ColorBox

In-Line Color and HDR/SDR Transform

Installation and Operation Guide

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AJA VIDEO SYSTEMS

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Chapter 1 – Introduction

Overview

Introduction

ColorBox from AJA is a high performance color management device specifically designed to meet the color conversion and color correction needs of broadcast, live events, and on-set applications. Supporting HDR, SDR, and Wide Color Gamut (WCG) signals, it utilizes 12G-SDI for single wire 4K/UltraHD up to 4:2:2 10-bit 60p or 4:4:4 12-bit 30p, with a unique color processing pipeline, and down-conversion. The ColorBox's ultra-low latency, less than ½ of a video line, makes it ideal for color managed workflows for live productions.

Built around a 33-point 3D LUT processor with tetrahedral interpolation, the AJA Color Pipeline provides additional 4x 1D LUTs and 2x 3x3 matrices that are each individually configurable or can be converted to Proc Amps or RGB Color Correctors. All of the color processing options can be easily managed via the web user interface, which can be accessed directly from a wired Ethernet connection.

ColorBox also includes processing pipelines from Colorfront, NBCU LUTs, and ACES. Additionally, ColorBox offers licensable upgrade options for advanced color managed workflows, including the Colorfront Engine, BBC HLG LUTs, and ORION-CONVERT. ORION-CONVERT's unique real time floating point math approach to color transformations produces higher precision results to get "access to the colors between the colors." This enables pixel perfect color transforms and round-tripping where maintaining color fidelity is paramount.

The ACES Pipeline includes support for ACES Metadata File (AMF). Internal AMF processing is built on the OpenColorIO (OCIO) from the Academy Software Foundation and supports configurable input and output transforms.

ColorBox can overlay information onto the image, including helpful user definable text fields, user loaded images such as graphic elements and frame lines, and more.

ColorBox also offers a sophisticated 4K test pattern generator and frame store, bringing useful tools to your workflow, including capturing up to a 4K image as a 16-bit .tiff file for the highest quality reference stills. These captures can be saved locally on ColorBox or onto third party connected computers which can simultaneously be running applications like Pomfort's Livegrade Pro/Studio, Assimilate Live Looks, and QTAKE Video Assist software.

Features

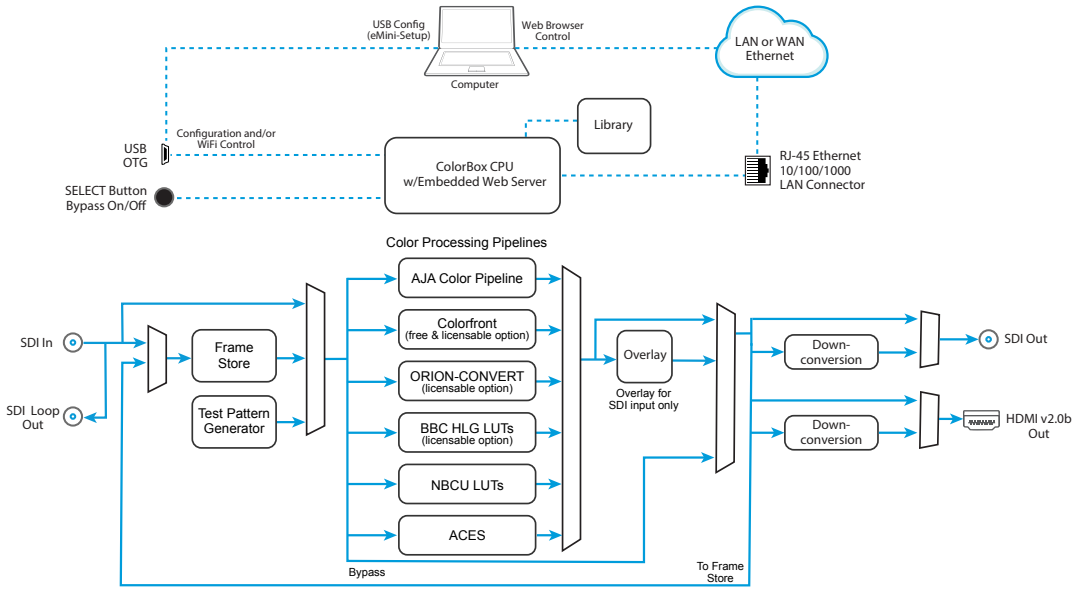
- 12-bit 4:4:4 12G-SDI I/O for up to 4K/UltraHD HDR/WCG 30p
- 10-bit 4:2:2 12G-SDI I/O for up to 4K/UltraHD HDR/WCG 60p
- 12-bit 4:4:4 HDMI 2.0 output for up to 4K/UltraHD HDR/WCG 30p
- 10-bit 4:2:2 HDMI 2.0 output for up to 4K/UltraHD HDR/WCG 60p
- Ultra-low latency, less than ½ a video line

- Extensive AJA Color Pipeline built around the 33-point 3D LUT processor with tetrahedral interpolation
  - 7x nodes plus Overlay
    - 1x 3D LUT processor, user configurable as 3D LUT or Dynamic
    - 4x 1D LUT processors, user configurable as 1D LUT, Dynamic, or Color Corrector
    - 2x 3x3 Matrix processors, user configurable as 3x3 Matrix, Dynamic, or ProcAmp
  - Supports industry standard file types, no conversion to proprietary format required
  - Configurable Colorspace, Range, and Transfer Characteristic
  - Full frame LUT processing
- Six Color Processing Pipelines
  - AJA Color
  - Colorfront Mode (Free and Licensable option)
  - ORION-CONVERT Mode (Licensable option)
  - BBC HLG LUT Mode (Licensable option)
  - NBCU LUTs
  - ACES
- Down-convert 4K to 2K or UHD to HD via SDI and/or HDMI outputs
- 4K/2K Crop for HDMI output
- Video Preview in web user interface (WebUI) for confidence monitoring
- Built-in Frame Store
  - Up to 4K/UltraHD frame capture and recall
  - Capture pre or post processed images
- Test Pattern up to 4K/UltraHD, 14 test patterns built-in
- Overlay information on output
  - User Text
  - User Overlay
  - Input and Output signal information
  - Pipeline Configuration
  - Overlay can be captured with image for future reference
- Onboard library for file management
  - 16x 1D LUTs
  - 16x 3D LUTs
  - 16x 3x3 Matrices
  - 16x Images
  - 16x Overlays
  - 16x AMFs
- Preset Management, 10 per Pipeline plus Startup Preset
- HDR signaling metadata management
- ANC metadata pass-through
- Embedded audio pass-through, SDI 16-Ch and HDMI 8-Ch
- Support for ARRI Alexa 35's Wireless Video Optimized LogC4 (WVO)
- Compact; 4 units can fit in just 1RU
- Ultra quiet fan operation suitable for on-set environments
- Lightweight, 1.0 lb (0.5 kg)
- Robust locking 4-pin mini-XLR power connector, DC power
- On/Off button so you can save power when not in use
- Select button used to bypass video processing
- Extensive API for 3rd party control integrations

- Embedded web server for remote control
- Configure IP Address via USB port and supplied AJA eMini-Setup software for Windows and macOS
- Three year warranty

Block Diagram

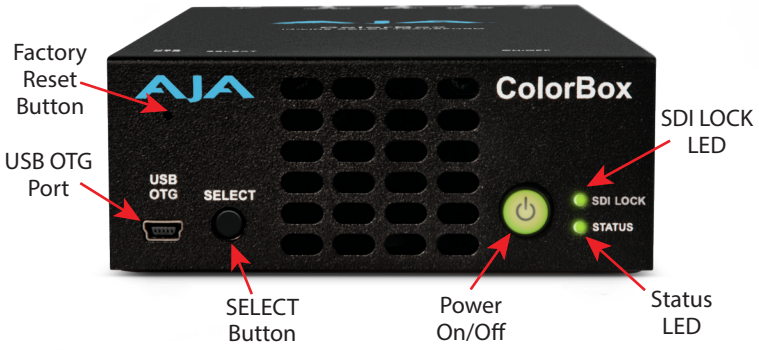
Figure 1. ColorBox Simplified Block Diagram



Hardware Description

Front Panel

Figure 2. ColorBox Front View



Mini USB OTG Port

The USB On-The-Go (OTG) port supports both host and client connections. Use the supplied USB adapter cable and the AJA eMini-Setup configuration application for initial network configuration (see*"eMini-Setup" on page 61*). ColorBox also supports the use of 3rd party USB WiFi adapters through this port. See *"Appendix A Specifications" on page 67* for a list of supported WiFi adapters.

SELECT Button

Pressing and holding the SELECT button places the ColorBox into hardware override bypass mode, bypassing all color processing and any overlay text. The ColorBox's video input will be directly routed to its output. While in bypass mode the STATUS LED is colored purple, and the WebUI processing pipeline indicates the bypassed video path. Releasing the button restores the ColorBox to its previous operational state.

The SELECT button is also used for SafeBoot. See *"ColorBox Firmware Update" on page 13*.

Power On/Off Button

Pressing the Power button immediately turns on ColorBox if it is off. Pressing and holding the Power button for three seconds turns the ColorBox off. ColorBox automatically powers on when DC power is first applied.

LED Descriptions

SDI LOCK LED

- Green = indicates ColorBox is locked to a valid and supported SDI input format
- Off = LED indicates ColorBox is not locked to a valid or supported input format

STATUS LED

The STATUS LED illuminates to report the following conditions in priority order.

Alarm status:

- Red = Overtemp (blinks red if Identify is also on and alarming)
- Red = Fan Failure (blinks red if Identify is also on and alarming)
- Flashing Blue = Identify
- Amber = Safeboot

Color Pipeline status:

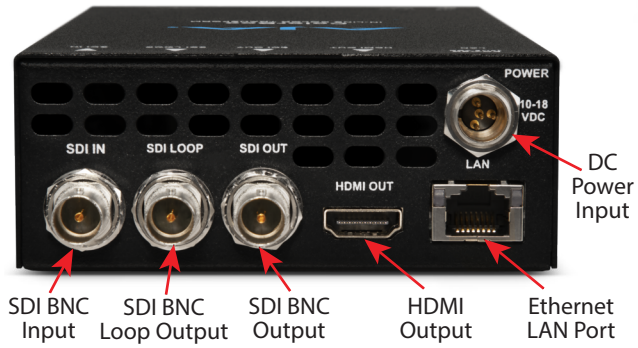
- Green = Processing
- Purple = Bypass

Factory Reset Button

The recessed Factory Reset button, when pressed using a paperclip or similar type object like a pin, clears all configuration data from the ColorBox, including the entire Library, all Images and Presets, and network settings (DHCP is enabled after reset). Any installed licenses, however, are retained after a Factory reset.

Rear Panel

Figure 3. ColorBox Rear View



SDI BNC Input

12G-SDI video Input to the ColorBox's internal Color Processing Pipeline.

SDI Video Loop Output

12G-SDI video loop output of the SDI BNC Input, with no color processing or overlay.

SDI BNC Output

12G-SDI Video Output, including color processing and overlay unless bypassed.

HDMI Video Output

HDMI Video Output (v2.0b), including color processing and overlay unless bypassed.

NOTE: The ColorBox HDMI output uses these settings when outputting an HDR (HLG or PQ) signal.

- Display Mastering Luminance: Min 0.0050, Max 4000
- MaxCLL: 0
- MaxFALL: 0

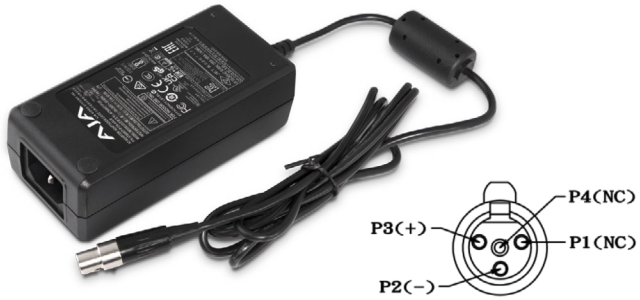
LAN Port

10/100/1000 Mbps Ethernet port (RJ45 connector), including network communications status LEDs.

