Io IP

Transport, Capture, Display

Installation and Operation Manual

Version 16.2
Published January 28, 2022

AJA VIDEO SYSTEMS

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Sales Email	sales@aja.com

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Chapter 1 – Introduction

Overview

Io IP is a powerful yet portable video and audio I/O device for professional IP based workflows. As part of AJA's industry-leading Io line of Thunderbolt capture and playback devices, Io IP works seamlessly with a large number of popular creative software applications, including out-of-the-box support for Adobe Premiere Pro, Apple FCP, and Avid Media Composer.

Designed as a flexible platform with support for SMPTE ST 2022-6 and ST 2110 uncompressed IP video/audio, Io IP brings the highest quality 2K, HD, and SD video and audio over IP to computers running Mac or Windows Operating Systems. Io IP can also support 4K/UltraHD p60 (2SI) capture or playback, via SMPTE ST 2110-23.

Io IP is also supported through the very same SDK as the rest of the KONA family, making it straight forward for developers to make the transition to Video over IP.

Io IP Features

Io IP is designed as a platform with the flexibility to support different uncompressed IP requirements at the highest quality for 4K/UltraHD, 2K/HD, SD video and audio over IP for host systems running Mac or Windows Operating Systems. By loading the appropriate firmware (aka bitfile), Io IP is able to change its 'personality' to fit the required workflow as follows.

s2022 firmware supports Rx and Tx for:

- YCbCr 4:2:2 10-bit for 2K/HD and SD.
- Supports 2022-7 for redundant Tx.

s2110 firmware supports Rx and Tx for:

- YCbCr 4:2:2 10-bit for 4K/UltraHD, 2K/HD and SD.
- Supports 2022-7 for redundant Tx up to 2K/HD.
- Supports 2110-23 can be used for 4K/UltraHD p60 (2SI) capture or playback.

s2110-RGB firmware supports Tx for:

- RGB 4:4:4 12-bit for 2K/HD post production rates (23, 24, 25)
- Supports 2022-7 for redundant Tx up to 2K/HD.

NOTE: NDI is supported on Io IP in the same way as it is supported on KONA 4, courtesy of running Newtek Connect.

Video Formats

See *"Appendix A Specifications" on page 72* for a listing of supported video formats.

Physical Connection for IP Video

- 2 x 10 GigE Ethernet SFP+ Cages - SFP+ modules (not included).

See *"Appendix A Specifications" on page 72* for a list of SFPs tested by AJA.

Inputs and Outputs

- Io IP ships by default with s2110 firmware for ST 2110 operation.
- For ST 2022-7 operation, a second SFP is used for redundant transport of the other SFP's signals.
- When supporting 4K with Io IP via ST 2110-23, note that both SFPs are being used in one direction, either input or output.
- Io IP HDMI output supports HDR signaling and monitoring for HDR10 and HLG. HLG support is application dependent. Check with your software manufacturer for compatibility.

Digital Audio Input

- 16-Channel embedded audio

Digital Audio Output

- 16-Channel embedded audio, 16- and 24-bit per channel, 48 kHz sample rate, synchronous
- 8-Channel HDMI embedded audio, 48 kHz sample rate, synchronous

Signal Timing

- 1x BNC assignable to reference video or LTC input
- Relevant to SMPTE ST 2022-6/7 workflows only
- Not used for SMPTE ST 2110 workflows

Internal HD/SD Hardware Downstream Keyer

Io IP provides a powerful hardware keyer that can place graphic files with an alpha channel over video in a selectable matte or the contents of the device's framebuffer from a software application. Key a bug or text over picture and avoid what might normally be a lengthy software render. Also, working with these software applications, you can key video that has an alpha-channel over video input or a matte.

NMOS

NMOS is a mechanism for providing discovery, registration and control in ST 2110 environments. A separate application, "AJA NMOS", supports automatic discovery of IP devices on the network, using an app (daemon) that operates in the background with minimal user configuration. The first AJA device accessed by the computer running the daemon can be discovered and subject to control by an external NMOS network control application. NMOS uses the IP address of the host machine for communications.

Generally, NMOS works as follows:

- When Io IP starts up, the NMOS app actively scans the network for an NMOS registry using MDNS/DNS. If found, the NMOS registry is informed who the Io IP device is, and its capabilities.
- If during startup the NMOS registry is not found, the NMOS app continues to announce Io IP's presence via MDNS so that it can later be discovered, and then after discovery, it can be manually registered in the network control application.

During installation AJA NMOS can be set to launch upon reboot or power up (see *"NMOS Installation" on page 16*). The application's function is to make the Io IP discoverable and controllable by various IP routing and control systems (e.g. Imagine, LAWO, Sony). Discovery, registration and network control are not part of SMPTE ST 2110 but are specified by JT-NM NMOS or Network Media Open Specification. Two parts of this standard are IS-04 Discovery and Registration and IS-05 Connection Management.

When the tray icon is clicked (on the Mac or right click on Windows), the AJA NMOS application offers a number of options:

- View Log - toggles opening or closing of the log window
- Stop/Start Service - allows the NMOS service to be stopped and restarted without quitting the application
- Enable/Disable Debug Log - enables or disables the generation of debug output to the AjaLogger and the log window
- Enable/Disable DNS Debug - enables or disables additional DNS debug information (independent of Debug Log setting)
- Enable/Disable Verbose Debug - enables or disables additional debug information if the Debug Log setting is enabled
- Select Interface - NMOS only uses one interface to access the registry. If there is only one interface, then that is not a problem. If there is more than one, then if auto is selected, it will automatically choose one based on whether it sees any mDNS messages on one of the interfaces. Otherwise, the interface can be selected.
- Set Registry IP - allows the registry ip address and port to be set manually.
- Quit - causes the NMOS application to exit

AJA Software & Utilities

Io IP operates with AJA's Desktop software package, developed for powerful integrated video/audio capture, editing, and production with a variety of 3rd-party software. AJA software is distributed as a unified package which includes all the software, firmware, plug-ins, and utility programs for the Io IP, as well as AJA's Io, KONA, and T-TAP products.

Two retail packages are available, one for Mac and one for Windows.

Mac and Windows Packages

These packages include:

Firmware

Firmware, otherwise referred to as a bit file or the Io IP's 'personality', refers to very low level code that defines the capabilities of the hardware. It is important to always update to the firmware recommended following install of new, or older versions of software.

Drivers

AJA device drivers for the host system OS provide tightly integrated hardware/software operation.

AJA Control Panel

The Control Panel provides:

- Source selection and control of your AJA hardware
- A block diagram to show visually what routing and processing is being performed

AJA Control Room

Control Room is a cross-platform software application for ingest, playback and output with AJA products.

AJA System Test

AJA System Test provides accurate and detailed evaluations of drive and system performance statistics, allowing you to measure the capabilities of your system for recording and playing back various resolutions and codecs. The application includes:

- System Disk Test
- AJA Device Test
- Disk + Device Test
- System Report

The application tests Read and Write, Capture and Playback speeds in both Megabytes per second and Frames per second. The disk speed tests differ from standard disk I/O performance applications in that they specifically test the system under conditions typically encountered with video capture, playback, and editing.

NOTE: Theoretically the best test (or simulation) is to fill your storage disk to 80% and then test capture at the highest data rate you will use.

3rd-Party Plug-ins

Plugins for popular 3rd-party Professional Video Applications from Adobe, Avid, Apple, OBS and Telestream.

NMOS App

Available for automatic discovery of IP devices.

Network Requirements

For uncompressed workflows (SMPTE ST 2022-6 and SMPTE ST 2110) a 10GbE switch is required.

For SMPTE ST 2110 specifically, a PTP clock source must also be deployed and the switch must therefore also be PTP aware.

In all cases the switch used must be both managed (configurable) and IGMP aware.

SFPs are not included with the purchase of Io IP. Recommended SFPs are listed in *"Specifications" on page 72*.

System Requirements

AJA Video recommends that your system meet minimum hardware and software requirements to achieve a satisfactory level of performance. Updates to system requirements are subject to change.

NOTE: See Software Vendor system requirements for GPU recommendations and additional hardware requirements and recommendations.

See the Io IP Release Notes, available on the AJA website and also installed with the software package, for detailed system requirements including OS, CPU, RAM, and GPU.

For IP installations specifically, AJA recommends:

- IP infrastructure with adequate bandwidth to sustain the capture and playback of the material you expect to be working with across the number of systems that are active at any given time
- For multi-seat installations, IP infrastructure that is comprised of fully managed switches and is in turn supported by a team of qualified network administrators
- For SMPTE ST 2022-7 implementations, two entirely independent network infrastructures are required for true redundancy

NOTE: For large scale installations with shared storage, IP, or for very high performance requirements, AJA recommends consultation with an experienced a system integrator. A consultant will be able to assist with many important variables.

Disk Storage Methods

To ensure performance and quality, the disk storage system used with the workstation must be able to meet the demands of storing real-time uncompressed media. At the very minimum, the disk storage system must be able to provide and maintain a consistent transfer rate from the workstation to disk (read/write). There are a variety of system configurations and peripherals that can provide this level of performance.

For more on disk storage performance see *"AJA System Test" on page 8*.

About Io IP Modal Operation

Io IP supports modal operation. Three different firmware versions are available:

- s2110
- s2110-RGB
- s2022

Io IP functionality depends on what firmware is currently installed.

NOTE: The Io IP will need to be reset after a different firmware version is installed.

s2110 Firmware: 10-bit, 4:2:2, YCbCr

- Firmware name "s2110".
- Supports a 10-bit pipeline from capture to LUTS, and input/output up to 2K/HD (or up to 4K/UltraHD via ST 2110-23).
- Allows import and export of 10-bit LUTS.
- Supports ST 2110 Receive and Transmit of YCbCr 422 10-bit at rates from 23.976 through 60 for broadcast workflows.
- This I/O configuration is to support live production based on SMPTE ST 2110 infrastructure.
- ST 2022-7 for ST 2110 is supported for Transmit (no Receive).

s2110 Firmware							
Resolutions	**Rates**	**I/O**	**Color**	**Subsample**	**Bit Depth**	**2022-7**	**2110-23**
4096 x 2160p	23.98, 24, 25, 29.97, 30, 50, 59.94, 60	Input + Output (Rx, Tx)	YCbCr	4:2:2	10-bit	No	Yes (2SI)
3840 x 2160p							
2048 x 1080p	23.98, 24, 25, 29.97, 30, 50, 59.94, 60	Input + Output (Rx, Tx)	YCbCr	4:2:2	10-bit	Tx only	No
2048 x 1080PsF	23.98, 24, 25						
1920 x 1080p	23.98, 24, 25, 29.97, 30, 50, 59.94, 60						
1920 x 1080PsF	23.98, 24, 25						
1920 x 1080i	50, 59.94						
1280 x 720p	50, 59.94, 60						
625i	50						
525i	59.94						

s2110 Unsupported Features

- ST-2022-7 Rx

s2110-RGB Firmware: 12-bit, 4:4:4, RGB

- Firmware name "s2110-RGB"
- Supports a full 12-bit pipeline from capture to LUTS, CSCs and output up to 2K/HD
- Can Color Space convert 12-bit, 4:4:4, RGB coming from host application to YCbCr, 4:2:2, 10-bit over ST 2110
- Allows import and export of 12-bit LUTS
- Supports ST 2110 Transmit of RGB 444 12-bit at 23.976, 24 and 25 for post-production workflows.
- This transmit only configuration is to support file based post-production workflows based on SMPTE ST 2110 infrastructure.

s2110-RGB Firmware							
Resolutions	**Rates**	**I/O**	**Color**	**Subsample**	**Bit Depth**	**2022-7**	**2110-23**
2048 x 1080p	23.98, 24, 25	Output only (Tx)	RGB	4:4:4	12-bit	No	No
1920 x 1080p							

s2110-RGB Unsupported Features

- Input (no ST 2110 Video or Audio, No Analog Audio) – these workflows mainly use file based assets rather than ingest
- ST-2022-7 – Post Production doesn't need the redundancy that Broadcasters and Telco's require
- HFR (no rates above 25p) – 23, 24, 25 covers the majority of post production around the globe
- SD, 720p, 1080i, 1080PsF, 4K/UltraHD
- Downstream Keyer

s2022 Firmware: 10-bit, 4:2:2, YCbCr

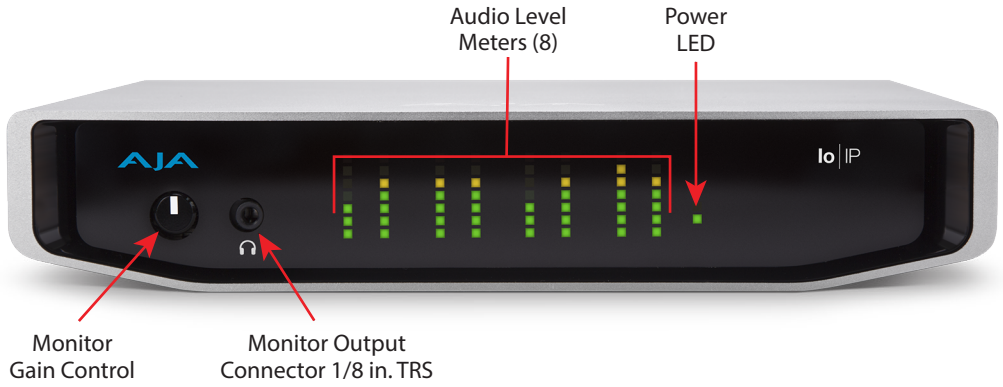
- Firmware name "s2022".
- Supports a 10-bit pipeline from capture to LUTS, and input/output up to 2K/HD.
- Allows import and export of 10-bit LUTS.
- Supports ST 2022-6 Receive and Transmit of YCbCr 422 10-bit at rates from 23.976 through 60 for broadcast workflows.
- This I/O configuration is to support live or post production based on SMPTE ST 2022-6 infrastructure.
- ST 2022-7 for ST 2022-6 is supported for Transmit (no Receive).

s2022 Firmware							
Resolutions	**Rates**	**I/O**	**Color**	**Subsample**	**Bit Depth**	**2022-7**	**2110-23**
2048 x 1080p	23.98, 24, 25, 29.97, 30	Input + Output (Rx, Tx)	YCbCr	4:2:2	10-bit	Yes	No
2048 x 1080PsF	23.98, 24, 25						
1920 x 1080p	23.98, 24, 25, 29.97, 30, 50, 59.94, 60						
1920 x 1080PsF	23.98, 24, 25						
1920 x 1080i	50, 59.94						
1280 x 720p	50, 59.94, 60						
625i	50						
525i	59.94						

Hardware Description

Front Panel Controls and Indicators

Figure 1. Io IP Front Panel



The Io IP front panel has the following controls and indicators:

Monitor Output and Gain Control

A 1/8 inch TRS connector is available for monitoring two channels of audio, selectable in channel pairs using the Control Panel application. Typically used with a pair of headphones.

The Monitor Gain knob on the left adjusts the monitor output level. Pushing in the knob extends it (for adjustment) or recesses it (to prevent accidental changes).

Audio Level Meters

The Audio Level Meters in the center of the front panel indicate:

- During Capture - The first 8 channels of the audio source selected (SDI, HDMI, Analog)
- During Playback - The sum of whatever sources are being played out via the AJA hardware; i.e. NLE timeline and mix of host system audio output (if applicable)

The meter's LEDs are colored to indicate the amount below 0dBfs when averaged over a one millisecond time interval:

dBfs	LED Color and Location
-2 db	Red LED 1 (top)
-12 db	Yellow LED 2
-20 db	Yellow LED 1
-30 db	Green LED 4
-40 db	Green LED 3
-50 db	Green LED 2
-60 db	Green LED 1 (bottom)

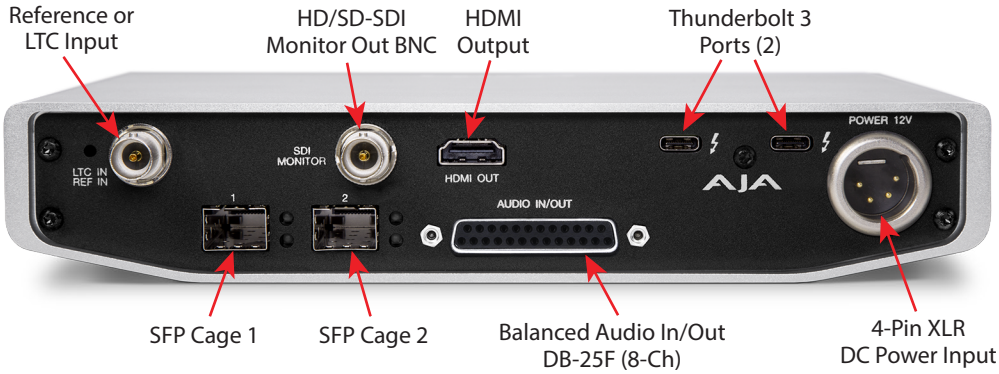
NOTE: These audio level meters are for guidance only. Third-party audio metering should be employed when doing critical audio editing and mixing.

Power LED

The power LED lights up yellow when power is provided via the power supply. Once a Thunderbolt 3 connection is made, and the host is in an active state, the light turns green.

Rear Panel Connectors

Figure 2. Io IP Rear Panel



Thunderbolt 3

The Io IP provides the third-generation Thunderbolt 3 (USB-C) ports to support increased bandwidth between host computer and I/O device. Two ports are provided for daisy-chained network configurations.

SFP Cages and Modules

Two SFP+ cages are provided to connect two separate 10 Gigabit Ethernet Links. Both links are bi-directional. Inputs and outputs for most uses will be set up over the same link if bandwidth allows it.

For a list of SFP+ modules tested by AJA, see *"Appendix A Specifications" on page 72*.

Dedicated SDI HD/SD Output

One BNC connector is provided for full-time, real-time output of 2K/HD/SD video. When running ST 2110 firmware, ANC data is included in the SDI monitor output.

HDMI Output

A full-size HDMI connector on the Io IP endplate provides HDMI 2.0 capability. HDMI also supports multi-channel embedded audio (8 channels). HDCP is not supported on the output. HDMI Output also supports HDR (HDR10 and HLG).

Reference Video

When in SMPTE 2022-6 mode, Io IP can lock to reference analog or tri-level input, or the incoming SMPTE 2022-6 stream.

For analog reference, a single BNC on the Io IP endplate allows you to synchronize Io IP outputs to your house analog or tri-level reference video signal (or black burst). If you have a sync generator or central piece of video equipment to use for synchronizing other video equipment in your studio, connect its output here.

When Io IP outputs video in SMPTE 2022-6 mode, it locks to this reference signal. When connecting a reference video source, the locking signal should be the same format as the Primary format selected in Io IP software. It is possible in some circumstances to use an alternate format video signal if the basic frame rate is compatible.

Io IP can also lock to an incoming SMPTE 2022-6 signal, or it can free run.

Balanced Analog Audio Input and Output

A 25-pin connector provides 8-channel balanced analog audio, 24-bit 48kHz sample rate D/A and A/D, for use with an industry standard 8x XLR on DB-25 breakout cable (cable not included). The eight analog audio channels can be configured four different ways:

- Ch 1-8 Output
- Ch 1-4 Input and Ch 5-8 Output (default setting)
- Ch 1-4 Output and Ch 5-8 Input
- Ch 1-8 Input

12V Power Connector

A standard 4-pin XLR type connector is provided for either battery or line source power using the supplied AC power adapter.

In This Manual

Chapter 1 - Introduces the product briefly, listing features and system requirements.

Chapter 2 - Provides complete instructions for installing and configuring the product.

Chapter 3 - Discusses operational aspects and how to work with 3rd-party software.

Appendix A - Presents a list of technical specifications for the product.

Appendix B - Provides important Safety and Compliance information.

Chapter 2 – Installation

Installation Overview

1. If not previously installed on your Thunderbolt equipped computer, ensure that appropriate third party application software is installed as detailed in its user documentation.
2. Download and install the latest Io IP software from:

   https://www.aja.com/en/support/downloads
3. Connect your Io IP to your computer using an appropriate Thunderbolt 3 cable (and adapter if required). Information about Thunderbolt including cable recommendations is available here:

   https://www.aja.com/solutions/thunderbolt
4. Insert compatible SFP module(s) into the SFP cage(s) and connect to your media network.
5. Connect the video and audio inputs and outputs to your Io IP .
6. Power up the unit (AC supply or battery). The Io IP will startup automatically.

IMPORTANT: You should wait at least two minutes after Io IP *powers up before you open AJA Control Panel.*

7. When you run AJA Control Panel, the Io IP is auto-discovered as long as it is properly cabled and powered up.
8. You will now be able to configure your Io IP for operation on your network.

Unpacking

Shipping Box Contents

As you unpack your shipment, carefully examine the contents. Ensure you received everything and that nothing was damaged during shipping. If you find any damage, immediately notify the shipping service and supply them with a complete description of the damage. AJA will repair or replace damaged items. If you find shipping damage, contact your AJA dealer or distributor for details on how to have your AJA device repaired or replaced.

NOTE: Save packing materials and the shipping box. If you ever require service or move your system use the packaging materials and box for safe shipment.

