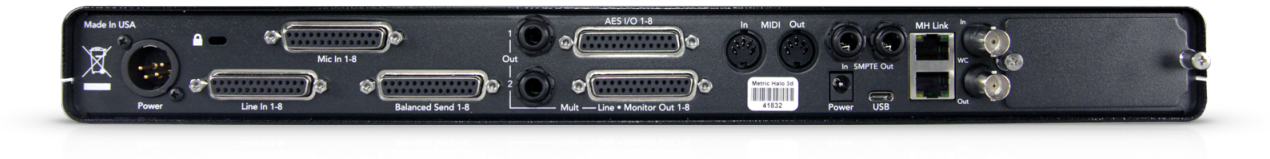
The ULN-8mkIV front panel also provides access to the Headphone output. The headphone output jack is a TRS 1/4" jack that provides the Left Channel on the tip, the Right Channel on the ring and the ground return for the two channels on the sleeve. These signals are all ground referred, so they may also be split and fed single-ended (unbalanced) to an external audio device.

The ULN-8mkIV headphone output is suited to a wide range of impedances. Headphones with lower impedance would be expected to get louder than those with higher impedance.

There are two DI inputs on the front panel, which are paralleled with Line inputs 1 and 2. The DI inputs can provide 0, 10, or 20db of gain selectable via internal jumpers.

More information regarding the front panel can be found in the ULN/LIO-8 Front Panel Guide.

ULN-8mkIV Rear Panel

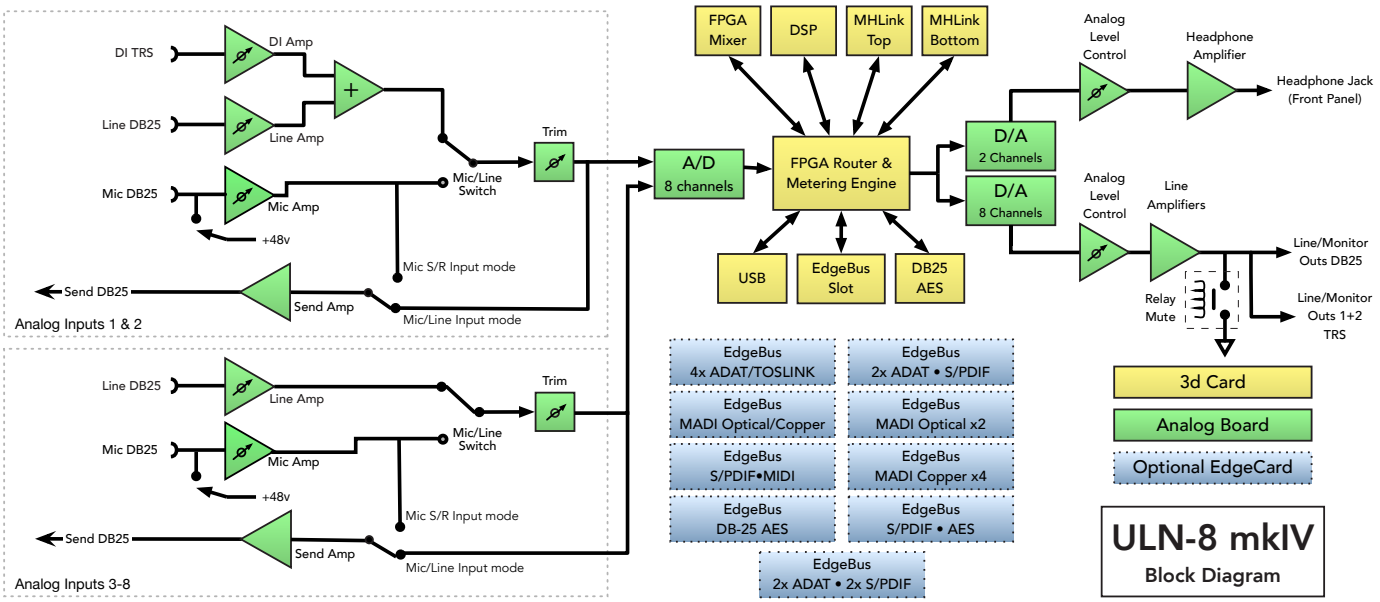


ULN-8mkIV Rear Panel

The ULN-8mkIV rear panel features:

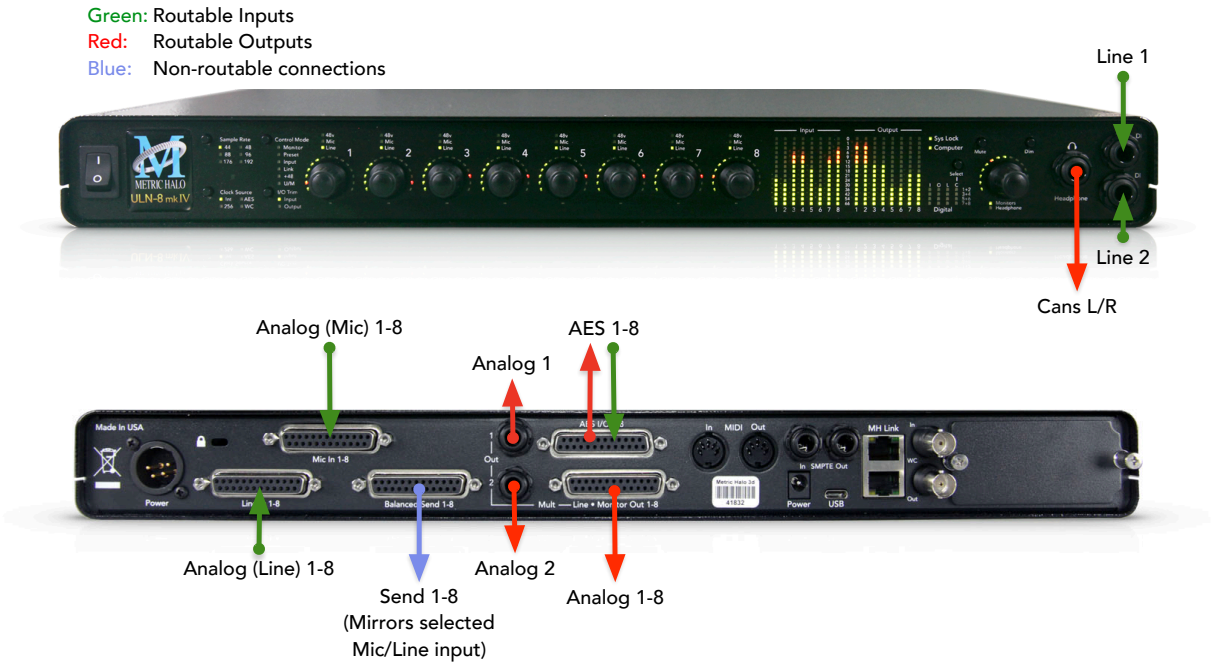
- 4 pin XLR DC power jack (14v - 28v, 32 Watts)
- 8 channels balanced mic inputs on DB25. Each input has:
  - -22 dB to +91.5 dB of gain range
  - Dynamic Range (-60 dB, flat 0-22.05 kHz, typ): 115 dB
  - +0/-1.0dB @ fs = 192KHz: 2.9 Hz - 64.7 kHz
  - Noise Floor (flat 0-22.05 kHz, typ): 115 dB
  - remote switchable 48v Phantom power, with 10mA current limit
- 8 channels balanced line inputs on DB25. Each input has:
  - -12 dB to +31.5 dB of gain range
  - Dynamic Range (-60 dB, flat 0-22.05 kHz, typ): 115 dB
  - +0/-1.0dB @ fs = 192KHz: 1.8 Hz - 64.7 kHz
  - Noise Floor (flat 0-22.05 kHz, typ): 115 dB
- 8 channels balanced line level sends on DB25 that mirror the selected input
- 8 channels balanced line/monitor outputs on DB25. Each output has:
  - 24-bit 192kHz D/A converters (120dB SNR)
  - Gain range from -96 dB to +30 dB
  - Outputs 1 and 2 also multed to 1/4" TRS connectors
- 8 channels AES digital I/O on DB25
  - Single wire mode for full 8 channels at 44.1-192KHz operation
- Wordclock input/output on BNC connectors
- MIDI I/O to connect a control surface to MIOConsole3d
- SMPTE input and output on 1/4" TRS
- 2 MHLink Gigabit Ethernet ports
- 1 USB-C port
- Kensington security slot
- 1 4-pin XLR power port, switched, compatible with any 4-pin XLR power system with the following characteristics: 9v - 30v DC, Pin 4 Hot, 15 Watts

