

UPMAX ISC Immersive Soundfield Controller

Linear Acoustic UPMAX ISC Immersive Soundfield Controller

Trusted Linear Acoustic upmixing for the immersive audio capabilities of Next Generation Audio systems.



Linear Acoustic UPMAX ISC

UPMAX ISC builds upon the proven and long-running lineup of Linear Acoustic upmixers, employs our latest algorithm, and adds support for the immersive audio requirements of Next Generation Audio.

UPMAX ISC is designed for live events and broadcasts and can be inserted on a mix bus or placed at the output of the mixing console in the OB truck at the venue for upmixing music, effects, and legacy content not natively presented in an immersive format.

It is equally at home in the airchain at the Network Operations Center (NOC) to ensure all programming – including commercials and interstitial content – is delivered to the viewer as a consistent immersive experience.

Features include:

- Upmixing from 2-, 3-, 5.1-, and 7.1-channel audio to immersive formats including 5.1.4 and 7.1.4
- Upmixing to legacy formats including 5.1- and 7.1-channel audio
- Automatic pass-through of native immersive content

Standard I/O includes 3Gb/s HD/SD-SDI, AES-3, and AES67 to support SMPTE ST 2110-30 and -31 workflows. Quad-Link SDI I/O for 4K video workflows or MAD1 I/O are available as mutually exclusive options.

Additional features include dual internal redundant auto-ranging power supplies, dual 1000BaseT Ethernet connections (one each for control and AES67), and a web-based user interface for setup, configuration, routing, control, and metering.

UPMAX ISC Quick Start Guide





Linear Acoustic UPMAX ISC Immersive Soundfield Controller

Introduction

Congratulations on your purchase of the Linear Acoustic® UPMAX® ISC Immersive Soundfield Controller.

UPMAX ISC builds upon the proven and long-running lineup of Linear Acoustic upmixers, employs our latest algorithm, and adds support for the immersive audio requirements of Next Generation Audio.

UPMAX ISC is designed for live events and broadcasts and can be inserted on a mix bus or placed at the output of the mixing console in the OB truck at the venue for upmixing music, effects, and legacy content not natively presented in an immersive format. It is equally at home in the airchain at the Broadcast Operations Center (BOC) to ensure all programming – including commercials and interstitial content – is delivered to the viewer as a consistent immersive experience.

Features include:

- Upmixing from 2-, 3-, 5.1-, and 7.1-channel audio to immersive formats including 5.1.4 and 7.1.2
- Upmixing to legacy formats including 5.1- and 7.1-channel audio
- Automatic pass-through of native immersive content
- 3Gb/s HD/SD-SDI, AES-3, and AES67 I/O to support SMPTE ST 2110-30 workflows (Quad-Link SDI I/O for 4K video workflows or MADI I/O are available as mutually exclusive options)
- Dual internal redundant auto-ranging power supplies
- Dual 1000BaseT Ethernet connections and web-based GUI

Hardware

UPMAX ISC Front Panel



Figure 1 - Front panel

The front panel of the UPMAX ISC includes the following:

- **Reset button** for restarting the unit from the front panel (1A)
- **Four status LEDs** indicating the **status of each power supply** (1B, 1C), the **overall status** of the unit (1D), and **sync** for the reference clock (1E)
- A **color LCD display** to show status and basic configuration parameters (1F)
- A **five-button navigation cluster** with Left, Right, Up, and Down arrows plus a green “OK” button (1G)
- A **USB port** used for software updates (1H)

The front panel is used for the initial setup and configuration including setting the IP address of the Control Ethernet port. Additional configuration is accomplished via the remote user interface

UPMAX ISC Rear Panel



Figure 2 - Rear panel

The rear panel includes the following connections:

- Two **RJ-45 Gigabit Ethernet connections**, one for network remote control (2A) and one for AES67 I/O (2B)
- Two independent **3Gb/s HD/SD-SDI inputs and outputs** (2C) on female BNC connectors
- **Quad-Link SDI or MADI I/O** (2D) - optional
- Five **AES-3 I/O connections** (2E) on female BNC connectors
- Parallel **GPI/O control port** (female DB-15) for five inputs and five outputs (2F)
- Two **IEC power inlets** for the redundant internal universal auto-ranging power supplies (2G)

Note: Although the hardware is present for two independent SDI I/O paths, only the first SDI I/O is active at this time. The second path will be enabled in a future firmware update.

Installation and Initial Setup

Installation

UPMAX ISC is a 1RU product intended to be permanently installed in a standard 19½” equipment rack and secured with four standard rack screws. UPMAX ISC is fan cooled with air intakes and exhausts located on the side of the unit just behind the front panel, but whenever possible, it is recommended to leave 1RU of empty space above and below the unit.

Power

Plug the supplied IEC power cords into the UPMAX ISC and connect each to different mains power sources. Remember that while redundant supplies do protect against the unit losing power in the event of a PSU failure, the loss of mains supply voltage is a bigger concern. Accordingly, each supply should be fed from a different circuit equipped with adequate surge protection and fitted with an uninterruptable power supply (UPS).

Boot Up and Splash Screen

The unit will power up as soon as the power cords are connected, and using the **Reset button** (1A) is not required on initial startup. The front panel of the unit will remain dark during most of the boot process but the **Status LED** (1D) will light. Once the boot process is complete, the Home Screen will appear and the Status LED will turn green.



Figure 3 - Front panel home screen

Setting IP Addresses

UPMAX ISC ships with DHCP enabled and will automatically retrieve an IP address when connected to a network with a DHCP server.

Important! The Control and AES67 Ethernet connections both require 1000BASE-T (Gigabit) switch ports in order to work properly.

If both the Control and AES67 ports will be used, they must be in different subnets. In-band control is available using the AES67 port.

If only one port will be used, set the unused port to “Static IP” with an IP Address of 0.0.0.0, a Subnet Mask of 0.0.0.1, and a Gateway of 0.0.0.0.

To set a fixed IP address for the Control port:

- Press the **Right button** once to show the Information screen and once more to navigate to the IP Configuration (Control) screen
- Press the **Down button** to highlight “Edit”
- Press the **OK button** to highlight “Use DHCP”
- Press the **Right button** to highlight “Yes”
- Press the **Up/Down buttons** to select “No”
- Press the **Left button** to highlight “DHCP” again
- Press the **Down button** to highlight “Address”
- Press the **Right button** to move to the first digit of the IP address
- Use the **Up/Down buttons** to change the value
- Use the **Right/Left buttons** to select another digit to edit
- When finished editing the Address field, press the **Right/Left buttons** to highlight “Address” again
- Press the **Down button** to navigate to the “Netmask” field, following the instructions above for entering the value
- When finished editing the Netmask field, press the **Right/Left buttons** to highlight “Netmask” again
- Press the **Down button** to navigate to the “Gateway” field, following the instructions above for entering the value
- When finished editing the Gateway field, press the **Right/Left buttons** to highlight “Gateway” again
- Press the **Down button** to highlight “Update”

Verify the information has been entered correctly and press the **OK button** to save the new values

If you notice incorrect information and need to start over, use the **Right button** to highlight “Cancel” followed by the **OK button**



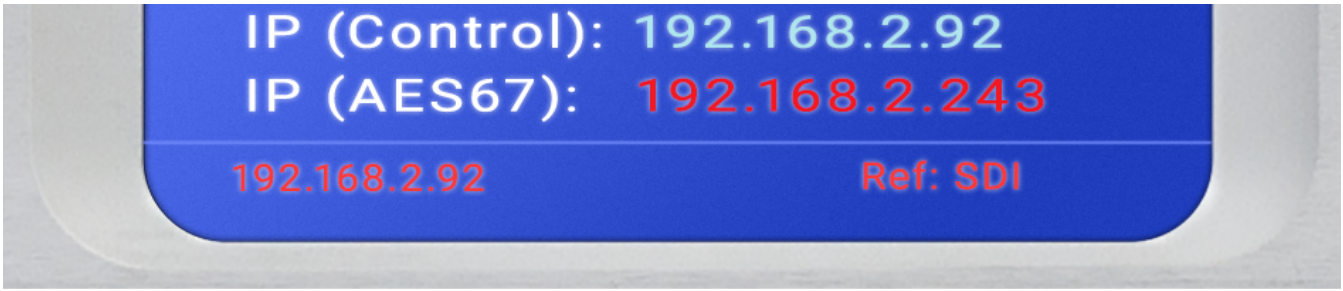


Figure 4- System information screen



Figure 5 - IP configuration (Control) screen

If you are using AES67 I/O, pressing the **Right button** from the IP Configuration (Control) screen will bring you to the IP Configuration (AES67) screen. The steps for configuring this port are identical to those above for the Control port.

Connecting Inputs and Outputs

The UPMAX ISC offers 3Gb/s HD/SD-SDI inputs and outputs, Quad-Link SDI or MADI I/O (optional and mutually exclusive), five AES-3 inputs and outputs on female BNC connectors, plus AES67 I/O via the AES67 Ethernet port. Connect the physical inputs and outputs as appropriate for your installation.

Connecting to the Web-Based User Interface

No special client software is required to remotely connect to the UPMAX ISC, and the HTML-5-based GUI is device, operating system, and browser agnostic. We recommend Google Chrome or Apple Safari. The computer or tablet should be on the same network and subnet as the UPMAX ISC.

Once both UPMAX ISC and your computer are connected to your network, enter the IP address of the UPMAX ISC in the URL field of your browser. Once connected, the **Home screen** will appear.

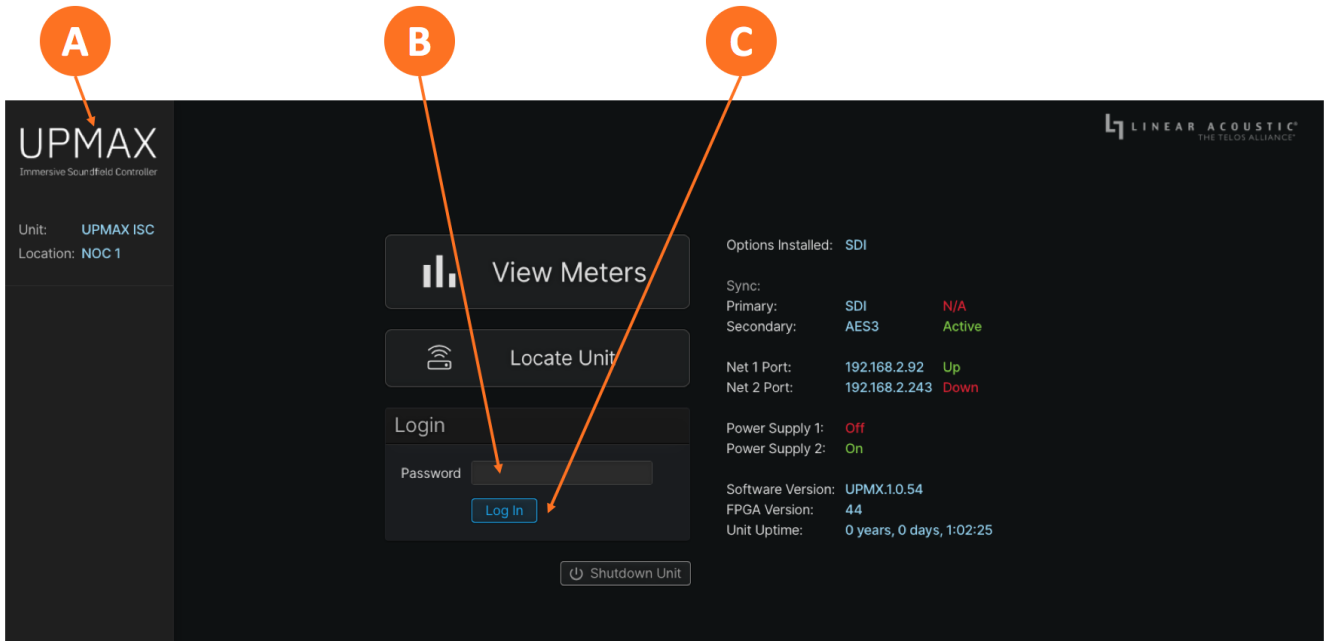


Figure 6 - Home screen

Clicking on the **UPMAX ISC logo** (6A) will always bring you back to the Home screen. To log in to the unit, enter the default password of **1234** into the **Password field** (6B) then click the **Log In button** (6C). The ability to change the password will be included in an upcoming software update.

UPMAX ISC User Manual V1.0.54

Applicable to V1.04.54 and earlier software versions.



Front and Rear Panel Overview

A brief overview of the front and rear panel controls and connections.