Power

ColorBox requires a DC power input in the range of 10-18V DC. An AJA power supply module is included with purchase. It accepts a 110-240VAC, 50/60Hz power input and outputs +12V DC.

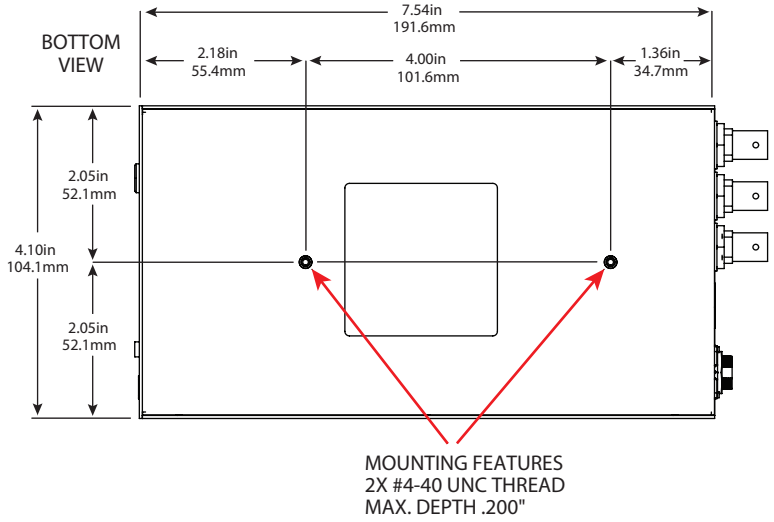
Figure 4. ColorBox External Power Supply



Bottom Panel

Two chassis mounting screw holes are located on the bottom of the unit, with 4 inch spacing between holes and 4-40 threads.

Figure 5. ColorBox Mounting Screw Holes



Chapter 2 – Installation

Overview

ColorBox requires an Ethernet network connection and is shipped from the factory with DHCP enabled. If your network has a DHCP server, by simply connecting ColorBox to your network with an Ethernet cable, the DHCP server will assign ColorBox a compatible IP address. However, you will need to know that IP address before you will be able to access ColorBox's internal web server for configuration.

The eMini-Setup application, available as a free download from the AJA website, lets you identify the current ColorBox IP address and, if necessary, configure its network settings so the unit can operate in your work environment. See *"Chapter 4 eMini-Setup" on page 61* for more information.

ColorBox Initial Configuration Summary

Typically, ColorBox installation consists of the following steps:

1. Download eMini-Setup from the AJA website and install it onto your computer (see *"Chapter 4 eMini-Setup" on page 61*).
2. Connect the ColorBox's USB OTG port to your computer's USB port.
3. Connect ColorBox's LAN port to a network that is accessible to your computer.
4. Power up the ColorBox.
5. Launch the eMini-Setup application on your computer. The eMini-Setup Network tab will display the ColorBox's current IP network settings.

NOTE: ColorBox ships from the factory configured by default for DHCP operation.

   A. If your ColorBox is connected to a network using DHCP, the DHCP assigned IP address is shown. Enter that IP address into a web browser on your connected computer. The ColorBox's internal web page will be displayed, allowing complete control of the device.

   B. If your ColorBox is not connected to a network, or your network does not use DHCP, you will need to configure it with a static IP address. See *"Static IP Address Configuration Using eMini-Setup" on page 12*.

   C. When set to DHCP, ColorBox selects automatic IP address assignment from the LAN DHCP server. If a DHCP server cannot be found, ColorBox will fall back to the previously entered Static IP address. If no Static IP address had been entered, the system fails over to a link local static IP address (169.254.x.x)

6. Once the IP addresses are compatible, enter the ColorBox's IP address into a web browser on your connected computer. The ColorBox's internal web page will be displayed, allowing complete control of the device.
7. Connect your video source to the ColorBox's SDI IN BNC connector.
8. Connect the ColorBox's SDI OUT BNC and/or HDMI OUT connector(s) to a reference color monitoring display.

NOTE: An SDI LOOP output connector is also available to pass unprocessed input video to downstream equipment.

9. If you will be using licensable options, acquire and install the options software license keys (see *" ColorBox Option Licensing" on page 12*).

NOTE: NBCU LUTs and Colorfront standard capabilities are available without licensing in ColorBox.

10. Configure your Color Processing Pipeline. This can involve importing LUT files and/or connecting to an external color correction system, such as:
    - Pomfort Livegrade Pro
    - Pomfort Livegrade Studio
    - Assimilate Live Looks
    - Assimilate Live Assist
    - QTAKE Video Assist
11. You will now be able to A/B compare your processed and unprocessed video on your color reference monitor and make color adjustments.

Static IP Address Configuration Using eMini-Setup

1. Ensure the ColorBox's USB Config port is connected to your computer, and the ColorBox's Ethernet port is also connected to your computer, either directly or via a non-DHCP network.
2. Launch the eMini-Setup application and go to the eMini-Setup Network tab.
3. Select **Static** as the IP Address Type.
4. You now should now be able to make any necessary network configuration changes.
    A. You can use eMini-Setup to edit the ColorBox's static IP address to be compatible with your computer's current network settings.
    B. Alternatively, you can change your computer's IP settings to be compatible with the ColorBox's static IP address.

NOTE: Typically compatible static IP settings will have identical values for the first three IP address numbers, different values for the last IP address number, and identical Subnet Masks.

ColorBox Option Licensing

NOTE: Watermarks are added to the ColorBox's video output when an unlicensed pipeline is being used. This lets you test the color science in advance of purchase.

ColorBox options can be purchased from an AJA reseller. Option licensing involves a License Key that is associated with a particular ColorBox that has a specific serial number. It is not a floating license. The License Key, once activated, is perpetual, non-volatile, and will not be affected by ColorBox resets or power cycling.

Licenses are available to enhance the following pipelines:

- ORION-CONVERT - Offers the necessary tools for broadcasters to create and deliver the HDR and SDR content consumers expect from a single master HDR workflow by providing critical controls required to set up the right conversion for your production. SDR, HLG, and PQ conversion are available utilizing floating point math that eliminates interpolation errors.
- BBC HLG LUT - Offers field proven HLG LUT conversion options with 19 LUTs, used particularly by television broadcasters who are looking for specific conversion criteria.
- Colorfront - Additional capabilities with license include Live Mode, SDR to Dolby Vision Preview, full parametric control of TV Mode, and TV Mode Sony

SLog3 transforms. SDR, HDR, and PQ transforms within TV Mode remain active without a license for ColorBox.

A single License Key can be used to enable multiple ColorBox options on that device. Watermarks displayed when running un-licensed options will be automatically removed after the License Key is activated.

1. Purchase the license from an AJA reseller and download the License Key to a computer that can access your ColorBox over a network.
2. In the ColorBox WebUI, go to System Settings > System.
3. Click **Browse** and locate the License Key file. It will have a file name that includes the serial number of the ColorBox to be licensed. The connected ColorBox's serial number is shown above, under System Details.
4. Select that license file and click **Accept**. The license file will load into that ColorBox. The gray dot next to the license name will turn blue indicating the option is now licensed and any watermarks associated with that option are automatically removed.
5. For the license to be fully enabled, power cycle the ColorBox.

NOTE: Do not change the License Key filename. ColorBox will reject the License Key if the filename is changed. The filename format is: AJA_COLORBOX-LIC-ACT_PERP_ XXXXXXXXX where XXXXXXXXX is the serial number of the ColorBox.

ColorBox Firmware Update

Visit the AJA website to locate and download the latest firmware.

https://www.aja.com/products/colorbox#support

New firmware downloaded from the website can be installed using the ColorBox's WebUI.

1. Download the ColorBox firmware to a computer that can access your ColorBox over a network.
2. In the ColorBox WebUI, go to System Settings > Firmware.
3. Click **Browse**, locate the ColorBox License firmware file and click **Upload**.
4. Click **Submit**. A message appears indicating the progress of the update.
5. A restart is required after the firmware is loaded, which can be accomplished by clicking that message's **Restart** button.
6. The ColorBox's web connection will disconnect,and then reconnect with the updated firmware.

ColorBox Safeboot

ColorBox has a safety feature where an internal “safeboot” copy of minimal system software is retained in the event the update process fails or the loaded software becomes corrupted. The safeboot software is intended only to restore the unit to a known configuration (the last network configuration settings are retained) with which you can successfully connect to the device over the network and download and reinstall fully functional system software.

NOTE: ColorBox safeboot software does not provide any video processing. You will need to install new ColorBox firmware to restore full operation.

ColorBox safeboot is initiated by holding in the front panel **SELECT** button for five seconds while powering up the unit, which launches the safeboot software version. When running safeboot the STATUS LED is colored amber, and an amber Safeboot warning alarm is shown on the ColorBox's WebUI.

With the safeboot software running, you will be able to update your ColorBox to the latest firmware version using its WebUI.

Chapter 3 – ColorBox Operation

Overview

An optimized web server in ColorBox allows remote control and parameter setting adjustments via a web browser client running on a network connected computer. The network can be a closed local area network, a straight computer-to-ColorBox cable, or even exposed through a firewall to a broadband WAN.

ColorBox uses a standard RJ-45 LAN connector and will automatically configure to work with a standard “straight-through” CAT 5 Ethernet cable or a null-modem (cross-over) cable.

NOTE: Safari is the preferred web browser for control on the Mac, and additionally Chrome and Firefox on Windows. Other web browsers may work, but AJA cannot guarantee consistent operation for all web browsers or web browser versions.

To connect to ColorBox, simply attach ColorBox to your network and enter ColorBox’s IP address into the web browser. If authentication has been configured, you may need to enter user name (default "admin") and the currently configured password.

About the ColorBox Library

The ColorBox Library is a local non-volatile repository of color processing files and images that can be quickly recalled for consistent use. Up to 16 1D LUTs, 3x3 Matrices, 3D LUTs, Images, and Overlays can be stored. Library files can be imported and exported via a network connection. Library files exported from one ColorBox can be imported to other ColorBoxes. This allows for easy sharing of pipeline configurations and their files, ensuring absolute color processing consistency.

When using the AJA Color Pipeline (ACP), stored Presets retain all files loaded into the nodes, either active or not. When loading an ACP Preset, all files that were stored in that Preset will populate the ColorBox Library if not already present. A warning will be displayed if not enough library locations are available.

ColorBox Image Files

Sixteen Frame Store image storage locations are available in the local Library. These images can be used in any pipeline mode, and images can be captured to the Library from any pipeline mode. Images can also be imported, exported, and deleted from the Library from any pipeline mode.

NOTE: When capturing images to the Frame Store, an Overlay can be captured on the output image. The Overlay can contain information such as User Text fields, Input and Output format information (including VPID), Timecode presence, Closed Captioning presence, Pipeline Configuration information, and user created keyable graphics that could be logos and/or framelines.

ColorBox Overlay Files

Sixteen Overlay image storage locations are also available in the local Library, which can be used for customer uploaded keyable .PNG files. These files can be used to overlay custom frame lines, images, logos, etc. with the push of a button.

About Presets

Each Color Processing Pipeline mode has 10 Presets, each of which can store and recall the current configuration of that pipeline. Included in each Preset are the currently selected LUTs, any Color Corrector or Proc Amp settings, the on/off state of each of that pipeline's nodes, and other pipeline specific parameters.

When using the AJA Color Pipeline (ACP), stored Presets retain all files loaded into the nodes, either active or not. When loading an ACP Preset, all files that were stored in that Preset will populate the ColorBox Library if not already present. A warning will be displayed if not enough library locations are available.