ULN-8mkIV 3d Signal Flow



ULN-8mkIV 3d Signal Flow

Making connections to the ULN-8mkIV



ULN-8mkIV Routing

Click here for more information on the available Edge Card configurations

There are eight classes of connections you can make to the ULN-8mkIV hardware:

1. Gigabit Ethernet (MHLink)
2. USB
3. Analog Audio
4. AES Digital Audio
5. Clock Sync
6. MIDI
7. SMPTE
8. Power

Computer Connections

- **MHLink (Gigabit Ethernet)** - The preferred method of connecting your computer to the ULN-8mkIV (or any Mobile I/O 3d audio device) is with a Gigabit Ethernet cable to one of the MHLink ports. This method enables the full capabilities of the 3d/MHLink environment with 128 channels at 32bit integer resolution input and output at all sample rates up to 192kHz. Daisy-chaining additional MHLink boxes dynamically and transparently integrates the new devices into the currently-running 3dConsole mixer, making all the added I/O ports and DSP engine power immediately available for use.

  MHLink requires the installation of the MHLinkDriver software. The latest MIOConsole3d installer package is available from: macOS MIOConsole3d installers (this will require a restart). Please see the section on software installation if you need clarification.

  > **macOS Permissions**
  > The MHLink Driver runs in macOS user space, so you do not need to approve a system extension, as the old kext driver required. On macOS 13 (Ventura) and later, macOS shows a notification when the driver is installed; you do not need to do anything. To confirm that the driver is enabled, open **System Settings** > **General** > **Login Items** (**Login Items & Extensions** in macOS 15 and later).
  >
  > The first time MIOConsole3d passes audio, macOS asks whether to let it access the "Microphone". Click **OK**: if you refuse, your recordings are filled with silence. To check it later, open **System Settings** > **Privacy & Security** > **Microphone** and make sure MIOConsole3d is turned on. Before macOS 13 (Ventura), it is in **System Preferences** > **Security & Privacy** > **Privacy** > **Microphone**.

  Note: With MHLink, you need to launch MIOConsole3d to establish the routing between MHLink and the attached box(es). The routing is established automatically as soon as you launch MIOConsole3d.

- **USB** - The secondary method of connecting to your ULN-8mkIV is with USB. USB connections for audio transport will be limited compared to MHLink. In a pinch, however, your ULN-8mkIV can be seen as an audio device by any computer with a UAC2 class-compliant USB port.

  Note: Connecting to USB does not require the installation of a software driver. See MIOConsole3d Preferences > Discovery before connecting USB to a computer which is also connected to an MHLink ethernet interface.

Analog Audio Connections

The analog I/O connections on the ULN-8mkIV have been engineered for maximum flexibility in that they support both balanced and unbalanced connections with a wide range of input and output levels and a wide range of matching impedances. The microphone inputs have an impedance of 3.3k Ω, and the line inputs are 10k Ω. With that in mind, there are a number of aspects of the design that you should take into account when interfacing with the ULN-8mkIV. All multichannel audio connections are made using industry standard DB25 connectors, which are pin-compatible with cables using the Tascam/Digidesign standard.

Wiring details for this connector can be found in the DB25 Pinouts appendix.

Whenever possible, use balanced connections with the ULN-8mkIV. The performance of balanced interconnects is much higher and much more resistant to noise interference and electrical (power) wiring problems. The expense of balanced interconnects is not substantially higher than unbalanced connections, so if the gear that you are interfacing with supports balanced connection — use it. If you cannot utilize balanced interconnects, there are connection schemes that you can use that will maximize performance.

On input, at line level, it is sufficient to simply use standard unbalanced (TS) connections. If you are interfacing with the Mobile I/O XLR inputs, you will need to ensure that pin 3 is grounded in the unbalanced adapter cable. More information about adjusting the input level can be found in the MIOConsole3d software chapter.

ULN-8mkIV DB25 cables should be wired pin 2 or Tip hot. The front and rear 1/4" connectors are wired Tip hot. The headphone connector is wired Tip/Left, Ring/Right, Sleeve/Ground.

Connecting to the DIs

The DI inputs provide an excellent high impedance input for directly connecting instruments to the ULN-8mkIV. These inputs are unity-gain summed with the corresponding line input from the back panel. This means that if you have signal connected to both the DI and line input for a given channel the ADC will see a mix of those two inputs. If you do not wish to have signal from one of the connectors you need to physically disconnect that input or otherwise ensure that no signal is present at the unused input.