UPMAX ISC Front Panel





Figure 2-1 - UPMAX ISC front panel

UPMAX ISC front panel features include:

- **Reset button** for restarting the unit from the front panel (2-1A)
- **Four status LEDs** indicating the **status of each power supply** (2-1B, 2-1C) the **overall status** of the unit (2-1D), and **sync** for the reference clock (2-1E).
- A **color LCD display** to show status and basic configuration parameters (2-1F)
- A **five-button navigation cluster** with Left, Right, Up, and Down arrows plus a green “OK” button (2-1G)
- A **USB port** used for software updates (2-1H)

Basic configuration and status monitoring can be performed using the front panel controls as outlined in the [Installation and Initial Setup Using the Front Panel Interface](#) section. Connecting to UPMAX ISC via the web-based user interface -covered in the [Remote User Interface](#) section - provides easier navigation and full control of the unit.

UPMAX ISC Rear Panel



Figure 2-2 - UPMAX ISC rear panel

The rear panel of the UPMAX ISC contains the following connections:

- Two **RJ-45 Gigabit Ethernet connections**, one for network remote control (2-2A) and one for AES67 I/O (2-2B)
- Two independent **3Gb/s HD/SD-SDI inputs and outputs** (2-2C) on female BNC connectors
- **Quad-Link SDI or MADI I/O** (2-2D) - optional
- Five **AES-3 I/O** connections (2-2E) on female BNC connectors
- Parallel **GPI/O control port** (female DB-15) for five inputs and five outputs (2-2F)
- Two **IEC power inlets** for the redundant internal universal auto-ranging power supplies (2-2G)

SDI I/O

Two sets of 3Gb/S HD/SD-SDI inputs and outputs are included. At this time however, only the connectors closest to the RJ-45 Ethernet connectors are active. The second SDI connection will be enabled in an upcoming firmware update.

AES-3 I/O

The top row of AES-3 connectors are inputs. The outputs comprise the bottom row. Connectors are arranged as follows:

- 1/2 = Left/Right (L/R)
- 3/4 = Center/LFE (C/LFE)
- 5/6 = Left Surround/Right Surround (Ls/Rs)
- 7/8 = Left Front Height/Right Front Height (Tfl/Tfr)
- 9/10 = Left Rear Height/Right Rear Height (Tbr/Tbl)

GPI/O

The active state for GPI is Low and is internally pulled up through a 10K ohm resistor. The active state for GPO is Low and is current-limited through a 33-ohm resistor.

The pinout for the DB-15 sub connector is as follows:

Pin Number	Function	Comment
1	+5v	
2	GPI In 1	Active Low
3	GPI In 2	Active Low
4	GPI In 3	Active Low
5	GPI In 4	Active Low
6	GPI In 5	Active Low
7	GND	
8	GND	
9	+5v	
10	GPO Out 1	Active Low
11	GPO Out 2	Active Low
12	GPO Out 3	Active Low
13	GPO Out 4	Active Low

14	GPO Out 5	Active Low
15	Status OK	Active High

Installation and Initial Setup Using the Front Panel Interface

Installing UPMAX ISC and using the front panel controls for basic setup and configuration.

Physical Installation

The UPMAX ISC is a 1RU product intended to be permanently installed in a standard 19½” equipment rack and secured with four standard rack screws.

UPMAX ISC is fan cooled with air intakes and exhausts located on the side of the unit just behind the front panel, but whenever possible it is recommended to leave 1RU of empty space above and below the unit.

i **IMPORTANT:** Please see the ["User Warnings and Cautions"](#) section of for important electrical safety information.

Power

The UPMAX ISC has two internal auto-ranging redundant power supplies protected by type T1AL25V fuses. Remember that while redundant supplies do protect against the unit losing power in the event of a PSU failure, the loss of mains supply voltage is a bigger concern. Accordingly, each supply should be fed from a different circuit equipped with adequate surge protection and fitted with an uninterruptible power supply (UPS). Providing the receptacles to which the supplied power cords are connected are grounded, the power connection serves as a ground. Additionally, the rear panel earthing terminal should be connected to a proper ground system with 20 – 14 AWG (0.5 – 1.5mm) wire.

Front Panel Buttons

As mentioned briefly in the [Front and Rear Panel Overview](#) section, the front panel of UPMAX ISC includes a five-button navigation cluster with Left, Right, Up, and Down arrow buttons plus a green “OK” button in the center.

The arrow buttons are used for navigating through the menus, and the “OK” button acts as an “Enter” or “Select” key.

The Home Screen

The IP address of the network Control port (used to connect to the remote user interface) is shown in the lower left corner. If a network connection is detected, the IP address will be yellow. If there is no network connection, the IP address will be red.

The primary reference clock source and status is shown in the lower right corner. Green indicates an active solid reference. Red indicates an inactive or missing reference.



Home screen

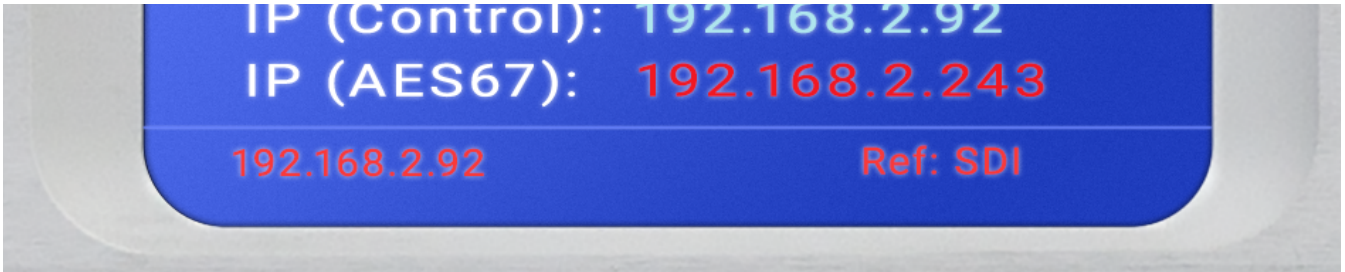
The Information Screen

Pressing the Right button navigates to the Information screen.

The name of this particular UPMAX ISC and its location are displayed at the top of the screen. These values can be customized using the remote interface as detailed in the "Upmixing" section.

The unit's unique serial number is shown next, followed by the current firmware version, the IP address of the Control port (the port used to connect to the remote interface), the IP address of the AES67 port (the port used to carry AES67 AoIP), and the current active clock reference.





Information screen

IP Configuration Screen

Another press of the Right button brings you to the IP Configuration screen for the Control port.

i IMPORTANT: The Control and AES67 Ethernet connections both require 1000BASE-T (Gigabit) switch ports in order to work properly.

If both the Control and AES67 ports will be used, they must be in different subnets. In-band control is available using the AES67 port.

If only one port will be used, set the unused port to “Static IP” with an IP Address of 0.0.0.0, a Subnet Mask of 0.0.0.1, and a Gateway of 0.0.0.0.

By default, the UPMAX ISC will automatically obtain an IP address from a DHCP server which will suffice to provide initial remote access to the unit for configuration purposes. A fixed IP address will be preferred in most cases and can be set as follows:

- Press the OK button to highlight “*Edit*”
- Press OK again to highlight “*Use DHCP*”
- Press the Right button to highlight “*Yes*”
- Press the Up/Down button to “*No*”
- Press the Left button to highlight the “*Static IP Address*” fields
 - Press the Down button to highlight “*Address*”
 - Press the Right button to move to the first digit of the IP address
 - Use the Up/Down buttons to change the selection
 - Press the Right/Left buttons to select another digit to edit
 - When finished editing the address field, press the Right or Left button to return to “*Address*”
 - Press the Down button to navigate to the Netmask and Gateway fields
- Repeat the above steps to edit the Netmask and Gateway fields; note that the gateway may be set to 000.000.000.000 if no gateway is required
- After the gateway is set, press the Left button to highlight “*Gateway*”
- Press the Down button to highlight “*Update*”
-

- Press OK to save the new IP information
- If you suddenly notice you've entered some incorrect information and need to bail out and start over, use the Right/Left buttons to highlight "Cancel" followed by "OK"

Pressing the Right button from the IP Configuration (Control) screen will bring you to the IP Configuration (AES67) screen. The steps for configuring this port are identical to those above for the Control port.

Finally, pressing the Right/Left buttons will eventually return you to the Home Screen.



IP configuration screen

Locate Mode

When you enable the "Locate Mode" from the remote user interface, the unit's front panel display will repeatedly change color until Locate Mode has been cleared by pressing any key on the front panel or by clicking again on the "Locate Mode" button on the remote user interface. Enabling Locate Mode affects only the unit's display and has no effect on the audio.

Special Function Key Presses

Performing a full Factory Reset and engaging the Hardware Relay Bypass are possible from the front panel by pushing and holding a particular combination of buttons.

Factory Reset

To reset the unit to its factory defaults, simultaneously press and hold the Left, Up, and Right buttons for ten seconds until a red countdown timer appears in the bottom left corner of the display.

i Important! Performing a factory reset will erase all I/O routing as well as any other custom settings you may have saved. **This information cannot be reclaimed once you reset the UPMAX ISC, even by contacting customer support or expressing genuine remorse for your decision.** We strongly recommend backing up your configuration to a computer before performing a factory reset to avoid re-setter's remorse. You have been warned!

Hardware Relay Bypass

UPMAX ISC includes a hard relay bypass that removes all internal circuits and processes from the signal path and connects each SDI and AES-3 input directly to its corresponding output.

To toggle the relay bypass on and off, simultaneously press and hold the Left, Down, and Right keys for three seconds until a red countdown timer appears in the bottom left corner of the display. **Do not confuse this sequence with the Factory Reset procedure described above.**

Remote User Interface

Connecting to UPMAX ISC using the web-based user interface.

Connecting to UPMAX ISC

As mentioned previously, certain settings and configurations can be accessed and performed using the front panel buttons and screen but the UPMAX ISC is designed to be connected to a network and operated through its web-based interface.

i IMPORTANT: As explained in detail in the [Installation and Initial Setup Using the Front Panel Interface](#) section, UPMAX ISC **must** be connected to 1000BASE-T (Gigabit) switch ports, and the Control and AES67 ports should **not** be connected to a common network with the same netmask/subnet.

No special client software is required, and the HTML-5-based GUI is device, operating system, and browser agnostic. We recommend using Google Chrome or Apple Safari. The computer or tablet should be on the same network and subnet as the UPMAX ISC.

Once the UPMAX ISC and your computer are connected to your network, enter the IP address of the UPMAX ISC to which you want to connect in the URL field of your browser. Once connected, the Home Screen will appear. As you navigate through the user interface, clicking on the **UPMAX ISC logo** (4-1A) in the top left corner will always return you to this screen.

Multiple users can connect to the same UPMAX ISC hardware simultaneously. Anyone connected to the unit will be able to see the information on this screen including the **unit's name** (4-1B) and **physical location** (4-1C).

Additionally, all users can access the **Meters screen** (4-1D) which shows input and output level meters along with pertinent information about the input or output bitstream (depending on the workflow selected).

See the section “UPMAX ISC Home Screen When Logged In” below for detailed information.

The **Locate Unit** feature (4-1E), which causes the front panel display of the unit to flash for easy identification in a crowded rack, can also be activated without logging in.

Additional information about installed options, clock sync, network status and IP address, power supply status, software and FPGA versions, and unit uptime **are displayed to the right of the screen** (4-1F).



Figure 4-1 - Home screen when not logged in

Logging In

Making modifications to the UPMAX ISC’s configuration, signal routing, or transcoding parameters via the remote user interface requires logging into the unit. At this time, only one level of access with is supported.

Enter the default password (1234) in the **password field** (4-1G) and click on the **Log in button** (4-1H). The password can be changed on the System page.

To remotely power down the unit, click on the **Shutdown Unit button** (4-1I).

UPMAX ISC Home Screen When Logged In

Additional menus become visible once you are logged in. These include the upmixing controls for the **Program Audio** (4-2A), the **I/O menus** (4-2B) which include clock, GPI/O, and delay controls, **detailed system-wide information and configuration settings** (4-2C) which includes the IP configuration menu, and the **Log Out button** (4-2D).

NOTE: This section is primarily an overview of the user interface to provide an explanation of the

various menus and screens. It is not intended to provide step-by-step instructions for setting up or operating the UPMAX ISC. Where applicable, references to specific sections will be made where you can find more detailed instructions for specific controls.



Figure 4-2 - Home screen when logged in

Program Menu

Clicking on the **Program 1** menu (4-3A) brings up the main menu for all signal processing and monitoring functions related to Program 1. The name of the program can be customized by clicking on the **program text field** (4-3B).