If Dynamic LUTs are being used in the AJA Color Pipeline, storing a Preset saves the latest Dynamic LUTs or 3x3 matrices values provided from the external color management system for that node. When recalling this preset, the Dynamic values are restored.

Each Preset saves only the current settings for the selected pipeline mode (i.e. AJA Color, Colorfront, BBC HLG LUTs, NBCU LUTs, and ACES). However, also included in each Preset is the current Bypass state, any Overlay text settings, the current Frame Store settings, and the recalled image whether or not it is enabled.

These settings apply to all ColorBox's pipeline modes.

NOTE: While it is rare to change pipeline modes during production, be aware that recalling a Preset from one pipeline mode can change the current Bypass or Overlay settings of other modes. If, after going to another mode, you immediately recall a Preset for that mode, you can ensure all of the settings will be restored, including Bypass and Overlay.

Startup Preset

Each Color Processing Pipeline mode can also be assigned a Startup Preset, which will be automatically recalled when that ColorBox starts up. This makes it possible for an expert to configure a Preset, select it for startup, and power down the ColorBox. Another perhaps less experienced person could then carry that ColorBox to its intended location, connect its inputs and outputs, and restore all the previous settings by simply powering up the unit.

NOTE: The Startup Preset number recalled on startup will be for the pipeline mode the ColorBox had selected when it was powered down.

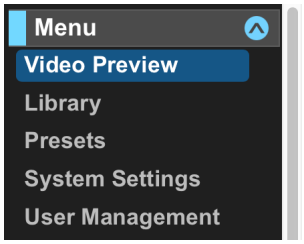
WebUI Description

Figure 6. ColorBox WebUI Example

All ColorBox web screens have certain areas and controls in common. Vertical and horizontal scroll bars appear when information extends past the border of a screen panel. The round blue Up/Down or Left/Right arrow button on each pane opens and closes that pane.

Menu Pane

Figure 7. ColorBox Menu Pane, Video Preview Selected



The Menu Pane is used to select what will be displayed in the central area of the screen.

Video Preview

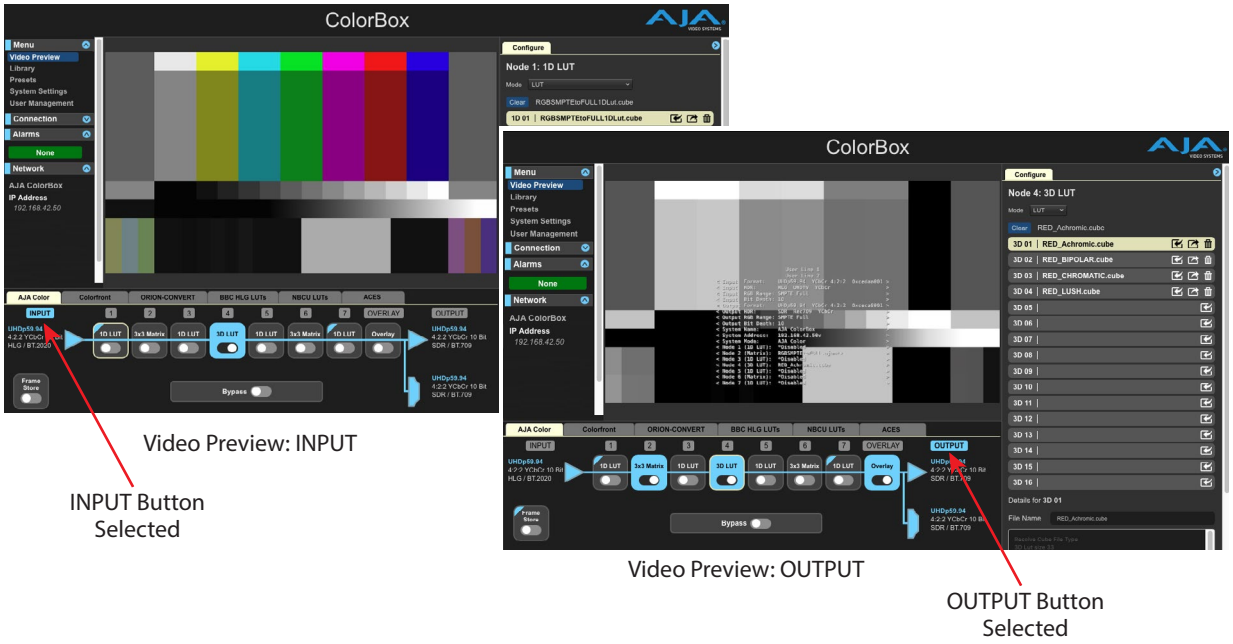
When Video Preview is selected from the menu, a low frame rate video preview of the input or output video is displayed for signal confidence monitoring.

NOTE: The colors shown by Video Preview confirm color processing is being performed, but may not be color accurate depending on several factors, including the display device.

Use the INPUT and OUTPUT buttons to select whether the input or output video is displayed. *Figure 8* shows a pipeline example with an achromatic LUT with Overlay Text ON.

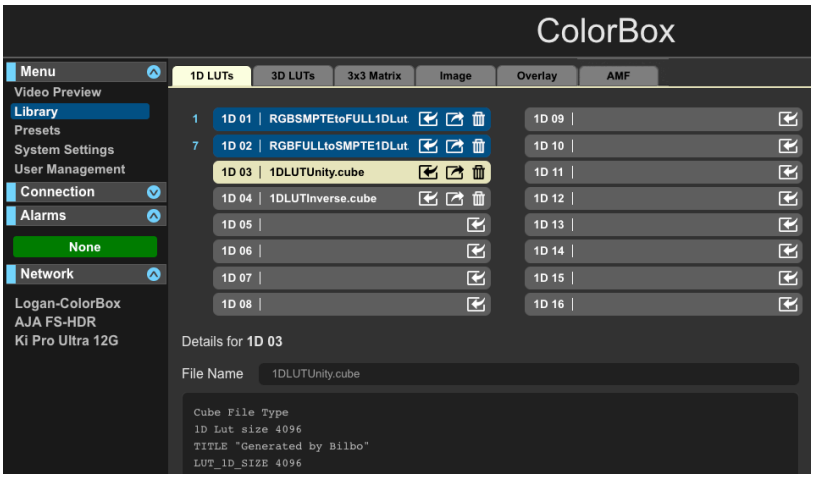
- When INPUT is selected, unprocessed video displays in Video Preview, without color change or overlay text.
- When OUTPUT is selected, processed video displays in Video Preview, with achromatic video and overlay text.

Figure 8. Video Preview Input vs Output



Library Pane

Figure 9. Library Pane, Image Example



The Library pane lets you manage all your files in one place. See *"About the ColorBox Library" on page 15* for more information.

When selected, this pane displays the ColorBox Library with tabs for 1D LUTs, 3D LUTs, 3x3 Matrix, Image files, Overlay, and AMF files. The LUTs and 3x3 Matrix files are available for use only in the AJA Color Pipeline Mode. AMF files are available for use only in the ACES Pipeline Mode. Image and Overlay files however, are available for use in all Pipeline modes.

The Library pane keeps you informed about what files are being used by displaying a blue node number next to a file if it is loaded into that node.

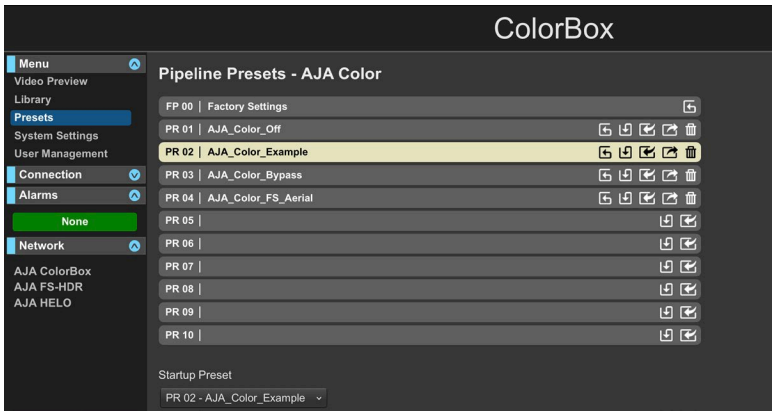
Files can be imported from and exported to a network location.

NOTE: LUTs from other providers can be loaded into AJA Color Pipeline nodes. For example, a free LUT downloaded from the Internet can be loaded into an AJA Color Pipeline node, and you can then A/B compare it to a different LUT, or see what their combination does to the output color.

NOTE: Information displayed in the Library pane can also be presented in the Configure pane. Deleting a file from either pane deletes the file from that ColorBox (see "Configure Pane" on page 23).

Presets Pane

Figure 10. Pipeline Presets Pane, AJA Color Example



The Presets pane lists the 10 Presets available for importing, exporting, saving and recalling Pipeline configurations, which can include images, for quick and reliable reuse. See *"About Presets" on page 16* for more information.

A Startup Preset can be chosen from a drop down list at the bottom of this pane, which will be automatically recalled when that ColorBox starts up.

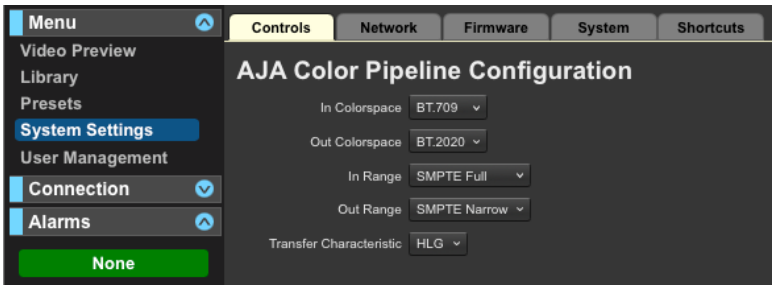
NOTE: The Startup Preset recalled on startup will be for the pipeline mode the ColorBox was configured for when it was powered down.

System Settings Pane

The System Setting pane displays various ColorBox parameters, depending on the tab selected at the top.

Controls Tab (AJA Color Pipeline and ACES Pipeline ONLY)

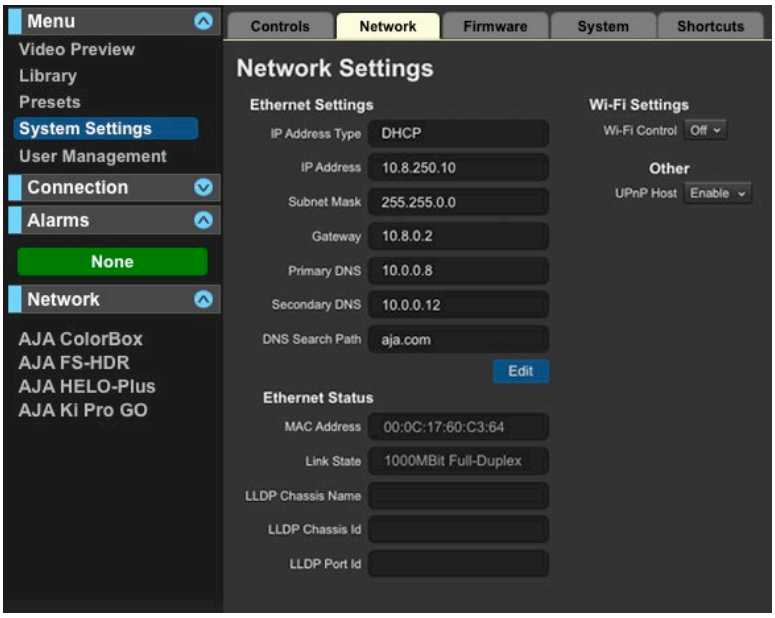
Figure 11. AJA Color Pipeline Configuration Settings



The Controls Tab settings only apply to the AJA Color and ACES Pipelines, and are not used in other pipeline modes. These controls will be grayed out (inactive) if not accessed from the AJA Color or ACES Pipelines. See *"Using the Controls Tab with the AJA Color Pipeline" on page 31* and *"Using the Controls Tab with the ACES Pipeline" on page 55* for detailed information.