You may notice that the MIOConsole3d has an input selection for “Inst”. This can be used as a visual reminder that you are plugged into the DI, but has no operational effect on the input. Selecting “Inst” on any channel of the ULN-8mkIV sets the input to Line +4; the only DI inputs are the front panel jacks for inputs 1 and 2.

Each DI input supports balanced connections via TRS cable. You can connect a source to the DI via a balanced interconnect (if the source is actually a balanced output), an unbalanced interconnect (if the source is unbalanced like most instruments), or a telescoping shielded cable (which is an alternate unbalanced connection that provides additional shielding).

Since the DI inputs provide an ultra-high input impedance, if you connect an unbalanced source to the DI via a balanced cable you will float the negative input and will effectively inject a large DC offset into the output of the DI which will cause the associated ADC to mute. As a result you must use either a TS cable or a telescoping shield cable with unbalanced sources.

When you remove the connector from the DI jack, the DI connects its inputs to ground internally to remove any possible residual DC offset or pickup noise. If you disconnect the cable from the source but leave it connected to the DI input, the cable will function as an antenna and will inject noise into your inputs and may cause enough of a DC offset to mute the ADC. As a result you should always disconnect the cable from the DI rather than the instrument.

Balanced Sends and Mic S/R Mode

The ULN-8mkIV has eight balanced sends; these mirror the analog input you have selected to feed that channel’s A/D converter. For example, if you select the Mic input on analog channel 1, the output of that mic preamp will be available at send 1. If you select the Line input on analog channel 1, the Line in signal

will be available at send 1. This allows you to use the sends as a splitter to feed a mixing console, recorder or other equipment.

Using analog inserts on the ULN-8mkIV
The "Mic S/R" input mode creates pre-converter inserts on a per-channel basis by utilizing the Mic input as the channel input and Line input as the insert return. For example, to insert a compressor on Analog 1:

1. Set Analog 1's input type to Mic S/R
2. Connect your signal (mic or line level) to Mic input 1
3. Connect Send 1 to your compressor's input
4. Connect your compressor's output to Line input 1

You have now inserted your compressor between the output of the mic preamp and the A/D converter.

You cannot route signal from a DAW channel to the balanced sends; to route signals from your computer to the D/A converters, you must use the Line/Monitor outputs.

AES Digital Audio

The ULN-8mkIV supports 8 channels of digital audio over copper-based connections. The native format of the ULN-8mkIV is AES, but can be converted to SPDIF or optical using third-party adapters. The ULN-8mkIV operates in single-wire mode, providing 8 channels of digital audio at all sample rates. The ULN-8mkIV's digital I/O connections are made using industry standard Tascam/Digidesign pinout DB25 cables.

Wiring details for this connector can be found in the DB25 Pinouts appendix.

Digital audio interface options can be greatly expanded through the addition of a Metric Halo EdgeCard™.

Clock Sync

Clock sync is a serious consideration in any digital audio system.

If you are recording analog sources with ULN-8mkIV, you can simply use the unit's high-quality internal clock source to drive the converters. This is the easiest case to deal with.

If you need to interface with other devices digitally or ensure sample accurate sync with video sources, the extensive clock synchronization capabilities of ULN-8mkIV will prove to be more reliable (and better sounding) than much higher priced alternatives.

There are three different ways to get external clock information into the unit:

1. Sending a word clock signal into the WC Input BNC.
2. Sending an AES signal into the Digital input.

The BNC word clock input port is a 75 Ohm terminated coaxial input. It should be driven by a 75 Ohm source driver and interconnected with 75 Ohm coaxial cable. If you do not use proper cabling and source drive, you will introduce reflections on the word clock cable which will propagate jitter into the recovered word clock.

The AES recommended procedure for distributing clock is to use an AES clock signal. The AES clock signal is an AES digital audio signal with no audio activity. The ULN-8mkIV only uses the AES preambles for clock recovery, so it is immune to data dependent jitter effects. This means you can reliably use the Digital Input as a clock source with or without audio data.

MIDI

The ULN-8mkIV offers MIDI input and output ports for direct connection of a control surface. These ports are only active while MIOConsole3d is running; the ULN-8mkIV cannot utilize a control surface in standalone operation. MIOConsole3d makes these ports available to other applications while it is running, but the MIDI implementation is currently optimized for control use only - it is not recommended to use these ports for connecting keyboards or other devices that require accurate timing.

SMPTE

The ULN-8mkIV has SMPTE input and output ports dedicated for timecode use. The SMPTE input and output are routed from the "SMPTE" category in the MIOConsole3d Source and Destination routing menus. Please note that MIOConsole3d does not natively decode or encode MTC at this time; if you need to synchronize to MTC, you will need third party software.

Power

One of ULN-8mkIV's great strengths is the flexibility of its power system. The ULN-8mkIV can be powered from any DC source in the range of 14V to 28V as long as it provides 32 Watts of power. The DC inputs on the ULN-8mkIV are a 2.1mm coaxial power connector, center positive and a 4-pin XLR connector Pin 4 Hot. So if you are powering the unit with a third party power source and it supplies 14V, the power source will have to provide 2.3 amps of current. If you are powering the unit with 24V, the power source will have to provide 1.3 amps of current, and so on.

The ULN-8mkIV ships with a world-ready 18 volt, 2 amp power supply. You can plug this supply into any AC power source from 90V to 240V, 50Hz - 60Hz, using an appropriate IEC power cord, and it will supply the proper power to the ULN-8mkIV on the 4 pin XLR power connector. Unfortunately, the power capacity supplied through a USB bus is insufficient to power a ULN-8mkIV.

As with all electronic devices, when connecting an external power source to the ULN-8mkIV, you should first connect the power source to the ULN-8mkIV while it is in an unenergized state (e.g. not connected to the mains or switched off). After the connection to the ULN-8mkIV has been made, you should energize the power source.

If you connect an energized power source to the ULN-8mkIV's 2.1mm power connector you may see a small spark when you make the connection. This is due to surge current and is normal if you connect a power source in this way. While this will not damage the ULN-8mkIV in any way, to avoid the spark just connect the power connector to ULN-8mkIV before connecting the power source to the wall.