Upmixing settings can be saved in a single program preset in the **Preset menu** (4-3C) for easy recall. Note that there are no factory presets, and so the menu field will appear blank until a user preset is created and saved.

Clicking on the **Preset management icon** (4-3D) reveals a dropdown menu with the following options:

- **Save:** Saves the current Program 1 settings to the selected preset, immediately over-writing the previous settings associated with the preset; note that if there are no user presets saved, the “Save As” dialogue box will appear and prompt you to enter the name of the new preset
- **Save As:** Saves the current Program 1 settings to a new preset; a “Save As” dialogue box will appear and prompt you to enter the name of the new preset
- **Delete:** Permanently deletes the selected preset
- **Import:** Allows you to import a preset that was previously exported and saved to the remote PC; this can be a handy tool when setting up multiple units that are configured in exactly the same way rather than setting each control individually

- **Export:** Allows you to export a preset either for safekeeping as a backup should it accidentally get erased from the unit, or for making it available for uploading to other units requiring the same configuration using the “Import” feature described above

The **Input Format field** (4-3E) displays the channel format of the input audio.

Audio levels are displayed on the **input meters** (4-3F) and **output meters** (4-3I).

The most commonly used controls for the upmixer are shown in the **Basic controls** portion of the screen (4-3G). The **Advanced controls menu** (4-H) is collapsed by default but can be expanded by clicking on the down arrow.

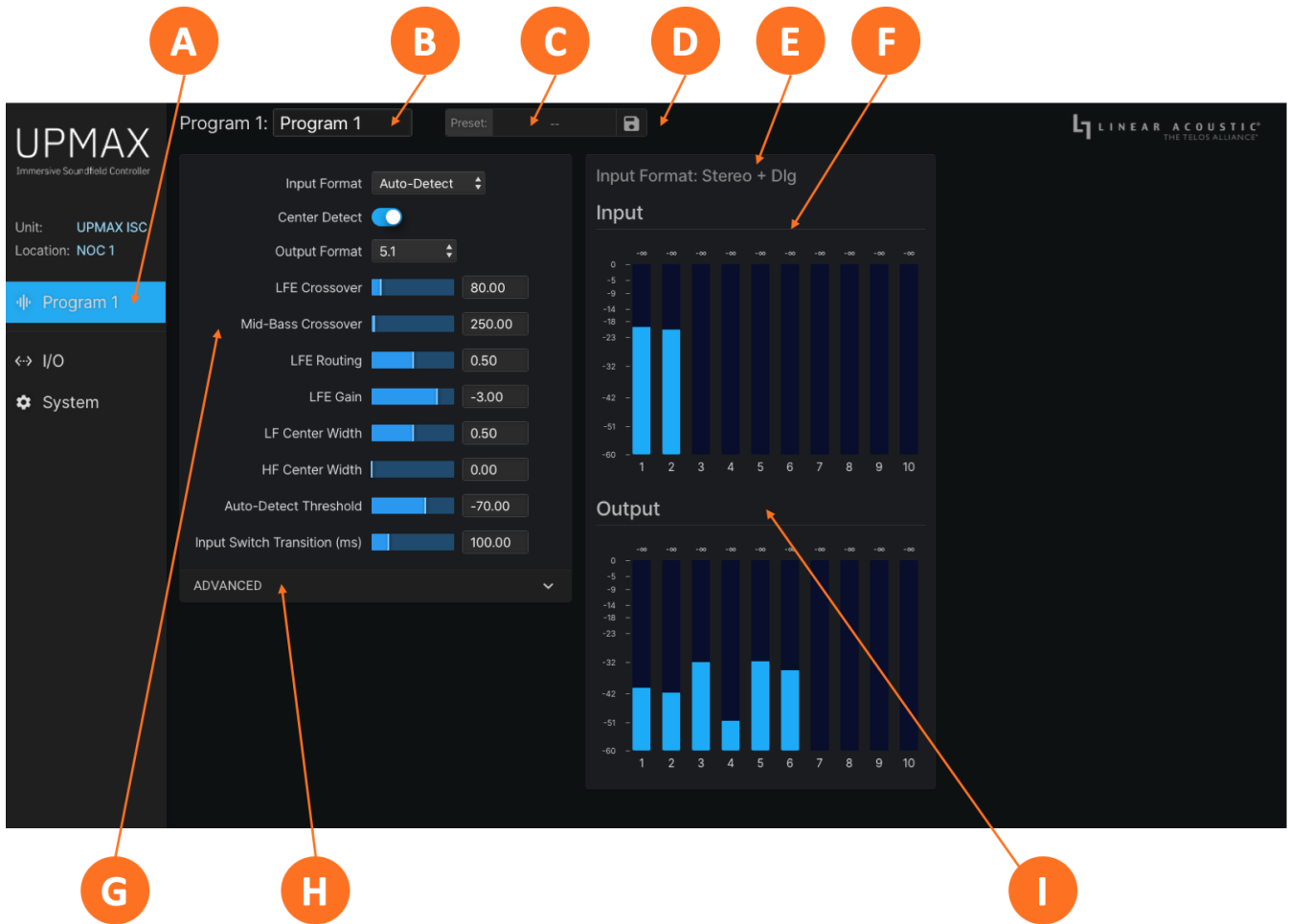


Figure 4-3 - Program menu

I/O, Clocking, and Reference

Configuring inputs, outputs, clock reference, delays, sample rate converters, and GPI/O.

Input and Output Routing

Connect your SDI, AES-3, and/or AES67 sources to the rear panel of the UPMAX ISC as required for your installation.

The UPMAX ISC can access any of the eight audio pairs carried in the incoming HD- or SD-SDI streams applied to SDI Input 1. Inputs and outputs for five stereo pairs via AES-3 are also provided. Any visible and accessible AES67 networked audio source can be input into UPMAX ISC for processing then returned to the network via AES67, embedded into the SDI output, and/or sent to the AES-3 output. UPMAX ISC supports taking an input signal from one source type and sending the resulting audio or bitstream to another output type.

Initial I/O Setup

Log into the UPMAX ISC and click on the **I/O menu** (5-1A). Choose between SDI/AES-3/MADI or AES67 inputs and outputs in the **Workflow menu** (5-1D). Program (processed) routing, Passthrough (unprocessed) routing, or both can be viewed by toggling the **Program/Passthrough switches** (5-1E).

Much like the upmixing presets described in the Program menu overview in the [Remote User Interface](#) section, I/O presets can also be saved and recalled in the **Preset menu** (5-1B). Clicking on the **I/O Preset management icon** (5-1C) reveals a dropdown menu with the following options:

- **Save:** Saves the current I/O settings to the selected preset, immediately over-writing the previous settings associated with the preset; note that if there are no user presets saved, the “Save As” dialogue box will appear and prompt you to enter the name of the new preset
- **Save As:** Saves the current I/O settings to a new preset; a “Save As” dialogue box will appear and prompt you to enter the name of the new preset
- **Delete:** Permanently deletes the selected preset
- **Import:** Allows you to import an I/O preset that was previously exported and saved to the remote PC; this can be a handy tool when setting up multiple units that are configured in exactly the same way rather than setting each control individually
- **Export:** Allows you to export an I/O preset either for safekeeping as a backup should it accidentally get erased from the unit, or for making it available for uploading to other units requiring the same configuration using the “Import” feature described above





Figure 5-1 - I/O menu

Routing a signal into the UPMAX ISC is a two-step process.

The first step is creating an input group from the **available physical hardware inputs** (5-2A). The second step is **routing the audio from these inputs into the upmixer input** (5-2B).

Routing a signal to the output is a similar two-step process which starts with creating an output group from the **available physical hardware outputs** (5-2D) and then **routing the audio from upmixer output** (5-2C) to the physical outputs.

The **Delete All Groups** button (5-2E) provides a quick way to – you guessed it – delete all groups simultaneously.

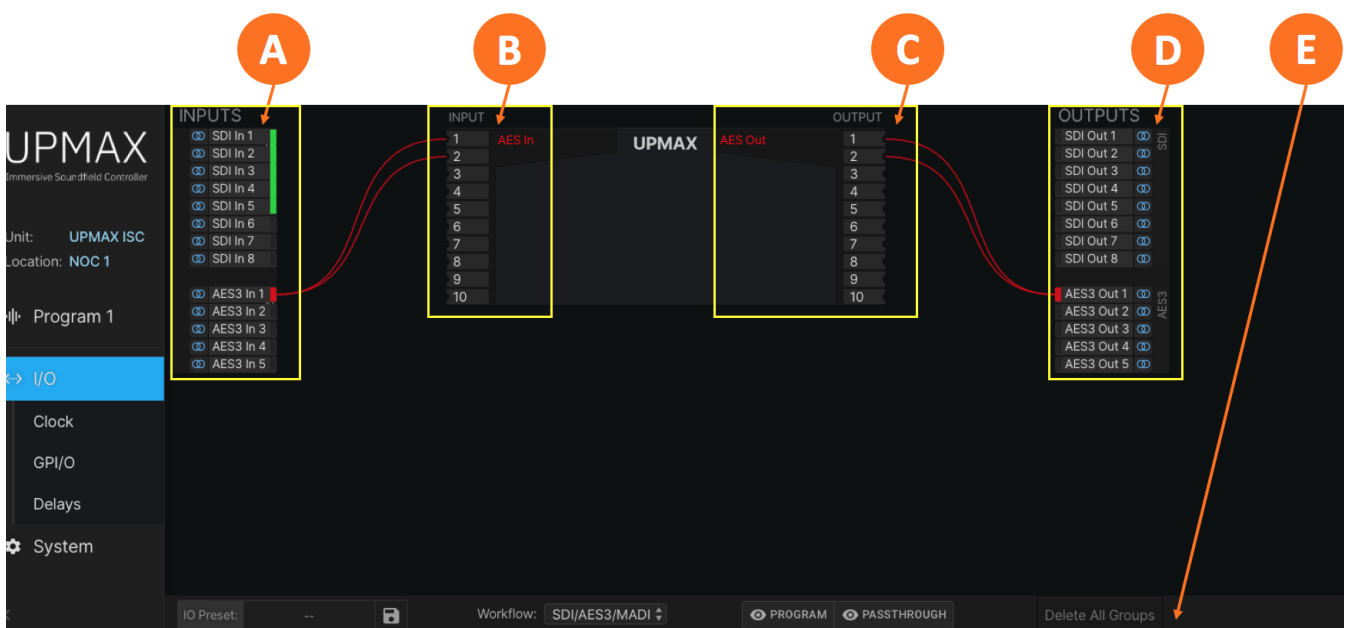


Figure 5-2 - Signal routing menu

Creating an Input Group

Click on your first **audio input source** (5-3A) to highlight it, then right-click and select “Create Input Group.” You may enter a custom name for this source in the **Label field** (5-3F) and **customize the color** (5-3D) of the graphical routing lines.

Multi-channel groups can be created by holding the “Shift” key while selecting sources (Shift + Click).

Creating groups using non-contiguous channels is accomplished by holding the “Ctl” key while selecting sources (Ctl + Shift).

NOTE: The channel order must still follow the proper convention to be properly assigned. For example, L/R, C/LFE, Ls/Rs, Lfh/Rfh, Lrs/Rrs if setting up a 5.1-channel input on SDI 1-6 with height channels on SDI 13-16.

If the channels in the input group are destined to be upmixed, select “Program” in the **View as switch** (5-3E). If the input group is being established only to pair shuffle or to pass through content without upmixing, choose “Passthrough.”

To quickly route a physical channel pair to the corresponding input to the upmixer – for example, to route AES 7/8 to input 7/8 of the upmixer – you may click on the **Align button** (5-3B) in lieu following the steps below for routing. Clicking the **Clear All button** (5-3C) acts as an “escape” button in case you need to start over.

Click the **Save button** (5-3G) to save the configuration or the **Cancel button** (5-2H) if you need to start over without saving your configuration.