Installing Io IP Software

NOTE: If your computer has previously had another video capture or multimedia device installed, ensure you uninstall any related software before installing Io IP. This will prevent any hardware or software conflicts.

Before installing the AJA Desktop Software package, ensure that your capture/editing application is installed as detailed in its user documentation. You cannot use the AJA Desktop Software package with a third-party application until the application has been installed and run at least once on your workstation. Next, install the AJA Desktop Software package. If at a later date you add any Io IP supported applications that require drivers, you must run the AJA install program again to install them.

NOTE: Always uninstall the previous version of the AJA Desktop Software package before updating your Io IP.

NMOS Installation

You can choose how to install AJA NMOS with the AJA Software Installer package.

The default Complete (PC) or Standard (macOS) installation choice will require you to manually launch the AJA NMOS application when you want to use NMOS. With the alternative Custom (PC) or Customize (macOS) installation choice you can check the AJA NMOS Service box, which will make AJA NMOS automatically launch on startup. In either case, NMOS operation will require your AJA device to be connected to a network that has a running NMOS control application.

macOS Installations

macOS High Sierra (10.13), macOS Mojave (10.14), macOS Catalina (10.15), macOS Big Sur (11.x) and macOS Monterey (12.x) all have security requirements that may present dialogs during installation. Please refer to the Release Notes for guidance

Io IP Firmware Installation

IMPORTANT: The firmware installed in your Io IP should match the version of the AJA software package. If a mis-match is present, the Io IP may not work and a "Not Valid, device needs firmware update" message will be displayed. Always update the firmware of your Io IP when you install an AJA software package. In addition, a restart is required after changing firmware to enable NMOS registration.

Types of Io IP Firmware

AJA Desktop Software can provide the Io IP with three different personalities, or modes of operation.

- s2022
- s2110
- s2110-RGB

Switching between these different Io IP operating modes requires loading the appropriate firmware bitfile and then resetting the Io IP.

Cabling the System

See *"Rear Panel Connectors" on page 13*.

Io IP Cable Connections

For 2022-6 and 2022-7 operation, 10GbE infrastructure can be connected with either a short (3 feet) Direct Attached cable, or optical fiber cable with appropriate SFPs.

Figure 3. IP Configuration Example for 2022-6 Workflow

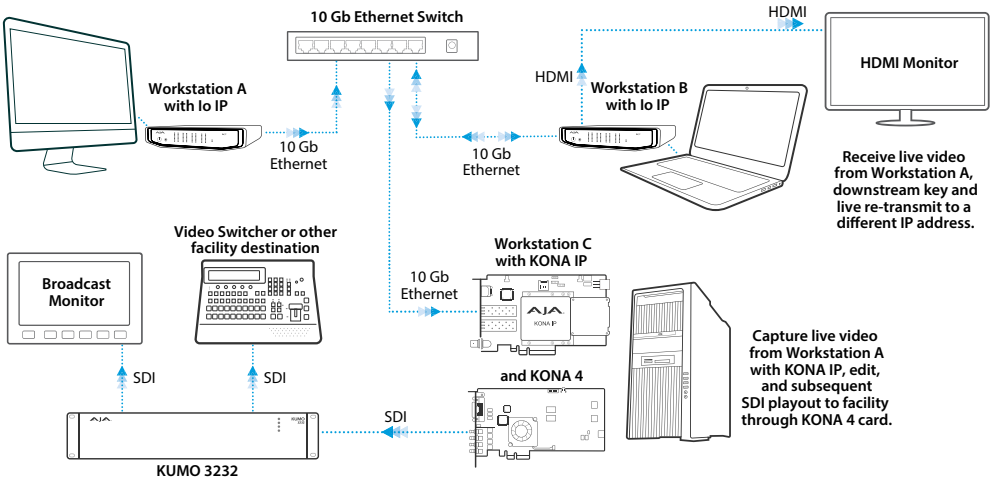
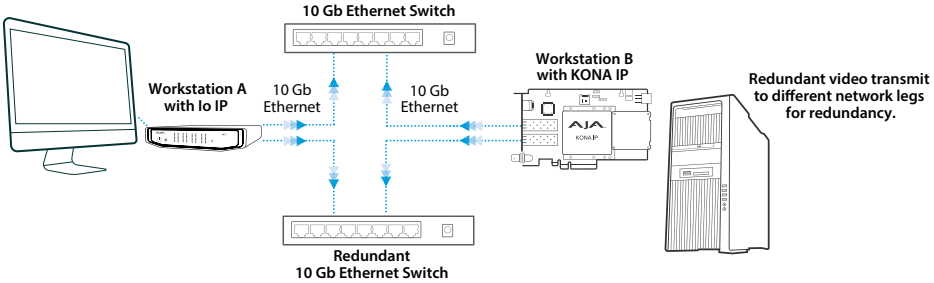


Figure 4. IP Configuration Example for 2022-7 Workflow



SFP Module Connections

For SMPTE 2022-6 / SMPTE 2022-7 operation (s2022), modules inserted into the two SFP+ cages can be used to connect two separate 10 Gigabit Ethernet Links.

With AJA Desktop Drivers, the SFP 1 and 2 modules are configured using AJA Control Panel software, using the Input, Output, and Network Settings tabs. In most cases, only SFP 1 will be used, providing up to two total streams of SD or HD video, each with 16 audio channels and metadata, for simultaneous input or output, i.e. when using SMPTE 2022-6. Both links are bi-directional (one In, one Out). When using SMPTE ST 2022-7, the Lower SFP carries a duplicate of the Upper SFP data.

For a list of SFP+ modules tested by AJA, see *"Appendix A Specifications" on page 72*.

Unicast and Multicast Support

Io IP supports both unicast and multicast operation. Unicast operation is point to point, from one sender to one receiver. Multicast operation is from one sender to possibly multiple receivers. In both cases, the sender transmits information to a location (IP address) on the network, and receivers access that information over the network using that location IP address. Compatible IP addresses are required for each type of operation. These network settings filter the IP addresses so the information is sent successfully to the desired receiver(s).

IMPORTANT: Proper network configuration settings vary, depending on your particular network environment. Because the process can be complicated, you should always consult with your facility's IP or Networking Engineering department before configuring Io IP network settings.

Listed below are example sets of compatible IP addresses that could be used in an isolated network to test Io IP network operation.

Table 1. Example Compatible Unicast IP Addresses

Control Panel Screen	Parameter	Io IP 1 (send)	Io IP 2 (receiver)
IP Network	Local IP Address	192.168.10.31	192.168.10.32
	Subnet Mask	255.255.255.0	255.255.255.0
IP Input	Destination IP Address	- - -	192.168.10.32
	Destination Port	- - -	2000
IP Output	Destination IP Address	192.168.10.32	- - -
	Destination Port	2000	- - -

Table 2. Example Compatible Multicast IP Addresses

Control Panel Screen	Parameter	Io IP 1 (send)	Io IP 2 (receiver 1)	Io IP 3 (receiver 2)
IP Network	Local IP Address	192.168.10.31	192.168.10.32	192.168.10.33
	Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0
IP Input	Destination IP Address	- - -	239.0.61.100	239.0.61.100
	Destination Port	- - -	10000	10000
IP Output	Destination IP Address	239.0.61.100	- - -	- - -
	Destination Port	10000	- - -	- - -

Chapter 3 – Io IP Operation

Using Io IP with Professional Video /Audio Software

After you install the AJA software package on your computer, you're ready to begin capturing and playing back video and audio using your choice of third-party software. You can go here for AJA software and documentation:

https://www.aja.com/en/support/downloads

For further support information and downloads for third-party software, go to:

https://www.aja.com/compatibility/io

Frequently Asked Question documents for various AJA products are available at:

https://www.aja.com/products/kona-ip#support

Capture Formats

When capturing, you can record data in the following file formats:

- DPX
- TGA
- BMP
- QuickTime
- MX
- MP4

NOTE: Support by Io IP of QuickTime for Windows has been discontinued. Instead, AJA supports ProRes family capture and playback for macOS and Windows via AJA Control Room.

NOTE: Other file types can be captured using third-party capture applications such as Sienna, Softron, Tools on Air, Drastic Technologies, or Quadrus.

AJA Control Panel Overview

The AJA Control Panel is a software application that provides a simple visual showing how the Io IP hardware is currently configured and allows you to make changes. You can change signal input and output parameters and define the video processing that will be performed.

The AJA software installer automatically installs the Control Panel application on your computer.

AJA Control Panel Operating Modes

AJA Control Panel has two fundamental operating modes.

Playback Mode - Used for playing back video files from the computer, usually with a non-linear editing application (NLE) or AJA Control Room, through the Io IP's video/audio outputs for viewing and/or external recording.

Capture Mode - Used for capturing video/audio signals that are coming into the Io IP from an external source to create video files on the computer using AJA Control Room or an NLE, or just for display on the Io IP outputs. This mode is also used for stand-alone video display or conversion when Control Panel is being used without an external controlling application.

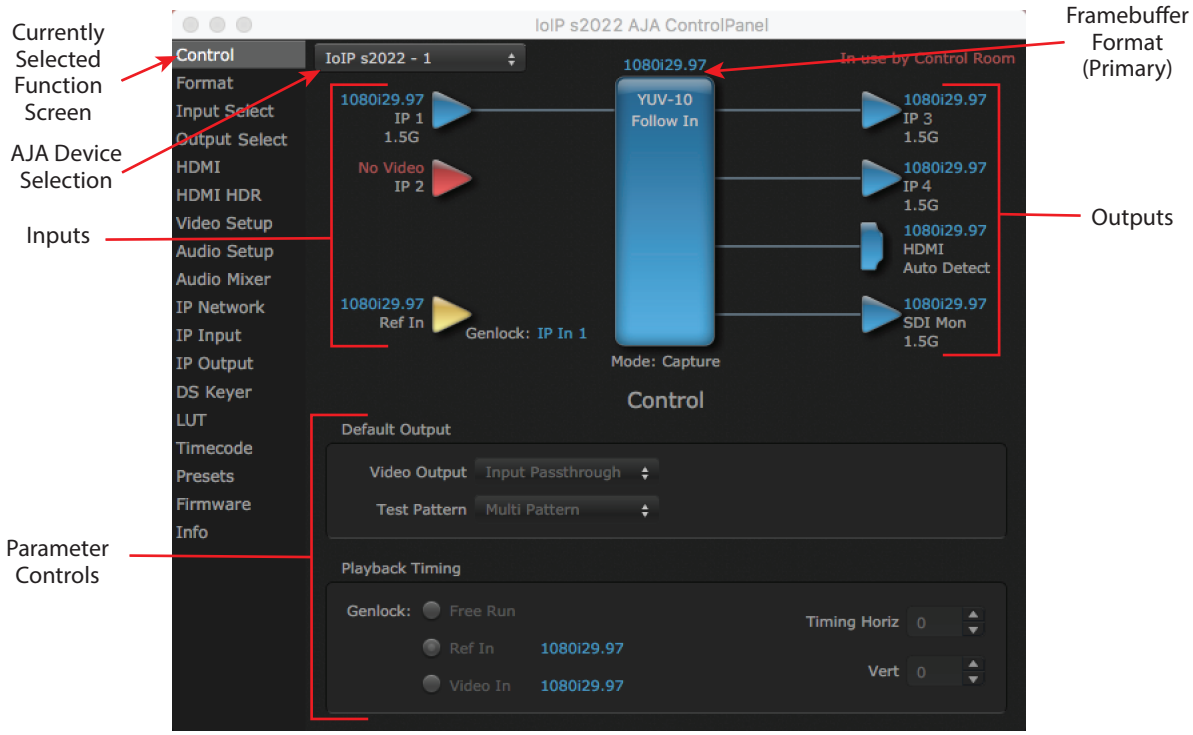
AJA Control Panel User Interface

The AJA Control Panel user interface includes a visual block diagram of the unit's current configuration. The current status, input and output settings, and many other details are depicted in the color-coded block diagram. Below this block diagram are various controls for changing operating parameters, which will vary depending on which function screen has been selected.

The left side of the AJA Control Panel provides a navigation list of available function screens. Clicking on a link (or alternatively, a related element in the block diagram) displays a function screen corresponding to that topic.

NOTE: Although Io IP is sending and receiving video over IP, once that data is decoded to memory it is governed by the same video menus used for SDI and HDMI based AJA I/O solutions.

Figure 5. AJA Control Panel, Block Diagram and Controls

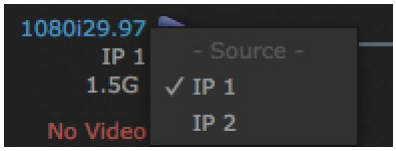


Block Diagram Area

The top block diagram area of the Control Panel screen is a visual representation of the processing, if any, that's currently occurring, including inputs/outputs, reference source, and system status. Lines between inputs, the framebuffer, and outputs, show a video path. Where there are no lines, there is no connection; this can be because an input or output isn't selected in the Input Select menu. The lines will also show whether the outputs are video or video + key.

You can click any of the function screen selection links in the left column to view its current settings or click on an icon to call up its related settings screen. You can also right-click or Control-click to see context-sensitive information and choices.

Figure 6. Context Sensitive Menu



Color Meanings

All items in the AJA Control Panel block diagram are color-coded to show what is happening in real time. This applies to both icons and text. These colors indicate:

Blue - Video is same format as the Primary Format (framebuffer)

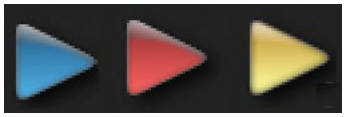
Yellow - Reference video (black burst or other reference source)

Red - The selected operation cannot be performed

Input/Output Icons

The input and output icons are triangles that together with their color show all the input and outputs and their status (selected, not selected, input present or not, format, etc.). A complete video path is shown when inputs and outputs are connected with lines going to/from the framebuffer.

Figure 7. Input/Output Icons



Framebuffer

The framebuffer is the "engine" where your third-party applications interface with the AJA device. The framebuffer has a format (called the "Primary Format") and color space that it follows, as defined in the linked menu screens or via external application software.

Device Format

The Device Format is the media format written to disk and used in your project. This is the format that the framebuffer will use and is shown in the Control Panel using the color blue. It is the format that the third-party application software will either receive from the AJA hardware, or is sending to the hardware. All icons in blue are the same as the Device Format used by the framebuffer. Also any text descriptions in the block diagram that appear in blue indicate that something is in the Device Format. For example:

- If the input and output icons are blue, you know that the same format is used throughout the video path. No format conversion is being performed.
- If the input or output icon colors differ (blue input and green output icons for example), you know that a format conversion is being performed.

Controlling Application

Figure 8. Control Panel In Use Message (in red)

In the top right corner, the Control Panel displays the name of the application controlling the unit. In some cases, applications may not always properly “let go” of the I/O interface as another takes over—you’ll be able to tell by looking at the Control Panel.

Presets

Setups can be named and saved as a snapshot (Preset) for recall at any time. You can save various AJA device Control Panel configurations associated with your frequent tasks. You don’t have to spend time resetting interface configurations, just load the previously saved Preset for each task. See *"Saving, Loading and Deleting Presets" on page 52* for more information.

If you work on multiple systems and want to carry your saved setups to another location, you can copy your saved Preset files on to movable storage and load them into any computer running the AJA Control Panel application.

Mac OS Preset Files Storage Location

- From the Finder, hold down the Option key (to display the Library directory) and click on Go/Library/Application Support/AJA/<device name>/Presets/

Windows Preset Files Storage Location

- c:\Users\<username>\AppData\Local\AJA\Control Panel\<device name> Presets\

NOTE: When you visually browse to the above location, depending on Windows OS setting you may not be able to visually see the folder referred to in the path. Instead, you have to fill out the rest of the Windows path manually (i.e. type the rest of the address in the navigation bar when you hit the "end" of the browsing path).

Default Preferences

When an AJA device starts up, a preference can determine what settings it will have it when it begins to operate. The AJA Control Panel offers two default preference settings:

- Local Preference - A preference stored from the last AJA device's Control Panel settings to be used on next startup of AJA Control Panel. This occurs on next restoration of the default state (triggered by start up of host CPU, startup of the AJA device, or when a third-party application releases the AJA device).
- Global Preference - A preference saved for use as a global default start state for an AJA device that can be shared by multiple users, applied on first startup, or by pressing the Control Panel **Reset Device...** button.

Local Preference

The Local Preference file (com.aja.devicesettings) exists to immediately and automatically store all parameter changes made by a user on a particular AJA device. When any control is changed in the Control Panel, that change is recorded in the Local Preference file stored in a unique location on that computer that is dedicated to that particular device, serial number, and logged-in user. Then, when AJA Control Panel is restarted for any reason, the AJA device being controlled restores the settings being used when Control Panel was last closed.

The Local Preference file can be accessed at the following locations.

On Mac:

- From the Finder, hold down the Option key (to display the Library directory) and click on Go/Library/Preferences/com.aja.devicesettings.

On Windows:

- C:\Users\<USER_NAME>\AppData\Local\aja\com.aja.devicesettings

NOTE: Clicking on the AJA Control Panel "Erase All Prefs" button deletes the existing Local Preference file from this location. This file will be recreated as soon as any Control Panel setting is changed.

NOTE: Clicking on the AJA Control Panel "Reset Device..." button will delete the existing Local Preference file. If a Global Preference file is found, these settings are reloaded. If a Global Preference file is not found, "factory defaults" are loaded and the device is set to that state

Global Preference

An administrator can establish a house standard for an AJA device by copying a preference file to a shared computer location. Once placed at that location, it becomes a Global Preference file where it will establish a standard default startup state for all users of that AJA device using that computer system. These settings preempt the initial AJA factory default settings, and are applied when an AJA device is first powered up, or when the Control Panel **Reset Device** button is pressed.

To establish a Global Preference, the administrator first configures the AJA device (which automatically creates a "com.aja.devicesettings" Local Preference file in the location identified above) and then copy or move or that file to the correct computer locations (manually or by pushing it out across the network) on all the computers that use the AJA device.

NOTE: If the user makes changes to an AJA Device's Control Panel settings, those changes are saved to the Local Preference file, which will take priority over the Global Preference file.

The shared computer locations for a Global Preference file are:

On Mac:

- From the Finder, click on Go/Computer/<System HD>/Users/Shared/AJA/ and copy or move the "com.aja.devicesettings file" described above to this location.

NOTE: The "AJA" folder needs to be created manually at this location before moving the preference file into it.

On Windows there are three possible shared locations depending on your system:

- C:\Users\Public\Aja\
- C:\Users\All Users\Aja\
- C:\ProgramData\Aja

  Copy or move the "com.aja.devicesettings file" described above to one of these locations.

NOTE: The AJA Control Panel Info screen displays the path to the Global Preference file on that computer.

NOTE: Clicking on the AJA Control Panel Erase All Prefs button does NOT delete an existing Global Preference file from this location.

Io IP Audio Monitoring

Io IP hardware can be used as your single audio monitoring solution whether you are auditioning music in a web browser, playing a movie file on the desktop, creating music, or playing a YouTube clip. As long as the output of your work or application is normally output via the host system audio, your AJA hardware can route this audio for monitoring. This cuts down on unnecessary cabling, and means you can take advantage of a consistent audio monitoring environment whatever you are currently doing with your host system.

NOTE: On first use, you will need to tell your operating system to use AJA hardware as the default Input and Output hardware.

Io IP lets you listen to Host System audio concurrently with your NLE audio. This is useful if you need to audition music tracks against playback of your NLE timeline, or if you need to Skype with a remote producer during an edit session, or for a myriad of other reasons.

You can also listen to Io IP Input concurrently with your NLE (with the exception of Avid Media Composer). This is useful if you need to listen out for the readiness of talent, or the presence of some other feed, whilst you continue to work.

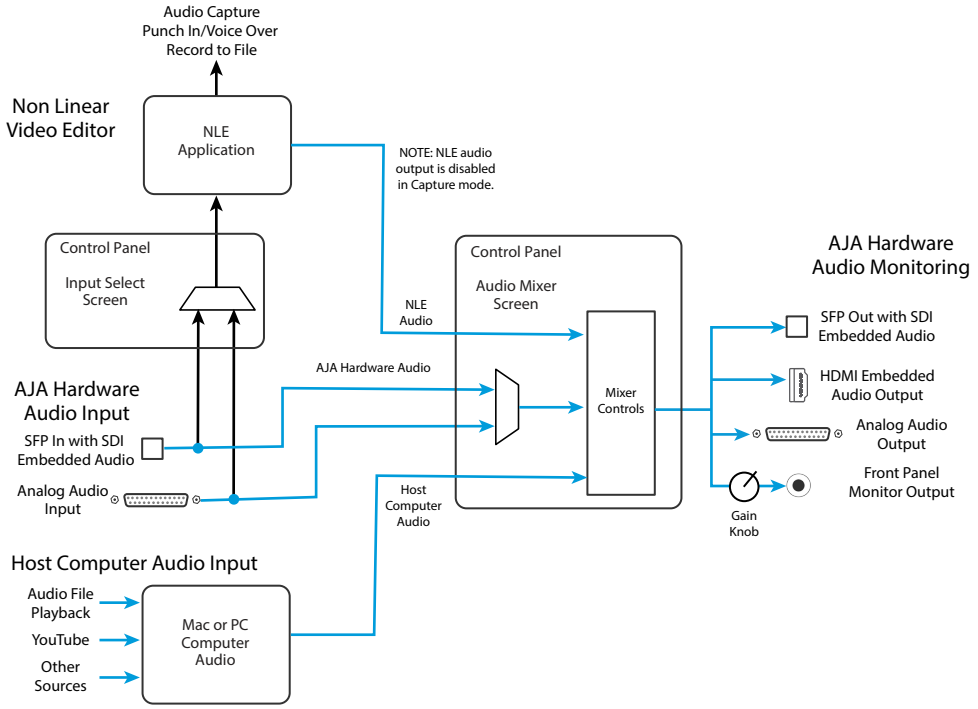
Io IP audio monitoring is routed and mixed using the Control Panel application's Audio Mixer screen. You can select sources to be monitored, and can adjust their levels. If you are using the 1/4 inch monitor output connector, an additional overall mix gain control is conveniently available on the Io IP's front panel.