ULN-8mkIV Specifications

Rails	
Preamp Rails	±15.8 Volts
Analog Rails (low power)	±9.9 Volts
Analog Rails (high power)	±12.6 Volts
Phantom Power	48 ± 0.1 Volts
Max Phantom Current Per Mic	10 ma

Table 2.1. ULN-8mkIV Voltage Rails

Maximum I/O Levels (Balanced)	
Peak Line Output @ 0 dBFS (no jumper/low power)	+18.5 dBu
Peak Line Output @ 0 dBFS (output jumper/low power)	+22.0 dBu

Maximum I/O Levels (Balanced)	
Peak Line Output @ 0 dBFS (output jumper/high power)	+24.5 dBu
Analog Send Max Output	+21.5 dBu
Mic Pre Max Input	+20 dBu
Line In Max Input	+24.5 dBu
Output Impedance	5 Ω

Table 2.2. ULN-8mkIV Maximum I/O Levels (Balanced)

Monitor Controller	
Nominal FS output (Balanced) Output Jumper Off	-19.0 dBu
Nominal FS output (Balanced) Output Jumper On	-12.0 dBu
Maximum Output	Same as Line
Gain Range	-96 dB to +30 dB
Gain Precision	±0.05 dB
Gain Step	0.5 dB

Table 2.3. ULN-8mkIV Monitor Controller

Mic Pre Input + ADC	
Input Impedance	3.3k Ω
Dynamic Range (-60 dB, flat 0-22.05 kHz, typ)	115 dB
Dynamic Range (-60 dB, A-weighted, typ)	118 dB
Noise Floor (flat 0-22.05 kHz, typ)	115 dB
Noise Floor (A-weighted, typ)	117.9 dB
Gain Range	-22 dB to +91.5 dB
Gain Precision	±0.05 dB
Gain Step	0.5 dB
THD D/A/A/D loop @ -12 dBFS	0.0007 %
THD D/A/A/D loop @ -12 dBFS +12 dB Gain	0.0015 %
THD D/A/A/D loop @ -0 dBFS	0.0023 %
Crosstalk @ 1kHz	-110dB
IMD 1k component (19 kHz/20kHz @ +8dBu)	-104 dBu
EIN @ 60 dB Gain (150 Ω Source Impedance)	-130.50 dBu
EIN @ 60 dB Gain (0 Ω Source Impedance)	-133.25 dBu
Analog Send Calibration (ADC = 0 dBFS)	+21.5 dBu
Phantom Power (Switchable Per Channel)	+48 Volts

Table 2.4. ULN-8mkIV Mic Pre Input + ADC

Mic Pre + ADC Frequency Response	
+0/-0.1dB @ fs = 44100 Hz	8.9 Hz - 20.5 kHz
+0/-1.0dB @ fs = 44100 Hz	2.9 Hz - 21.0 kHz

Mic Pre + ADC Frequency Response	
+0/-0.1dB @ fs = 96000 Hz	8.9 Hz - 43.9 kHz
+0/-1.0dB @ fs = 96000 Hz	2.9 Hz - 45.4 kHz
+0/-0.1dB @ fs = 192000 Hz	8.9 Hz - 42.1 kHz
+0/-1.0dB @ fs = 192000 Hz	2.9 Hz - 64.7 kHz
5° low-end in-channel phase deviation point	20.0 Hz
Interchannel phase 0 Hz - 20 kHz	< ±0.05°
Crosstalk from SMPTE Input	< -142 dB

Table 2.5. ULN-8mkIV Mic Pre + ADC Frequency Response

Line Input + ADC	
Input Impedance	10k Ω
Dynamic Range (-60 dB, flat 0-22.05 kHz, typ)	115 dB
Dynamic Range (-60 dB, A-weighted, typ)	118 dB
Noise Floor (flat 0-22.05 kHz, typ)	115 dB
Noise Floor (A-weighted, typ)	117.9 dB
THD D/A/A/D loop @ -12 dBFS	0.0005 %
THD D/A/A/D loop @ -0 dBFS	0.0015 %
Crosstalk @ 1kHz	-127 dB
IMD 1k component (19 kHz/20kHz @ +8dBu)	-104 dBu
Gain Range	-12 dB to +31.5 dB
Gain Precision	±0.05 dB
Gain Step	0.5 dB

Table 2.6. ULN-8mkIV Line Input + ADC

Line Input + ADC Frequency Response	
+0/-0.1dB @ fs = 44100 Hz	5.7 Hz - 20.5 kHz
+0/-1.0dB @ fs = 44100 Hz	1.8 Hz - 21.0 kHz
+0/-0.1dB @ fs = 96000 Hz	5.7 Hz - 43.9 kHz
+0/-1.0dB @ fs = 96000 Hz	1.8 Hz - 45.4 kHz
+0/-0.1dB @ fs = 192000 Hz	5.7 Hz - 42.1 kHz
+0/-1.0dB @ fs = 192000 Hz	1.8 Hz - 64.7 kHz
5° low-end in-channel phase deviation point	10.7 Hz
Interchannel phase 0 Hz - 20 kHz	< ±0.05°
Crosstalk from SMPTE Input	< -142 dB

Table 2.7. ULN-8mkIV Line Input + ADC Frequency Response

Round Trip Latency (analog in to analog out)	
ULN-8 3d	116 samples
ULN-8mkIV	18 samples

Table 2.8. ULN-8mkIV Converter Latency

Input Processing	
M/S Decode	Instantiable
parametric EQ	Instantiable
Dynamics	Instantiable
Limiting	Instantiable
Character	Instantiable
Transient Control	Instantiable
Reverb	Instantiable
Delay	Instantiable
Nearly Infinite Combinations via +DSP	Instantiable

Table 2.9. ULN-8mkIV Input Processing

Output Processing	
M/S Encode	Instantiable
parametric EQ	Instantiable
Dynamics	Instantiable
Limiting	Instantiable
Character	Instantiable
Transient Control	Instantiable
Reverb	Instantiable
Dither	Instantiable
Mix Foldown	Instantiable
Signal Generation	Instantiable
Nearly Infinite Combinations via +DSP	Instantiable

Table 2.10. ULN-8mkIV Output Processing

Front Panel	
Indicator LEDs (Bicolor)	495
Meters	16
Segments per Meter	15
Channel Encoder Knobs	8
Encoders Have Shaft Push Buttoms	Yes
Monitor Controller Encoder Knobs	1
Monitor Controller Mute	Yes
Monitor Controller Dim	Yes
Indicators Per Encoder	16
Sample Rate Indicators	6
Clock Source Indicators	4
AES Clock Source Indicators	4
AES Lock Indicators	4
AES Input Signal Indicators	4