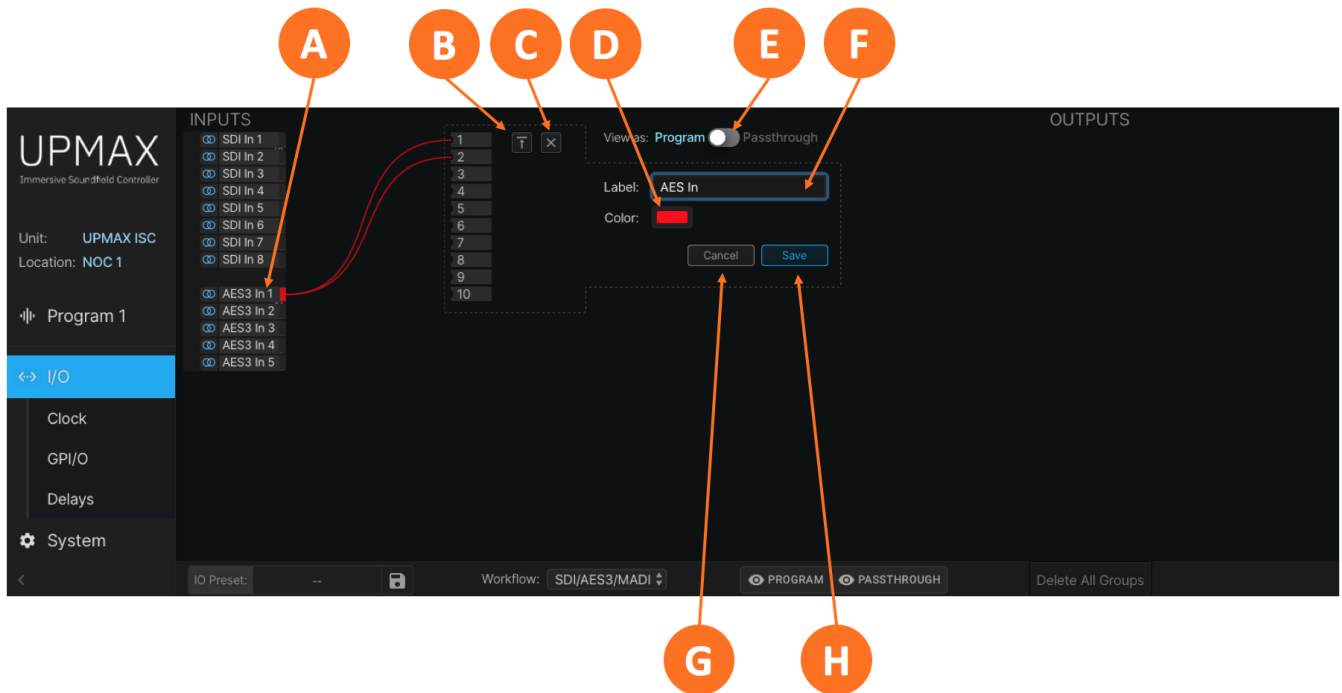
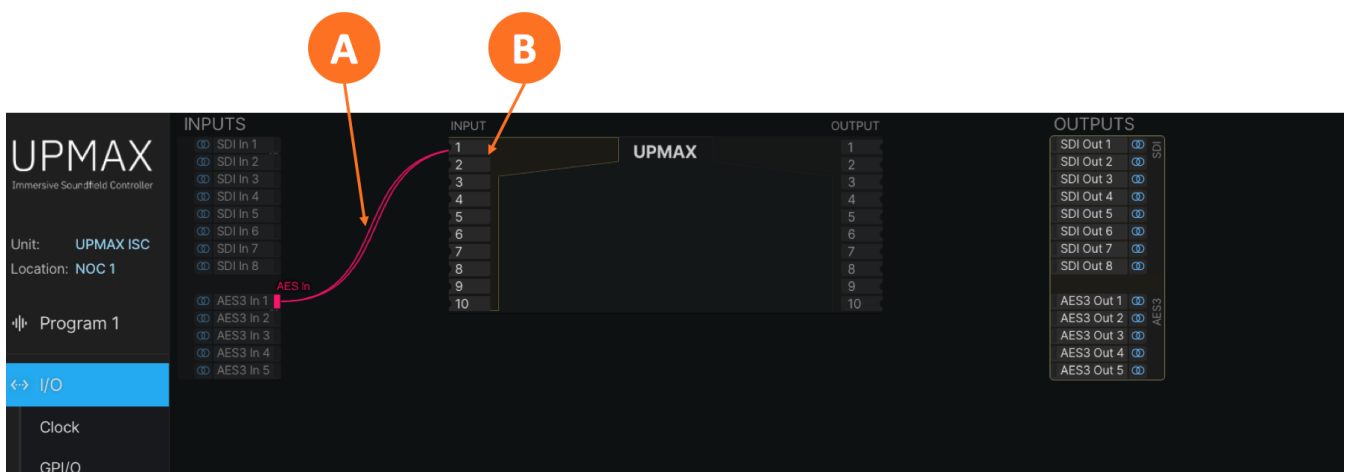


Figure 5-3 - Creating an input group

Routing Audio to the Upmixer Input

After creating and saving the input, it is necessary to route the physical audio input pair to the input of the upmixer. Click on the **input audio pair** (5-4A), drag the lines to the desired **upmixer input pair** (5-4B), then release the left mouse button.



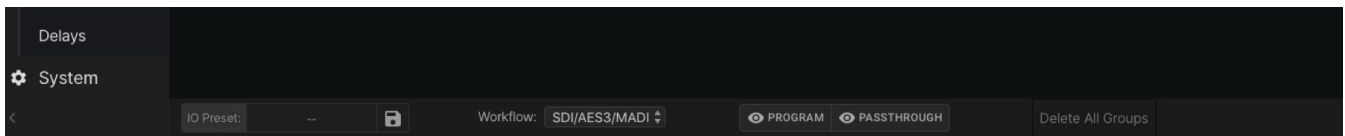


Figure 5-4 - Routing input audio

To edit, delete or re-assign an existing group, or to add an additional assignment for the same input audio pair, right-click on the **colored rectangle** (5-5A) to the right of the appropriate pair. The **Edit menu** (5-5B) will appear and offer the following options:

- **Add Assignment:** Only one upmixing instance is available in this software version, but additional instances are planned for future versions at which point it will be possible to route a group to multiple upmixers with this control
- **Remove All Assignments:** Clears all current channel mapping for the selected input audio pair
- **Edit Group:** Allows the input name and color to be changed
- **Delete Group:** Completely clears the input group

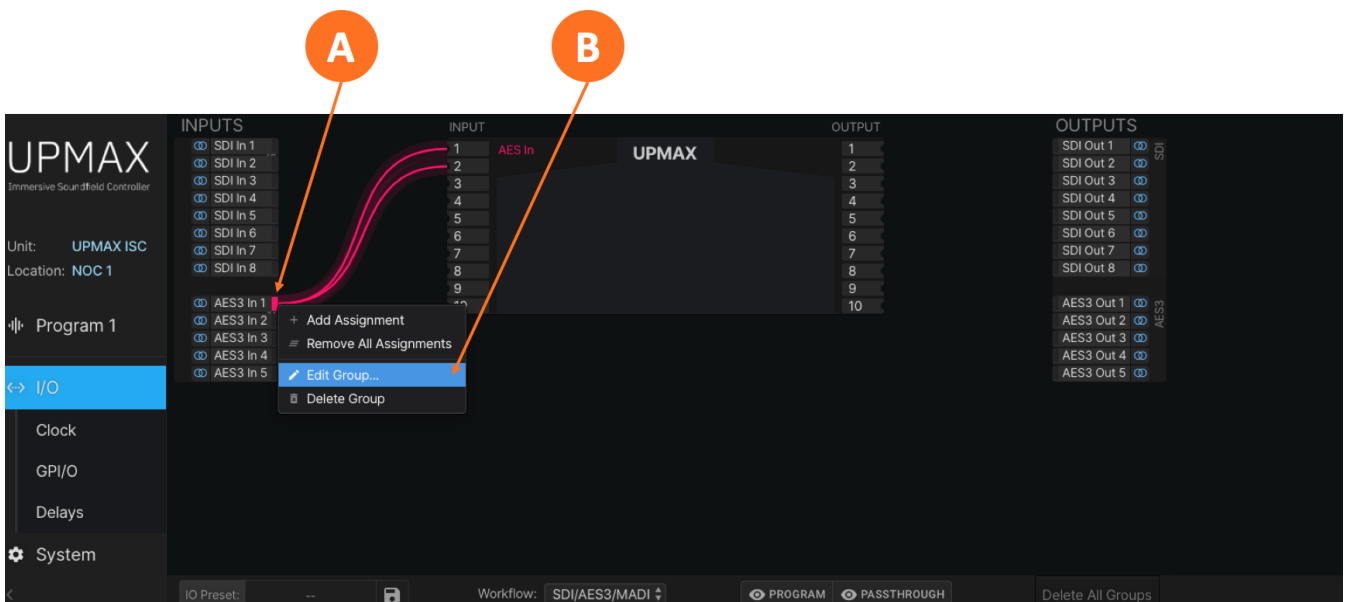


Figure 5-5 - Editing or deleting an input group

Creating an Output Group

The steps for creating an output group are identical to creating an input group, but with the Outputs menu.

Routing Audio to the Program Output

Once the first output group has been created and saved, drag the output audio lines from the physical outputs to the desired output pair of the upmixer, then click “Save.”

GPI/O

UPMAX ISC features five GPI and five GPO functions through its rear panel DB-15 connector, activated by a

momentary contact closure

GPI/O Pinout

Pin	Function	Pin	Function
Pin 1	+5VDC	Pin 9	+5VDC
Pin 2	GPI 1	Pin 10	GPO 1
Pin 3	GPI 2	Pin 11	GPO 2
Pin 4	GPI 3	Pin 12	GPO 3
Pin 5	GPI 4	Pin 13	GPO 4
Pin 6	GPI 5	Pin 14	GPO 5
Pin 7	Ground	Pin 15	Status OK
Pin 8	Ground		

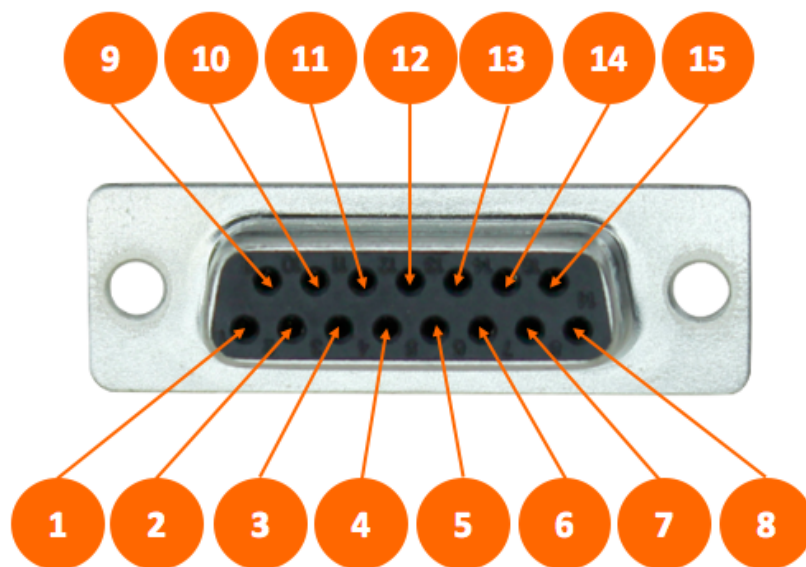


Figure 5-6 - GPIO pinout

Latency and Delay

Latency through the UPMAX ISC varies depending on which inputs and outputs are used and whether or not SRCs are enabled. In any case, it will be necessary to compensate for any latency incurring in the encoding process. Please see the Specifications section of this manual for latency measurements for the current software version.

To compensate for the processor's latency and avoid lip-sync issues, an SDI video delay is provided in the **Delays sub-menu** of the I/O menu (5-7A). Click on the millisecond and/or microsecond fields in the **Video Delay section** (5-7B) and type in the required value. If the output needs to be delayed by an even frame (the value of which will vary depending on frame rate), simply enter that number.

Note: Entering an even frame value will result in a situation where it is necessary to add additional audio delay to the AES67 and AES-3 outputs so that they match the timing of the SDI output signal. This can be accomplished by setting the **Audio Delay** (5-7C) to a value equal to the difference between a full-frame and the latency of the unit.