The mixed audio monitor signal is routed to:

- Front Panel Monitor Output (headphone jack)
- SDI Embedded Audio Out
- HDMI Embedded Audio Out
- Analog Audio Out (via DB25 cable)

IMPORTANT: Even though you can hear changes in the signals and levels adjusted with the Audio Mixer screen, these changes are NOT recorded to disk during NLE Capture or Audio Punch In / Voice Over to Timeline. The Audio Mixer screen is dedicated for monitoring only, not program mixing.

Figure 9. Io IP Audio Monitoring Routing Diagram



To control which AJA hardware audio is used during recording, you use the Control Panel application's Input Select Screen, Audio Input Select drop down to select from:

- SDI embedded
- Analog (via DB25 cable)

Any level adjustments to Capture or Audio Punch In / Voice Over to Timeline recording operations will either need to be made upstream of the AJA input, or else via adjustments within the main NLE application (e.g. via a pass through mix tool).

Control Panel Function Screens

Table 3. Io IP Function Screens

Screen	Functions
Control	Configure some basic Io IP operation options and output timing.
Format	Select the framebuffer Device format.
Input Select	View and edit input selections and audio mapping.
Output Select	Select output format.
HDMI	Configure the HDMI Output
HDR	Configure High Dynamic Range settings for HDMI output
Video Setup	Configure Video such as composite black level, progressive format and ancillary data (Closed Caption) option.
Audio Setup	Configures Audio options such as analog audio monitor level.
Audio Mixer	Select and mix audio sources for playback and capture.
IP Config	(ST 2110 only) Configure network parameters.
IP Network	(ST 2022 only) Configure network parameters for the location of each Io IP physical SFP cage.

Screen	Functions
IP Input	(ST 2022 only) Configure parameters for receiving inputs from the media network.
IP Output	(ST 2022 only) Configure parameters for sending outputs to the media network.
DS Keyer	Setup and control the insertion of keyed video from the frame buffer or graphics files with alpha channel.
LUT	Load a lookup table (LUT) file to adjust the calibration of color for any source.
Timecode	Monitors SMPTE 12M-2 timecode and configure timecode window burn output.
Presets	Add or delete saved preset configurations (handy for quick and easy recall of different Io IP settings for varied workflows).
Firmware	Install firmware from your currently installed AJA software package.
Info	Display status information and the firmware version number. This information is generally intended for troubleshooting/support.

Control Panel Operation in ST 2022-6 Mode

Control Screen

The Io IP can be controlled by various software applications running on a host computer. The Control screen is where you select how the Io IP directs video and is used by application software. This screen also provides control for configuring output timing with regard to external reference video and horizontal/vertical delay. The top of the Control Screen shows the currently selected AJA device if more than one is available in your system.

Default Output

This is where you select what the Io IP will output as a default when no application has control of the board, such as when the Mac Finder or Windows Navigation Pane is active. Since Io IP can be controlled by software applications as well as its own control panel, the output can change dynamically. When you select many video applications, they will take control of the Io IP inputs and outputs. However, when an application that doesn't take control is active, these settings determine what Io IP will output.

Input Passthrough

This selection directs Io IP to route video from its selected input through the device for processing and output.

Test Pattern

This selection directs the Io IP to output a choice of preset pattern when no other application is using the Io IP. You can choose from:

- Black, Color Bars (75% or 100%), Ramp, Multiburst, Line Sweep, Multi Pattern, or Flat Field, Check Field, White, Border, Linear Ramp, Slant Ramp, Zone Plate, and Color Quadrant

In addition to the preset test pattern choices, a "Load File..." selection at the bottom of the menu allows you to load any standard RGB graphics file (.tif,.psd, etc.) into the frame buffer for display.

While in Test Pattern mode, you can select RGB or YUV output via a pulldown menu.

NOTE: The graphic file will not be scaled to fit. If it's smaller than the current frame buffer format, Io IP will center it in the frame. If it's larger than the current frame buffer format, it will be cropped on the right and bottom. Also some graphics formats and bit depths may not be supported. Once a graphic file is loaded into the frame buffer it will be retained until it is overwritten by another graphic or test pattern, or when power is turned off. Graphic file names are only "remembered" in the menu until the AJA Control Panel application closed.

Hold Last App

This selection directs Io IP to hold and output the last frame of video from the last application to control Io IP. This can be helpful when operating in an environment where you're switching back and forth between multiple application windows.

Fan Settings

Io IP offers a fan speed control. The High setting forces maximum fan cooling, with some increased noise, but this setting could be appropriate if the unit is located in, for example, a machine room rather than an editing suite.

- Auto - Fan speed controlled by temperature, increasing or decreasing automatically.
- High - Fan always operates at its highest speed.

Playback Timing

Use these controls to set Genlock and Timing adjustment.

Genlock

Selects how Io IP will synchronize program video:

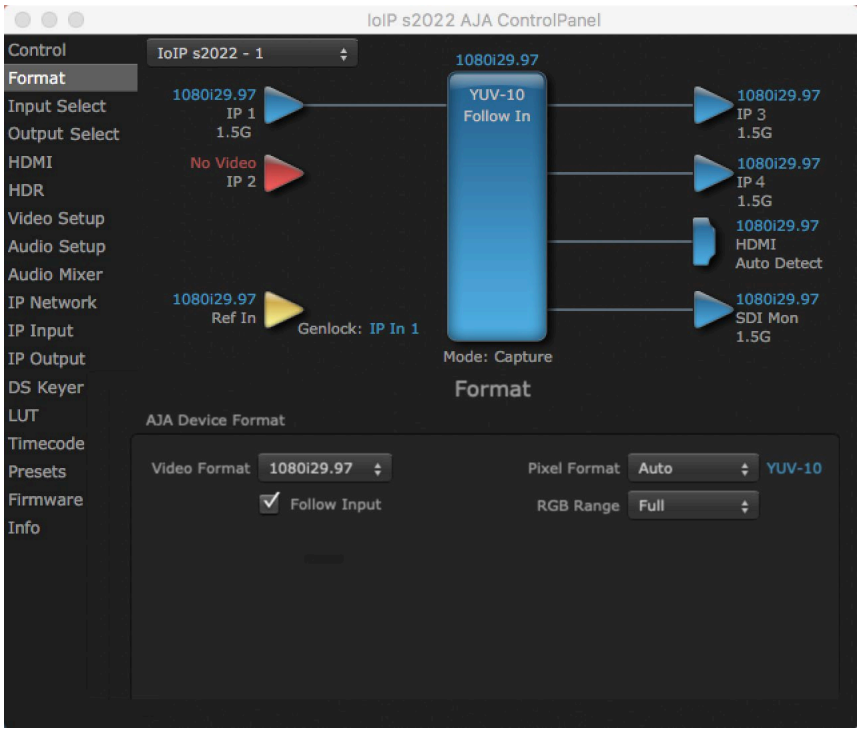
- Freerun - In this mode, Io IP generates sync without an external reference source
- Ref In - Directs Io IP to use the Ref Video source for sync (usually an analog black burst video signal)
- Video In - Directs Io IP to use whichever video input source has been selected in the Inputs Screen for sync

Timing (Horiz and Vert):

These two pull-downs allow output timing adjustment with reference to the Ref Video source selected:

- Horizontal selects a number of pixels (clocks) to offset
- Vertical specifies a number of lines to offset

Format Screen



The Format Screen shows the video format currently in use by the Io IP framebuffer (called the Primary Format) and allows you to change it. All throughout the Control Panel, choices are always presented based on what Io IP can do with the signals available and the inputs/outputs selected.

AJA Device Format

Video Format

This pull-down menu shows the currently selected Device format. If you select an alternate value using the pull-down, it will change the format used by Io IP's framebuffer.

When a change is made via the Video Format pull-down or by clicking an icon and selecting a new format via a contextual menu, the block diagram will change to reflect the new format.

Pixel Format

Use this pulldown menu to choose: YUV-10, YUV-8, RGB-10, or ARGB-8 or RGB-12.

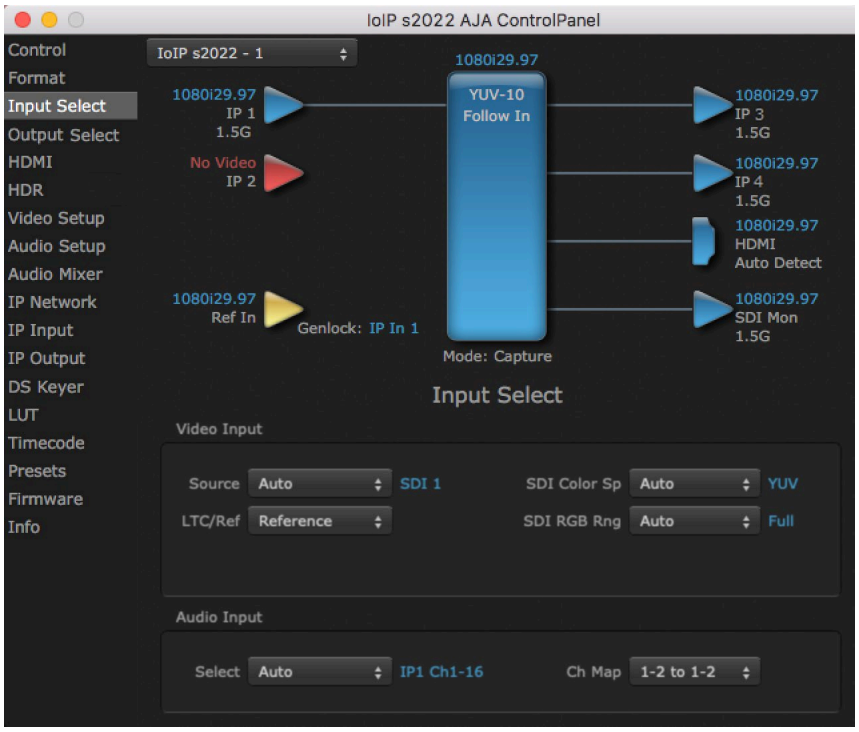
RGB Range

The RGB Range pulldown menu allows you to select either Auto, Full-range (0-1023) or SMPTE range (typically 64-940) for RGB color output.

Follow Input

Enabling the Follow Input checkbox allows the Control Panel Buffer to auto-switch to whatever is the detected input format. This feature works only if the controlling application supports input-based capture—AJA Control Room for example.

Input Select Screen



On the Input Select Screen you can view the currently selected video and audio input sources and map audio sources to the channels supported by your editing application.

Video Input

Source

The pulldown menu allows you to change the currently selected video input. Select from IP 1 or IP 2.

LTC/Ref

Use the LTC/Ref menu pulldown to identify the type of signal being received by the LTC/Ref BNC:

- Reference - BNC is used as a video reference input
- LTC- BNC is used for linear time code (LTC) input

SDI Color Sp

Sets the color space. Select from Auto, YUV, or RGB.

SDI RGB Rng

Sets the RGB range. Select from Auto, SMPTE, or Full.

Audio Input

Select the audio input. Choose from:

- Analog - Analog input (four or eight channels, depending on configuration).
- IP1 Ch 1-16 - IP1 embedded SDI or HDMI incoming audio (up to 16 mono channels)
- IP2 Ch 1-16 - IP 2 embedded SDI or HDMI incoming audio (up to 16 mono channels)

Ch Map

If only two channels were selected in the third-party application you are using, you can select which two channels will be mapped to that application. Different Audio Input selections can have different channel mapping capabilities. Select from:

- 1-2 to 1-2
- 3-4 to 1-2
- 5-6 to 1-2
- 7-8 to 1-2
- 9-10 to 1-2
- 11-12 to 1-2
- 13-14 to 1-2
- 15-16 to 1-2

NOTE: This setting does not affect the embedded audio being sent to the Io IP's BNC or HDMI output connectors.

Output Select Screen

The IP Output Screen shows the current settings for both of the IP outputs. The outputs can be configured independently.

Output Options

Select

- Auto - Automatically selects the output format, based on the input or selected format.
- Primary - Selects the framebuffer format for output.
- Video+Key - When selected, this indicates that the SDI 3 video is set to the same format as the framebuffer. SDI 4 is set to a video key signal associated with SDI 3 (the shape to be cut out from the video - this will appear as a black and white image/matte). Using the second Io IP output as an Alpha Channel key, with the video output, may be useful for feeding production switchers, DVEs or other professional video equipment.

Color Space

Sets the color space. Select from Auto, YUV, or RGB.

RGB Range

Sets the RGB range. Select from Auto, SMPTE, or Full.

3G Transport

Sets the output transport. Select from:

- Auto - Automatically selects the transport, based on the input or selected format.
- 2xHD-DL - Dual link HD output transport, using two BNCs.
- 3Gb
- 3Ga

HDMI Screen

HDMI Output

Select

- Primary - The HDMI Output of the Io IP is always the primary format. The current format and frame rate are displayed on the right.
- Stereo 3D - A pulldown menu for 3D output allows you to select either Side-by-Side or Top-Bottom (Stacked) output of left-eye and right-eye signals.

NOTE: This selection must agree with the format selection in the third-party CineForm Codec pulldown menu (NOT included with AJA Desktop Software).

Audio Ch

An Audio Channel pulldown allows you to select the number of embedded audio channels for the HDMI output.

Ch 3/4 Swap

This checkbox controls HDMI input audio channel placement. Some multi-channel audio decoder systems route the low frequency effects audio to channel 4, and some to channel 3. If you want to monitor or pass audio though to another device, this control can be used to align these two channels correctly.

- Checked - (default) HDMI audio channel 3 is moved to channel 4's location, and input channel 4 is moved to channel 3's location.
- Unchecked - HDMI audio retains the original 3 and 4 channel locations.

Protocol

The Protocol pull down allows you to choose between two “Auto” modes, or to explicitly force the output to a desired protocol.

- Auto Detect - (most reliable) AJA device attempt to reconfigure the HDMI output to match the current protocol setting of the output monitor. This option will be the most reliable in creating an output image. However, the output may result in loss of audio.
- Auto Set - (best quality) The AJA device HDMI out will attempt to automatically set the output monitor into the best protocol, usually HDMI.
- HDMI - Forces the use of the HDMI protocol regardless of the attached device’s EDID. Connection may fail if output monitor does not support the HDMI protocol.
- DVI: - Forces the use of the DVI protocol regardless of the attached device’s EDID.

Color Space

The Color Space pulldown allows you to choose between two “Auto” modes, or to explicitly force the output to a desired color space regardless of the attached device’s EDID or user application needs.

- Auto Detect - (most reliable) AJA device attempt to reconfigure the HDMI output to match the current color space setting of the output monitor EDID. This option will be the most reliable in creating an output image. However, the output may result in an inferior image due to color space conversion and loss of bit depth.
- Auto Set - (best quality) The AJA device will attempt to automatically set the output monitor into the best color space and bit depth that matches the user's application needs regardless of EDID of the output monitor. This may result in loss of image if the output monitor does not support a specific color space mode.
- RGBA-8 - Forces the use of RGBA-8.
- RGB-10 - Forces the use of RGB-10.
- RGB-12 - Forces the use of RGB-12.
- YUV-8 - Forces the use of YUV-8.
- YUV-10vForces the use of YUV-10.

RGB Range

The RGB Range pulldown menu allows you to select the type of RGB color output.

- SMPTE - (typically 64-940)
- Full - (0-1023)

HDR Screen

The HDR screen provides a sub tab setup for HDR playback simultaneously via both SDI and HDMI.

For SDI destinations, the HDR data is delivered in-band using VPID signaling for SDR/HDR Transfer Characteristics, Colorimetry and Luminance.

For HDMI destinations, side-band information is used to inform an HDMI sink device (such as a TV or monitor) that the video content is HDR. This includes generation of the Dynamic Range and Mastering Infoframe and the static metadata descriptors as defined in CTA-861.3 and HDMI v2.0a.

Included are preset primaries values for BT.2020 and DCI P3 color gamuts.

Two tabbed screens are available. The HDR Capture tab settings affect the HDR metadata saved with your captured video, while the HDR Playback tab settings affect what HDR metatdata is included the Io IP's HDMI and SDI outputs.

HDR Capture Settings

Colorimetry

- Auto - (default)
- SDR - Standard Dynamic Range
- P3 - P3 colorspace
- 2020 - BT.2020, typically used with HDR
- Custom - Allows custom values for the Digital Primaries.

Transfer

The Electrical Optical Transfer Function metadata bit tells the HDMI display which EOTF to use.

- Auto - (default)
- SDR - Standard Dynamic Range
- PQ -

- HLG (Hybrid Log Gamma) - No meta-data for Digital Primaries.

Luminance

- Auto - (default)
- YCbCr -
- ICtCp - IPT color space

Digital Primaries

Selecting Custom HDR Mode allows the editing of digital primaries information that is passed as metadata accompanying the video signal. However, when HLG selected as the EOTF digital primaries information cannot be edited, because HLG does not use metadata.

Display Mastering Luminance

Represents the minimum and maximum Display Mastering Luminance.

- Minimum: Defines the floor of the SMPTE ST 2086 color volume (in the case of HDR) and is determined by the mastering environment.
  - Range: 0.0000 cd/m2 to 1.0000 cd/m2.
  - Step size: 0.0002 cd/m2.
- Maximum: Defines the ceiling of the SMPTE ST 2086 color volume (in the case of HDR) and is determined by the mastering environment.
  - Range: 1 cd/m2 to 65535 cd/m2.
  - Step size: 1 cd/m2.

Maximum Content Light Level (CLL)

Represents the highest-value pixel component in an entire scene. It is determined by analyzing each frame of video, and can be determined in the post environment.

- Range: 1 cd/m2 to 65535 cd/m2.
- Step size: 1 cd/m2.

Maximum Frame Average Light Level (FALL)

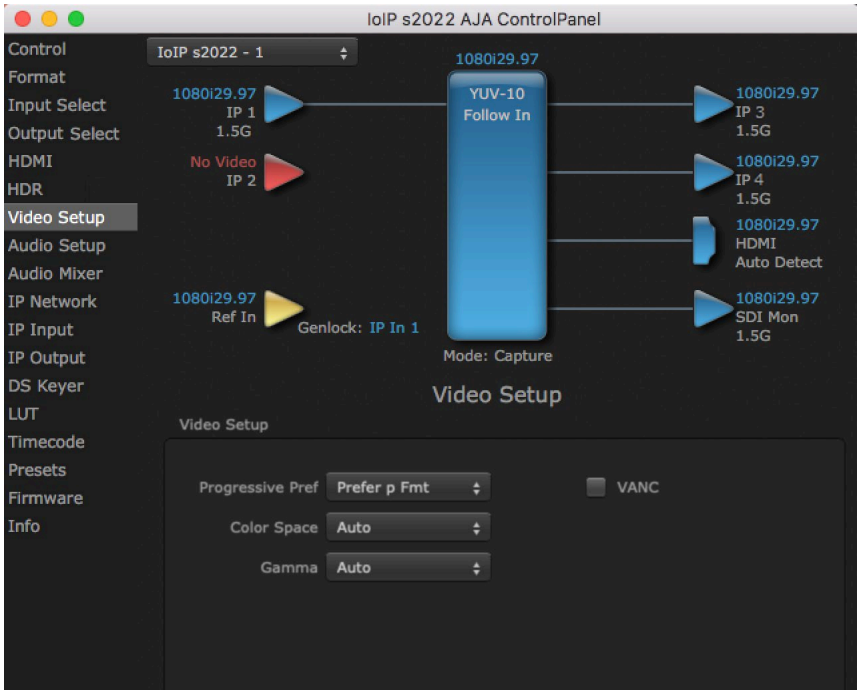
Represents the maximum of frame-based average light levels taken over an entire scene, and can be determined in the post environment.

- Range: 1 cd/m2 to 65535 cd/m2.
- Step size: 1 cd/m2.

HDR Playback Settings

The HDR Playback tab settings are identical to the HDR Capture settings, but affect the Io IP's HDMI and SDI outputs.

Video Setup Screen



The Video Setup screen shows various other settings which will affect how video inputs and outputs behave, and how Io IP interacts with some software applications.

Video Setup

Progressive Pref

Allows you to choose to prefer p (progressive frames) or PsF (progressive segmented frames) on non-interlaced output. This feature is used to default the hardware to use either p or PsF output over SDI when it has not been specified by the application.