Front Panel	
AES Output Signal Indicators	4
System Lock Indicator	1
Firewire Indicator	1
Front Panel Modes	14
Headphone Output (Dedicated DAC)	TRS Stereo
DI Inputs (2)	TRS Balanced
DI Input Impedance	10M Ω
DI Input Fixed Gain (Jumper Selectable)	0/10/20 dB
DI Input Variable Gain	-12 dB to 31.5 dB
Power Switch (Jumper Defeatable)	Toggle

Table 2.11. ULN-8mkIV Front Panel

Back Panel	
MIDI Connectors (In and Out)	5-Pin DIN
SMPTE Connectors (In and Out)	Balanced TRS
Word Clock Connectors (In and Out)	75 Ω BNC
AES Connector (8 Channels In and Out)	DB-25
AES Connector Pinout	Tascam/Digidesign Digital
Mic Input Connector (8 Channels)	DB-25
Mic Input Pinout	Tascam/Digidesign Analog
Line Input Connector (8 Channels)	DB-25
Line Input Pinout	Tascam/Digidesign Analog
Send Output Connector (8 Channels)	DB-25
Send Output Pinout	Tascam/Digidesign Analog
Line/Monitor Output Connector (8 Channels)	DB-25
Line/Monitor Output Pinout	Tascam/Digidesign Analog
Line/Monitor Mult Output Connectors (Analog 1/2)	TRS Balanced
Gigabit Ethernet MHLink Connectors (2)	RJ-45 8-pin
USB-C	
Metric Halo EdgeCard™ expansion slot	
Power (Unswitched)	2.1mm Coaxial
Power (Switched)	4-Pin XLR
Security Slot	Kensignton

Table 2.12. ULN-8mkIV Back Panel

Software	
Driver	Core Audio (macOS)
macOS	10.11.6 or later
Architectures	Apple Silicon and Intel
MIOConsole3d	Included

Software	
Record Panel	Included
LTC Decoder	Included
Mixer	Included
DSP Processing	Included

Table 2.13. ULN-8mkIV Software

Power	
Voltage	14v - 28v
Power	32 Watts
External Supply (Input)	100-240VAC
External Supply (Max Input Current)	1.2 A
External Supply (Output)	18 VDC
External Supply (Max Output Current)	2.0 A
External Supply Connector	4-Pin XLR

Table 2.14. ULN-8mkIV Power

Case	
Material	Powder Coated Aluminum
Fasteners	3mm Phillips Head
Weight	6 lbs
Weight	2.7 kg
Dimensions	17" x 13" x 1.72"
Dimensions	432 x 330 x 44 mm
Rack Ears (included)	Powder Coated Steel
Rear Rack Mounts	Available

Table 2.15. ULN-8mkIV Case

3. ULN/LIO-8/mkIV Front Panel Guide

Front Panel Operations

The ULN-8 and LIO-8 feature a flexible front panel with comprehensive controls, status and meter readouts. The Front Panel allows you to utilize the interface without any computer attached and also communicates bidirectionally with MIOConsole3d to keep the Console controls and the Front Panel controls synchronized at all times.

Front panel operations are identical for mkIV ULN and LIO-8 models.



ULN-8 Front Panel

> **For LIO-8 users:** References to "Mic" features apply only if you have the optional ULN-R microphone preamps installed.

The Front Panel is split into a number of functional areas. From the power switch on the far left, moving to the right you will find:

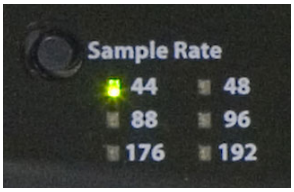
- Sample Rate Indicators and Control
- Clock Source Indicators and Control
- Control Mode Indicators and Selector
- I/O Trim Mode Indicators and Selector
- Analog Input Mode Indicators (above the knobs)
- Per Channel Control Knobs with value indicators
- High Resolution 15 Segment Input Meters
- High Resolution 15 Segment Output Meters
- System Status Indicators
- AES Status Indicators (per channel pair)
  - Input Signal present
  - Output Signal present
  - Input Locked
  - Cable Select for Clock Source
- Monitor Control Section
  - Mute and Dim buttons for Monitor and Headphone outs
  - Monitor/Headphone volume control Knob
  - Dedicated Headphone out jack
- Ultra-Hi-Z Direct Inputs summed to the channel 1 and 2 line inputs

Let's take each of these functional areas one by one and explain the details.

Sample Rate Indicators and Control

The Sample Rate area of the Front Panel has 6 indicator LEDs to show you the nominal sample rate that the box is running at. The available sample rates are: 44.1k , 48k , 88.2k , 96k , 176.4k , 192k

The Front Panel also has a tactile switch next to the "Sample Rate" legend that may be used to cycle through the available nominal sample rates when the unit is running on internal clock. Every time you press the tact switch, the unit will switch to the next higher sample rate, unless it is currently at 192k, in which case it will switch back to 44.1k.



Sample Rate

These indicators show the current nominal rate, so if you are externally clocked from a source that is running at a pulled-up or pulled-down rate, the indicator will show the closest nominal rate.

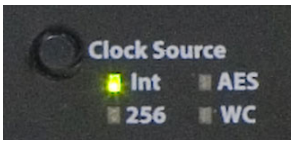
> **Note:** The front panel Sample Rate control is only operational on the Root (box #1) of an MHLink domain, whether running online or standalone. All connected boxes will display the current sample rate, but the control switch is only active on the root box.

Clock Source Indicators and Control

Clock Source control is active only on the Root box (box #1 in an MHLink domain). Four indicator LEDs show you the currently selected clock source for the domain. The clock sources are:

- Int — indicates audio clock source is set to Internal Clock
- AES — clock is set to the rear panel AES port (set by the AES Status Indicators to the right of the Meters array)
- 256 — currently unused
- WC — Clock set to rear panel BNC Word Clock input

The tactile switch next to the "Clock Source" legend steps through the available clock sources. When using a clock source other than Internal, pushing the Clock Source button cycles through the 1, 2, and 4x clock rates for the currently selected source before moving to the next selection.