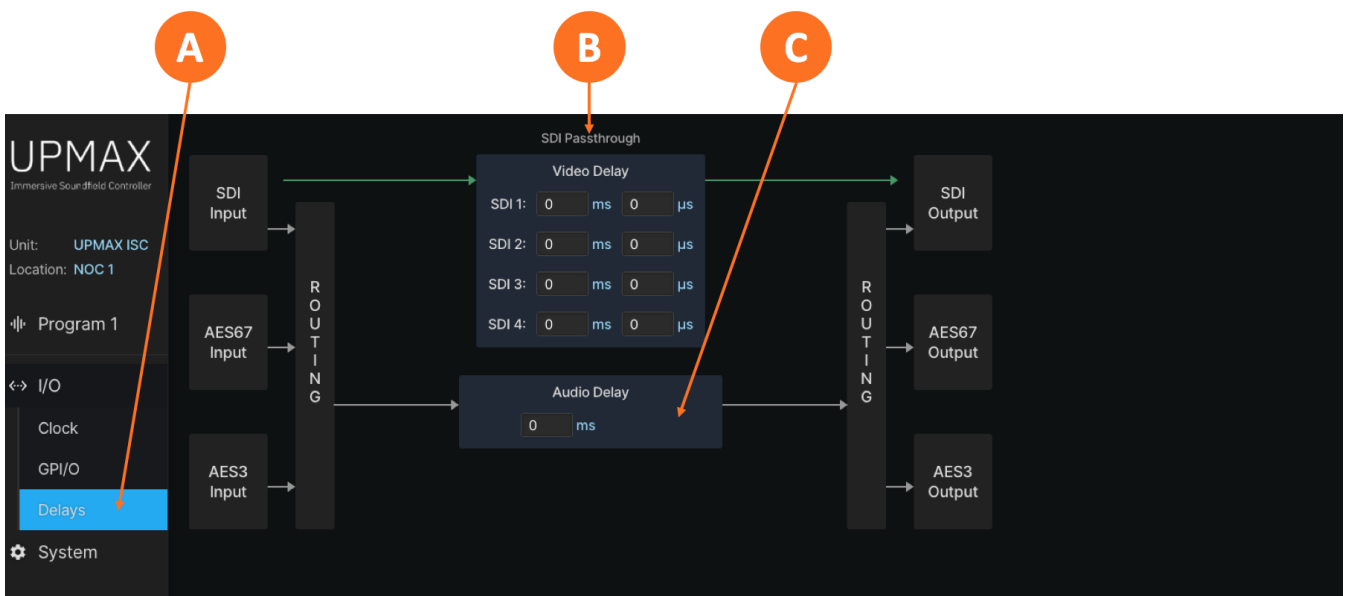


Figure 5-7 - Delays menu

Sample Rate Converters

Sample rate converters (SRCs) are provided on each SDI input pair, each SDI output pair of the first SDI output, and each AES-3 input pair, for a total of 36 SRCs altogether. The AES-3 output is always synced to the active reference clock. **There are no SRCs in the AES67 path.**

The SRCs can be enabled and disabled per pair by clicking on **I/O** (5-8A), highlighting then right-clicking on the appropriate input or output pair, and then selecting **Input Settings** (5-8B) (or Output Settings as appropriate).

Use the **SRC enable switch** (5-8C) to enable or disable the SRC for each active pair.

A **Used counter** (5-8D) is provided to help keep track of how many SRCs are in use and how many are available.

The **Configuration switch** (5-8E) allows the SRCs to be distributed in one of two ways: 20 can be made available for Input and 16 for Output, or all 36 can be reserved for only the Input.

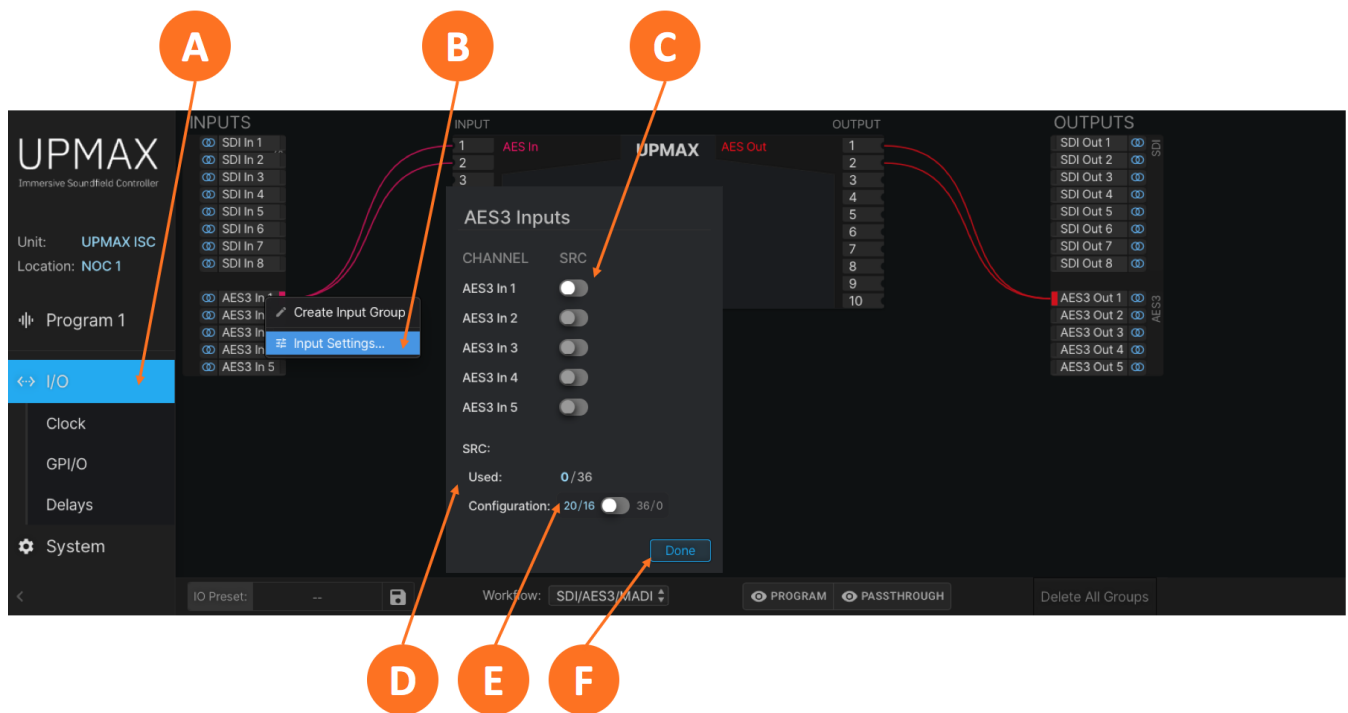


Figure 5-8 - Sample rate converters

Clock Reference

Because the UPMAX ISC supports multiple input and output formats, having a firm grasp of the clock sync (reference) requirements is critical.

Clock Reference Requirements

Sample Rate Converters (SRCs) are provided on both SDI inputs, the SDI 1 output, and the AES-3 input. The AES-3 output is always synced to the active reference clock. There are no SRCs in the AES67 path.

Reference clock source options include:

- Internal 48kHz
- SDI Input
- AES-3 Input
- MADi Input (when optional MADi card is present)
- PTP (AES67)

When all input sources are SDI and the output of the processor is routed to the embedded SDI output, the reference signal present on the SDI input **must** be used.

When using AES-3 I/O, the UPMAX ISC can be referenced to either the AES-3 clock (using the SRCs in the SDI path) or to the SDI clock (using the SRCs in the AES-3 path).

When using an AES-3 source without an accompanying reference, the UPMAX ISC's 48kHz internal clock can be used as the system reference if necessary, providing the SRC on the AES-3 input is enabled.

Whenever AES67 audio is used either on the input, the output, or both, the UPMAX ISC **must** slave to an externally-generated PTP clock as it cannot generate its own PTP reference.

NOTE: The UPMAX ISC is set to operate in slave mode by default. There are controls in the Sync/QoS sub-menu of the System menu to change this should the ability to operate as a clock master be introduced in future software versions, but only Slave Only mode is currently supported.

Setting Clock Reference

Click on the **Clock menu** (5-9A). Use the dropdown menus to choose a **Primary Reference Clock** and a **Secondary Reference Clock** (5-9C) and, if needed, a **VRef clock source** (5-9E).

A **status field** (5-9D) is provided for the selected Primary and Secondary Reference Clocks to the right of the dropdown menu. The absence or presence of a signal for each input type along with the format, resolution, and frame rate for incoming SDI signals is shown in the **Input Status** section (5-9B).

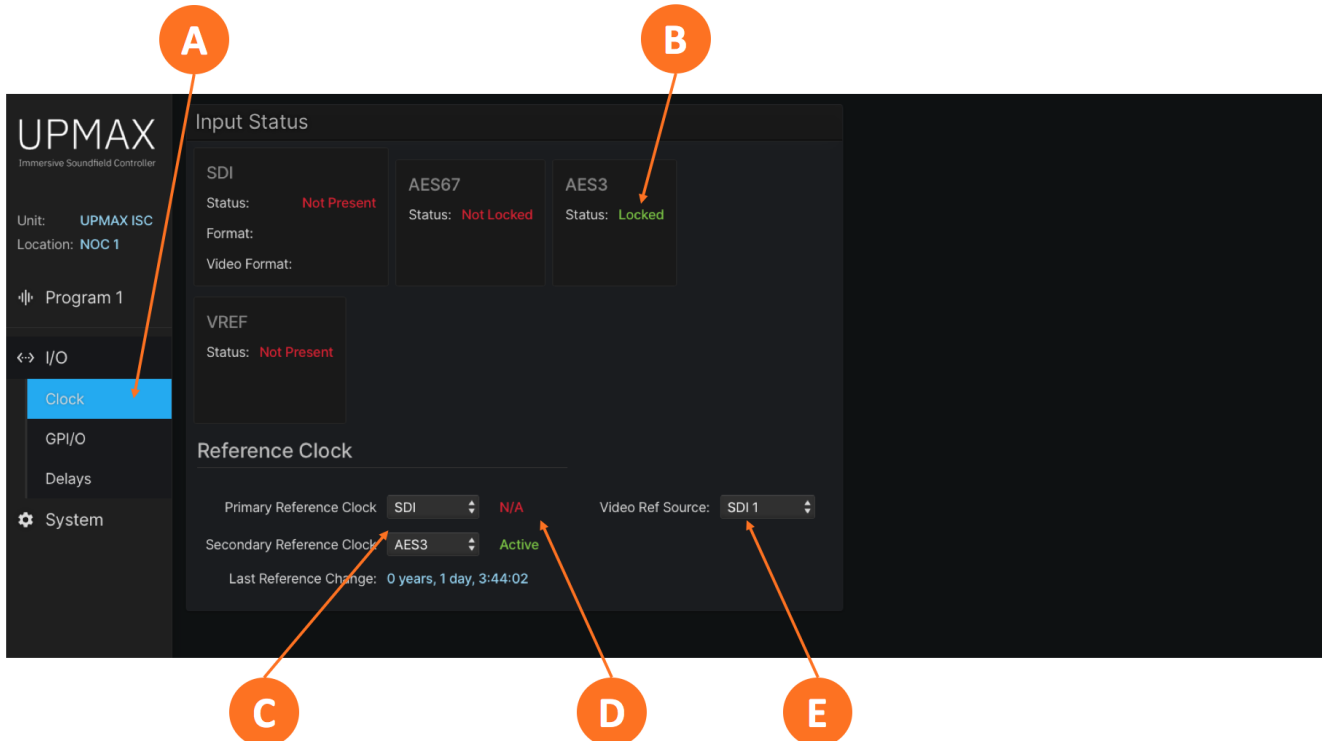


Figure 5-9 - Clock reference

The UPMAX ISC offers five GPI and five GPO functions through its rear panel DB-15 connector, activated by a momentary contact closure. The configuration is done by first clicking on the **GPI/O menu** (5-10A).