Color Space

Sets the video color space. Select from:

- Auto
- Rec 601
- Rec 709

Gamma

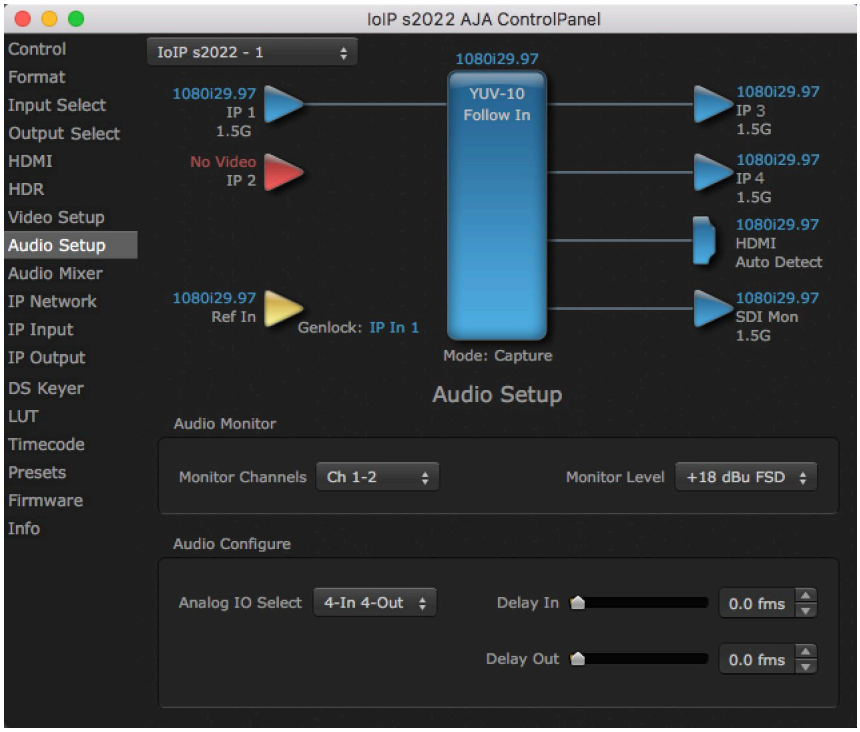
Sets the video gamma. Intended for use with legacy Apple displays. Select from:

- Auto
- Gamma 1.8

VANC Checkbox (inactive on Io IP)

This checkbox enables the tall frame buffers that include VANC, which is not supported by Io IP. When using SMPTE ST 2110 the video flow is the video raster only. VANC/HANC is sent on a separate IP flow, along with audio. ST 2110 is designed to support separate essence flows for each data type.

Audio Setup Screen



The Audio Setup Screen shows the current settings for the analog audio output, allowing you to re-configure it when desired.

Audio Monitor

Monitor Channels

Use the drop-down menu to select which two audio channels to monitor. Select from:

- Ch 1-2 through Ch 15-16.

NOTE: This setting only applies to dual channel monitoring environments.

Monitor Level

Allows adjustment of the analog monitor level, to match the audio to your operating levels. Select from:

- +24 dBu FSD
- +18 dBu FSD (default)
- +15 dBu FSD
- +12 dBu FSD

Lock Audio Gain To Unity

When set, Io IP will ignore the third-party application gain setting and set the audio gain at unity. When not set, this checkbox tells the Io IP to get the audio gain setting from the application.

Audio Configure

Analog IO Select

This setting controls how the analog audio inputs and outputs are configured. Select from:

- 8-Out (Ch 1-8 output)
- 4-In 4-Out (Ch 1-4 input, Ch 5-8 output)
- 4-Out 4-In (Ch 1-4 output, Ch 5-8 input)
- 8-In (Ch 1-8 input)

Delay In

Here you can set up to 6 frames (in tenths of a frame) of input audio delay.

Delay Out

Here you can set up to 6 frames (in tenths of a frame) of output audio delay. The AJA Control Panel delays all audio outputs—SDI, HDMI, and Analog.

IMPORTANT: If you use Control Panel delay, do not use other delay settings in your applications, as they can conflict.

Audio Mixer Screen

The Audio Mixer screen has two tabs; Playback and Capture. These tabs display what sources are available for monitoring / mixing via the AJA hardware when in either of those two modes (if applicable). The controls on this screen are dedicated only to monitoring adjustments, and do not affect the level at which inbound audio signals are captured to storage.

The selection check boxes and screen slider controls affect the following Io IP, outputs:

- SDI Embedded Audio Out
- HDMI Embedded Audio Out
- Analog Audio Out (via DB25 cable)
- Front Panel Monitor Out (headphone jack) - This level can also be adjusted with the front panel gain knob, and is additive to the screen slider controls.

IMPORTANT: Even though you can hear changes in the signals and levels adjusted with *the Audio Mixer screen, these changes are NOT recorded to disk during NLE Capture or Audio Punch In / Voice Over to Timeline. In addition, muting or activating sources on this screen will not affect audio signals being recorded. The Audio Mixer screen is dedicated for monitoring only, not program mixing.*

The branching arrow on the lower right indicates which sources are being routed for monitoring in that operating mode, and is colored blue when active and red when disabled.

Each source has a confidence meter, which enables you to tell immediately if you have a source arriving correctly at the AJA hardware (without having to launch any other software). The level sliders allow a simple plus or minus adjustment to the Source level being monitored. This is to allow for fine-tuning of your listening environment (on occasions the host system audio can be unexpectedly loud, or an incoming feed may be very loud or very quiet).

Two different Audio Mixer screens are available, selected by clicking on the Playback Monitor or Capture Monitor tabs. During regular editing, the Playback tab is used to control your monitoring experience. During capture operations, the Capture tab is used for your monitoring experience.

Controls in each tab are only in effect when Io IP, is in the correct operating mode, as determined by the controlling application or the Control Panel application's Default Output setting. When the mode doesn't match, the mode indicator on the right goes red (see Figure 51 on page 69). However, settings can be adjusted while in that disabled mode, and will be applied when you return to that operating mode.

Audio Mixer Playback Monitor Tab

Playback Source Selection

Clicking the On checkbox selects the audio for that item for playback to the audio monitor outputs. Multiple sources can be selected simultaneously.

Main App

If an external application is controlling the Io IP, it will be displayed in the Item Select column and its audio can be selected for playback with the checkbox.

AJA Input

Selects for monitoring the audio being input to Io IP,.

NOTE: The AJA Input Item Select dropdown selection is linked to the Input Select screen's Audio Input Select dropdown. Changing the setting on one screen will also change the setting on the other screen.

In the Item Select column, click on the dropdown and choose from:

- Analog - The Analog Audio being received on the Io IP, DB-25 connector.
- IP Ch 1-16 - The embedded audio being received by the Io IP.

Host Audio

Selects the audio from the host computer, thus enabling the AJA hardware to monitor anything that would normally be presented via the host laptop, CPU or computer monitor. For example, an editor could sample music from an online library, while concurrently playing back their NLE timeline. Or, a producer and editor could be communicating live during an editing session, using Skype or some other video calling tool.

Source Gain

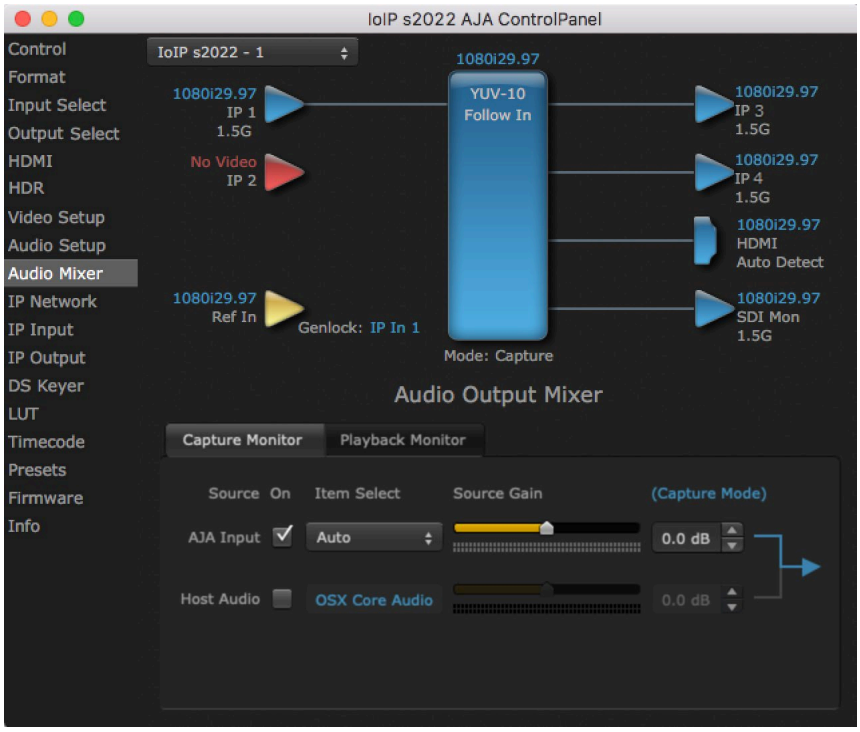
Meters display the input audio levels of the source, colored green when that source is On, and gray when that source is not selected. The levels shown do not change when the gain is adjusted, because the input levels are being monitored, not the output levels.

When activated, the source gain controls can be used to adjust the monitoring output gain of that source, from +6dB to - infinity (mute). Adjustment methods include:

- Sliders - The sliders on the right can be used to change the values for each color.
- Numeric Entry - You also enter a numeric value by clicking on the displayed number, and can increase or decrease the values clicking on the up/down arrow boxes.
- Cut and Paste - Right clicking on a displayed number opens a Cut, Copy, Paste dropdown menu for convenient numeric entry.

As mentioned before, these controls are for monitoring only, and do not change the audio recorded to a NLE file. Any actual recording level adjustments to Capture or Audio Punch In / Voice Over to Timeline operations will either need to be made upstream of the AJA input, or else via adjustments within the main NLE application (e.g. via a pass through mix tool).

Audio Mixer Capture Monitor Tab



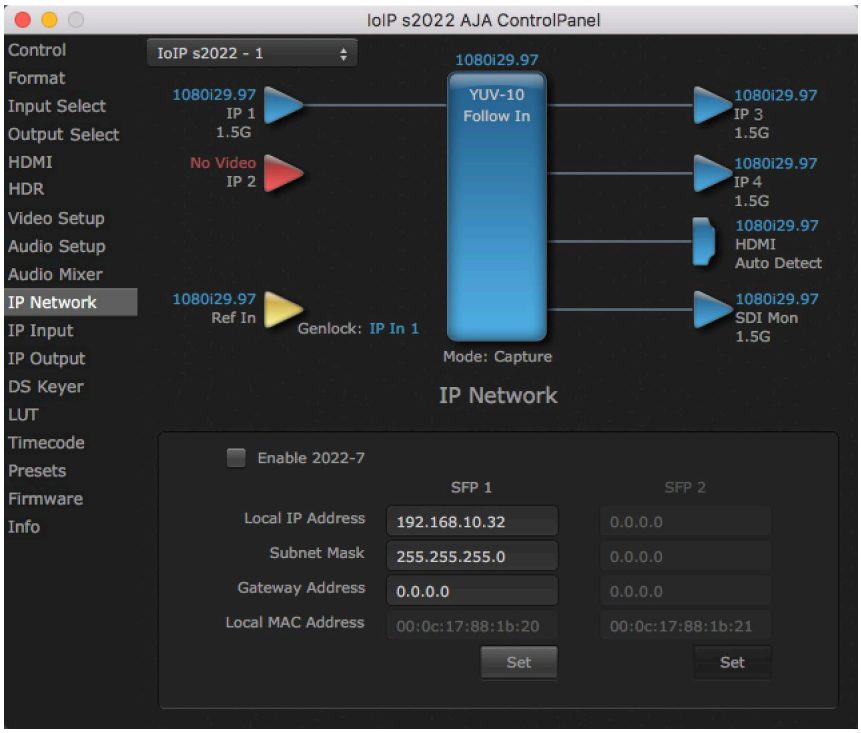
The Capture Monitor Mode screen is used to select and mix audio to be monitored during capture operations.

IMPORTANT: Even though you can hear changes in the signals and levels adjusted with the Audio Mixer screen, these changes are NOT recorded to disk during NLE Capture or Audio Punch In / Voice Over to Timeline. In addition, muting or activating sources on this screen will not affect audio signals being recorded. The Audio Mixer screen is dedicated for monitoring only, not program mixing.

The controls on this screen are similar to those on the Playback Monitor Mode screen, except the Main App is not available for selection (you cannot capture from the application that is capturing). See "Audio Mixer Playback Monitor Mode Screen" on page 70 for more information.

NOTE: If you want different behavior when the Capture tab is triggered; i.e. for host system audio to be muted, then simply check the host system audio in the Capture tab only. This way when you exit NLE Capture and return to regular editing, the Playback tab settings will be applied and your host system audio monitoring will resume.

IP Network Screen



The IP Network Screen lets you input the network parameters that define the location of each physical SFP+ cage of the Io IP hardware.

Enable 2022-7

Enables 2022-7 redundant network operation. See *"IP Network Screen, 2022-7 Operation" on page 42* for more information.

Local IP Address

This is the IP address that identifies each physical Io IP SFP+ link on the network. This field must be filled in for at least one of the Io IP SFPs for Io IP to work properly.

Subnet Mask

This is the subnet mask defined by the system administrator. Generally speaking, this value must be defined in the AJA Control Panel for Io IP to work correctly on the network.

Gateway Address

This is the IP address of a network gateway to a remote network. This value must be defined if/when the Io IP needs to send signals to, or receive signals from a remote network.

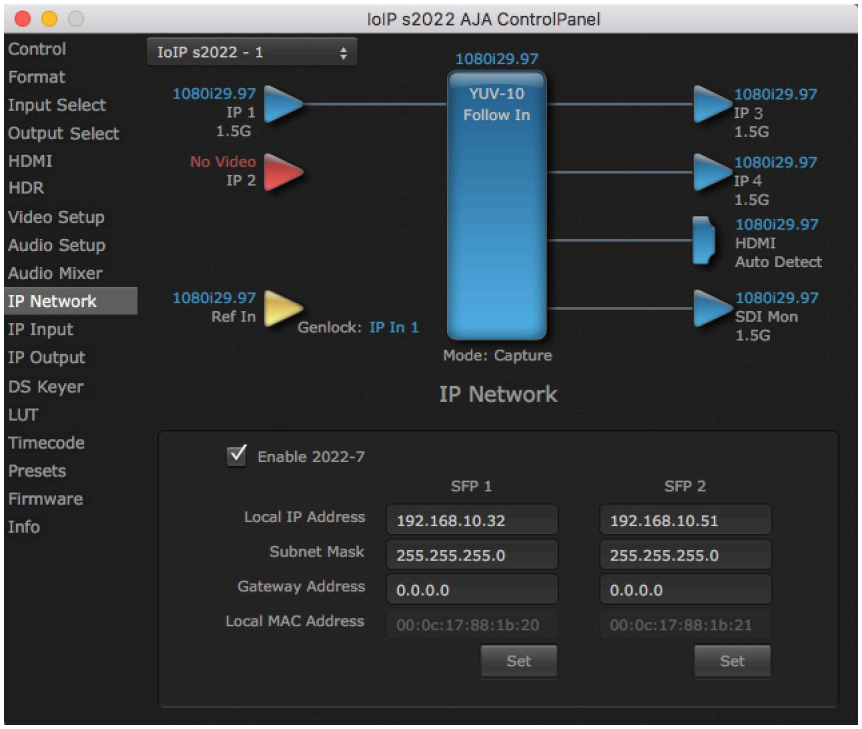
Local MAC Address

This is an information display field that cannot be changed. It is the MAC address that is assigned to the specific SFP cage on the Io IP.

Set Button

Click the 'Set' button to apply the changes.

IP Network Screen, 2022-7 Operation



Enabling 2022-7 makes it possible to configure redundant networking capabilities using both SFP modules. No additional inputs or outputs are activated. In 2022-7 operation each SFP transmits and receives the same information. This allows the use of two separate network paths, making recovery possible if one path fails.

When 2022-7 is enabled, additional settings are available for configuring your network settings.

- SFP Top - Indicates the top physical SFP cage on the Io IP board, farthest from the copper contacts where the Io IP connects to its PCIe slot.
- SFP Bottom - Indicates the bottom physical SFP cage on the Io IP board closest to the copper contacts where the Io IP connects to its PCIe slot.

IP Input Screen

The IP Input Screen on Io IP, lets you define parameters for receiving inputs to the Io IP from another device on the network. This screen has two tabs, one for each Channel.

NOTE: *The IP 1 Input and IP 2 Input labels do not represent the physical SFP cages on the Io IP. They represent different transmissions being received by the Io IP, possibly over the same 10GbE link.*

Channel 1 or 2

Select the input channel to be configured.

Multicast

When selected, Multicast operation is used. Enter a valid multicast IP address into the Dest IP Address field.

Unicast

When selected, Unicast operation is used. The Dest IP Address field is automatically filled with that device's Local IP Address (from the IP Network screen) and the field will be grayed out (not editable).

NOTE: *Turning off Unicast operation makes the Dest IP Address editable, but it retains the previously applied Unicast IP address. You must edit the Dest IP Address field on this screen to resume Multicast operation.*

Destination IP Addr

This filter lets you specify the network address where a multicast from another device on the network can be found.

Destination Port

This filter lets you specify the port number being used to send a multicast to the 'Destination IP' address specified above.

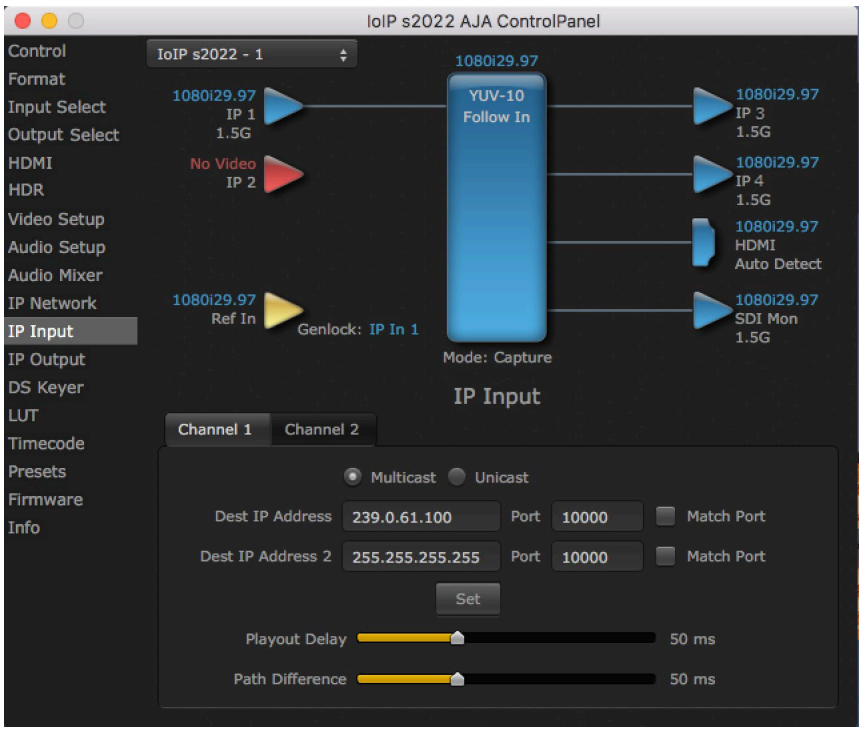
Match Checkboxes

The 'Match' checkbox can be used to match the Destination Port to the Destination IP Address.

Playout Delay

The Playout Delay slider can be used to adjust the amount of buffering before packets are sent to the network, in a range of 0 to 150 milliseconds. Network traffic conditions may require setting a larger buffer. Default is 50 milliseconds.

IP Input Screen, 2022-7 Operation



These fields will only be available when 2022-7 is Enabled in the IP Network section. See *"IP Network Screen, 2022-7 Operation" on page 42*.

Destination IP Addr 2

This filter lets you specify the network address where a duplicate multicast from another 2022-7 device on the network can be found. That device should be sending two duplicate IP video multicasts and the IP addresses of those streams will be specified in 'Destination IP Addr' and 'Destination IP Addr 2'.

Destination Port 2

This filter lets you specify the port number being used to send a multicast to the 'Destination IP Addr 2' address specified above.

Path Difference

The Path Difference slider can be used to adjust the buffering used for redundant operation, where the paths through the network of the two streams may have different delays. Adjustable in a range of 0 to 150 milliseconds, with 50 milliseconds the default.

IP Output Screen

The IP Output Screen on Io IP lets you define parameters for sending outputs from the Io IP onto the network. This screen has two tabs, one for each Channel.

NOTE: The IP 1 Input and IP 2 Input labels do not represent the physical SFP cages on the Io IP. They represent different transmissions being received by the Io IP, possibly over the same 10GbE link.

Channel 1 or 2

Select the output channel to be configured.

Destination IP Addr

This parameter lets you specify the network address where a multicast from this Io IP can be sent for use by other devices on the network.

Destination Port

This lets you specify the port number being used to send a multicast to the Destination IP address specified above.