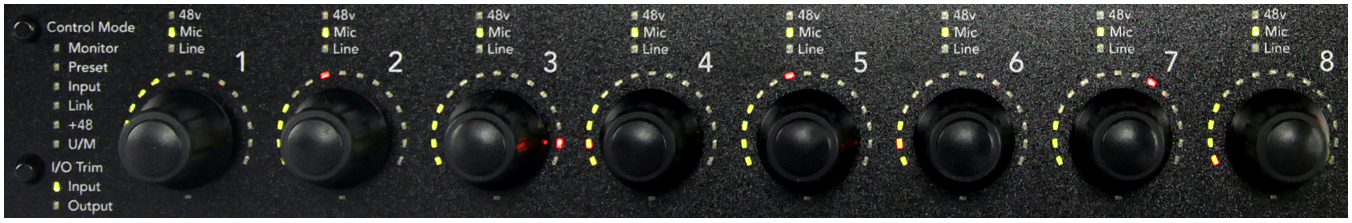


Clock Source

> **Note:** Front panel Clock Source selection is only active in standalone mode. Clock Source indicators only light on the box acting as clock source for the domain.

Multifunction controls section

The **Control Mode**, **I/O Trim** and channel control knobs 1 through 8 work in concert to offer front panel Monitor Controller Source and Output selection, offline selection of Preset Boot States and Snapshots, control of the mic preamps, and analog input and output gain trims.



Control Mode selector, I/O Trim and per-channel control knobs

Control Mode Indicators and Selector

The Control Mode area of the Front Panel has 6 indicator LEDs to show you the currently selected front panel control mode for the box.

Pressing the tactile switch next to the "Control Mode" legend selects the next control mode in the list.



Control Mode

When *none* of the Control Mode LEDs are lit (as shown above), the front panel is in **I/O Trim** mode, and the channel knobs 1 through 8 control the analog input or output trims. Pushing a channel knob in this mode will show the current analog gain setting for that channel.

This is the default state of the LIO/ULN-8 front panel.

To directly access a particular control mode, press and hold the Control Mode button, and while holding the Control Mode button, press the knob switch for the mode you want to select directly.

I/O Trim Indicators and Selector

The I/O Trim control has 2 indicator LEDs:

- Input
- Output

The tactile switch next to the "I/O Trim" legend switches between the two control modes.

When Input is lit, the eight channel control knobs operate the Input gain. Pressing the knob will show the current gain setting numerically on the Output meter array to the right of the control knobs.

The details of each focus mode will be addressed in the dedicated control mode sections of the documentation below. In addition, the Input trim mode and Output trim mode will also be discussed in more detail.

Channel Control Knobs

The eight numbered knobs are detented rotary encoders with integrated push button switches. Each knob has a ring of 15 bi-color (red/green) LEDs around it and a bi-color "flexi" led below it. Both the ring of LEDs and the "flexi" LED may be used for different purposes depending on the current control mode.



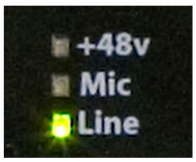
Front Panel Control Knob

Analog Input Mode Indicators

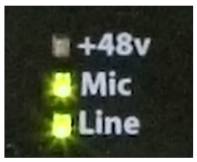
Each knob has 3 LEDs above it that reflect the state of the associated analog input channel mode. The Input Mode area is above the 8 channel control knobs.

- +48v
- Mic
- Line

The +48v indicator is illuminated RED when the associated Mic Pre channel has Phantom power energized.



Line Input selected



Mic S/R mode selected

Mic/Line Indicator

The Mic and Line indicators are utilized as a group and are illuminated to indicate the following input modes:

Mic	Line	Mode
On (green)	Off	Input from Mic Pre Input
Off	On (green)	Input from Line Input
On (green)	On (green)	Mic Send/Return Mode

Table 3.1. Mic/Line Indicator Modes

In analog I/O control modes (e.g. Input, Link, +48, Input Trim and Output Trim) each knob is associated with the channel number indicated next to the knob.

Monitor and Preset modes, each knob reflects an associated selection number for the mode.

The data displayed in the indicator ring around each knob is also determined by the currently selected mode. The indicator ring supports displaying the following kinds of data:

- High Resolution "Digital Dual Vernier™" gain readout
- Input Meters
- Selected State for Mode Selection (Monitor, Preset, and U/M Modes)
- Link Status Indication (Link Mode)

Digital Dual Vernier™ Indication Technology
All of the control knobs utilize Digital Dual Vernier technology to provide precise indication of the current setting of the associated value over a wide range. Each knob has 15 bi-color indicators. The dual vernier approach uses two different colors to indicate both the coarse setting of the control and the fine offset from the coarse setting.

The coarse setting is indicated by segments that are illuminated green. As the coarse setting increases, segments are illuminated in a clockwise direction starting from the left hand side of the ring. Each illuminated green segment indicates a 7.5 dB increase in level.

A single segment will be illuminated Red to indicate the positive offset from the current coarse setting indicated by the green bar. Each fine segment indicates an increase of 0.5 dB. When no segment is illuminated Red, it means that there is no offset (0 dB) from the level indicated by the green bar.

The details of each of these indication modes will be discussed in the dedicated control mode sections of the documentation below.

Meters on the Knobs

The input knobs support an additional indicator mode, when the Front Panel is in Input Trim mode: Input Meter mode. When this mode is selected, rather than showing the Dual Vernier level of the input gain on each knob, the channel's input meter is shown on the indicator ring of the corresponding knob. The configured break-point colors are used for the indicators, and if the input channel clips, the same settings for full-bar clip indication and hold are used on the knob indicator meters.

This mode, combined with the precise numerical readout of the gain available on the front panel, is ideal for tracking because the channel levels are indicated concentrically around the control used to adjust the channel gain. This allows you to simply reach out to a clipping or overly high channel and turn it down without having to engage in any difficult mental gymnastics to try to correlate the meter with the control.

Toggling meter modes
To toggle between meters on the knob mode and dual vernier mode, press and hold knob #1 and then (while still holding knob #1) press knob #8.

Control Mode Details

The following sections detail each of the aforementioned Control Modes. Click a link to go to any control directly.

Control Mode section:

1. Monitor
2. Preset
3. Input
4. Link
5. +48
6. U/M (to be implemented)

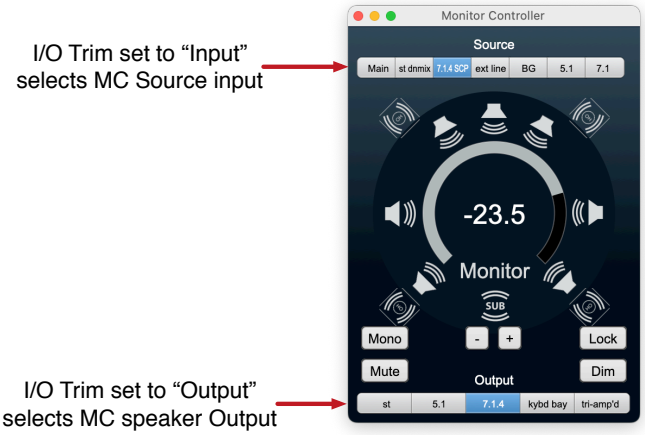
I/O Trim section:

1. Input
2. Output

Monitor

When Monitor Mode is selected, the integrated switches in the 8 channel control knobs function as selector switches for the Monitor Controller in MIOConsole3d. Monitor Mode requires MIOConsole3d to be running to function.