Network Tab

Figure 12. Network Settings



The Network Tab gives information about the ColorBox's network settings, and allows changing them to meet your network environment. For ColorBox, various network settings are configured using eMini-Setup. See *"eMini-Setup User Interface" on page 63.*

IP Address Type - IP Address Type determines the type of TCP/IP network configuration to be used. DHCP enables connecting to the network DHCP server, which assigns the IP Address, Netmask, and Gateway automatically. Static lets you set these parameters manually.

- DHCP (default) - Selects automatic IP address assignment from the LAN DHCP server. If a DHCP server cannot be found, ColorBox will fall back to the previously entered Static IP address. If no Static IP address had been entered, the system fails over to a link local static IP address (169.254.x.x).
- Static - Assigns a static IP address manually.

IP Address - IP Address determines a static IP address to be used for TCP/IP networking. Consult your network administrator about how to set this value.

- If IP Address Type is set to DHCP, the IP address is set automatically by the network DHCP server.
- If IP Address Type is set to Static, enter an IP address compatible with your LAN. This must be configured using AJA eMini-Setup..
- If IP Address Type is set to DHCP and there is a DHCP failure, the IP address is set to a link local static IP address.

Subnet Mask - Subnet Mask determines the subnet mask to be used for TCP/IP networking.

- Use a subnet mask compatible with your LAN. This is only needed for Static IP configurations. The factory default Subnet Mask is 255.255.255.0.
- If IP Address Type is set to DHCP, the Subnet Mask is set by the DHCP server and cannot be changed by the user.

Gateway- Gateway determines the gateway or router used on your LAN for TCP/IP networking. Without a properly configured default gateway (whether you have a router/gateway or not), your ColorBox will be unable to see other ColorBoxes on the network, although you may still be able to control this ColorBox via a web browser. Also, without a proper gateway defined, the discovery feature on the Network web page will not list other units on the network.

- Use a default gateway or router address. This is only needed for Static IP configurations.
- If IP Address Type is set to DHCP, the Default Gateway is set by the DHCP server and cannot be changed by the user.

Primary and Secondary DNS Servers - In DHCP mode, reports the current DNS Server IP addresses. In Static mode, allows entry of DNS Server IP addresses.

CAUTION: *If DNS servers are not present or have incorrectly entered IPs, then wherever ColorBox specifies machines by name the names won't work, although numeric IP addresses will still work.*

CAUTION: *When using Static IP addressing for* ColorBox*, be sure to also enter a valid DNS server address in the "Primary DNS Server" field. If the DNS Server address is not entered or is invalid, URLs in streaming destinations won't work and an Alarm will be displayed:*

DNS Search Path- Defines the Domain Name System search path for the ColorBox.

MAC Address - Reports the connected ColorBox's Media Access Control Address.

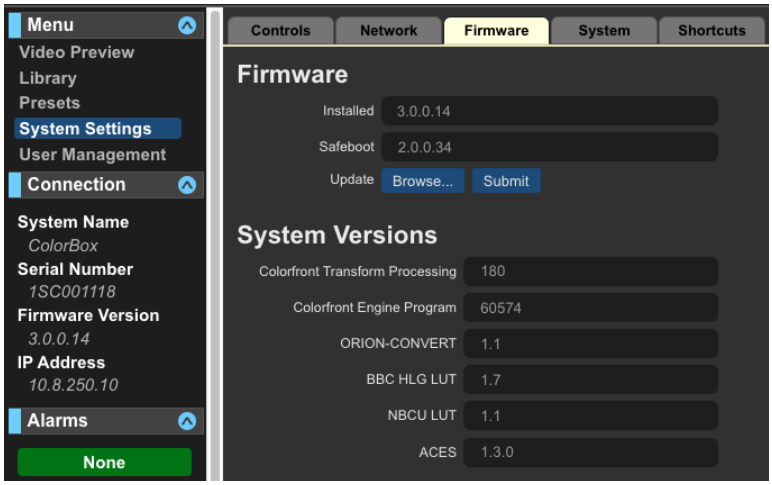
Link State - Reports the link speed of the Ethernet connection.

WiFi Control - This requires a 3rd party WiFi USB adapter. Follow the instructions for the selected adapter and input the necessary network settings into the WiFi device and the ColorBox you wish to control over WiFi.

UPnP Host - When this parameter is enabled, you can view the ColorBox on a Windows Network. Any ColorBoxes on the network will be listed under Other Devices. If your system does not have network discovery enabled, you may need to enable it following the Windows help instructions to make network devices visible in the Windows Network window.

Firmware Tab

Figure 13. Firmware Information

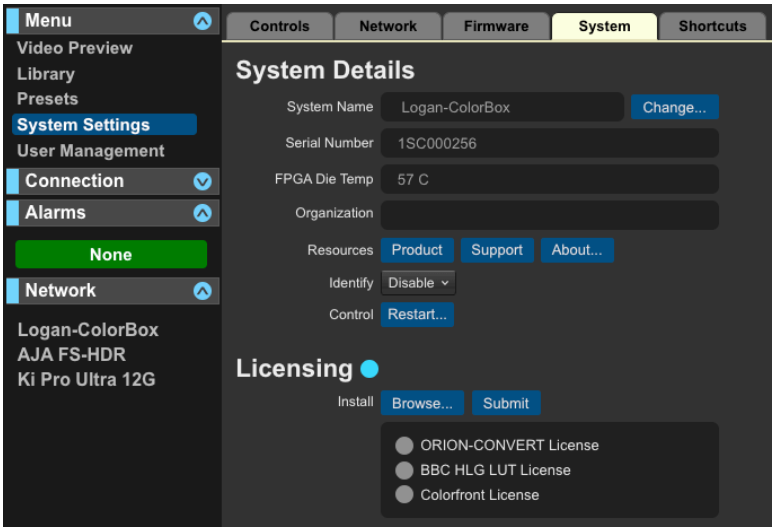


The Firmware Tab gives information about the ColorBox's firmware, and is used to update its firmware. A restart is required after the firmware is loaded.

See *"ColorBox Firmware Update" on page 13* for instructions.

System Tab

Figure 14. System Details



System Name - Click the Change button to enter a custom name for this ColorBox, which can be useful if more than one ColorBox is being used in a production. This name appears in the Network tab of AJA devices connected on that network.

Product - Opens ColorBox page on the AJA website for an overview of the product.

Support - Opens ColorBox page on the AJA website and presents Contact Support information.

About - Opens About ColorBox information panel.

Identify - Selecting Enable will make the front panel STATUS LED of the connected ColorBox turn blue and blink. This can be useful to identify a particular ColorBox when several are in use at the same time.

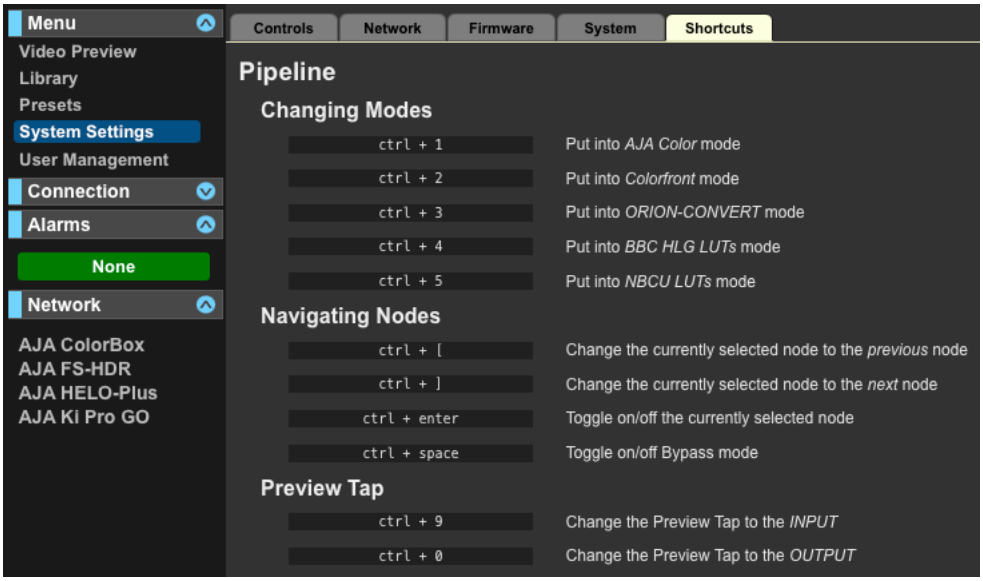
Restart - Opens a window allowing you to restart your ColorBox.

Licensing - Used to install license keys for optional features. See *"ColorBox Option Licensing" on page 12* for instructions.

Shortcuts Tab

The System Settings Shortcuts pane displays keystroke shortcuts available for faster system operation.

Figure 15. System Settings Pane, Shortcuts

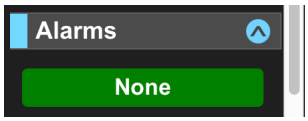


Connection Pane

The Connection pane displays information for the connected ColorBox (*Figure 6 on page 17*).

Alarms Pane

Figure 16. ColorBox Alarms Pane



Alarms are displayed in a pane on the left side of the screen. For example, if the ColorBox overheats an Overtemp Alarm will be displayed. Clicking on the arrow opens or closes this pane to show or hide the alarms.

Network Pane

At-a-glance you can see the AJA devices that are present on the same local LAN using the Network pane (*Figure 6 on page 17*). This feature is only available when the AJA devices have IP addresses configured under a common network and subnet and are connected to the network.

Click on the device's name to switch the browser to that particular AJA device.

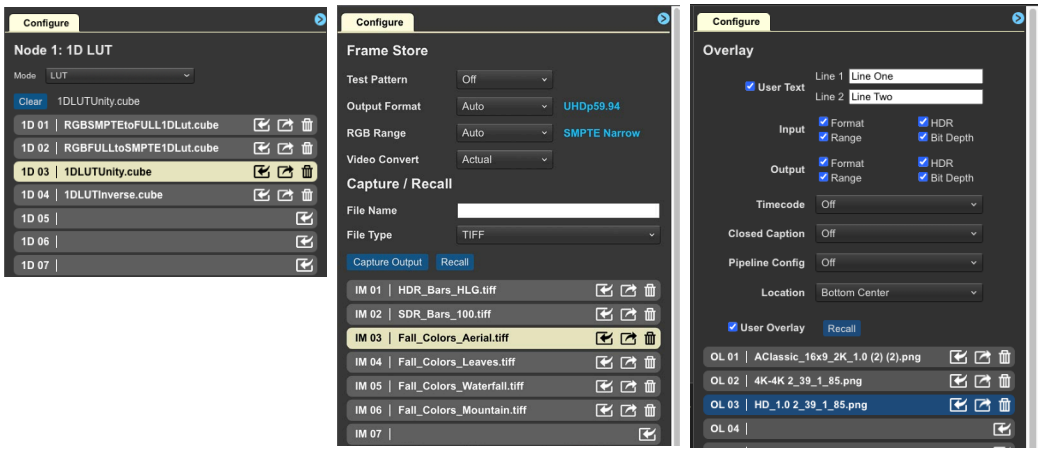
The ColorBox name appearing on this list can be changed (see*"System Tab" on page 22*).

Configure Pane

On the right side of the screen the Configure pane displays parameters and controls for the selected item in the currently active pipeline. The selected pipeline item will be outlined in light yellow (*Figure 6 on page 17*).

Different configuration options will be available, depending on the pipeline mode you are using and the pipeline item selected. Controls available in the Configure pane can include selecting and loading LUTs for use in a particular node, importing, exporting and deleting LUT and Image files, and adjusting Color Corrector and Proc Amp settings.