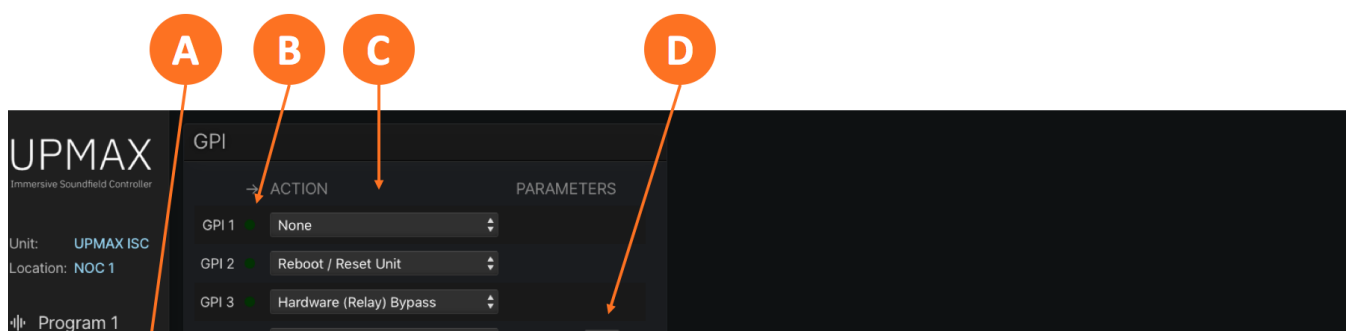
GPI/O Actions

GPI Actions (5-10C) include:

- None
- Reboot/Reset Unit
- Hardware (Relay) Bypass
- Recall Preset
- Recall I/O Preset

GPO Events (5-10E) include:

- None
- GPI Passthrough
- Power Supply 1 up
- Power Supply 2 up
- Power Supply 1 down
- Power Supply 2 down
- Unit resetting
- Unit rebooting
- Unit powering down
- Unit above temperature
- Unit bypass (relay bypass) active
- Change in reference
- Primary reference clock is lost
- Secondary reference is lost
- Primary reference clock is active
- Secondary reference is active
- Internal reference is active



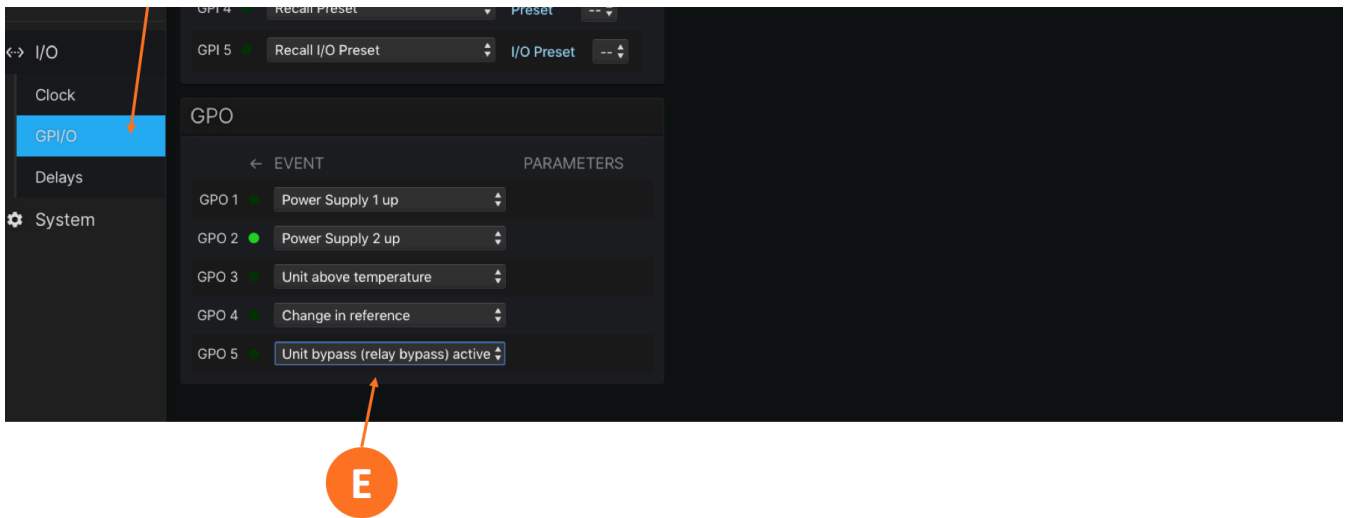


Figure 5-10 - GPI/O menu

The **State Indicator** (5-10B) for each function will light green for the duration of the closure on GPIs. For GPOs, it will light green for the duration of the active event.

A choice of associated **Parameters** (5-10D) is displayed for applicable Actions. At this time, there are no user-defined parameters associated with any GPI or GPO. Should functions with such parameters be included in future software releases, they will appear in a dropdown menu.

Upmixing

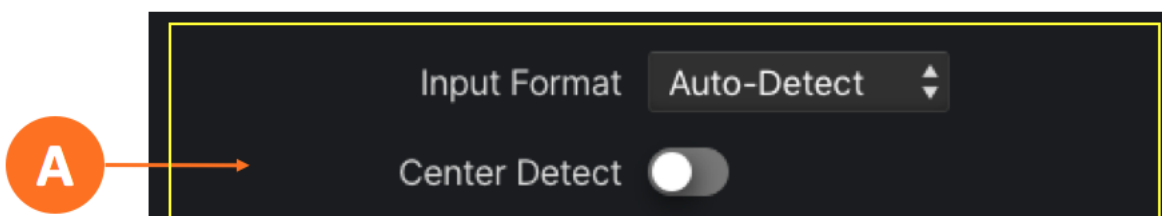
An overview and explanation of the upmixing controls.

UPMAX ISC uses the latest Linear Acoustic® upmixing algorithm for upmixing from 2-, 3-, 5.1-, and 7.1-channel audio to immersive formats including 5.1.2, 5.1.4 and 7.1.2. If the channel count and format of the incoming content matches the desired output format, UPMAX ISC will pass it through as-is.

The UPMAX menu is separated into Basic and Advanced sections. The Basic menu is displayed by default. The Advanced menu can be expanded with a dropdown menu as needed.

Basic UPMAX Menu

The controls in the Basic menu can be divided into four basic groups: **Format controls** (6-1A), **LFE Channel controls** (6-1B), **Center Width controls** (6-1C), and **Auto-Detect controls** (6-1D).



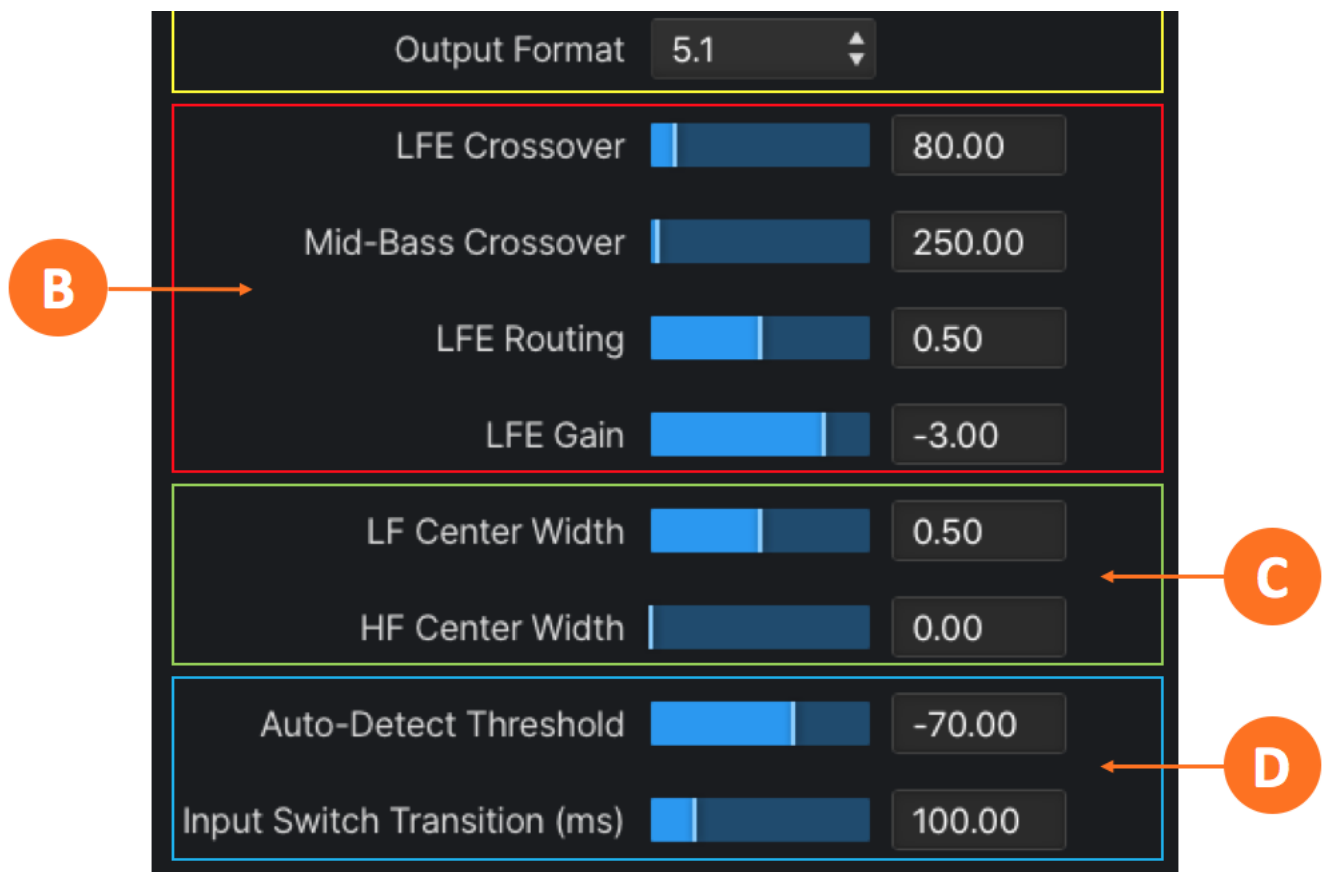


Figure 6-1 - Basic UPMAX control grouping

Format Controls

Input Format

The **Input Format menu** (6-2A) is used to specify the channel format of the source audio. If the input format matches the selected output format (as selected with the Output Format control) the unit will pass the signal through as-is without additional processing. Input options include:

- **Auto Detect:** In this mode, the unit continuously monitors the input signal to determine its format and will automatically switch to one of the processing modes below (Stereo, Stereo + Dialog, or 5.1)
- **Stereo:** Stereo content will be upmixed to the desired output format
- **Stereo + Dialog:** Stereo content will be upmixed to the desired output format, while a dedicated dialog input on Channel 3 will be passed through to the Center output
- **5.1:** 5-1-channel content will be upmixed to the desired output format
- **Pass-through:** Pass-through will pass the input signal directly through to the output with no additional processing; this can be used as a “soft bypass” function as the signal still runs through the upmixer and therefore incurs the same amount of latency as it would if it was actually upmixing a signal, thereby preserving A/V sync and avoiding lip-sync issues

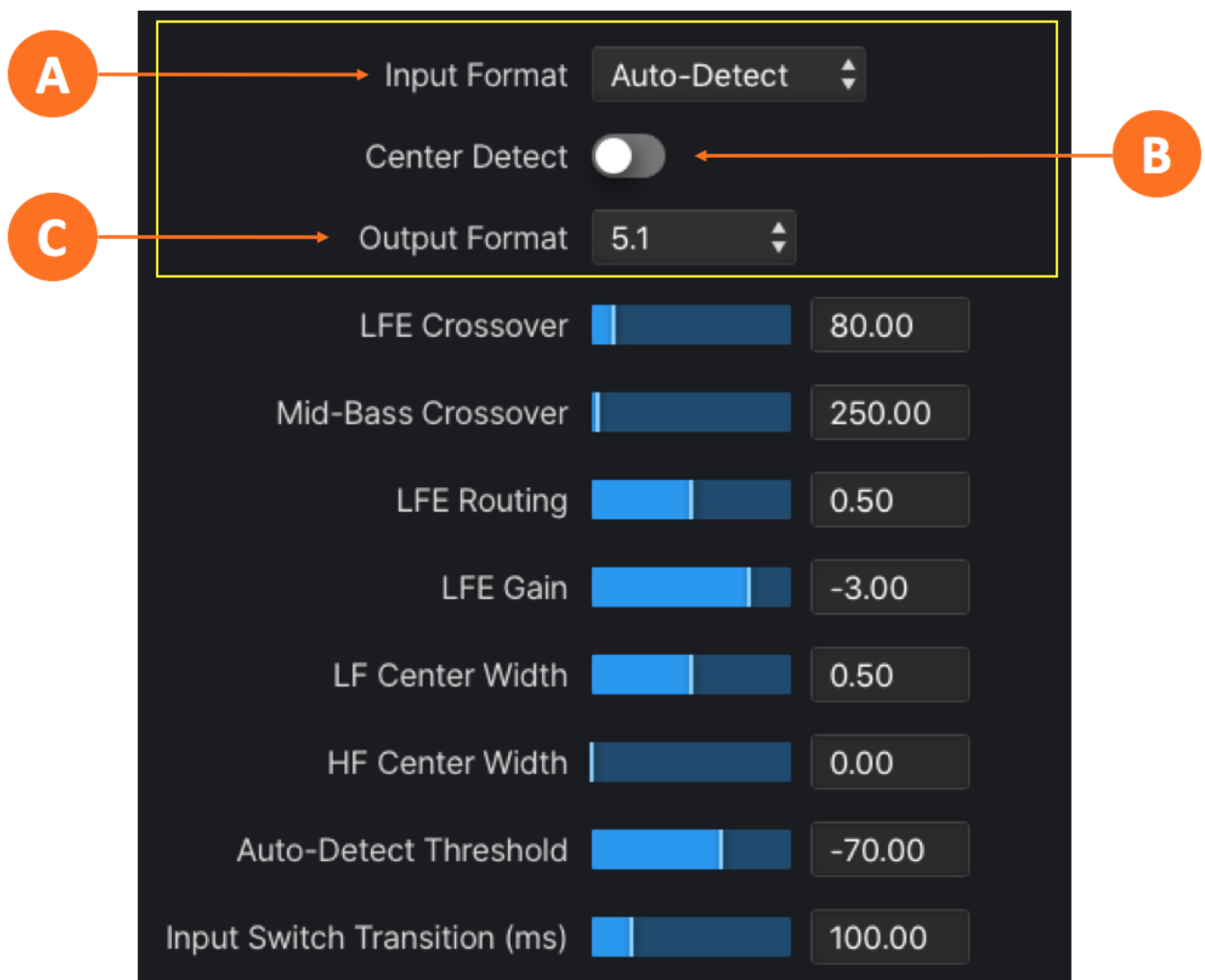
When Auto Detect is selected, enabling the **Center Detect control** (6-2B) upmixes stereo content to the specified output format but ignores the presence of audio on Channel 3, which is typically dialog. The Channel 3 audio is time-aligned and summed with the upmixed version of the audio at the output. This is

especially useful in sports production where announcer dialog is often routed on a separate bus, giving downstream facilities the options to edit or replace the announcer track.