In Monitor Mode, the I/O Trim selection controls which Monitor Controller Selector the switches will affect. If the I/O Trim selection indicator is on Input, then the selection controls will choose from the Monitor Controller Input Sources. If the I/O Trim selection indicator is on Output, then the selection controls will choose from the Monitor Controller Output Destination.



Monitor Source and Output selection

The currently selected path (source or destination) is indicated by illuminating the ring around the corresponding knob in yellow.

Communication between the MIOConsole3d Monitor Controller and the front panel is bi-directional — making changes in the software will be reflected on the Front Panel, and making changes via the Front Panel will be reflected in the software.

Preset

Preset Mode is used to load pre-programmed hardware configurations for all the boxes in a domain without the need for a host computer. Presets are created in the MIOConsole3d application and programmed to the boxes from the MIOConsole3d System Status Pane.

You can use this feature to pre-configure complex routings and processing for a rack of boxes within the studio, and then recall these configurations on location as a stand-alone pre-amp/converter rig, including any processing that you find appropriate for your uses. For example, you could pre-configure low-cut filters or M/S decoders on channel pairs, and have that configuration available for instant recall.

See the Boot States and Snapshots section for full details.

In Preset Mode, the eight channel control knobs function as your selector switches. The snapshot registers that have a preset stored in memory will have their rings illuminated in dim green. Empty registers will be dark.

Pressing a knob that has a dim green ring will load that snapshot and will change the illumination to bright green (which indicates the currently loaded snapshot).

> **Front panel recall on the ULN-8/LIO-8**
> On the ULN-8 and LIO-8, encoder 1 recalls the "Boot State" snapshot.
>
> User snapshot #1 is recalled on encoder 2 and so on through snapshot #7 on encoder 8.
>
> There is no snapshot recall on the Monitor Control encoder, since that button toggles between Monitor and headphones volume control.

Input

When Input Mode is selected, the knob shaft switches toggle the corresponding input mode between Line, Mic and Mic S/R modes. The rotary knob continues to indicate and control the currently selected I/O Trim (see below).

Link

When Link Mode is selected, the knob shaft switches can be used to configure linking between the trim knobs. The trim link system implemented in the control panel is very flexible.

Both Input Gain Links and Output Gain links can be controlled. You choose which set of links is being edit by choosing between Input Trim mode and Output Trim mode.

Link Model: The basic model of the trim link system is that you choose a master knob and then choose other knobs to be linked to that master knob. When you change the gain on the master, the same gain change is applied to the slave knobs. The link is unidirectional. This means that if you turn one of the slave knobs, that gain change created by that action will only be applied to the slave knob itself, and not to the master that it is linked to or any of the other slaves. Now, each knob can be a master and two or more knobs can be cross-linked, so you *can* configure bi-directional links, but you may want to consider the benefits of unidirectional links as they allow you to trim a slave gain relative to a master gain *after the link has been created*.

When you first enter Link Mode, all the knob indicators will be off. You choose a master knob by pressing the knob switch. The master knob indicator will be illuminated green. Now you can press the knob switches for the slave knobs that you would like to assign to the selected master (the knobs assigned as slaves will illuminate in yellow). To choose a new master knob to configure, press the knob switch on the currently selected master knob (the one illuminated in green) and all the knob indicators will turn off. Now you can select another master knob to configure by pressing the knob button.

If you want to configure a pair (say 1 and 2) of knobs cross-linked, you can follow these steps:

1. Select Link Mode
2. Press knob 1 to select it as a master — it will illuminate green
3. Press knob 2 to select it as a slave of knob 1 — it will illuminate yellow
4. Press knob 1 to deselect it — this will remove the illumination from all the knobs
5. Press knob 2 to select it as a master — it will illuminate green
6. Press knob 1 to select it as a slave of knob 2 — it will illuminate yellow
7. Press knob 2 to deselect it — this will remove the illumination from all the knobs

After step 4, knob 2 was slaved to knob 1 -- rotating knob 1 would change both knob 1 gain and knob 2 gain, but changing the knob 2 gain would not change knob 1's gain. After step 7 knob 1 was also slaved to knob 2, so changing either knob will cause a corresponding change in both knobs.

+48

When Input Mode is selected, the knob shaft switches toggle the corresponding input preamp's phantom power on and off. It is possible to turn on the preamp phantom power even if the line input is currently selected. This is so that you can use the input mode to switch between the Line and Mic inputs without pulsing the phantom power on and off. The rotary knob continues to indicate and control the currently selected I/O Trim (see below).

U/M — User Mode

When User Mode is selected, the knobs function as a software configured control surface for MIOConsole3d. At the present time, there are no functions in MIOConsole3d that are controlled by User Mode.

Input Trim

When the Input Trim light is the only illuminated indicator in the Control Mode Column, the Front Panel is in Input Trim Control Mode. When Input Trim Control Mode is selected, rotating one of the 8 control knobs will adjust the input gain of the associated analog input channel (and preamp, if the selected input is the Mic input). The current gain of the channel is indicated via Metric Halo's Digital Dual Vernier™ indication technology in the indicator ring around the knob. When you change a gain or press the knob shaft switch, the current gain is indicated numerically on the output meter area of the front panel.

By default, each click of the knob will increase (CW) or decrease (CCW) the gain of the associated channel by 0.5 dB. If you press and hold the knob shaft button while rotating the knob, it will adjust the gain by 3 dB per click.

The box automatically interpolates the gain in hardware as you are changing it -- allowing even dramatic changes in the gain to be made clicklessly and transparently.

Changes to channel gains are automatically applied across any link-groups that you have configured, allowing you to seamlessly adjust gains on 1 to 8 channels simultaneously.

Output Trim

When the Output Trim light is the only illuminated indicator in the Control Mode Column, the Front Panel is in Output Trim Control Mode. When Output Trim Control Mode is selected, rotating one of the 8 control knobs will adjust the output gain of the associated analog output channel. The current gain of the channel is indicated via Digital Dual Vernier indication technology in the indicator ring around the knob. When you change a gain or press the knob shaft switch, the current gain is indicated numerically on the output meter area of the front panel.