Figure 17. Configure Pane, 1D LUT, Frame Store, and Overlay Examples



When a node is selected that has a Library associated with it, the Configure pane on the right offers similar controls, but also allows you to select a file to load into the selected node. This cannot be accomplished in the Library pane.

NOTE: Information displayed in the Configure pane can also be presented in the Library pane. Deleting a file from either pane deletes the file from that ColorBox (see "Library Pane" on page 18).

LUT Selection

With the desired pipeline and node selected, simply click on the name of the desired LUT listed in the Configure pane to load it into that pipeline's node. The LUT will be applied when that node is turned on.

Frame Store Image Selection

With the desired pipeline selected, select the Frame Store node, click on the name of the desired file listed in the Configure pane, and then click **Recall** to load that file for use with that pipeline.

To route that image file to the ColorBox's output, simply turn on the Frame Store node.

Overlay File Selection

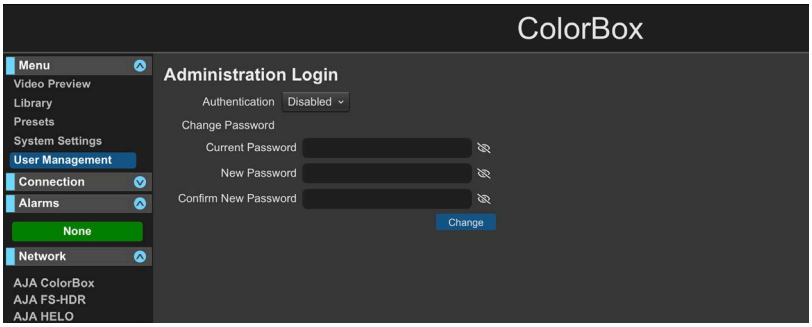
With the desired pipeline selected, select the Overlay node, click on the name of the desired Overlay file listed in the Configure pane, click **Recall** to load that file for use with that pipeline, and then click on the **User Overlay** box to activate the overlay image.

To route that image file to the ColorBox's output simply turn on the Overlay node.

NOTE: To include an Overlay with a Frame Store capture, the Overlay Configure pane User Overlay box must be checked before you turn on the Frame Store node.

User Management Pane

Figure 18. User Management Pane Example



Access to the ColorBox over the network can be managed by configuring an Administration Login for that device. The default User Name and Password are both "admin".

When Authentication is Enabled, you will need to perform a login each time you access the ColorBox via its WebUI. The browser presents the login screen first, requiring you to log in before you can access any other browser screens.

NOTE: If authentication is used, it provides only a minimum security safeguard against unauthorized use of the ColorBox. The authentication mechanism is simple and does not provide robust security.

ColorBox Pipelines

The lower area of the screen has a signal flow diagram of the currently selected Color Processing Pipeline. ColorBox comes with a range of pipelines to choose from.

- AJA Color Pipeline (ACP)
- Colorfront Pipeline
- ORION-CONVERT Pipeline
- BBC HLG LUTs Pipeline
- NBCU LUTs Pipeline
- ACES Pipeline

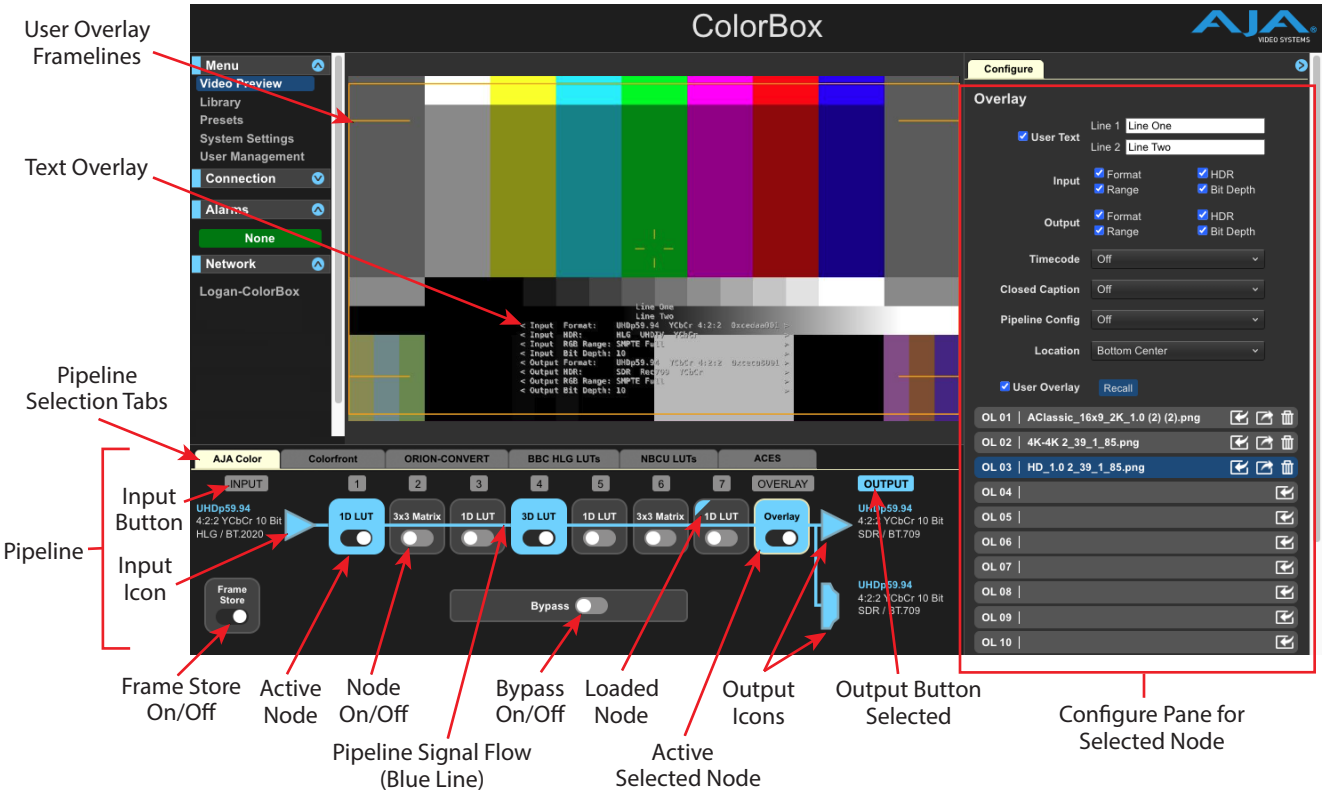
Some pipelines are designed specifically for live broadcast or live event needs. Others, like the AJA Color Pipeline (ACP), offer great flexibility for more control over each step of a transform for any application.

ColorBox pipelines like BBC HLG LUTs or ORION-CONVERT and some Colorfront functions will display a watermark over the image until a license is applied offering you the ability to evaluate the color science prior to purchasing the optional license. Only one processing pipeline can be displayed and made active at a time. Tabs at the top allow selection of one of the available pipeline modes.

NOTE: It is assumed only one pipeline mode will be used at a time. Switching between ColorBox pipeline modes during actual production is discouraged.

Pipeline General Description

Figure 19. AJA Color Pipeline Example, with Overlay



Pipeline Selection Tabs

Clicking on a pipeline tab selects that pipeline and makes it active. Any color or other processing configured in that pipeline will immediately be applied to the ColorBox's outputs, and any color processing configured in other pipeline modes will be disabled. Different pipelines will have different signal flow diagrams.

NOTE: Switching from one pipeline mode to another requires ColorBox to reconfigure its internal pipeline, which requires a few seconds.

Pipeline Video Format Information

The current input and output video format information is displayed on the left and right sides of the pipeline display. The input video format information will only change if the actual video input format changes. Pipeline parameter changes, however, can change some of the output video format information.

Pipeline Nodes

Each selected pipeline has processing node boxes. Clicking on a node box selects that node for configuration, that box will be outlined in light yellow, and parameters available for that node will be displayed in the Configure pane on the right side of the screen. Each node has an on/off toggle switch used to activate or disable that node.

INPUT and OUTPUT Buttons (All Pipelines)

Labeled buttons above the video format information are used to select whether the Input (unprocessed) or Output (processed) video signal is displayed on the Video Preview display. In addition, these buttons select which signal is routed to the Frame Store input for capture. These buttons are highlighted when chosen, and do not have a yellow border, indicating they do not change the information shown on the Configure pane. INPUT and OUTPUT button selections apply to all ColorBox pipelines.

INPUT

When selected, displays the unprocessed video input signal on the Video Preview pane and routes that signal to the Frame Store input. The Capture button on the Frame Store Configure pane will then be labeled "Capture Input".

OUTPUT

When selected, displays the processed video output signal on the Video Preview pane, including Overlay if enabled, and routes that signal to the Frame Store input. The Capture button on the Frame Store Configure pane will then be labeled "Capture Output".

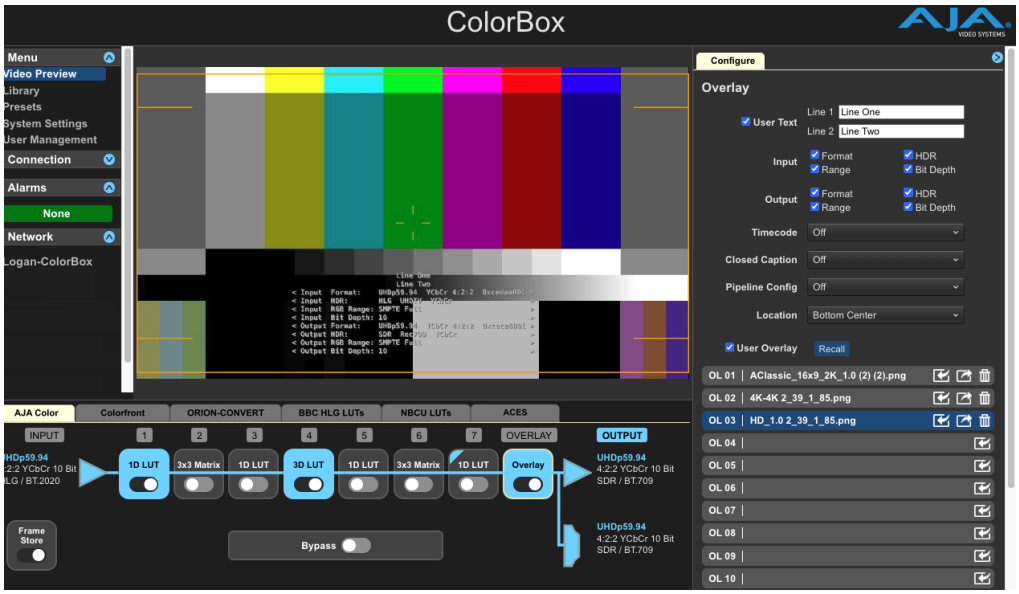
Input and Output Icons (All Pipelines)

Clicking on the pipeline Input triangle on the left displays input signal information in the Configure pane, and clicking on the Output triangle or HDMI icon on the right displays output signal information and optional Output configurations (see *"SDI/HDMI Output Configurations" on page 58*). These buttons do not change the Video Preview image, if shown, which always displays the signal selected with the INPUT and OUTPUT buttons, described above.

Input and Output Icon selections apply to all ColorBox pipelines.

Overlay (All Pipelines)

Figure 20. Configure Pane Overlay Settings



When Overlay has been selected in a pipeline, the Configure pane presents overlay text parameters, along with a list of user imported graphic files that can be keyed over the processed video output.

The Overlay settings are shared with all ColorBox pipeline modes. Any Overlay adjustment made in one mode will affect the Overlay behavior in every other ColorBox pipeline mode.

NOTE: Whenever the Frame Store is active the Overlay becomes unavailable and is removed from the ColorBox pipeline signal flow diagram.