Output Format

The **Output Format menu** (6-2C) determines the output channel configuration. Output options include:

- **5.1:** Provides a constant 5.1-channel output from Stereo, Stereo + Dialog, and 5.1-channel input sources
- **5.1 Legacy:** Like the standard 5.1 output, it provides a constant 5.1-channel output from Stereo, Stereo + Dialog, and 5.1-channel input sources but with upmixing that is sonically closer to the previous UPMAX algorithm used in the Linear Acoustic UPMAX v4 upmixer and the algorithm employed in the various Linear Acoustic AERO®-series processors
- **7.1:** Provides a constant 7.1-channel output from Stereo, Stereo + Dialog, 5.1-channel, and 7.1-channel input sources
- **7.1+2:** Provides a constant 7.1.2-channel output from Stereo, Stereo + Dialog, 5.1-channel, 7.1-channel, or 7.1.2-channel input sources
- **5.1+4:** Provides a constant 5.1.4-channel output from Stereo, Stereo + Dialog, 5.1-channel, or 5.1.4-channel input sources



LFE Channel Controls

The LFE channel controls are used to tune the crossover frequencies, gain, and signal routing of the low-frequency effects audio.

LFE Crossover

The **LFE Crossover control** (6-3A) defines the frequency at which audio below the setting is routed to the LFE channel and audio above is sent to the Lf, Rf, C, Ls, and Rs channels. The crossover is typically set between 60 and 100Hz. This control works in combination with the LFE Routing and LFE Gain controls to create the LFE Channel.

Mid-Bass Crossover

Audio sent to the Center channel is split into two bands, LF and HF. The **Mid-Bass Crossover control** (6-3B) defines the crossover frequency of the split.

Splitting the Center channel into two bands allows the user to freely control the width of each frequency band across the Center, Left, and Right soundstage.

This can be very useful in keeping the main phase-correlated signal (HF band) in the Center Channel for dialog while spreading the lower frequency portion of the Center channel audio (the LF band) - which could still contain some low-frequency dialog along with music and effects - across all three front channels.

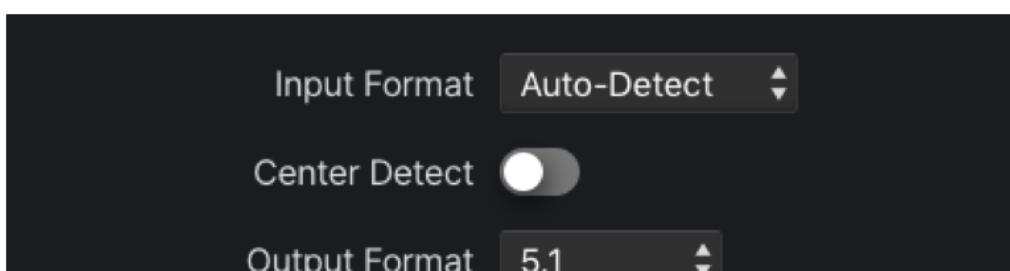
LFE Routing

The **LFE Routing control** (6-3C) balances the amount of LFE content (audio below the LFE Crossover Frequency setting) sent to the LFE channel versus what remains in the Lf, Rf, C, Ls, and Rs channels.

Setting this control to 0.50 sends 50% of the audio below the LFE Crossover the LFE channel and leaves 50% in Lf, Rf, C, Ls, and Rs channels. A setting of 0 sends no audio below the crossover frequency to the LFE channel, while a setting of 1 sends all audio below the crossover frequency to LFE channels, effectively removing it entirely from the remaining channels.

LFE Gain

The overall gain level of the LFE channel is set by the **LFE Gain control** (6-3D) and is typically set at a value of 0dB.



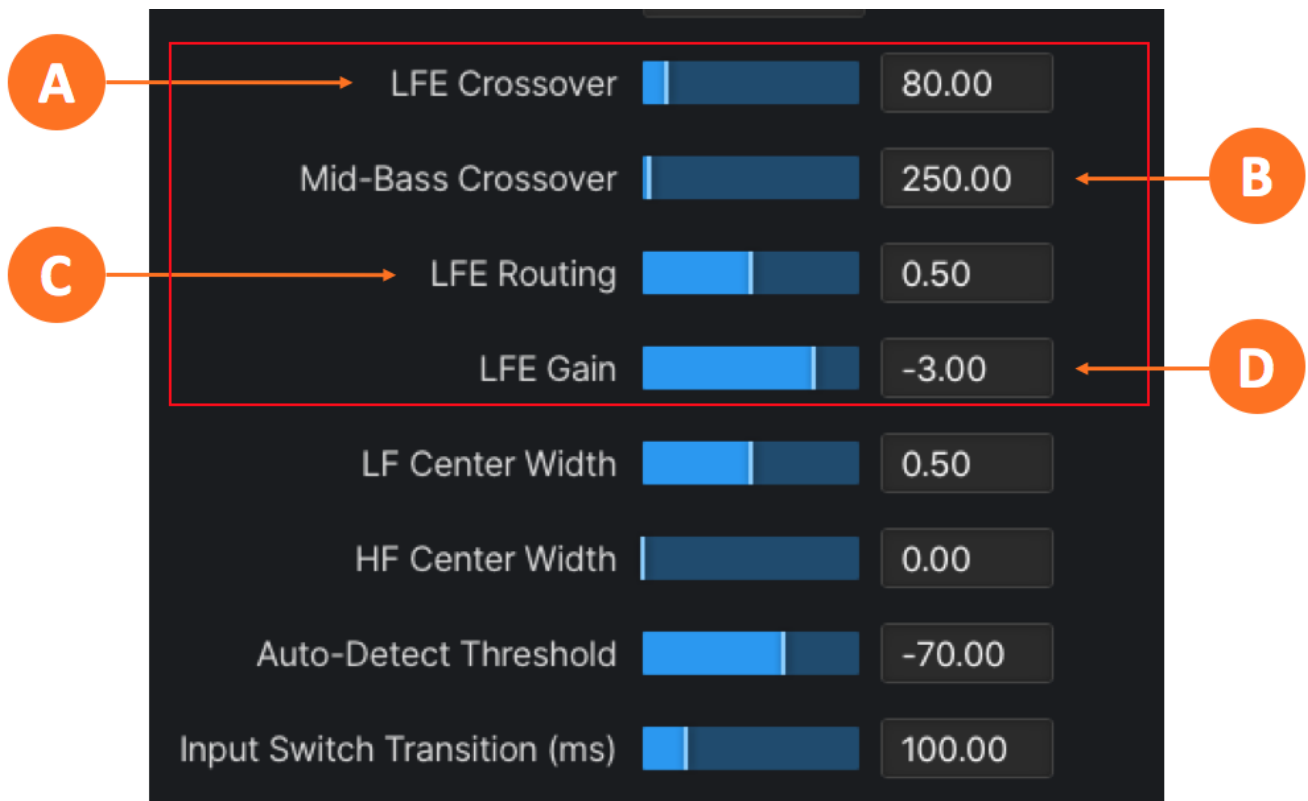


Figure 6-3 - LFE channel controls

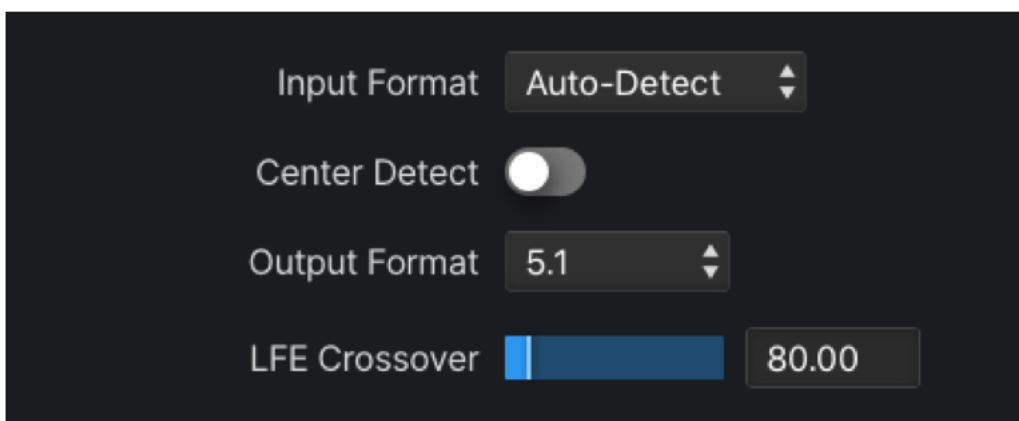
Center Width Controls

These controls define the routing of the Center channel LF and HF bands across the Left, Center, and Right channels. Used in combination with the Mid-Bass Crossover frequency control, they provide the ability to craft the image of the Front channels in a way that maintains a direct sonic-visual association of dialog while providing a pleasant and wide image of the phase-correlated elements. Values are expressed in a decimal format but easily correlate to a percentage value (0.00 = 0%, 0.50 = 50%, 1.00 = 100%, etc.).

The **LF Center Width control** (6-4A) determines the amount of LF audio routed to the Center versus the Left and Right Channels.

The **HF Center Width control** (6-4B) does the same for audio in the HF band.

A setting of 0% sends all audio in the respective band to the Center channel, while a setting of 100% sends audio to the Left and Right channels only. Intermediate values provide a blend to create any desired mix.