Destination IP Addr 2

This field will only be available when 2022-7 is Enabled in the IP Network section. This filter lets you specify the network address where a duplicate multicast from this Io IP output can be sent. This IP output will then be sent to both the address specified in 'Remote IP Addr', and to the address specified in 'Remote IP Addr 2'.

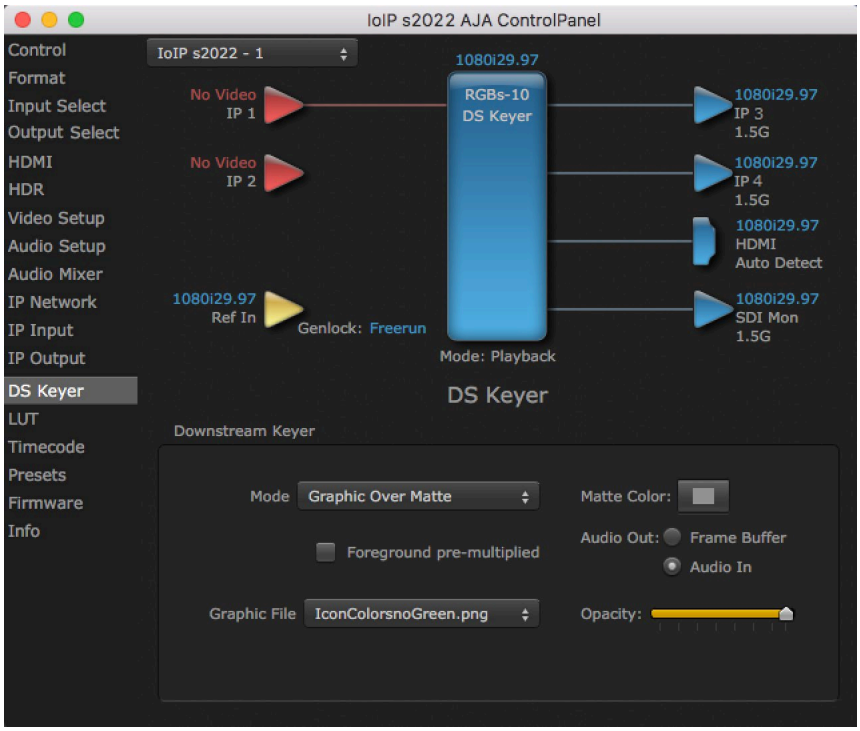
Destination Port 2

This field will only be available when 2022-7. It lets you specify the port number being used to send a multicast to the 'Remote IP Addr 2' address specified above.

Enable Checkbox

The 'Enable' checkbox connects the Io IP to the network address specified by all the matched output parameters. Any time a parameter is changed, the output should be re-enabled.

DS Keyer Screen



Io IP has a hardware-based downstream keyer that is ideal for putting logos, "bugs" or other video material with an alpha channel on top of video being played out or printed to tape. A typical application would be putting a television station's call letters or channel over program video content. Keyed video can be from the Io IP's internal Frame Buffer (from storage, Video In, etc.) or from a graphics file that has an alpha channel (PhotoShop etc.).

Settings in the DS Keyer Screen provide control over how the keyer operates and whether it's turned on or off.

Downstream Keyer

Mode

- Downstream Keyer Off - When this pulldown menu item is selected the downstream keyer will be turned off.
- Frame Buffer over Matte - Places the keyed video with alpha channel currently in the Frame Buffer over a fixed color matte determined by the "Matte Color" setting set separately.
- Frame Buffer over Video In - Places the keyed video currently in the Frame Buffer over the video input for playout or print-to-tape.
- Graphic over Matte - Places a graphics file having an alpha channel (chosen in "Graphic File" pulldown) over a fixed color matte determined by the "Matte Color" setting set separately.
- Graphic over Video In - Places a graphics file having an alpha channel (chosen in "Graphic File" pulldown) over the video input for playout or print-to-tape.

- Graphic over Frame Buffer - Places a graphics file having an alpha channel (chosen in “Graphic File” pulldown) over the current contents of the Io IP’s Frame Buffer (which might be from storage, video In, KONA TV, etc.).

Matte Color

Only available when the pulldown “Frame Buffer over Matte” or “Graphic over Matte” are selected-pressing this button brings up a color selection dialog. The dialog provides a variety of ways to select a matte color including a color wheel, color picker (choose from a location anywhere on the computer screen), numeric sliders, swatches, “crayons”, and spectrums. The matte chosen will be used as a video background under the keyed video.

Foreground pre-multiplied (checkbox)

Use to avoid “matte lines” and improve the appearance of the foreground (key) being composited over the background.

Audio Out

- Frame Buffer - Select audio out to be routed from the contents of the Frame Buffer.
- Audio In - Select audio out to be routed from Io IP’s currently selected input(s).

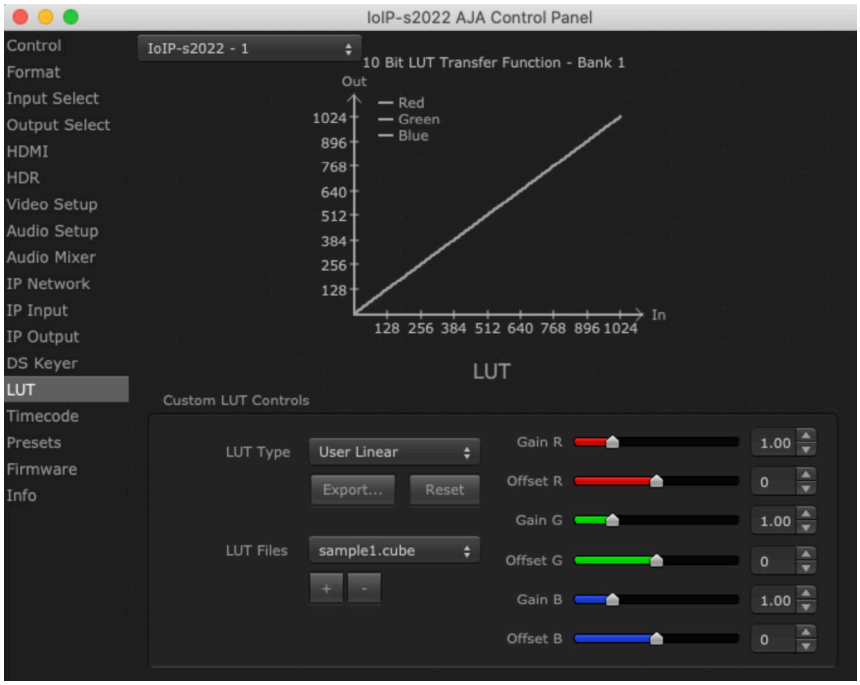
Opacity

This slider controls the transparency of the keyed video (over the background) from translucent to completely opaque.

Graphic File Load

This pulldown allows you to choose from any recently accessed file or select a new file (“Load File...”), which then brings up a file dialogue. Remember that the file raster (pixel x pixel count) should match the primary format in the frame buffer. Example: you wish to key a logo on top of your 1920x1080 footage, the still image with alpha channel that you load should be 1920x1080.

LUT Screen



The LUT screen allows you to create a custom color look up table (LUT) on the Io IP output, for matching a production "look" on a specific display. These custom LUTs can also be exported as .cube files for use with supported AJA devices and compatible professional applications. Users can also load externally generated LUT files into the Io IP to ensure consistent color among different devices.

NOTE: .cube files are the new standard for importing and exporting LUTs with AJA Control Room as of v16.2. Prior to v16.2, Control Room supported CSV files containing LUT information. While this LUT formatting is still supported for import, it is no longer supported for export.

The bit depth of LUT files depends on the version of firmware installed into Io IP.

- When s2110 or s2022 firmware is installed, the Io IP creates and uses 10-bit LUT files.
- When s2110-RGB firmware is installed, the Io IP creates and uses 12-bit LUT files.
- 10-bit LUT files can only be used with 2110 and 2022 firmware, and 12-bit LUT files can only be used with s110-RGB firmware.

Custom LUT Controls

The LUT Transfer Function screen displays an approximate representation of the effect of the current LUT settings. When the controls are activated by selecting a User LUT Type, Red, Blue, and Green curves show the transfer functions of each color.

NOTE: The displayed curves are approximate,. Curves for some extreme settings may diverge significantly from the actual transfer functions.

LUT Type

Selects the type of LUT. Choose from

- Auto - LUT will be automatically selected. This setting intelligently applies the type of LUT required in the majority of use cases. For example, if the Frame

Buffer is set to SD 608 and the Output set to HD 709, then an industry standard curve for changing 608 to 709 color space is applied.

- Linear - A linear 1:1 LUT is applied, resulting in no color change (every value for source is mapped to the same value for output).
- SMPTE->FullRange - A conversion LUT from SMPTE to Full Range is applied.
- FullRange->SMPTE - A conversion LUT from Full Range to SMPTE is applied.
- User Linear - Activates the Gain and Offset controls, allowing the manual creation of a custom LUT. Initial default setting is linear.

Figure 10. Example LUT Transfer Function Curves

- User Film Stream - Activates the Gain and Offset controls with a default curve matching Grass Valley FilmStream cameras, and also allowing manual creation of a custom LUT.
- User LUT File - See *"LUT Files"* below.

Gain and Offset Controls

When activated, the controls on the right allow adjustment of Gain and Offset for Red, Blue and Green.

- Sliders - The sliders on the right can be used to change the values for each color.
- Numeric Entry - You also enter a numeric value by clicking on the displayed number, and can increase or decrease the values clicking on the up/down arrow boxes.
- Cut and Paste - Right clicking on a displayed number opens a Cut, Copy, Paste dropdown menu for convenient numeric entry.

Export

The Export button can be used to save the current LUT values as a .cube file. The LUT file can be named and you can specify the location to save the file. This Export feature lets you take the custom LUT with you and re-import it to another system or location for consistency.

Reset

Clicking on the Reset button resets the currently selected LUT Type to its default values (not active for a User LUT file).

LUT Files

The User LUT File setting above activates the LUT Files dropdown, allowing the selection of a previously saved LUT file. You can create a custom LUT file using most text editors or spread sheets, provided the data is arranged according to the LUT File Format Specification that follows (see *"LUT File Format Specification" on page 50*).

Uploading Custom User LUT file

Once the LUT file is created, you can upload it with the following steps:

1. Before loading a LUT, make sure you are using an RGB/RGBA frame buffer format, and that you have a AJA Video Device that supports LUTs.
2. Open AJA Control Panel and select the "LUT" pane.
3. Click the "LUT Type" popup and choose "User LUT File" menu item. Note "LUT Files" options become enabled.
4. Click the "+" button and use the navigation dialog to choose a custom LUT file. The LUT is now loaded.

LUT File Format Specification

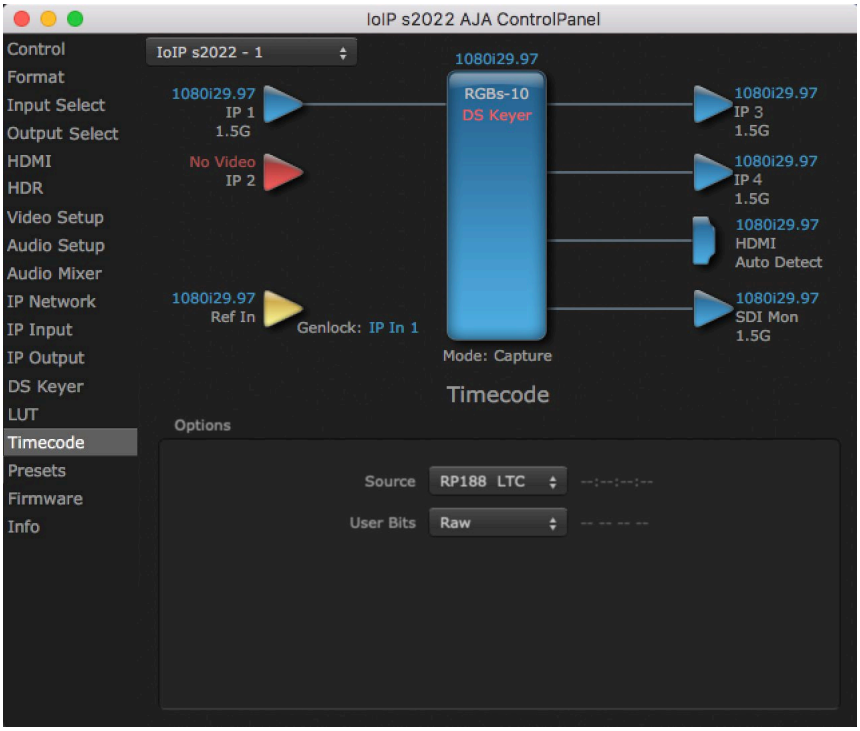
LUT files are normal text files that contain 1025 lines (numbered 0 - 1024). Each line contains 3 integer values in the range 0 - 1023, representing 10 bit R, G, B component output values. Component values may be separated by one or more commas, spaces, or tabs. The example below show LUT File contents for Line 0, Line 1, Line 2, and Line 1024, with several valid ways to separate the numbers in a line, using comma and space, tab, or only space.

- 16, 17, 17
- 17 18 18
- 19 19 21
- …
- 1000, 1022, 1023

In the example above, the first line (Line 0) represents the output values for the case where R=0, G=0, or B=0. In other words, if the R component of a pixel is set to 0, then set R component value to 16. Likewise, if G is set to 0, then set G to 17. The second line (Line 1) does a similar thing for input component values equal to 1.

A simple way to construct a LUT file is to go to user linear in Control Panel and make some modifications, then click export and you will have a .cube file. You can then either import that LUT on a different workstation, or else use a text editor to make manual adjustments if desired.

Timecode Screen



The Timecode Screen selects the timecode stream read for applications that use it (for example, when the timecode source is set to "Use control panel setting," AJA Control Room will read the selected stream). It is also used for monitoring the RP-188 timecode embedded in the digital data stream, and can be used for selecting a timecode offset (if required).

Options

Source

In RP-188 timecode (SMPTE 12M-2) there can be multiple timecode types in the data stream. Use this pull-down to select the one you wish to monitor:

- RP188 LTC (Linear timecode)
- RP188 VITC (Vertical Interval timecode)

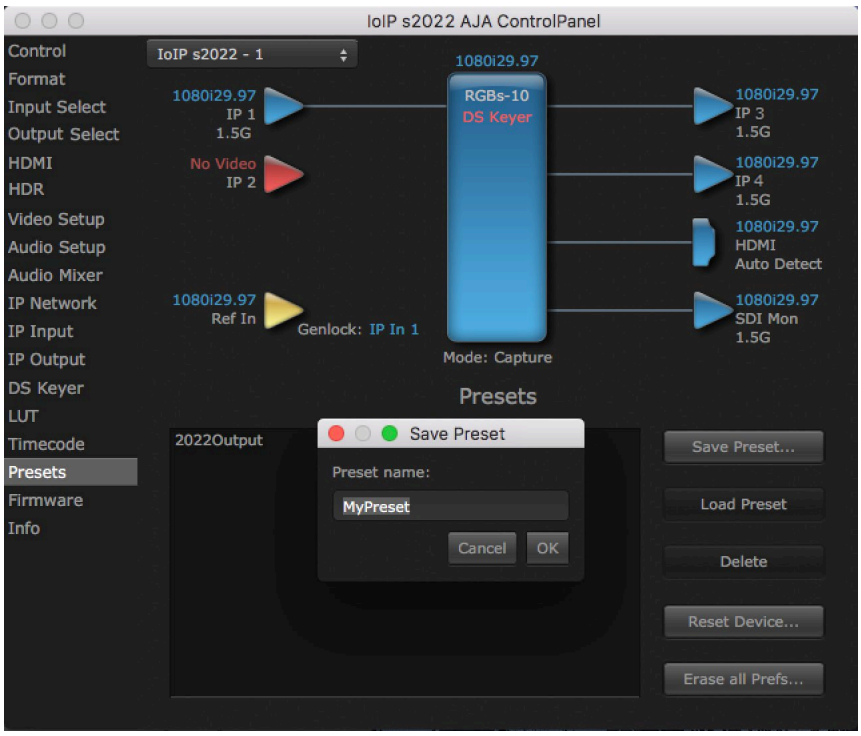
The selection will be displayed in the timecode value to the right of the pull-down.

User Bits

Select from Raw or VFR. For monitoring a variable framerate (VFR) timecode (such as Varicam), you may wish to select VFR for User-bits. KONA will detect and interpret the user-bits and display them next to the checkbox. You will see the original framerate (30 fps in the figure below) followed by the adjusted frame padding (two digits reporting discarded and retained frame padding).

NOTE: SMPTE 12M-2 is the updated name and specification for what was RP-188. SMPTE RP 188 defines a standard for the transmission of time code and control code in the ancillary data space of a digital television data stream. Time code information is transmitted in the ancillary data space as defined in ANSI/SMPTE 291M. Multiple codes can be transmitted within a single digital video data stream. Other time information, such as real time clock, DTTR tape timer information, and other user-defined information, may also be carried in the ancillary time code packet instead of time code. The actual information transmitted through the interface is identified by the coding of a distributed binary bit. Equipment manufacturers can use the meta data for different purposes.

Presets Screen



After configuring the AJA Control Panel screens, you can then save all your settings as a snapshot for later recall, called a preset. In this way, you can organize presets for all your typical tasks, eliminating manual reconfiguration.

Saving, Loading and Deleting Presets

To save a preset, simply go to the Presets screen and click “Save Preset”. A dialog will be presented asking you for a file name. Enter a meaningful name and click “OK”. Thereafter the preset will be available under the Control Panel “Presets” list.

From the Presets screen you can manage your collection of presets easily. To Load or Delete a stored preset, just select it with your mouse and then click the “Load Preset” or “Delete” button respectively .

Transferring Saved Presets

If you want to use a saved Preset on another workstation, you can simply copy the file on removable storage and install it at the new location. The Preset files are stored at:

Mac OS Preset Files Storage Location

- From the Finder, hold down the Option key (to display the Library directory) and click on Go/Library/Application Support/AJA/<device name>/Presets/

Windows Preset Files Storage Location

- c:\Users\<username>\AppData\Local\AJA\Control Panel\<device name> Presets\

Reset to Default

When you click the "Reset Device" button the Default User Preference file will be deleted and AJA Control Panel will do one of the following:

- If a Default Global Preference if found, it is loaded and the device is set to this state.
- If a Default Global Preference file is not found, “factory defaults” are loaded and the device is set to this state.

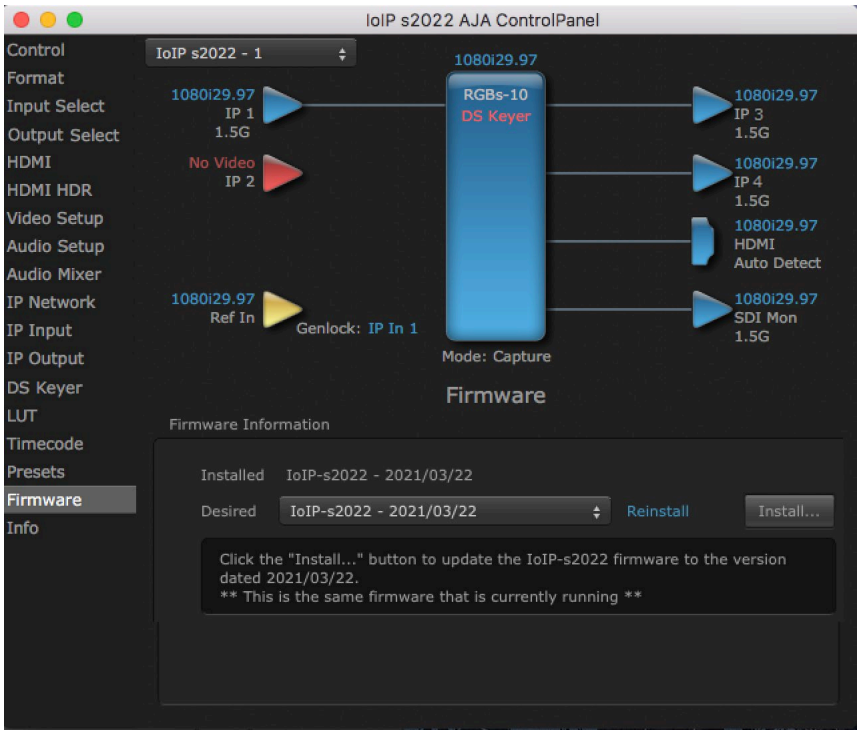
NOTE: See "Default Preferences" on page 22 for more information.

Erase all Prefs

For technical support purposes you may be required to remove the current Preference settings. Clicking on the "Erase all Prefs" button deletes the current Default User Preference file without accessing a Default Global Preference file, if one exists. Current AJA device settings are not altered, but changing any setting will immediately regenerate a Default Use Preference file with the changed settings.

NOTE: Clicking on the AJA Control Panel Erase All Prefs button does NOT delete an existing Global Preference file from that shared location.