Overlay Text

When the Overlay node has been selected in a pipeline, the Configure pane displays controls allowing the addition of various types of text information to the processed video output.

The following information can be displayed:

- User Text lines (2)
- Input and Output VPID for Format, Range, HDR, and Bit Depth
- Timecode presence
- Closed Caption presence
- Pipeline Configuration
- Location (of overlay text on screen)

The customizable user text lines are great for overlaying, for example, information such as camera or lens information if the camera can't provide it.

User Overlay Images

The User Overlay feature provides the ability to import, export, and overlay custom images onto the ColorBox's video output.

The User Overlay feature supports:

- .PNG format files
- Up to 4096 x 2160 resolution
- Standard raster sizes
- Automatically scales to fit source raster
- Available in all pipelines

Those images could be frame lines or any other image (such as logos, etc.) imported as .png files to the Overlay library. The ability to see frame lines on-set gives the production the best chance at capturing the shot composition correctly.

An Overlay image file can be displayed with or without the overlay text information, and can include shaded surrounds with transparency modified for masking/dimming camera OSD information.

Recall - Click this button to load the selected Overlay file into Overlay node.

User Overlay - Click on this check box to toggle the Overlay image on and off in the Overlay node. The overlay image, and any selected overlay text, will then be routed to the ColorBox's output when the Overlay node is turned on.

Figure 21. AJA Color Pipeline Example, with Frame Store Selected

When the Frame Store has been selected in a pipeline, the Configure pane displays Frame Store parameters, from which you can import, export, capture and recall video images up to 4K (4096x2160) resolution, as well adjust the Test Pattern generator and other controls.

The Frame Store is shared with all ColorBox pipeline modes. Any Frame Store adjustment made in one mode will affect Frame Store behavior in every other ColorBox pipeline mode.

Test Patterns

The following test patterns are available:

Black	Slant Ramp	BT.2111 HLG Narrow
Color Bars 100%	Zone Plate	BT.2111 PQ Narrow
Color Bars 75%	Quad Border	BT.2111 PQ Wide
Color Bars SMPTE	Circle	NBCU HLG Fancy BT.2111 Color Bars
Linear Ramp	EBU HDR HLG Color Bars	

Switching the Frame Store toggle On routes the output of the Frame Store to the input of the Color Processing Pipeline, as shown by the pipeline signal flow diagram (*Figure 22 on page 30*).

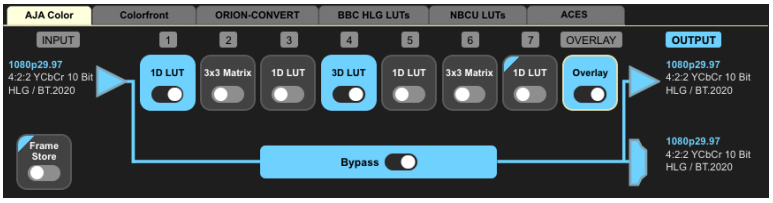
Figure 22. AJA Color Pipeline Example, with Frame Store On

NOTE: Whenever the Frame Store is On, Overlay becomes unavailable and is removed from the ColorBox pipeline signal flow diagram.

Bypass (All Pipelines)

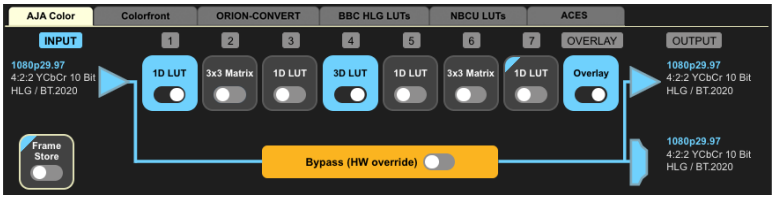
Clicking on the Bypass on/off toggle switches ColorBox into a hardware bypass mode, where all color processing is bypassed. The Pipeline signal flow line will show Bypass is active.

Figure 23. Pipeline Bypass On



This signal routing is identical to pressing the front panel SELECT button, in which case a yellow Bypass (HW override) message is displayed.

Figure 24. Pipeline Hardware Bypass On



AJA Color Pipeline

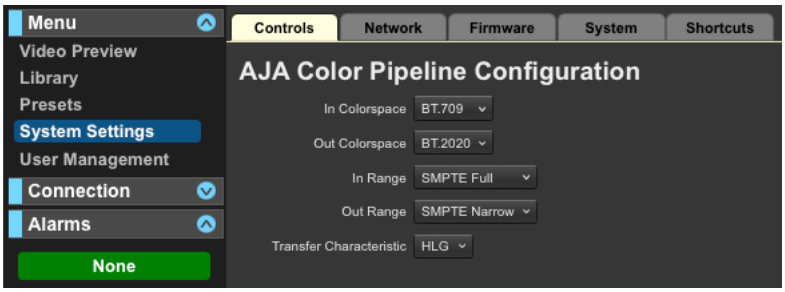
NOTE: The Frame Store, Bypass, and Overlay controls are available in all ColorBox pipeline modes, and their settings are applied to all the other pipeline modes. These settings are also saved to Presets.

The AJA Color Pipeline has seven color processing nodes, along with the Overlay, Frame Store and Bypass features. This pipeline has four 1D LUT nodes, two 3x3 Matrix nodes, and one 3D LUT node. Each of these seven nodes can be configured with different types of processing, depending on the type of node.

NOTE: LUTS from other providers can be loaded into AJA Color Pipeline nodes. For example, a free LUT downloaded from the Internet can be loaded into an AJA Color Pipeline node, and you can then A/B compare it to a different LUT, or see what their combination does to the output color.

Using the Controls Tab with the AJA Color Pipeline

Figure 25. AJA Color Pipeline Configuration Settings



The settings on this screen allows you to configure the input and output range (SMPTE/Full), Colorspace (BT.709/BT.2020), and the HDR output Transfer Characteristic (SDR/PQ/HLG) that will be used with the AJA Color Pipeline.

NOTE: The settings on this tab must match how the LUT was designed. This setting is persistent when switching between AJA Color and ACES pipelines.

In Colorspace - Select either BT.709 or BT.2020 as the input color space.

Out Colorspace - Select either BT.709 or BT.2020 as the output color space.

In Range - Select either SMPTE Full or SMPTE Narrow.

- SMPTE Full selects a full input scaling/range, which includes sub-blacks and super-whites. Input video values of 0-1023 (10 bit) or 0-4095 (12 bit) are scaled to 0-1 before being sent to the LUT processor.
- SMPTE Narrow selects a narrow input scaling/range, such that an input video value of 0 represents black, and an input video value of 1 represents white. Input video values of 64-940 (10 bit) or 256-3760 (12 bit) are scaled to 0-1 before being sent to the LUT processor.

Out Range - Select either SMPTE Full or SMPTE Narrow.

- SMPTE Full selects a full output scaling/range, which includes sub-blacks and super-whites. Output values from 0-1 are scaled to 0-1023 (10 bit) or 0-4095 (12 bit).
- SMPTE Narrow selects a narrow output scaling/range. Output values from 0-1 will be scaled to 64-940 (10 bit) or 256-3760 (12 bit).

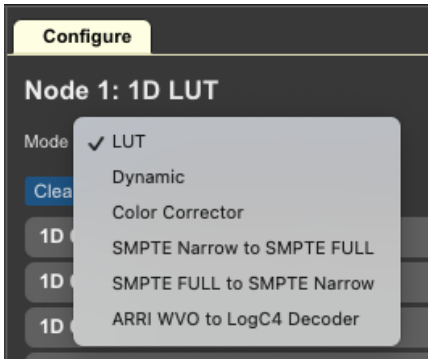
Transfer Characteristic - Select either SDR, HLG or PQ.

- This setting indicates the transfer characteristic that will be signaled in the SDI Output VPID, as well as the EOTF that will be signaled in the HDMI Output HDR Infoframe. This setting has no effect on the pixel values.

1D LUT Nodes

With four 1D LUTs it is easy to manage your Color Processing Pipeline to get the best possible image. 1D LUTs are commonly used as “shaper LUTs” wrapping around the 3D LUT. The front shaper 1D LUT allows you map perceptually significant values, typically the darker part of the colorspace, to use more of the 3D LUT transform data set resulting in a more effective use of the 3D LUT to produce a better image. The backside shaper 1D LUT is usually the inverse of the front, mapping pixel values into the original dynamic range. 1D LUTs can also be effectively used as log-to-linear and linear-to-log transforms.

Figure 26. AJA Color 1D LUT Modes



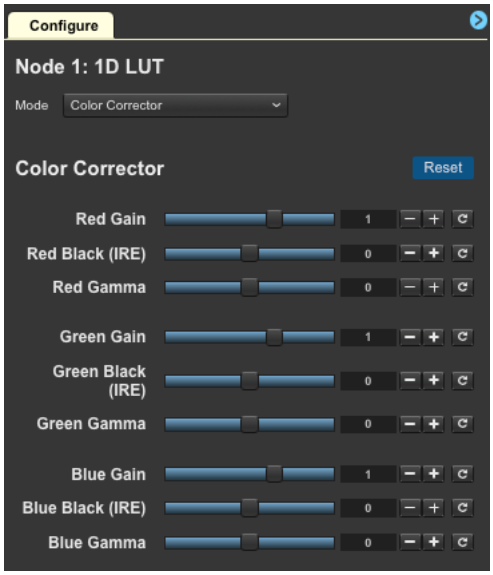
Options, selected in that node's Configuration pane, include:

- LUT
- Dynamic
- Color Corrector
- SMPTE Narrow to SMPTE FULL
- SMPTE FULL to SMPTE Narrow
- ARRI WVO to LogC4 Decoder (see *"ARRI WVO to LogC4 Decoder in the AJA Color Pipeline" on page 60*).

RGB Color Corrector

In the AJA Color Pipeline (ACP), 1D LUT nodes can be set up as RGB Color Correctors for color correcting a source before or after 3D LUT processing. This is a common workflow in live production applications.

Figure 27. Color Corrector Controls



NOTE: RGB Color Correctors are also available with the BBC HLG LUTs and NBCU LUTs pipelines.

3x3 Matrix Nodes

ColorBox's two 3x3 Matrices provide the operator a means to perform different color processing tasks outside of a LUT using their own 3x3 matrix files. 3x3 Matrices are commonly used for colorspace conversion, for example between RGB and XYZ or YUV, BT. 709 and BT. 2020, or other color spaces with different primaries. A 3x3 Matrix can be used to color balance a signal if the white balance is off. They can also be used for look creation such as film emulation.

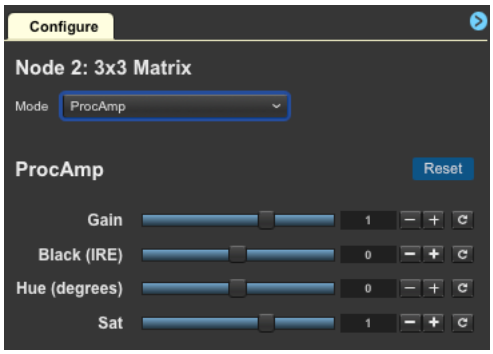
Available options are:

- Matrix
- Dynamic
- Proc Amp
- SMPTE Narrow to SMPTE FULL
- SMPTE FULL to SMPTE Narrow

Proc Amp

In the AJA Color Pipeline, 3x3 Matrices can be set up as Proc Amps for adjusting a signal's Gain, Black level, Hue, and Saturation before 3D LUT processing. This is a common workflow in live production applications.

Figure 28. Proc Amp Controls



NOTE: Proc Amps are also available with the BBC HLG LUTs and NBCU LUTs pipelines.

3D LUT Node

This primary 33-point 3D LUT uses tetrahedral interpolation for the highest accuracy conversion. 3D LUTs provide full volumetric non-linear color adjustment and a 33-point 3D LUT is a requirement for color managed and monitor calibration workflows. Similarly, high end movie and television productions depend on 3D LUT processing for look generation, distribution, and management.