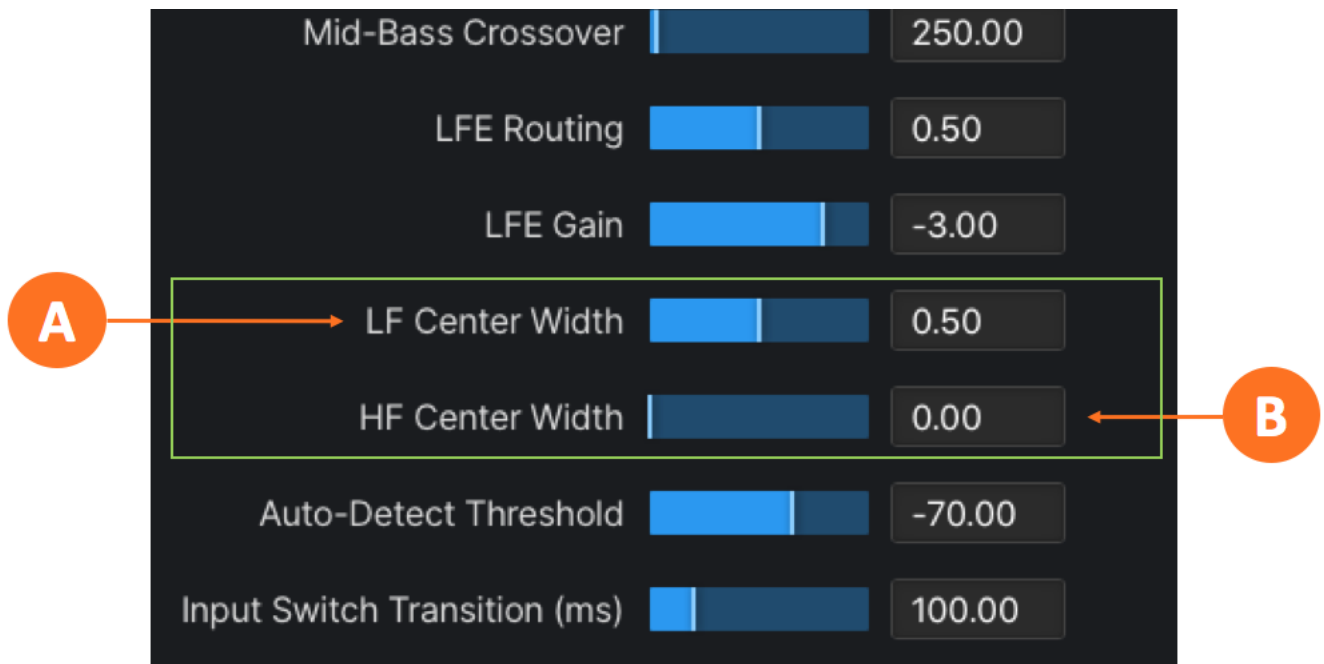


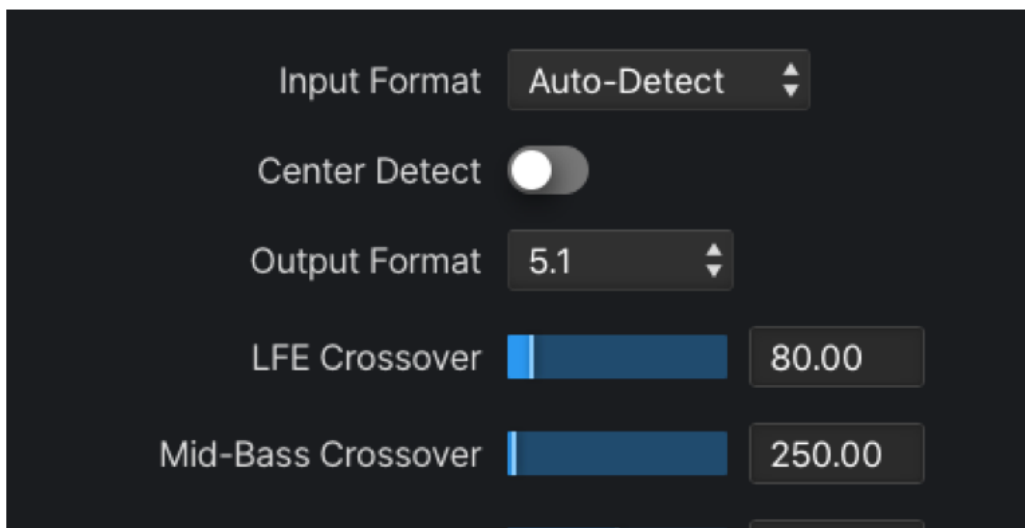
Figure 6-4 - Center Width controls

Auto-Detect Controls

When the Input Format is set to Auto-Detect, the UPMAX ISC continuously monitors the input signal to determine its format and will automatically switch between upmixing to the selected Output Mode and pass-through.

The level at which the detector circuit determines that the incoming signal is program audio (and not noise or silence) is set by the **Auto-Detect Threshold control** (6-5A). The proper setting depends largely on the quietness (or noisiness) of channels that are not muted but also contain no audio. Set too low, it may cause a false trigger to upmix; set too high, it may cause a late transition to upmixing. The default value of -70dB should work well for modern production while values as high as -63dB may be required for noisy sources.

The amount of time in milliseconds a signal must stay above the Auto-Detect threshold before the unit begins upmixing - or below the threshold to cease upmixing - is determined the **Input Switch Transition control** (6-5B). A value between 10ms and 12ms is a good starting point for most material.



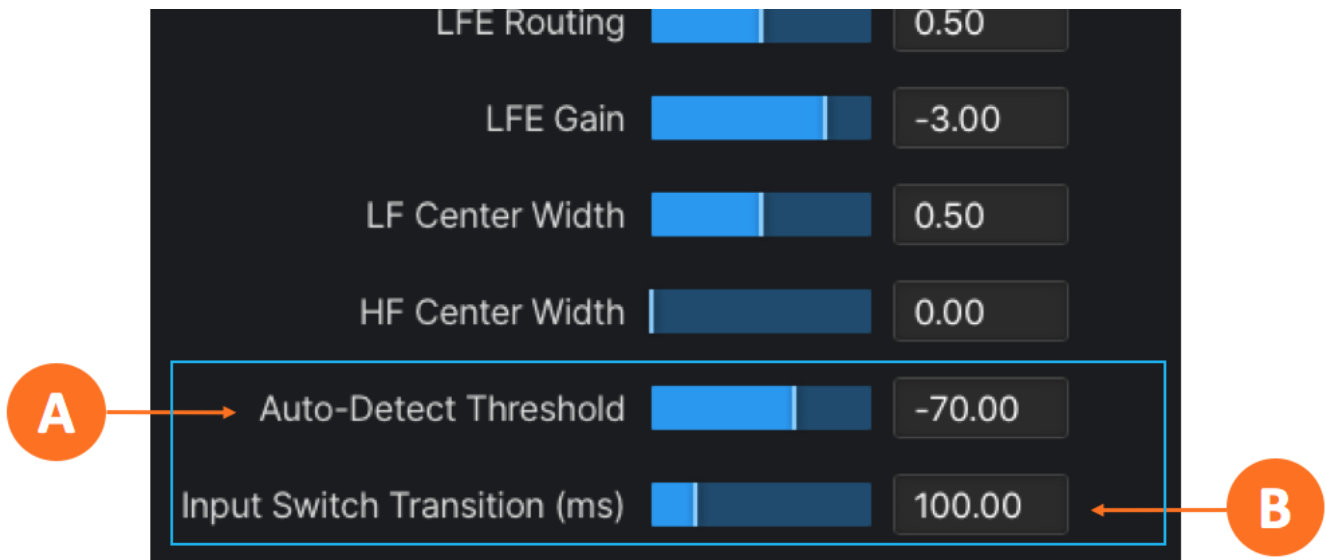


Figure 6-5 - Auto-Detect controls

Advanced UPMAX Menu

The Advanced parameters are included for audio experts who wish to dig deep and tweak settings for very specific applications or demanding tastes. They are not required for most users and are accordingly not displayed by default.

NOTE: Some advanced controls - specifically those relating to additional side and height channels - will be grayed out if they are not applicable to the selected output format.

Cycles per Octave

The **Cycles per Octave control** (6-6A) defines the number of teeth there are in one octave of frequency change of the comb filter. The comb filter is used to separate different frequency components of the input signal to aid in steering sounds in the surround field.

Minimum Comb Filter Frequency

The lowest frequency of the comb filter is set by the **Minimum Comb Filter Frequency control** (6-6B). For most applications, this should be set at or near the same frequency as the Mid-Bass Crossover frequency.

Comb Filter Level

The **Comb Filter Level control** (6-6C) sets the overall level of the comb filter. This control can have a significant impact on the movement of audio between the front and rear channels, with higher values rendering a greater sense of depth. In nearly all cases, leaving this control at its default value will result in the most pleasing soundfield.

Front-Rear Balance Factor

The **Front-Rear Balance Factor control** (6-6D) determines the amount of upmixed sound pushed to the surround channels (analogous to the Surround Depth control in previous UPMAX versions). A value of 0 sends all audio to the Rear channels while a value of 1 sends no audio to the Rear channels. A value of 67 sends 33% of the audio to the Rear channels and keeps 67% of the audio in the Front channels.

Center Channel Gain

The **Center Channel Gain control** (6-6E) sets the volume of the Center channel created by the upmixer, which is typically dialog.

Rear Channel Downmix Level

In order for a stereo downmix to render at the same level as the original stereo source that was upmixed, the gain applied to the rear channels must be the inverse of the Dolby Rear Channel Downmix Level.

The Dolby standard Ls/Rs downmix level is -3dB, and so the **Rear Channel Downmix Level control** (6-6F) should be set to +3dB. Changing this setting by a small amount (-3 to +3) from the recommended +3 setting will not have a significant effect on the downmix, but can have a great effect on the upmixed presentation.

Front-High Crossover

The **Front-High Crossover control** (6-6G) adjusts the crossover point between the Front Left and Right channels and the Front Height channels when upmixing to 5.1.2, 5.1.4, and 7.1.2 formats. The crossover is very gentle and the effect of this control is subtle. The audio spectrum in the Front Height channels is determined by a combination of this control and the Lows in Heights control (described below).

Side-Rear Filter Crossover

The **Side-Rear Filter Crossover control** (6-6H) adjusts the crossover point between the Left and Right Surround channels and the Left and Right Back channels when upmixing to 7.1, 7.1.2, and 5.1.4 output formats.

Side-to-Rear Gain LF

The **Side-to-Rear Gain LF control** (6-6I) adjusts the gain of the low-frequency content in the Surround and Rear channels when upmixing to 7.1 and 7.1.2 output formats.

Side-to-Rear Gain HF

The **Side-to-Rear Gain HF control** (6-6J) adjusts the gain of the high-frequency content in the Surround and Rear channels when upmixing to 7.1 and 7.1.2 output formats.

Rear Channel Boost

The gain of the Left Rear and Right Rear channels when upmixing is set by the **Rear Channel Boost control** (6-6K).

Highs in Laterals

The **Highs in Laterals control** (6-6L) determines to what degree higher frequencies from the ear-level to height speaker crossover circuit are mixed back into the ear-level speakers when upmixing to 5.1.4 and 7.1.2 output formats. The audio spectrum in these channels is determined by a combination of this control and the Lows in Heights control (described below).

Lows in Heights

The **Lows in Heights control** (5-6M) determines to what degree lower frequencies from the ear-level to height speaker crossover circuit are mixed back into the height speakers when upmixing to 5.1.4 and 7.1.2 output formats. The audio spectrum of the Front Height channels is determined by a combination of this control and the Highs in Laterals control (described above).

Ceiling Speaker Gain

The **Ceiling Speaker Gain control** (6-6N) determines the amount of gain added to the Height channels when upmixing to 5.1.4 and 7.1.2 output formats.

Master Gain

The **Master Gain control** (6-6O) sets the output level of all upmixed channels.

The image shows a screenshot of an 'ADVANCED' audio settings menu. The menu is dark-themed and contains ten settings, each with a slider and a numerical value. The settings are labeled with orange circles containing letters A through J. Arrows point from these labels to the corresponding settings.

Label	Control Name	Value
A	Cycles Per Octave	2.50
B	Min Comb Filter Frequency	300.00
C	Comb Filter Level	1.00
D	Front-Rear Balance Factor	0.30
E	Center Channel Gain	0.00
F	Rear Channel Dmx Level	0.70
G	Front-High Crossover	8000
H	Side-Rear/Rear-High Crossover	0.00
I	Side-To-Rear Gain LF	24.00
J	Side-To-Rear Gain HF	-24.00

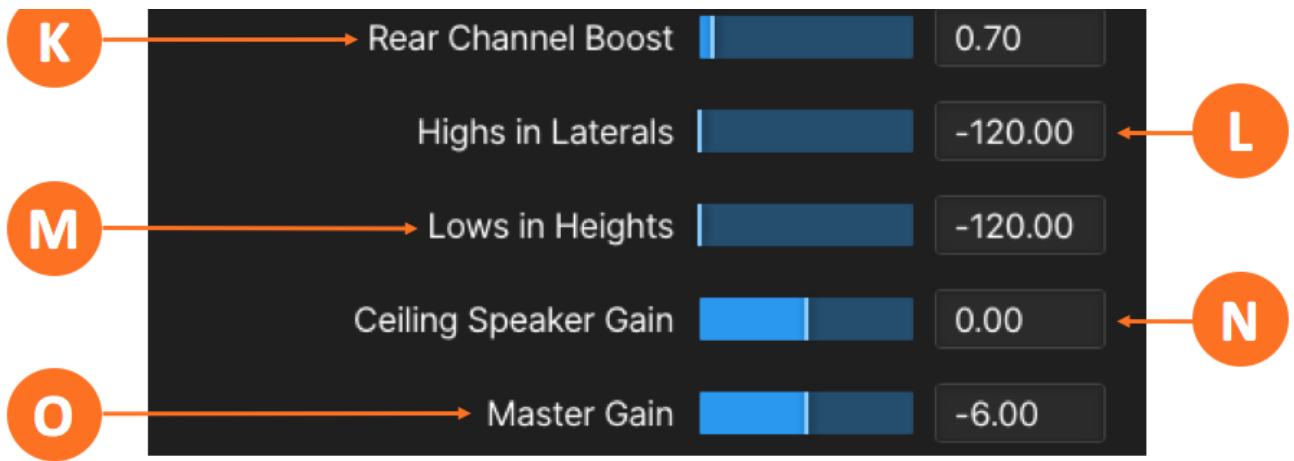


Figure 6-6 - Advanced menu controls