Firmware Screen



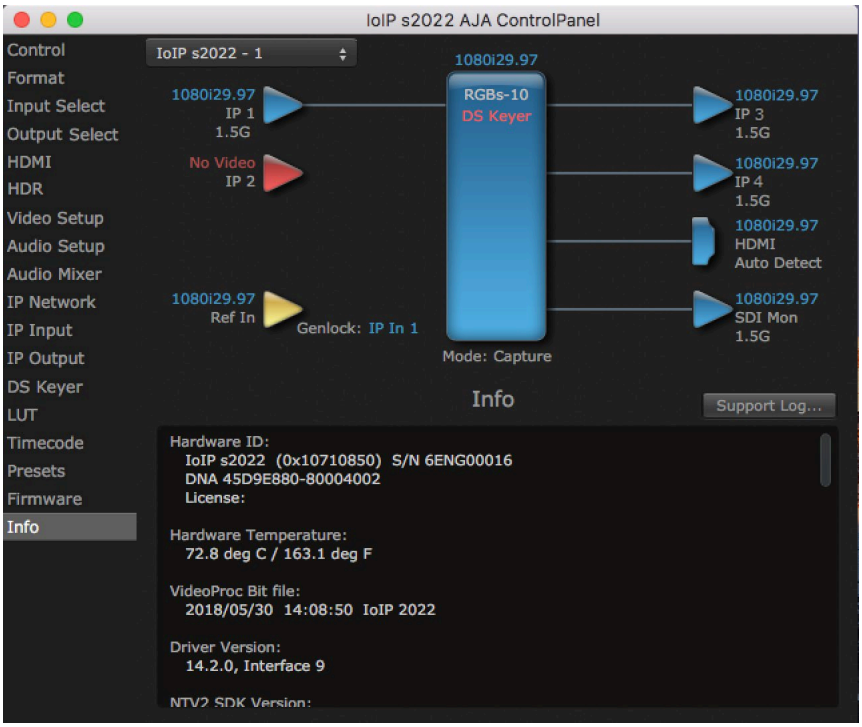
Three versions of firmware are available for Io IP. You can select from:

- s2022
- s2110
- s2110-RGB

NOTE: *When you change between operating modes, you may need to connect to a different physical media network, or reconfigure that media network for compatible operation.*

Click **Install** to erase the current firmware and load the desired firmware. After changing the firmware you will need to reset the Io IP.

Info Screen



The Info Screen shows the software files that have been installed on your system. This information may be needed if you talk to an AJA Customer Service representative to determine if files are missing or need updating.

Control Panel Operation with s2110 Firmware

Overview

Io IP's s2110 firmware supports the transport of uncompressed SDI video (up to 4Kp60) and embedded digital audio streams over a network. These audio and video streams can be sent and received independently.

Requirements

- 10G network
- PTP network timing system

General Operation

When running s2110 firmware, a new Io IP must be configured before operation. Once initially configured, that Io IP can be set to receive JSON or SDP information, which completes that device's configuration for a specific workflow task (playing back and/or capturing SDI video and audio over the network).

Because of the complexity of setting up IP configurations for ST 2110 operation, IT experts at your facility may have created a set of files you can use for quick and easy Io IP re-configuration. A shared network location or other method may also be established to hold these files, to ensure easy access to the correct configuration files for various workflows.

AJA Control Panel s2110 Firmware Follow Input Settings

The correct setting of AJA's Control Panel application's "Follow Input" parameter is required, depending on the type of transport:

- **Follow Input** should be On for HD/SD SDPs.
- **Follow Input** should be Off for script to script configurations. The frame rate will need to be manually set.
- **Follow Input** should be Off for 4K/UltraHD SDP's, which will maintain the board in 4K/UltraHD operation.

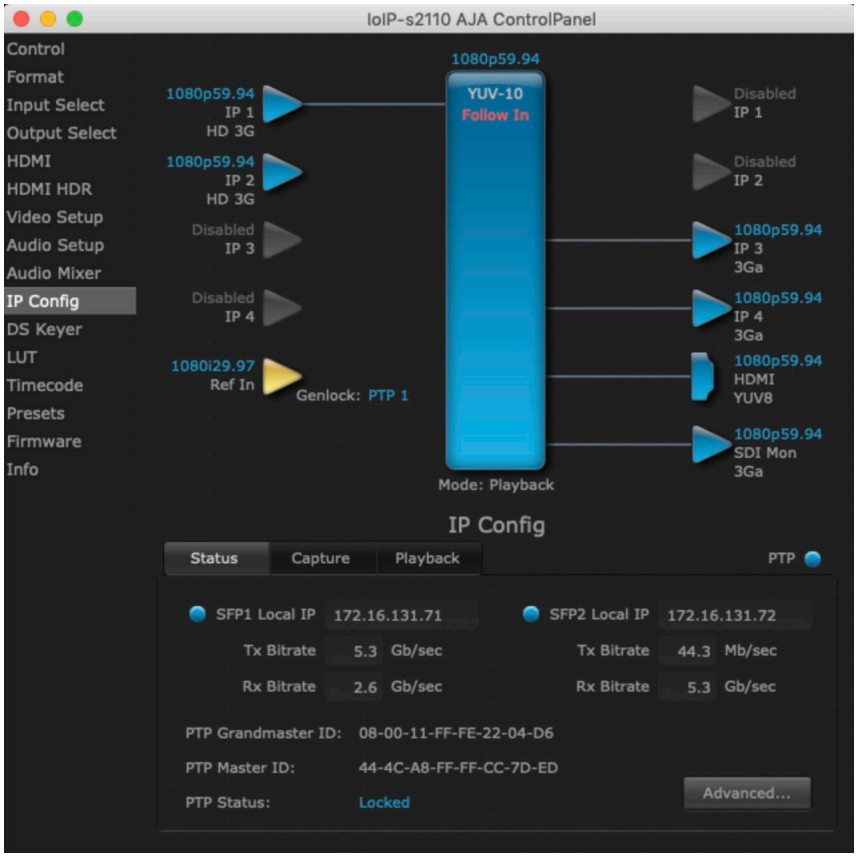
AJA Device s2110 Presets and Resets

Control Panel user defined Presets save and restore the video state and video options currently set in Control Panel. IP parameters are not included. Use exported scripts to save IP parameters.

The Control Panel "Reset Device" button reset clears all IP settings and puts the device back to fresh state. This is recommended when setting up a new script or generating a new set of parameters, but is not required.

IP Config Status Tab

The Control Panel screens available with s2110 firmware are similar to those with s2022 firmware. The IP Config screen parameters are arranged differently, however, with three tabs.



The s2110 Status screen reports various network statuses, including IP addresses and PTP operation. It also permits access to IP configuration options.

SFP1 Local IP

The Local IP address of the top SFP is displayed. The current transmit and receive bitrates are also reported, in Gb/sec.

SFP2 Local IP

Same as above, but for the lower SFP module, if installed.

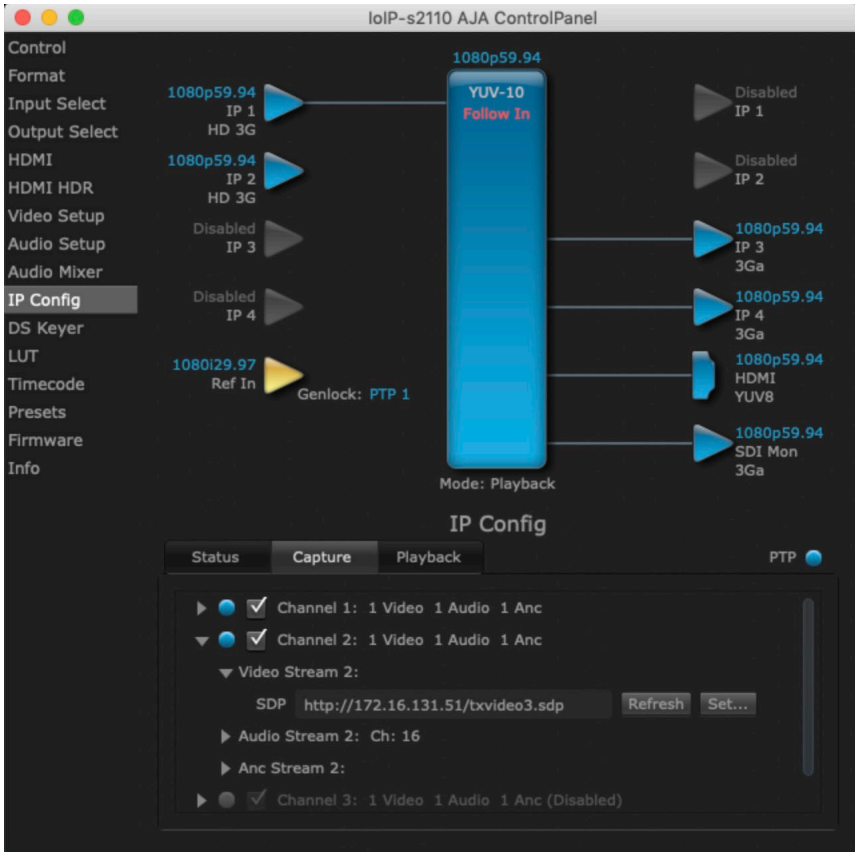
PTP Information

The PTP Grandmaster and Master IDs are displayed, as well as the current PTP Status.

Advanced Button

Clicking on the Advanced button takes you to the 2110 IP configuration windows. See *"IP Config Editor Window" on page 60* for more information.

IP Config Capture Tab



The Capture Tab screen shows the current settings for receiving IP streams, the status of that stream, and allows activating and deactivating each stream.

Session Description Protocol (SDP) information, used for easy configuration, can also be loaded and refreshed from this screen.

Channel 1-4

Click on the box to enable the configured stream (check mark). Activity of that stream is indicated by the color of the dot: blue = active, red = inactive.

Clicking on the triangles display information for that video or audio playback stream.

SDP

The current SDP information is displayed for that stream.

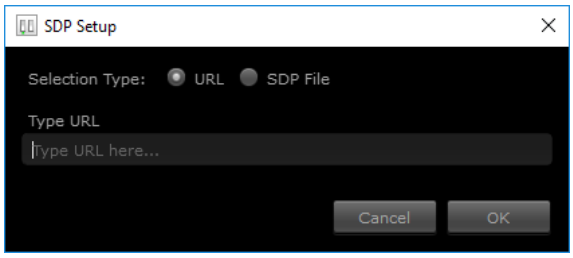
Refresh

Click **Refresh** to update the configuration information. Use when the source frame rate has changed.

Set

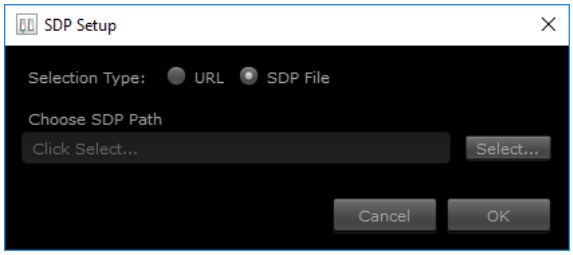
Click **Set** to open a dialog box allowing you to enter SDP configuration information for the source of the desired stream.

- Select **URL** to enter the text of a network location where the desired SDP information resides. This can be a URL of a Io IP transmit device.



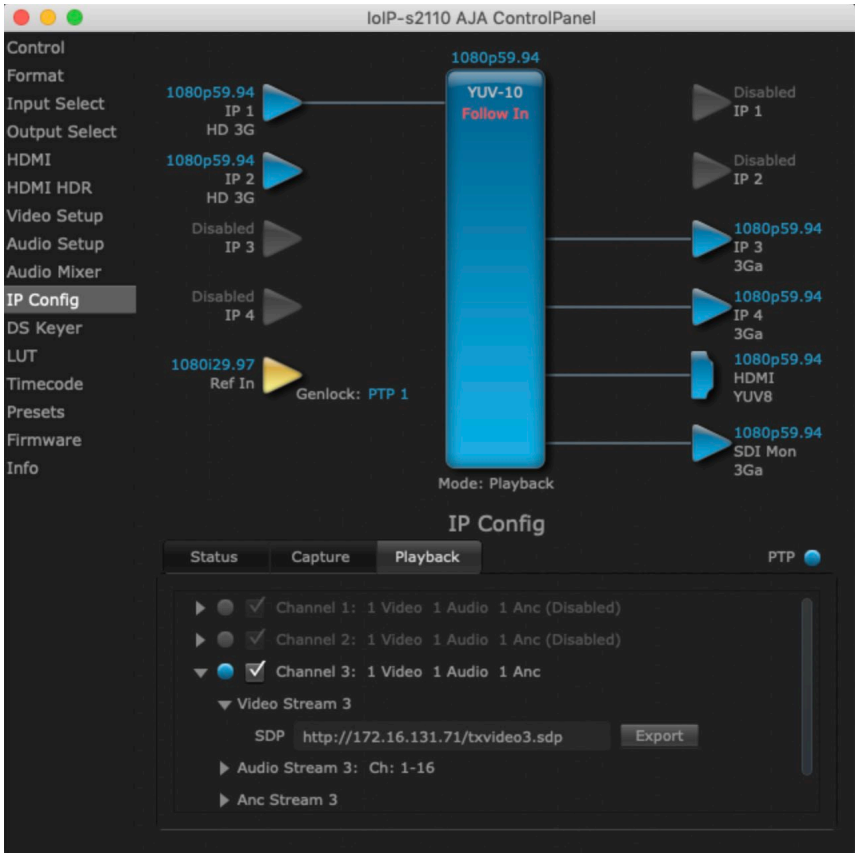
NOTE: When using a URL for configuration, you need to turn Control Panel's "Follow Input" setting On and use Refresh if the incoming signal format changes.

- Select **SDP File** to browse to a location with the desired SDP source stream information. The location selected must point to an SDP file that was created by the source that is transmitting the signal.



NOTE: When using an SDP for configuration, you need to turn Control Panel's "Follow Input" setting On and if the incoming signal format changes you will need to generate and import a new SDP file to accommodate the format change.

IP Config Playback Tab



Channel 1-4

Click on the box to enable the configured stream (check mark) Activity of that stream is indicated by the color of the dot: blue = active, red = inactive.

Clicking on the triangles display information for that video or audio playback stream.

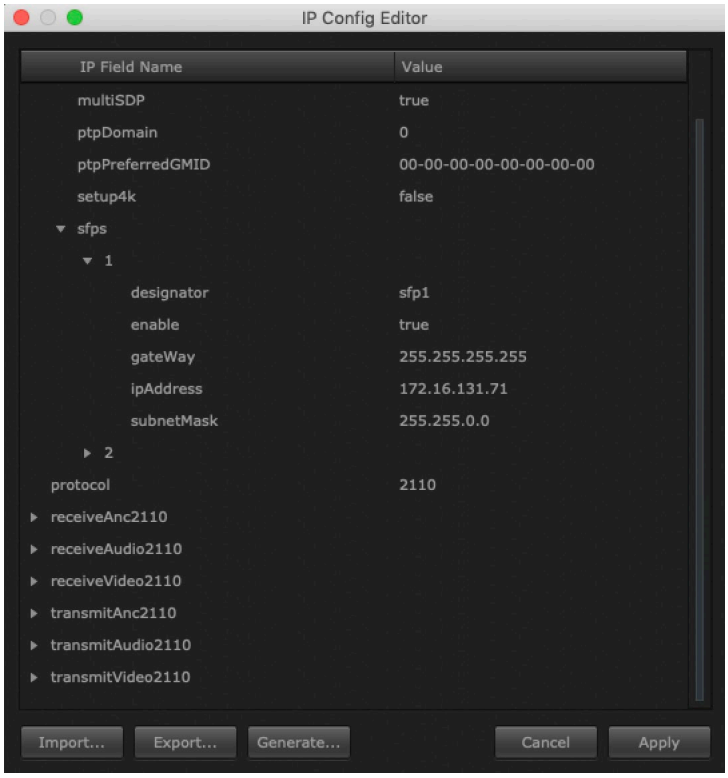
SDP

The current SDP information is displayed for that stream. This text can be copied and pasted to configure another Io IP's capture stream.

Export

Click **Export** to name and save an SDP configuration file for that transmit stream, which can be used to configure another Io IP's capture stream.

IP Config Editor Window



In the Status tab screen, clicking on **Advanced** opens an IP Config Editor window, used for advanced configuration. Click on the triangles to reveal editable configuration information, listed by IP Field Name and Value.

Import

Click **Import** to open a navigation window allowing you to import a JSON file into the editor. Imported values are not activated on the Io IP until applied.

Export

Click **Export** to open a navigation window allowing you to name and export the current configuration as JSON file.

Generate

Click **Generate** to open an initial IP Configuration window allowing you to create the current configuration as JSON file (see *"Generate Window" on page 61*).

Cancel

Cancels any currently changed settings and closes the window.

Apply

Click **Apply** to apply the current settings to the Io IP's basic IP settings.

NOTE: Applying a basic configuration affects the Io IP's currently configured network playback stream information, but does not affect the currently loaded capture stream information.

Generate Window

The Generate window lets you edit and create the base IP addresses to be used by that Io IP.

IMPORTANT: Each Io IP ships by default with the same SFP base IP address. This must be changed to ensure each device on the network has a unique IP address.

Defaults

Resets the IP values to factory defaults. These values are not activated on the Io IP until applied.

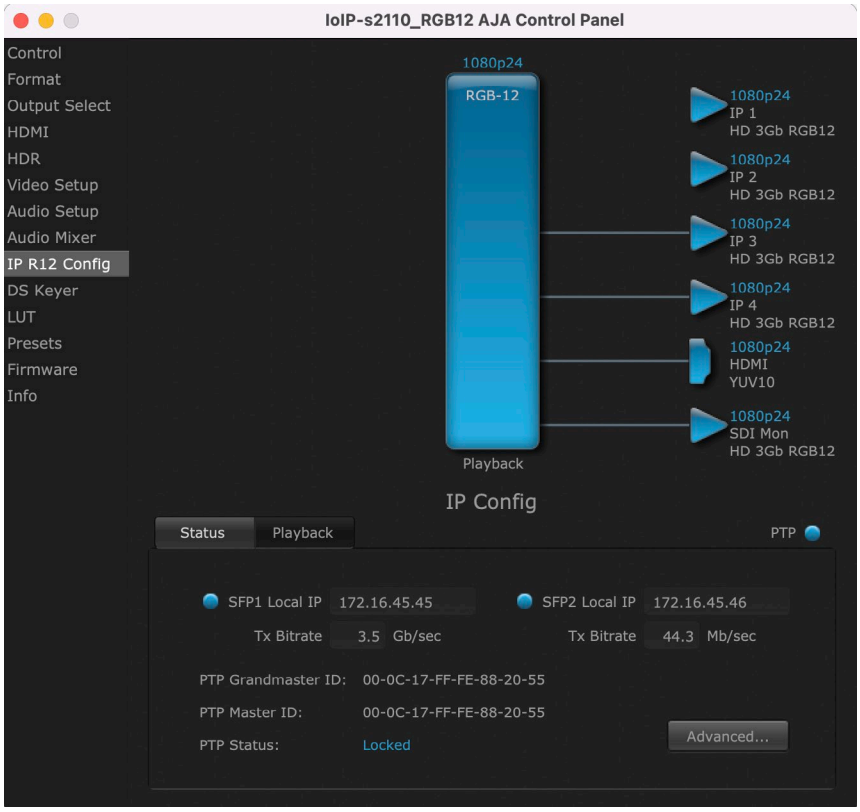
Cancel

Cancels any currently changed settings and closes the window.

Generate

Generates a set of basic IP addresses based on the values entered above. Generated values are not activated on the Io IP until applied.

IP R12 Config Screen



When 2110-RGB firmware is installed, the IP R12 screen replaces the IP configuration screens.

This screen is used for configuring 12-bit transmit of RGB over IP. You can right click on block diagram icons to open panes to set these parameters.

1. Set frame buffer to RGB 12 (right click on frame buffer).
2. Set transport to RGB (right click of output icon).

NOTE: High frame rate of RGB is not supported.

Chapter 4 – Advanced ST 2110 Configuration

This Chapter offers technical information regarding IT configuration for ST 2110 workflows, useful to IT professionals responsible for network system administration.

Configuration Summary

With s2110 firmware, each Io IP must be configured before operation. This configuration process can be accomplished using AJA's Control Panel software, and includes the following steps:

- Create a unique base IP address for each SFP module.
- Create JSON or SDP configuration files that determine the IP attributes of each transmit and receive stream.
- Apply the correct configuration file for each stream to the each Io IP.