When set to Dynamic, the 3D LUT is fully controllable through 3rd party software like Pomfort's Livegrade and Assimilate Live Looks.

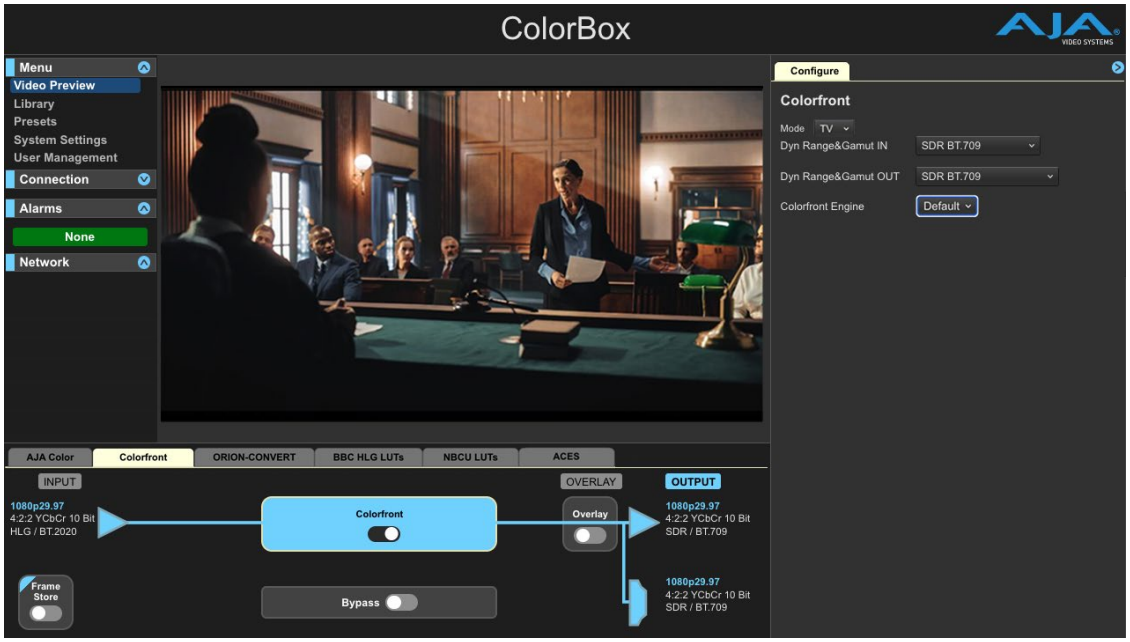
Available options are:

- LUT
- Dynamic

Dynamic LUTs

A node can be configured for Dynamic LUT operation and be controlled by a third-party Look Management system, providing real-time modification of LUT information. Dynamic LUT operation allows a third party application to transfer LUTs to the ColorBox over Ethernet without user intervention. As changes are made to the LUT in the third party application, the new LUT is instantly loaded into the ColorBox's node. Dynamic LUT operational procedures will vary, depending on the third party application being used.

Colorfront Pipeline



NOTE: The Frame Store, Bypass, and Overlay controls are available on all ColorBox pipeline modes, and their settings are applied to all the other pipeline modes. These settings are also saved to Presets.

Colorfront Standard Capabilities

ColorBox HDR/WCG capabilities leverage video and color space processing algorithms within the Colorfront Engine, specially licensed by AJA from Colorfront. Colorfront offers a Color Processing Pipeline with set and forget SDR and HDR transforms designed for use wherever HDR productions are performed. The Colorfront Pipeline includes:

- Built-in SDR, HLG, and PQ transforms
- Optimized transforms designed for broadcast television workflows
- Maintains perceptual integrity
- Full bypass node for 12G-SDI and HDMI v2.0
- Support for ITU BT.2408, Operational Practices in HDR Television Production

Dyn Range&Gamut IN

- SDR BT.709
- PQ BT.2020
- HLG BT.2100

Dyn Range&Gamut OUT

- SDR BT.709
- PQ BT.2020
- HLG BT.2100

Colorfront Optional Licensed Capabilities

This license is required to be purchased to enable Colorfront Live Mode, SDR to Dolby Vision Preview, parametric controls of TV Mode, and TV mode Sony SLog3 support.

NOTE: Watermarks are added to the ColorBox's video output when an unlicensed pipeline is being used. This lets you test the color science in advance of purchase.

Figure 29. Watermarked Content in Unlicensed Mode

Colorfront TV Mode

ColorBox's Colorfront TV Mode provides operators access to new Brightness, Highlight, Super Highlight, and Colorfulness tools that enable greater control over critical elements in color conversions. With this expanded toolset, get controlled corrections within the guardrails of Colorfront's perceptual processing algorithm, which will maintain perceived color, hue, and saturation without hard clipping artifacts. TV Mode also includes Sony S-Log3 conversions as part of the license upgrade, which have proven advantageous in modern live production applications.

NOTE: ColorBox v 2.0 firmware includes significant modifications to Colorfront Engine TV Mode parameters. A preset with TV Mode color settings saved using an earlier firmware version may not reproduce the originally intended color adjustments if that Preset is recalled by a ColorBox running v2.0 or newer firmware.

When Colorfront TV Mode is selected, the following profiles are available:

DynRange&Gamut IN

SDR BT.709 (default)	Standard Dynamic Range input with BT.709 color space.
HLG BT.2020	HDR input with HLG curve and BT.2020 color space.
PQ BT.2020	HDR input with PQ curve and BT.2020 color space.
Sony SLog3 BT.2020	A Sony proprietary format with wide dynamic range and a BT.2020 color space.

DynRange&Gamut OUT

SDR BT.709 (default)	Standard Dynamic Range input with BT.709 color space.
HLG BT.2020	HDR input with HLG curve and BT.2020 color space.
PQ BT.2020	HDR input with PQ curve and BT.2020 color space.
PQ BT.2020 ConstrainP3	HDR input with PQ curve and BT. 2020 color space, constrained to P3.
Sony SLog3 BT.2020	A Sony proprietary format with wide dynamic range and a BT.2020 color space.

Colorfront Engine

The Colorfront Engine parameter Enables and Disables Colorfront Engine user adjustments.

Default	Colorfront Engine settings are set to default, but adjustment settings are retained, allowing easy A/B visual comparison.
Adjust	Currently configured Colorfront adjustments are reapplied to the system output. In this mode further adjustments can be made.

When Default is selected all Colorfront settings are temporarily reset. When Adjust is selected, the previously set Colorfront adjustments are restored, and additional Colorfront parameters become available for further adjustment:

Reset Button

Click on the **Reset** button reset the Colorfront settings in Adjust menu to unity. This reset cannot be undone.

Brightness

Adjusts the overall brightness or darkness of an image. It is "display-referred" brightness or gain. Even when set to maximum it does not clip, and performs a perceptual roll off maintaining proper color and hue. Brightness adjustments are perceptually constant, that is, the perceived color, hue, and saturation remain constant.

- Range -1.00 to +1.00 (default 0)

Highlight

Adjusts the highlight brightness of the picture from midtones to highlights. This control is usually used in tandem with Brightness, to alter the remap grayscale. Highlight adjustments are perceptually constant, that is, the perceived color, hue, and saturation remain constant.

- Range -1.00 to +1.00 (default 0)

Super Highlight

Adjusts the extreme highlights or bright areas of an image, and does not affect the bottom end of the signal. These adjustments are perceptually constant, that is, the perceived color, hue, and saturation remain constant.

- Range -1.00 to +1.00 (default 0)

Colorfulness

Adjusts perceptual colorfulness as opposed to mathematical saturation, overriding the colorfulness compensation in the perceptual model. As an image gets brighter, its apparent colorfulness increases, and, conversely, as it gets dimmer, it appears less colorful (Hunt effect). The default setting conforms to the ideal perceptual mapping.

- Range -1.00 to +1.00 (default 0)

Color Corrector

Colorfront Engine TV Mode incorporates its own color corrector, separate from the ColorBox's Color Corrector available in other modes. The parameters available when this Color Corrector is on include:

Master Lift	Red Lift	Green Lift	Blue Lift
Master Gamma	Red Gamma	Green Gamma	Blue Gamma
Master Gain	Red Gain	Green Gain	Blue Gain
Saturation			

Camera Correction

Enables or disables Exposure, Color Temp, and Tint adjustments.

Off (default)	Camera correction settings are not applied, hiding the following parameters.
On	Camera correction settings are applied, and can be adjusted using the following parameters.

Exposure

Scene referred linear light adjustment to compensate for scene lighting intensity. The Exposure control is the equivalent of adjusting the number of photons landing on the camera sensor.

- Range +4.00/-4.00 (default 0.00)

Color Temp

Scene referred linear light adjustment to compensate for color temperature. The Color Temp control affects the image the same as changing the lighting color temperature in front of the camera.

- Range + 10.00/-10.00 (default 0.00)

Tint

The Tint Control compensates for the coloration that most neutral-density (ND) filters add to the image. Adjusts an equivalent of an image's color tint.

- Range +16.00/-16.00 (default 0.00)

Roundtrip

For SDR to HDR and back to SDR conversions, turning this control On maintains a roundtrip technical vectorscope match, at the expense of a slight reduction in an ideal perceptual match. This only affects color, not the grayscale. For the best picture result, leave this setting at the default Off setting. Roundtrip should only be used for special cases.

- Select On or Off (default).

Clamp to Legal

Brightness settings can reach up to 108%. Turning this control On ensures the brightness maximum stays at 100%. This setting does not clip the signal, but instead performs a perceptual clamp maintaining the original perceived color, hue, and saturation.

- Select On or Off (default).

Colorfront Live Mode

ColorBox's Colorfront Live mode is designed primarily for broadcast style workflows, supporting a variety of color space formats, including camera log.

When Live Mode is selected, the following parameters are available:

DynRange&Gamut IN

This parameter is used to identify the Dynamic Range, OETF, and Color Gamut of the incoming video. This information is used by the Video Processor to choose the appropriate internal processing to be used with that input signal. The following profiles are available:

SDR BT.709 100 Nits (default)	Standard Dynamic Range input with BT.709 color space.
SDR Extended BT.709	Standard Dynamic Range input with BT.709 color space with values between SMPTE and Full Range Max preserved.
PQ BT.2020 1000 Nits	HDR input with PQ curve and BT.2020 color space.
PQ P3D65 1000 Nits	HDR input with PQ curve and P3 (cinema) color space.
Hybrid Log Gamma BT.2100	HDR input with HLG curve and BT.2100 color space.
HLG Extended BT.709	BT.709 color space, values between SMPTE and Full Range Max are preserved for more headroom, and support for HLG superwhites.
HLG Extended BT.2100	BT.2020 color space, values between SMPTE and Full Range Max are preserved for more headroom, and support for HLG superwhites.
Sony SLog3 S-Gamut3	A Sony proprietary format with wide dynamic range and an almost native camera color space.
Sony SLog3 S-Gamut3 Cine	A Sony proprietary format with wide dynamic range and a slightly wider than DCI-P3 color space.
Sony SLog3 BT.2020	A Sony proprietary format with wide dynamic range and a BT.2020 color space.
ARRI Log C Wide Gamut	ARRI Log C proprietary camera format.
ARRI LogC4 Wide Gamut 4	ARRI LogC4 proprietary camera format.
ARRI LogC4 Wide Gamut 4 WVO	ARRI LogC4 proprietary camera format with WVO decoder.
Panasonic V-Log	A Panasonic proprietary camera format.
RED Log3G10 Wide Gamut	A RED proprietary camera format.
Canon Log 2	Canon Log 2 proprietary camera format.
Canon Log 3	Canon Log 3 proprietary camera format.