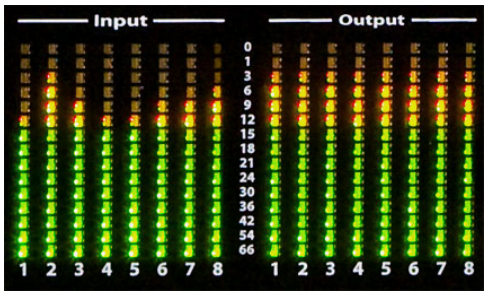
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High Resolution Meters

The Front Panel provides 16 meter bars with 15 segments per bar. Every segment is a bi-color LED with programmable color. The meters are grouped into two 8 meter blocks; the block on the left hand side is used for Analog Input meters and the block on the right is used for Analog Output meters. The 15 segments of the meters are used to indicate signal levels at -66, -54, -42, -36, -30, -24, -21, -18, -15, -12, -9, -6, -3, -1, and 0 dBFS.



Analog I/O Meters

Since each element in the meter is a bi-color LED, the colors of the segments is under software control. The meters are configured to show green until -12 dBFS, yellow until -1 dBFS, and red for the 0 dBFS indicator.

When the level of a specific metered channel hits 0dBFS the *entire* meter bar turns red, and remains red for three seconds clip-hold time. This unique functionality immediately and unmistakably alerts you to overs that occur.

The default setting for the output meter block is for the clip threshold to be at 0dB (which means that the full-bar clip indication never turns on). This is configured this way because any setting lower than 0dB will indicate nearly continuous clipping in most contemporary mastered material.

The output meter section has a secondary function in addition to metering the analog output channels. When you make a change to an I/O or monitor gain from the front panel, the output meter section is temporarily used as a bitmap display that numerically shows the current gain level in dB. The digits are arranged in two rows. The top row shows the tens and units places and the bottom row shows the overall sign and the tenths place. When the gain is positive (greater than or equal to 0 dB), the digits are shown in green. When the gain is negative (less than 0 dB), the digits are shown in yellow.



Front Panel Numeric Readout

Below left shows the gain being read out is +10.0 dB, and below right is the readout at -21.5 dB:



Positive Gain Display



Negative Gain Display

Gain Display examples

System Status Indicators

The Front Panel has two system status indicators between the meters array and volume control knob to let you know if the box has detected a valid computer connection, and to let you know if the system's internal PLL is locked.



System Status

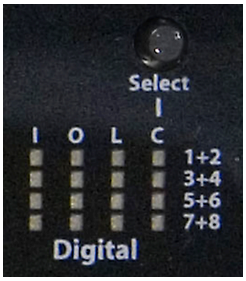
The **Sys Lock** indicator will be illuminated green when the internal clock PLL is connected and locked to the domain clock. This indicator lets you know if the box is locked to a valid system clock source.

The **Computer** Indicator will be illuminated green to indicate that this box has a stable connection with a computer over MHLink or USB. This indicator is labeled **Firewire** (as shown above right) on older boxes which have since been upgraded to 3d or mkIV.

On multi-unit MHLink domains, the Root box connection to the Host computer is indicated by **Computer**, and the MHLink connection on MHLink minion boxes is indicated by **Sys Lock**. A green Computer light on a minion indicates an active USB Satellite Computer Port (SCP) connection.

AES Status Indicators

There are four rows of status LEDs. Each row represents a different AES port/cable. Each port carries two channels of audio, so the columns are labeled 1+2, 3+4, 5+6 and 7+8.



AES Indicators

The columns provide indicators for 4 different types of status:

- **I** — **Input** Level for corresponding port
- **O** — **Output** Level for corresponding port

  The Input Level and Output Level indicators show the highest level on the channel pair via brightness and color. They can be treated as "signal present indicators".

- **L** — The **Locked** indicator is illuminated when the AES receiver for the corresponding input port detects and locks to a valid AES signal. Please note that this does NOT indicate that the input is locked at the same rate as the rest of the box, only that there is valid AES signal coming into that port. When the **Locked** LED is lit, it means that port (a) can be used as an AES clock source and (b) will provide valid audio if as long as the incoming signal is running at the same rate as the rest of the box.
- **C** — **Clock** Source illuminates to indicate the port currently selected as the external AES clock reference via the *Select* tact switch (directly above the **C** column). At most one of the 4 AES Clock

source indicators will be illuminated. If the box's clock source is not set to AES, then none of these indicators will be illuminated.

Note that front panel clock source selection is only available in standalone mode.

Monitor Control Section

The Front Panel provides a Monitor Control Section that allows you to control both the dedicated headphone monitor level and the monitor level of the outputs assigned to the monitor controller. You switch between the headphones and the monitor controller by pressing the monitor control knob (activating the integrated switch). The currently selected path is indicated by the currently illuminated LED under the monitor control knob.



Monitor Control Knob

In addition to the Monitor Control knob, there are two tact switches above the Monitor Control knob — Mute and Dim. These two buttons function as toggle switches and apply to the currently selected monitor path. When the MUTE is engaged, the selected path indicator turns Red and the output is muted. When the DIM is engaged, the selected path indicated turns yellow, and the output level is turned down by 20 dB. Both MUTE and DIM can be engaged at the same time, and the MUTE mode will dominate.

The Front Panel includes a dedicated headphone output with its own discrete DAC, headphone amp and analog domain volume control. The monitor control knob controls the Volume Control for this output when the monitor control mode is set to Cans.



Headphones Jack

Front Panel DI Inputs

The Front Panel provides two Ultra-Hi-Z Direct Instrument inputs that are summed into the Channel 1 and Channel 2 line input paths. The DI inputs have programmable gains that are configured via internal pin jumpers (this requires opening the box). The signals applied at the DI will appear on the corresponding line inputs mixed with any signal present at the line input on the back panel. If you do not want this mixing, you should ensure that only one connector is actually utilized at a time (the back-panel connector or the DI connector). You can utilize this to good effect if you need to add an additional input -- but the sum is a unity gain sum so you need to get the relative levels correct at the inputs. The mix of these inputs is routed at the a/d converter input stage.



DI Jacks

LED Brightness Adjustment

Adjust the front panel LED brightness by holding down the I/O Trim tact switch and rotating channel encoder 8.

This control is available in any front panel control mode.