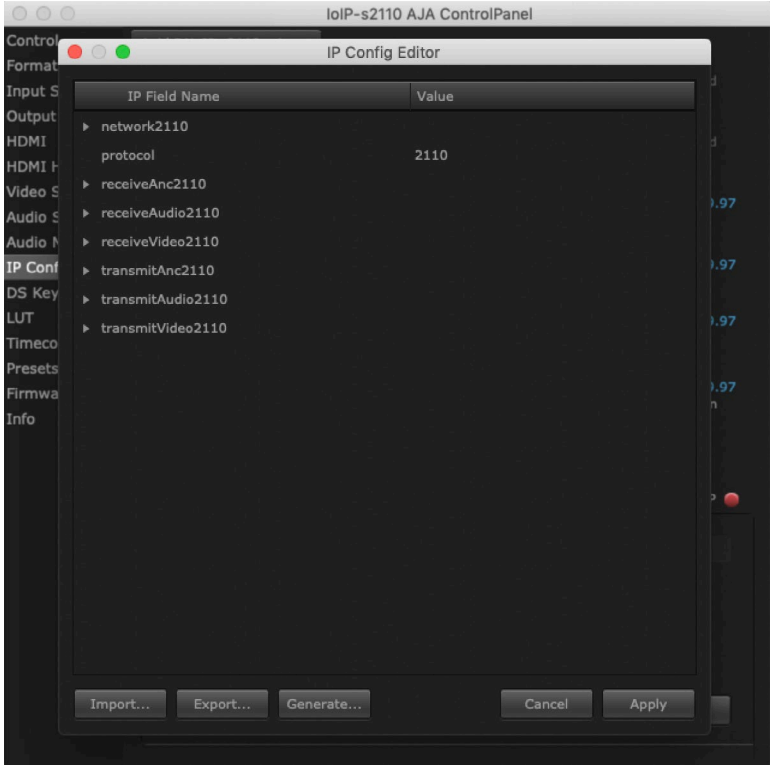
Io IP running s2110 firmware supports three configuration methods to specify the required transmit and receive stream IP information:

- JSON Script - Generate and apply a JavaScript Object Notation (JSON) file containing all the required information for each Io IP. The Control Panel **Follow Input** parameter of the capture Io IP must be turned Off, and the user manually sets the Control Panel frame buffer format to match the input. For advanced users only after initial setup.
- SDP URL - Enter the URL of a network location that has a desired Session Description Protocol (SDP) file for a stream to be received. This may be the URL of the transmitting Io IP device itself. The Control Panel **Follow Input** parameter must be turned On before applying the configuration, and the operator uses **Refresh** to update the Io IP's frame buffer format if the incoming signal format changes.
- SDP File - Export an SDP file from a transmit Io IP and then import it into a receive Io IP. This file reflects the transmit device's output configuration at the time of creation, and a new SDP file must be generated and imported if the incoming signal format changes. The Control Panel **Follow Input** parameter must be turned On before applying each configuration.

Initial Io IP ST 2110 Installation and Network Configuration

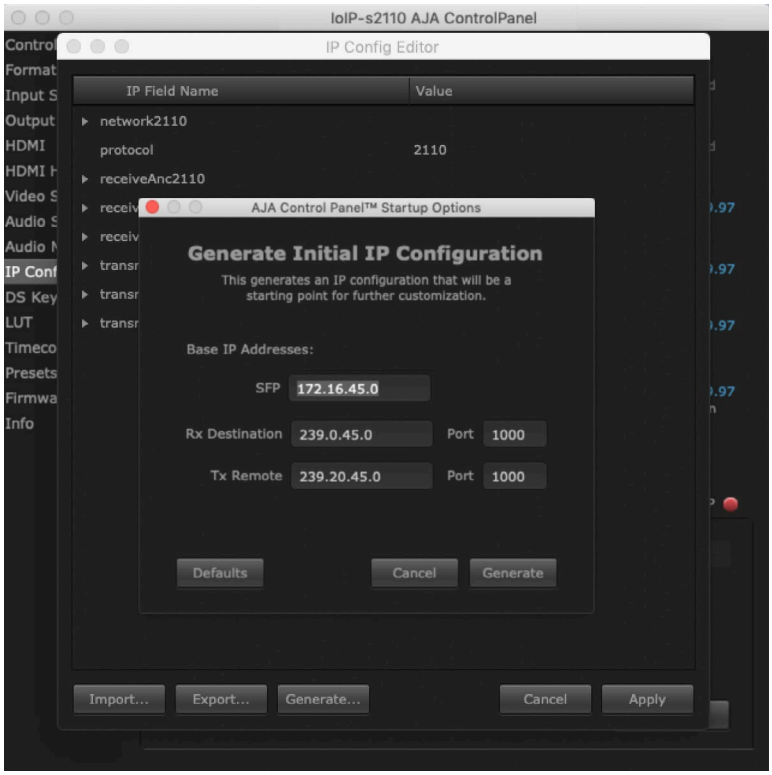
1. Install the Io IP with SFP module(s) into your computer.
2. Install AJA's Desktop Software package on the same computer.
3. Connect the Io IP's SFP module(s) to your 10 GigE media network.
4. Connect the Io IP's HDMI output to a compatible HDMI monitor.
5. Launch AJA's Control Panel application and select **IP Config**.
6. In the Status tab, click on **Advanced**.

Figure 11. Generating an Initial ST 2110 Configuration



7. Click on **Generate** at the bottom of the screen, which opens the Generate window.

Figure 12. SFP Configuration IP Address



8. In the SFP field, enter a unique IP address for the Io IP's top SFP.

IMPORTANT: Each Io IP ships by default to generate the same IP address. This default address must be changed so each device on the network has a unique IP address.

IMPORTANT: Io IP's automatic configuration file creation process generates a compatible set of IP addresses by incrementing the basic IP address. AJA recommends separating adjacent IP addresses for different Io IP devices by at least two in the third octet, to keep each SFP (up to two per device) unique.

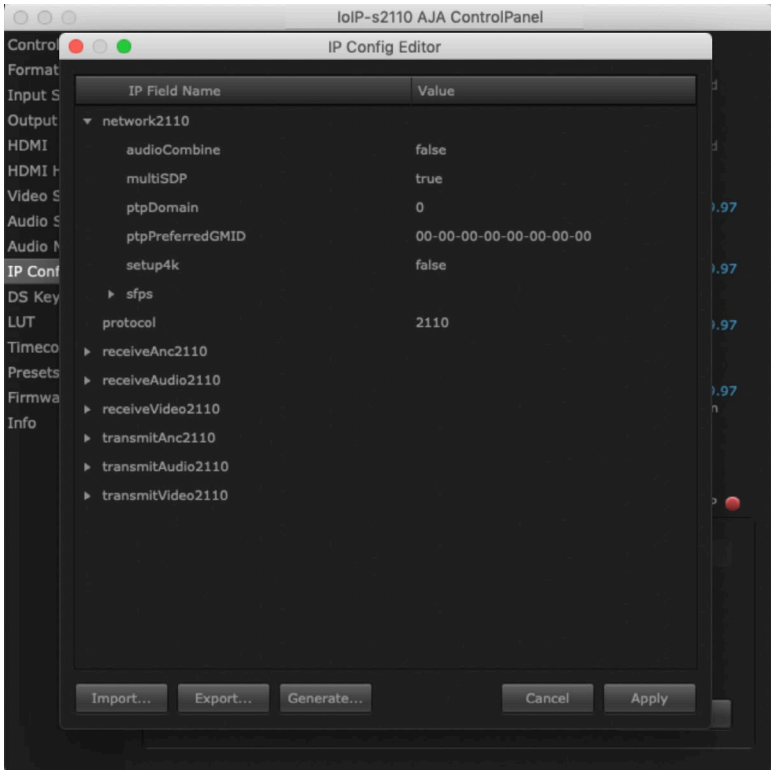
IMPORTANT: Keep careful records of what IP addresses have been assigned on the network to avoid accidental duplication.

9. Click on the second window's **Generate** button, then click **Apply**. This creates a generic configuration defined with four transmit video streams, four receive video streams, four audio transmit streams, and four receive transmit streams. The various IP addresses generated are derived from the base IP value you entered.

NOTE: Default IP addresses can be used for testing, but for actual deployment AJA recommends having a facility administrator manage IP configuration.

10. Click on the Network triangle and enter a valid IP address for your facility's PTP master clock, which is required for ST 2110 operation.

Figure 13. PTP Configuration



11. Using these values as a starting point, you can now open other data fields in the editor to manually adjust the remaining configuration values as required. When the configuration is complete, click **Apply** to enable the settings for that Io IP.

12. This JSON file can be named and exported to a shared network location, and then be imported as needed into other Io IP transmit and receive devices to be used as a starting point for further configuration.

Transmit/Receive Example

One simple way to test actual operation over the network is to configure two Io IPs with complimentary settings, as follows:

1. Perform an initial configuration on a Io IP device as described above, entering a different address. This will be used as the playback device.
2. Import that configuration to a second Io IP, edit that base SFP address (for example, increment by 100), and swap the RX and TX IP addresses for that second device. These complimentary configurations allow bi-directional transport between the two Io IPs.

Io IP **Device**	**Base SFP**	**Rx Destination**	**Tx Remote**	**Port**
Io IP #1	172.16.45.0	239.0.45.0	239.20.45.0	1000
Io IP #2	172.16.45.100	239.20.45.0	239.0.45.0	1000

3. You should now be able to open AJA's Control Room application on each computer and test playback and capture.

Transmit Redundancy with ST 2110 via ST 2022-7

For JSON Configuration (Transmit only)

1. Go into Advanced Ip Config / Generate for JSON.
2. Set Tx Remote to the IP address to which you are sending.
3. On your output channel (either Ch 3 or Ch 4) navigate to transmitVideo and enable SFP 2 by setting it to true. Note: Do not use channel 3 and 4 to do this, just pick one or the other.
4. Manually set the frame rate in the frame buffer within AJA Control Panel.
5. The IP device will now be sending identical packets on SFP 1 and SFP 2 for redundancy.
6. Setup a receiver to subscribe to the 2 IP addresses that you have sent on the output channels above.

Figure 14. Transmit Redundancy Settings

UltraHD Configuration

To send/ receive 4K/UltraHD over IP:

1. Be sure to have SFP2 connected as well as SFP1.
2. Use Generate or Manually configure IP settings.
3. Uncheck Follow Input (on Receiver).
4. Manually set frame buffer to desired 4K/UltraHD format.

4K/UltraHD Configuration (2110)

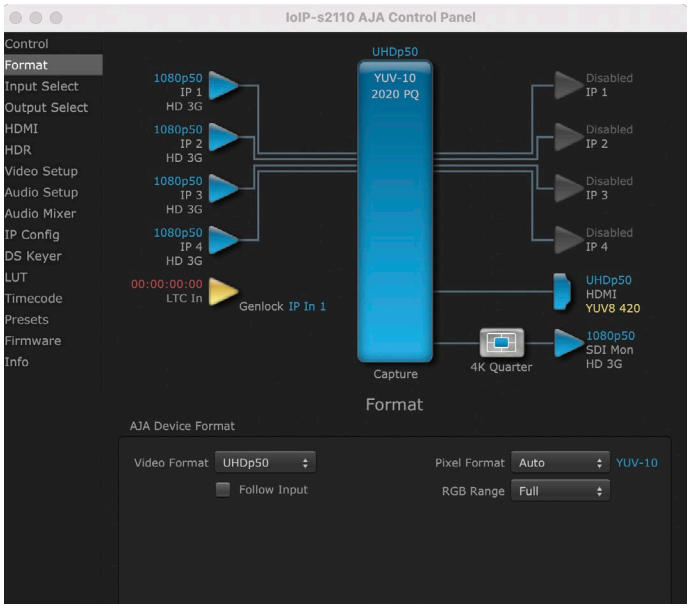
To setup UltraHD or 4K operation start by using the Generate feature in the advanced tab of the IP config from Control Panel. This will enumerate the IP settings to allow basic operation over IP. This is a good starting point for all configurations. Be sure to have both SFP 1 and SFP 2 connected as 4K/UltraHD will require the use of it. If you are sending between the AJA devices such as a KONA IP and Io IP, inversely set the Rx Destination Address and the Tx Remote between the two devices.

If the Io IP is going to be used for transmitting the signal, once the Tx Remote parameters are set and generated, setup to playback 4K/UltraHD signal through, test pattern of control panel, control room or other AJA compatible video playback software (ex Media Composer, Premiere, etc).

For receiving a 4K/UltraHD signal on the Io IP generate addresses using the Rx Destination (which can be set in the Generate feature of advanced tab in IP config) to match the Tx remote you setup on your sending device.

Put Control Panel into capture mode and then turn follow input off (by unchecking it) in the format pane of Control Panel and set the video format to match what you are sending to it. If the signal is present you will see the 4 inputs light up blue with your signal and you are now capturing uhh/4k video over IP.

Figure 15. Control Panel Format Screen,4K/Ultra HD



4x4 Audio, with Protection 2022-7

The Io IP will automatically generate 16 ch audio over a single audio stream in the basic setup using the Generate feature. However if you need a more specific audio configuration, you can edit the IP configuration to match your desired setup.

Audio Channel Number Settings

The audio packet interval (audioPktInterval) parameters may need to be adjusted depending on the number of audio channels being transported. The packet interval must be shorter (more frequent) with more audio channels to accommodate the increased audio data. Recommended settings are:

- For 8 channels and below set the packet interval to 1ms (1000us).
- For 16 channels set the packet interval to 125us .

NOTE: 125us will also operate for 4 and 8 channel audio.

Configuration Example

Here is an example of how you can setup sending 4 channels audio per each of the 4 audio streams that Io IP offers. This example will also include enabling SFP 2 for 2022-7 redundancy on transmit.

1. Open Advanced tab from the IP config pane of Control Panel
   - In the Network 2110 Tab: Set AudioCombine to True

2. In the TransmitAudio2110 tab,set 1 parameters as follows
   - Set AudioPktInterval to 1000us
   - Set Enable to true
   - Set FirstAudio Channel to 0
   - Set NumAudio Channels to 4
   - Set sfp1Enable to True
   - Set sfp2Enable to True (For 2022-7 Redundancy)
3. Set 2 in the same way as 1 except set the first audio to 4 in order to send the second set of four audio channels on this next audio steam.
   - Set AudioPktInterval to 1000us
   - Set Enable to true
   - Set FirstAudio Channel to 4
   - Set NumAudio Channels to 4
   - Set sfp1Enable to True
   - Set sfp2Enable to True (For 2022-7 Redundancy)

See *Figure 16 on page 69*.

Figure 16. 4x4 Audio Settings, Channels 1 and 2

4. Set 3 in the same way as 1 except set the first audio to 8 in order to send the third set of four audio channels on this next audio steam.
   - Set AudioPktInterval to 1000us
   - Set Enable to true
   - Set FirstAudio Channel to 8
   - Set NumAudio Channels to 4
   - Set sfp1Enable to True
   - Set sfp2Enable to True (For 2022-7 Redundancy)
5. Set 4 in the same way as 1 except set the first audio to 12 in order to send the fourth set of four audio channels on this next audio steam.
   - Set AudioPktInterval to 1000us
   - Set Enable to true
   - Set FirstAudio Channel to 12
   - Set NumAudio Channels to 4
   - Set sfp1Enable to True
   - Set sfp2Enable to True (For 2022-7 Redundancy)

See *Figure 17 on page 70*.

Figure 17. 4x4 Audio Settings, Channels 3 and4

Guidance for SMPTE ST 2110-23

For JSON Configuration

1. Go into Advanced Ip Config / Generate for JSON.
2. When doing this behavior is to now automatically set up for 2K/HD on SFP 1, or 4K/UltraHD across both SFPS.
3. Set Tx Remote to the IP address to which you are sending.
4. On receiving device use this same IP address (i.e. Rx IP address should match your Tx IP address).
5. Un-check follow input on the receiving Io IP.
6. Manually set the frame rate in the frame buffer within AJA Control Panel.

For SDPs

1. Change the 4K/UltraHD network settings in the JSON 4K setup from false to true.
2. Un-check follow input.
3. Then just one SDP is entered in capture input 1 and sets automatically for all four streams.
4. Manually change frame buffer on any format change.

Appendix A – Specifications

Io IP Tech Specs

Video Formats

- (4K)** 4096 x 2160p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- (UltraHD)** 3840 x 2160p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- (2K) 2048 x 1080p 23.98, 24, 25, 29.97, 30, 50*, 59.94*, 60*
- (2K) 2048 x 1080PsF 23.98, 24, 25
- (HD) 1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
- (HD) 1080PsF 23.98, 24, 25, 29.97, 30
- (HD) 1080i 50, 59.94
- (HD) 720p 50, 59.94, 60
- (SD) 625i 50
- (SD) 525i 59.94

*SMPTE ST 2110 only

**2SI over IP via ST 2110-23 only

Note: High Frame Rate capabilities are dependent on host system attributes. Not all systems and configurations will support all frame rates.

Media Transport Interfaces

- SMPTE ST 2110 (-10, -20, -21, -23, -30, -40), 2022-6
  - 2x SFP+ Cages - SFPs not included
- Recommended 10 GigE SFP+ modules:
  - Arista Networks SFP-10G-SR Compatible 10GBASE-SR
  - Fiberstore SFP-10GSR-85 10G SFP+ 850nm
  - Finisar FTLX1471D3BCL (for single mode 1310nm)
  - Mellanox MFM1T02A-SR 850nm 10G

Video Input IP

- SMPTE ST 2110, 2022-6
  - YCbCr 4:2:2 10-bit
  - Single channel* input available when using ST 2110 or ST 2022-6 to receive 2K/HD
  - 4-channels input available when using ST 2110-23 to receive 4K/UltraHD**
  - ANC support
  - Rx support for Narrow Senders**

*Capture and simultaneous monitoring is supported up to 2K/HD

**SMPTE ST 2110 only

Video Output IP

- SMPTE ST 2110, 2022-6
  - RGB 4:4:4 12-bit, YCbCr 4:2:2 10-bit
  - Single channel* output available when using ST 2110 or ST 2022-6 to transmit 2K/HD
  - 4-channels output available when using ST 2110-23 to transmit 4K/UltraHD**
  - ANC support
  - Tx support for ST 2022-7 up to 2K/HD
  - Tx support for Narrow Receivers**

*Capture and simultaneous monitoring is supported up to 2K/HD

**SMPTE ST 2110 only

Video Output Digital

- 3G-SDI, SMPTE 425
  - RGB 4:4:4 12-bit*, YCbCr 4:2:2 10-bit
  - 2K/HD downsample available when working with 4K/UltraHD via ST 2110-23
- 1.5G-SDI, SMPTE 292M
  - Single Link HD-SDI YCbCr 4:2:2 10-bit
  - Dual Link RGB 4:4:4 12-bit*, Dual Link YCbCr 4:2:2 10-bit
- 270 Mbps SDI, SMPTE 259M-C
  - YCbCr 4:2:2 10-bit, 8-bit
- HDMI v2.0
  - 30/36-bits/pixel, RGB or YUV, 6 Gbps per color component
  - 4K/UltraHD, 2K/HD and SD
  - 2K/HD downsample available when working with 4K/UltraHD via ST 2110-23

*Bit depth support is application dependent. Check with your software manufacturer for compatibility.

HDR

- SDI: VPID signaling for SDR/HDR Transfer Characteristics, Colorimetry and Luminance
- HDMI: HDR10 Support - HDR Infoframe metadata, compatible with HDMI 2.0a/CTA-861.3
- HDMI: HLG Support - compatible with HDMI 2.0b/CTA-861-G

Note: HDR support is application dependent. Check with your software manufacturer for compatibility.

Audio Input IP

- Up to 16-channel embedded audio, 24-bit per channel, 48 kHz synchronous

Audio Inputs Analog

- 8-channel, 24 and 16-bit A/D analog audio, 48 kHz sample rate, balanced, using industry standard 8x XLR on DB-25 breakout cable (cable not included)
- +24 dBu full scale digital (0 dBFS)
- +/- 0.2 dB 20 to 20 kHz frequency response
- Input supported across Ch 1-8, Ch 1-4, or Ch 5-8 depending on the chosen configuration

Audio Output IP

- Up to 16-channel embedded audio, 24-bit per channel, 48 kHz synchronous

Audio Output Digital

- 16-channel, 24-bit SDI embedded audio, 48 kHz sample rate, synchronous
- 8-channel HDMI embedded audio, 48 kHz sample rate, synchronous

Audio Outputs Analog

- 8-channel, 24-bit D/A analog audio, 48 kHz sample rate, balanced, using industry standard 8x XLR on DB-25 breakout cable (cable not included)
- +24 dBu full scale digital (0 dBFS)
- +/- 0.2 dB 20 to 20 kHz frequency response
- Output supported across Ch 1-8, Ch 1-4, or Ch 5-8 depending on the chosen configuration

Downstream Keyer

- Supports graphics up to 2K/HD with alpha channel over video, matte or framebuffer, or framebuffer content over incoming video or matte

Reference and LTC I/O

- 1x BNC assignable to Reference video or LTC input

Reference

- Analog Color Black (1V) or Composite Sync (2 or 4V) or HD Tri-Level Sync (1V)
- Reference input is terminated into 75 ohms when Genlock is set to Ref In
- Applicable in SMPTE ST 2022-6/7 environments

Discovery, Registration and Control

- NMOS Tx/Rx support for SMPTE ST 2110 according to standards IS-04 v1.3 and IS-05 v1.1
  - Applicable in SMPTE ST 2110 environments
- LLDP

IP Clock

- PTP support compliant with PTP PTPv2 / IEEE 1588-2008
- Applicable in SMPTE ST 2110 environments

Electrical Interface

- Thunderbolt 3 (2x)

Size (w x d x h)

- 8.74" x 8.11" x 1.65" (222.0 x 206.0 x 41.9 mm)

Weight

- 3.3 lbs (1.5 kg)

Power (device only)

- 10-20V, 33W typical, 38W max, 72W max with USB-C power delivery to external devices

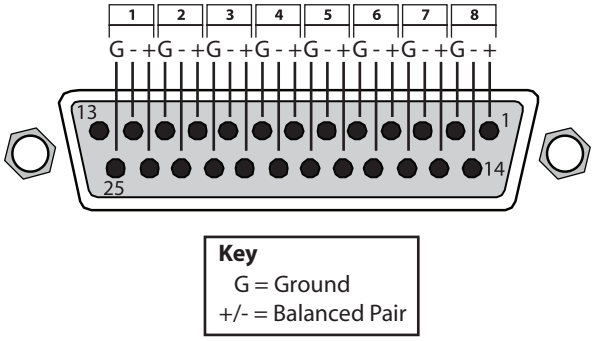
Environment

- Safe Operating Temperature Range: 0 to 40 C (32 to 104 F)
- Safe Storage Temperature (Power OFF): -40 to 60 C (-40 to 140 F)
- Operating Relative Humidity: 10-90% noncondensing
- Operating Altitude: <3,000 meters (<10,000 feet)

Audio Connection Pinouts

Analog Audio

Figure 18. DB-25 Analog Audio Connector Pinouts



Appendix B – Safety and Compliance

Federal Communications Commission (FCC) Compliance Notices

Class A Interference Statement

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15, Subpart B of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Canadian ICES Statement

Canadian Department of Communications Radio Interference Regulations

This digital apparatus does not exceed the Class A limits for radio-noise emissions from a digital apparatus as set out in the Radio Interference Regulations of the Canadian Department of Communications. This Class A digital apparatus complies with Canadian ICES-003.

Règlement sur le brouillage radioélectrique du ministère des Communications

Cet appareil numérique respecte les limites de bruits radioélectriques visant les appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique du ministère des Communications du Canada. Cet appareil numérique de la Classe A est conforme à la norme NMB-003 du Canada.

European Union and European Free Trade Association (EFTA) Regulatory Compliance

This equipment may be operated in the countries that comprise the member countries of the European Union and the European Free Trade Association. These countries, listed in the following paragraph, are referred to as The European Community throughout this document:

AUSTRIA, BELGIUM, BULGARIA, CYPRUS, CZECH REPUBLIC, DENMARK, ESTONIA, FINLAND, FRANCE, GERMANY, GREECE, HUNGARY, IRELAND, ITALY, LATVIA, LITHUANIA, LUXEMBOURG, MALTA, NETHERLANDS, POLAND, PORTUGAL, ROMANIA, SLOVAKIA, SLOVENIA, SPAIN, SWEDEN, UNITED KINGDOM, ICELAND, LICHTENSTEIN, NORWAY, SWITZERLAND

Declaration of Conformity

Marking by this symbol indicates compliance with the Essential Requirements of the EMC Directive of the European Union 2014/30/EU.

This equipment meets the following conformance standards:

This equipment meets the following conformance standards:

Safety

EN 62368-1: 2014 + A11 (T-Mark License),

IEC 62368-1: 2014 (CB Scheme Certificate)

Emissions

EN 55032: 2012 + AC: 2013, CISPR 32: 2015

EN 61000-3-2: 2014, EN 61000-3-3: 2013

Immunity

EN 55103-2: 2009

61000-4-2: 2009, EN 61000-4-3: 2006 + A1: 2008 + A2: 2010,

EN 61000-4-4: 2004 + A1: 2010, EN 61000-4-5: 2006,

EN 61000-4-6: 2009, EN 61000-4-11: 2004

Environments: E2, E3 and E4

The product is also licensed for additional country specific standards as required for the International Marketplace.

Warning! This is a Class A product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take appropriate measures.

Achtung! Dieses ist ein Gerät der Funkstörgrenzwertklasse A. In Wohnbereichen können bei Betrieb dieses Gerätes Rundfunkstörungen auftreten, in welchen Fällen der Benutzer für entsprechende Gegenmaßnahmen verantwortlich ist.

Attention! Ceci est un produit de Classe A. Dans un environnement domestique, ce produit risque de créer des interférences radioélectriques, il appartiendra alors à l?utilisateur de prendre les mesures spécifiques appropriées..

Recycling Notice

This symbol on the product or its packaging indicates that this product must not be disposed of with your other household waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste for recycling, please contact your local authority, or where you purchased your product.

Korea KCC Compliance Statement

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Taiwan Compliance Statement

警告使用者：
這是甲類的資訊產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

This is a Class A product based on the standard of the Bureau of Standards, Metrology and Inspection (BSMI) CNS 13438, Class A. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Japan Compliance Statement

この装置は、クラスＡ情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。 ＶＣＣＩ－Ａ

This is a Class A product based on the standard of the VCCI Council (VCCI 32: 2016). If this equipment is used in a domestic environment, radio interference may occur, in which case, the user may be required to take corrective actions.

China Compliance Statement

This product has been tested to the following Chinese standards:

GB/T13837-2012, GB17625.1-2012 and GB8898-2011

This product meets the requirements of implementation rules for compulsory certification (REFNO.CNCA-C08-01:2014) under certificate number 2018010805038172.

Translated Warning and Caution Messages

The following caution statements, warning conventions, and warning messages apply to this product and manual.

Warning Symbol

Caution Symbol

Before Operation Please Read These Instructions

Warning! Read and follow all warning notices and instructions marked on the product or included in the documentation.

Avertissement! Lisez et conformez-vous à tous les avis et instructions d'avertissement indiqués sur le produit ou dans la documentation.

Warnung! Lesen und befolgen Sie die Warnhinweise und Anweisungen, die auf dem Produkt angebracht oder in der Dokumentation enthalten sind.

¡Advertencia! Lea y siga todas las instrucciones y advertencias marcadas en el producto o incluidas en la documentación.

Aviso! Leia e siga todos os avisos e instruções assinalados no produto ou incluídos na documentação.

Avviso! Leggere e seguire tutti gli avvisi e le istruzioni presenti sul prodotto o inclusi nella documentazione.

Warning! Do not use this device near water and clean only with a dry cloth.

Avertissement! N'utilisez pas cet appareil près de l'eau et nettoyez-le seulement avec un tissu sec.

Warnung! Das Gerät nicht in der Nähe von Wasser verwenden und nur mit einem trockenen Tuch säubern.

¡Advertencia! No utilice este dispositivo cerca del agua y límpielo solamente con un paño seco.

Aviso! Não utilize este dispositivo perto da água e limpe-o somente com um pano seco.

Avviso! Non utilizzare questo dispositivo vicino all'acqua e pulirlo soltanto con un panno asciutto.

Warning! Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.

Avertissement! Ne bloquez aucune ouverture de ventilation. Suivez les instructions du fabricant lors de l'installation.

Warnung! Die Lüftungsöffnungen dürfen nicht blockiert werden. Nur gemäß den Anweisungen des Herstellers installieren.

¡Advertencia! No bloquee ninguna de las aberturas de la ventilación. Instale de acuerdo con las instrucciones del fabricante.

Aviso! Não obstrua nenhuma das aberturas de ventilação. Instale de acordo com as instruções do fabricante.

Avviso! Non ostruire le aperture di ventilazione. Installare in conformità con le istruzioni del fornitore.

Warning! Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

Avertissement! N'installez pas l'appareil près d'une source de chaleur telle que des radiateurs, des bouches d'air de chauffage, des fourneaux ou d'autres appareils (amplificateurs compris) qui produisent de la chaleur.

Warnung! Nicht in der Nähe von Wärmequellen wie Heizkörpern, Heizregistern, Öfen oder anderen Wärme erzeugenden Geräten (einschließlich Verstärkern) aufstellen.

¡Advertencia! No instale cerca de fuentes de calor tales como radiadores, registros de calor, estufas u otros aparatos (incluidos amplificadores) que generan calor.

Aviso! Não instale perto de nenhuma fonte de calor tal como radiadores, saídas de calor, fogões ou outros aparelhos (incluindo amplificadores) que produzam calor.

Avviso! Non installare vicino a fonti di calore come termosifoni, diffusori di aria calda, stufe o altri apparecchi (amplificatori compresi) che emettono calore

Warning! Unplug this device during lightning storms or when unused for long periods of time.

Avertissement! Débranchez cet appareil pendant les orages avec éclairsou s'il est inutilisé pendant de longues périodes.

Warnung! Das Gerät ist bei Gewitterstürmen oder wenn es über lange Zeiträume ungenutzt bleibt vom Netz zu trennen.

¡Advertencia! Desenchufe este dispositivo durante tormentas eléctricas o cuando no se lo utilice por largos periodos del tiempo.

Aviso! Desconecte este dispositivo da tomada durante trovoadas ou quando não é utilizado durante longos períodos de tempo.

Avviso! Utilizzare soltanto i collegamenti e gli accessori specificati e/o venduti dal produttore, quali il treppiedi e l'esoscheletro.

Warning! Do not open the chassis. There are no user-serviceable parts inside. Opening the chassis will void the warranty unless performed by an AJA service center or licensed facility.

Avertissement! Ne pas ouvrir le châssis. Aucun élément à l'intérieur du châssis ne peut être réparé par l'utilisateur. La garantie sera annulée si le châssis est ouvert par toute autre personne qu'un technicien d'un centre de service ou d'un établissement agréé AJA.

Warnung! Öffnen Sie das Gehäuse nicht. Keine der Geräteteile können vom Benutzer gewartet werden. Durch das Öffnen des Gehäuses wird die Garantie hinfällig, es sei denn, solche Wartungsarbeiten werden in einem AJA-Service-Center oder einem lizenzierten Betrieb vorgenommen.

¡Advertencia! No abra el chasis. El interior no contiene piezas reparables por el usuario. El abrir el chasis anulará la garantía a menos que se lo haga en un centro de servicio AJA o en un local autorizado.

Advertência! Não abra o chassi. Não há internamente nenhuma peça que permita manutenção pelo usuário. Abrir o chassi anula a garantia, a menos que a abertura seja realizada por uma central de serviços da AJA ou por um local autorizado.

Avvertenza! Non aprire lo chassis. All'interno non ci sono parti riparabili dall'utente. L'apertura dello chassis invaliderà la garanzia se non viene effettuata da un centro ufficiale o autorizzato AJA.

Warning! Only use attachments and accessories specified and/or sold by the manufacturer.

Avertissement! Utilisez seulement les attaches et accessoires spécifiés et/ou vendus par le fabricant.

Warnung! Verwenden Sie nur Zusatzgeräte und Zubehör angegeben und / oder verkauft wurde durch den Hersteller.

¡Advertencia! Utilice solamente los accesorios y conexiones especificados y/o vendidos por el fabricante.

Aviso! Utilize apenas equipamentos/acessórios especificados e/ou vendidos pelo fabricante.

Avviso! Utilizzare soltanto i collegamenti e gli accessori specificati e/o venduti dal produttore.

Warning! Refer all servicing to qualified service personnel. Servicing is required when the device has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the device, the device has been exposed to rain or moisture, does not operate normally, or has been dropped.

Avertissement! Référez-vous au personnel de service qualifié pour tout entretien. L'entretien est exigé quand l'appareil a été endommagé de quelque manière que ce soit, par exemple lorsque le cordon d'alimentation ou la prise sont endommagés, que du liquide a été versé ou des objets sont tombés dans l'appareil, que l'appareil a été exposé à la pluie ou à l'humidité, ne fonctionne pas normalement ou est tombé.

Warnung! Das Gerät sollte nur von qualifizierten Fachkräften gewartet werden. Eine Wartung ist fällig, wenn das Gerät in irgendeiner Weise beschädigt wurde, wie bei beschädigtem Netzkabel oder Netzstecker, falls Flüssigkeiten oder Objekte in das Gerät gelangen, das Gerät Regen oder Feuchtigkeit ausgesetzt wurde, nicht ordnungsgemäß funktioniert oder fallen gelassen wurde.

¡Advertencia! Consulte al personal calificado por cuestiones de reparación. El servicio de reparación se requiere cuando el dispositivo ha recibido cualquier tipo de daño, por ejemplo cable o espigas dañadas, se ha derramado líquido o se han caído objetos dentro del dispositivo, el dispositivo ha sido expuesto a la lluvia o humedad, o no funciona de modo normal, o se ha caído.

Aviso! Remeta todos os serviços de manutenção para o pessoal de assistência qualificado. A prestação de serviços de manutenção é exigida quando o dispositivo foi danificado mediante qualquer forma, como um cabo de alimentação ou ficha que se encontra danificado/a, quando foi derramado líquido ou caíram objectos sobre o dispositivo, quando o dispositivo foi exposto à chuva ou à humidade, quando não funciona normalmente ou quando foi deixado cair.

Avviso! Fare riferimento al personale qualificato per tutti gli interventi di assistenza. L'assistenza è necessaria quando il dispositivo è stato danneggiato in qualche modo, ad esempio se il cavo di alimentazione o la spina sono danneggiati, è stato rovesciato del liquido è stato rovesciato o qualche oggetto è caduto nel dispositivo, il dispositivo è stato esposto a pioggia o umidità, non funziona correttamente o è caduto

Warning! Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

Avertissement! La sécurité de la prise polarisée ou de la prise de type mise à la terre ne doit en aucun cas être empêchée de fonctionner. Une prise polarisée a deux broches, l'une étant plus large que l'autre. Une prise de type mise à la terre a deux broches et une troisième broche pour la mise à la terre. La broche large ou la troisième broche sont fournies pour votre sécurité. Si la prise fournie ne s'insère pas dans votre prise femelle, consultez un électricien pour le remplacement de la prise femelle obsolète.

Warnung! Der Sicherheitszweck des gepolten bzw. Schukosteckers ist zu berücksichtigen. Ein gepolter Stecker verfügt über zwei Pole, von denen einer breiter als der andere ist. Ein Schukostecker verfügt neben den zwei Polen noch über einen dritten Pol zur Erdung. Der breite Pol bzw. der Erdungspol dienen der Sicherheit. Wenn der zur Verfügung gestellte Stecker nicht in Ihren Anschluss passt, konsultieren Sie einen Elektriker, um den veralteten Anschluss zu ersetzen.

¡Advertencia! No eche por tierra la finalidad del tipo de enchufe polarizado con conexión a tierra. Un enchufe polarizado tiene dos espigas, una más ancha que la otra. Un enchufe con conexión a tierra tiene dos espigas iguales y una tercera espiga que sirve para la conexión a tierra. La expiga ancha, o la tercera espiga, sirven para su seguridad. Si el enchufe suministrado no encaja en el tomacorriente, consulte con un electricista para reemplazar el tomacorriente obsoleto.

Aviso! Não anule a finalidade da segurança da ficha polarizada ou do tipo ligação terra. Uma ficha polarizada tem duas lâminas sendo uma mais larga do que a outra. Uma ficha do tipo de ligação à terra tem duas lâminas e um terceiro terminal de ligação à terra. A lâmina larga ou o terceiro terminal são fornecidos para sua segurança. Se a ficha fornecida não couber na sua tomada, consulte um electricista para a substituição da tomada obsoleta.

Avviso! Non compromettere la sicurezza della spina polarizzata o con messa a terra. Una spina polarizzata ha due spinotti, di cui uno più largo. Una spina con messa a terra ha due spinotti e un terzo polo per la messa a terra. Lo spinotto largo o il terzo polo sono forniti per motivi di sicurezza. Se la spina fornita non si inserisce nella presa di corrente, contattare un elettricista per la sostituzione della presa obsoleta.

Warning! Disconnect the external AC power supply line cord(s) from the mains power before moving the unit.

Avertissement! Retirez le ou les cordons d'alimentation en CA de la source d'alimentation principale lorsque vous déplacez l'appareil.

Warnung! Trennen Sie die Wechselstrom-Versorgungskabel vom Netzstrom, bevor Sie das Gerät verschieben.

¡Advertencia! Cuando mueva la unidad desenchufe de la red eléctrica el/los cable(s) de la fuente de alimentación CA tipo brick.

Advertência! Remova os cabos CA de alimentação brick da rede elétrica ao mover a unidade.

Avvertenza! Scollegare il cavo dell'alimentatore quando si sposta l'unità.

Warning! Since the Mains plug is used as the disconnection for the device, it must remain readily accessible and operable.

Avertissement! Puisque la prise principale est utilisée pour débrancher l'appareil, elle doit rester aisément accessible et fonctionnelle.

Warnung! Da der Netzstecker als Trennvorrichtung dient, muss er stets zugänglich und funktionsfähig sein.

¡Advertencia! Puesto que el enchufe de la red eléctrica se utiliza como dispositivo de desconexión, debe seguir siendo fácilmente accesible y operable.

Aviso! Dado que a ficha principal é utilizada como a desconexão para o dispositivo, esta deve manter-se prontamente acessível e funcional.

Avviso! Poiché il cavo di alimentazione viene usato come dispositivo di sconnessione, deve rimane prontamente accessibile e operabile.

Warning! Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the device.

Avertissement! Protégez le cordon d'alimentation pour que l'on ne marche pas dessus ou qu'on le pince, en particulier au niveau des prises mâles, des réceptacles de convenance, et à l'endroit où il sort de l'appareil.

Warnung! Vermeiden Sie, dass auf das Netzkabel getreten oder das Kabel geknickt wird, insbesondere an den Steckern, den Steckdosen und am Kabelausgang am Gerät.

¡Advertencia! Proteja el cable de energía para que no se le pise ni apriete, en especial cerca del enchufe, los receptáculos de conveniencia y el punto del que salen del equipo.

Aviso! Proteja o cabo de alimentação de ser pisado ou de ser comprimido particularmente nas fichas, em tomadas de parede de conveniência e no ponto de onde sai do dispositivo.

Avviso! Proteggere il cavo di alimentazione in modo che nessuno ci cammini sopra e che non venga schiacciato soprattutto in corrispondenza delle spine e del punto in cui esce dal dispositivo.

Warranty and Liability Information

Limited Warranty on Hardware

AJA Video Systems, Inc. (AJA Video) warrants that the hardware product, not including storage modules or software components, will be free from defects in materials and workmanship for a period of three years from the date of purchase. AJA Video warrants that the storage modules provided as part of the hardware product will be free from defects in materials and workmanship for a period of one year from the date of purchase. AJA Video provides a separate software warranty as part of the license agreement applicable to software components.

If the Customer brings a valid claim under this limited warranty for a hardware product or storage module (hereafter, a "product") during the applicable warranty period, AJA Video will, at its sole option and as the Customer's sole remedy for breach of the above warranty, provide one of the following remedies:

- Repair or facilitate the repair the product within a reasonable period of time, free of charge for parts and labor.
- Replace the product with a direct replacement or with a product that performs substantially the same function as the original product.
- Issue a refund of the original purchase price less depreciation to be determined based on the age of the product at the time remedy is sought under this limited warranty.

To obtain service under this warranty, the Customer must notify AJA Video of the defect before expiration of the warranty period and make suitable arrangements for the performance of service by contacting AJA Video support through the channels set forth on the support contacts web page at https://www.aja.com/support. Except as stated, the Customer shall bear all shipping, packing, insurance and other costs, excluding parts and labor, to effectuate repair. Customer shall pack and ship the defective product to a service center designated by AJA Video, with shipping charges prepaid. AJA Video shall pay to return the product to Customer, but only if to a location within the country in which the AJA Video service center is located. SOME JURISDICTIONS DO NOT ALLOW THE EXCLUSION OF IMPLIED WARRANTIES OR LIMITATIONS ON APPLICABLE STATUTORY RIGHTS OF A CONSUMER, SO SOME OR ALL OF THE TERMS OF THIS PARAGRAPH MAY NOT APPLY TO YOU.

Limitation of Liability

Under no circumstances shall AJA video BE LIABLE IN ANY WAY FOR ANY LOST, CORRUPTED OR DESTROYED DATA, FOOTAGE OR WORK, OR FOR ANY OTHER INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES OR LOST PROFITS, OR FOR ANY THIRD PARTY CLAIM, IN CONNECTION WITH THE PRODUCT, WHETHER RESULTING FROM DEFECTS IN THE PRODUCT, SOFTWARE OR HARDWARE FAILURE, OR ANY OTHER CAUSE WHATSOEVER, EVEN IF AJA VIDEO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. AJA VIDEO'S LIABILITY IN CONNECTION WITH THE PRODUCT SHALL UNDER NO CIRCUMSTANCES EXCEED THE PURCHASE PRICE PAID FOR THE PRODUCT. The foregoing limitations apply even if any remedy set forth in this LIMITED WARRANTY fails of its essential purpose. SOME JURISDICTIONS DO NOT ALLOW THE LIMITATION OF LIABILITY FOR PERSONAL INJURY, OR OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO SOME OR ALL OF THE TERMS OF THIS PARAGRAPH MAY NOT APPLY TO YOU.

Governing Law and Language; Your Rights

This limited warranty is the only warranty provided by AJA Video on the hardware product. It supersedes all prior or contemporaneous understandings regarding such subject matter. No amendment to or modification of this warranty will be binding unless in writing and signed by AJA Video. The laws of the State of California, USA will govern this warranty and any dispute arising from it. Any translation of this

Agreement is intended for convenience and to meet local requirements and in the event of a dispute between the English and any non-English versions, the English version of this warranty will govern. This limited warranty gives you specific legal rights and you may have other rights that vary from jurisdiction to jurisdiction, some of which are noted above.

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