DynRange&Gamut OUT

This parameter can be used to specify the Dynamic Range, OETF, and Color Gamut of the outgoing video, and determines the color conversion (if any) to be applied. The following profiles are available:

SDR BT.709 100 Nits (default)	Standard Dynamic Range output with BT.709 color space.
SDR Extended BT.709	Standard Dynamic Range input with BT.709 color space with values between SMPTE and Full Range Max preserved.
PQ BT.2020 1000 Nits	HDR output with PQ curve and BT.2020 color space.
PQ P3D65 1000 Nits	HDR output with PQ curve and P3D65 color space.
Hybrid Log Gamma BT.2100	HDR output with HLG curve and BT.2100 color space.
HLG Extended BT.709	BT.709 color space, values between SMPTE and Full Range Max are preserved for more headroom, and support for HLG superwhites.
HLG Extended BT.2100	BT.2020 color space, values between SMPTE and Full Range Max are preserved for more headroom, and support for HLG superwhites.
Sony SLog3 S-Gamut3	A Sony proprietary format with wide dynamic range and an almost native camera color space.
Sony SLog3 BT.2020	A Sony proprietary format, with wide dynamic range and a BT.2020 color space.
ARRI Log C Wide Gamut	ARRI Log C proprietary camera format.
ARRI LogC4 Wide Gamut 4	ARRI LogC4 proprietary camera format.

SDR Preview

Allows users to quickly preview what an HDR signal may look like on an SDR monitor, without having to switch between HDR and SDR modes on that monitor (which may go black during the change-over). The default setting is Off, and this generally should be used during production. When set to On, the HDR signal is cleanly transformed to SDR, allowing quick A/B comparison on an HDR display in HDR mode.

NOTE: The SDR Preview parameter only applies when the ColorBox's Dyn Range&Gamut OUT parameter is set to HDR (PQ or HLG).

Off (default) On	Off (no preview processing). Output is transformed to 100 Nits SDR.

Colorfront Engine

The Colorfront Engine parameter Enables and Disables Colorfront Engine user adjustments.

Default	Colorfront Engine settings are set to default, but adjustment settings are retained, allowing easy A/B visual comparison.
Adjust	Currently configured Colorfront adjustments are reapplied to the system output. In this mode further adjustments can be made.

When Default is selected all Colorfront settings are temporarily reset. When Adjust is selected, the previously set Colorfront adjustments are restored, and additional Colorfront parameters become available for further adjustment:

Reset Button

Click on the **Reset** button reset the Colorfront Settings in Adjust menu to unity. This reset cannot be undone.

HDR Amount

This adjustment guides the Colorfront Engine's color volume expansion algorithm. The setting applies to all conversions whether SDR to HDR, HDR to HDR, HDR to SDR, and SDR to SDR.

- Range +/-1.00, Default 0.00

Amb Light Comp

Ambient Light Compensation adjusts the signal based on the intended ambient light settings of the of the mastering or viewing environment. Of course a variety of ambient light environments exist, but this knob may be useful, for example, at an outdoor sports stadium when driving an LED scoreboard and video display at either mid-day or at night.

- Range +/-1.00, Default 0.00

HDR Log Look

If the Input Dynamic Range and Gamut is set to a Log format (e.g. Sony S-Log3 or Canon Log3), this control adjusts the look between dramatic (cinema) and broadcast (television), with dramatic being 0.0 and broadcast 1.0.

- Range +1.00/0.00, Default 0.500

NOTE: This parameter only applies if the ColorBox's input is a camera log format.

SDR Softness

If the Input Dynamic Range and Gamut is set to SDR BT.709 100 Nits, this control adjusts how the SDR brights/highlights are mapped into brights and speculars of the 1000 nit HDR output range. This control can be used to accommodate SDR source material that was produced at different "knee" points and slopes.

- Range +1.00/0.00, Default 0.00

NOTE: This parameter only applies if the ColorBox's input is SDR.

Master Lift

Simultaneously adjusts the bottom side of the Reds, Greens, and Blues.

- Range +/-1.00, Default 0.00

Red Lift

Adjusts the bottom side of the Reds.

- Range +/-1.00, Default 0.00

Green Lift

Adjusts the bottom side of the Greens.

- Range +/-1.00, Default 0.00

Blue Lift

Adjusts the bottom side of the Blues.

- Range +/-1.00, Default 0.00

Master Gamma

Simultaneously adjusts the midlevel (between shadows and highlights) of the Reds, Greens, and Blues.

- Range +2.00/0.00, Default 1.00

Red Gamma

Adjusts the midlevel (between shadows and highlights) of the Reds.

- Range +2.00/0.00, Default 1.00

Green Gamma

Adjusts the midlevel (between shadows and highlights) of the Greens.

- Range +2.00/0.00, Default 1.00

Blue Gamma

Adjusts the midlevel (between shadows and highlights) of the Blues.

- Range +2.00/0.00, Default 1.00

Master Gain

Simultaneously adjusts the top side of Reds, Greens, and Blues.

- Range +5.00/0.00, Default 1.00

Red Gain

Adjusts the top side of the Reds.

- Range +5.00/0.00, Default 1.00

Green Gain

Adjusts the top side of the Greens.

- Range +5.00/0.00, Default 1.00

Blue Gain

Adjusts the top side of the Blues.

- Range +5.00/0.00, Default 1.00

Saturation

Adjusts the chrominance saturation of the signal. At 0.0 a monochrome image is created.

- Range +2.00/0.00, Default 1.00

Exposure

Scene referred linear light adjustment to compensate for scene lighting intensity. The Exposure control is the equivalent of adjusting the photons landing on the camera sensor.

- Range +4.00/-4.00, Default 0.00

Color Temp

Scene referred linear light adjustment to compensate for color temperature. The Color Temp control affects the image the same as changing the lighting color temperature in front of the camera.

- Range +10.00/-10.00, Default 0.00

Tint

The Tint Control compensates for the coloration that most neutral-density (ND) filters add to the image.

- Range +16.00/-16.00, Default 0.00

PQ Output Nit Level

This parameter sets the maximum output Nit level for a PQ signal. Currently almost all PQ production is mastered to 1000 Nits maximum, so a processing step is required to fit any video data above 1000 nits down to 1000 nits or less. The Colorfront Engine transform remaps PQ output video data above the set level.

- Variable adjustments from 48-4000 Nits, default 1000 Nits.

NOTE: This parameter only applies if the ColorBox's Dyn Range&Gamut OUT setting is PQ BT.2020 1000 Nits.

P3 Colorspace Clamp

This parameter limits the PQ output video data to be within the P3 gamut. If the Clamp is on and the output signal contains colors that extend past P3 into BT.2020, the Colorfront Engine transform will remap PQ output video data to be within P3.

- Select On or Off (default).

NOTE: This parameter only applies if the ColorBox's Dyn Range&Gamut OUT setting is PQ BT.2020 1000 Nits.

BT.2408 Mode

This function provides a transform that meets the targets defined in the ITU publication ITU-R BT.2408 Operational Practices in HDR Television Production for converting SDR to HDR or HDR to SDR. Specifically, 100% reference white is mapped to 203 nits in 1000 nit HDR, which is a 75% signal level in HLG and 58% signal level in PQ, and vice versa.

- Range 0.00/+1.00, Default 0.0
- When set to 0, this function is off (no BT.2408 mapping)
- When set to 1, the function is on (full BT.2408 mapping)
- Values between 0 and 1 will apply an intermediate BT.2408 mapping.

NOTE: This parameter only applies to SDR > HDR (PQ or HLG), or HDR (PQ or HLG) > SDR conversions.

Colorfront SDR to Dolby Vision Preview Mode

ColorBox's Colorfront SDR to Dolby Vision Preview mode, together with Colorfront Transkoder, enables productions to deliver HDR/Dolby Vision content more rapidly while keeping costs low. With the same simple set of controls for highlight and contrast in both products, colorists can grade in SDR and preview in real-time what the Dolby Vision HDR will look like using ColorBox prior to Transkoder encoding it with the proper Dolby Vision metadata. This enables fast creation of Dolby Vision HDR graded content that guarantees a precise roundtrip match between the original and derived SDR content. While the tool is primarily used for preview, it can also be applied as an SDR to HDR conversion in live production to produce a perceptually matching HDR output.

NOTE: ColorBox does not produce Dolby Vision metadata.

When SDR to Dolby Vision Preview Mode is selected, the following parameters are available:

Highlights

Influences the brightness of pixels and determines the HDR level by specifying the intensity of bright pixels.

Low Mid (default) High	300 Nits 600 Nits 1000 Nits

Contrast

Specifies contrasts between blacks and whites.

Low Mid (default) High	Diminishes the darkness of blacks and reduces the brightness of whites. Balanced darkness of blacks and brightness of whites. Intensifies the darkness of blacks and enhances the brightness of whites.

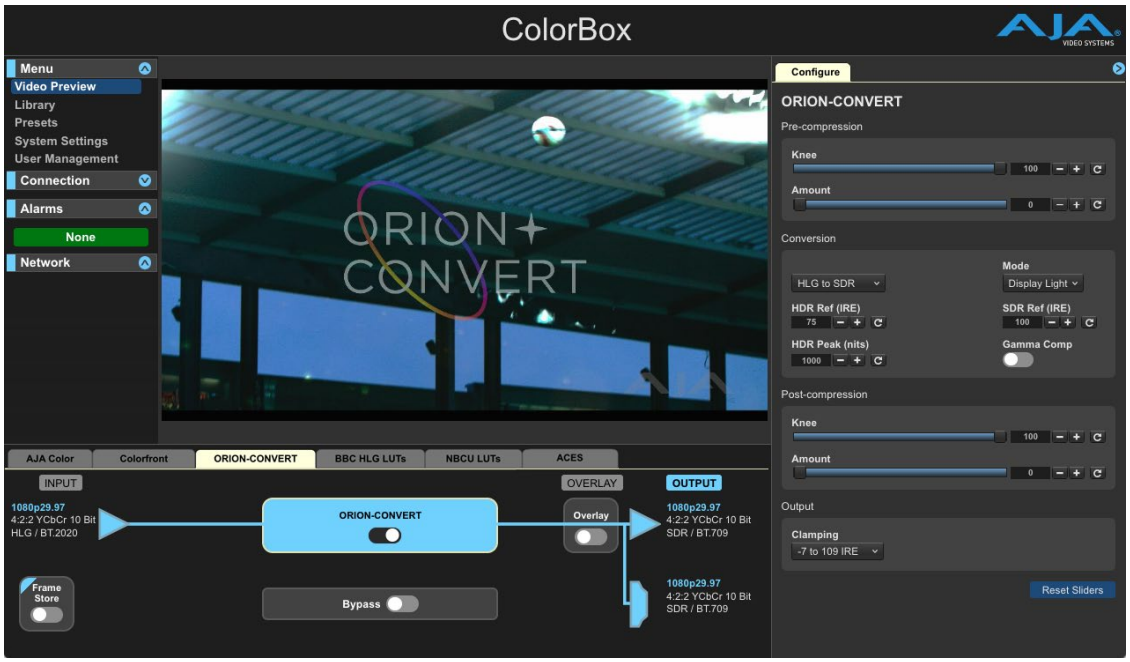
Bypass

Similar function to turning the Colorfront node to off or enabling the Bypass node in the pipeline UI. Options are Off (default), On.

Reset

Resets Colorfront SDR to Dolby Vision Preview parameters to default states.

ORION-CONVERT Pipeline



NOTE: The Frame Store, Bypass, and Overlay controls are available on all ColorBox pipeline modes, and their settings are applied to all the other pipeline modes. These settings are also saved to Presets.

Overview

ORION-CONVERT brings the power of Cromorama color science to real time hardware based conversion. ORION-CONVERT offers the necessary tools for broadcasters to create and deliver the HDR and SDR content consumers expect from a single master HDR workflow by providing critical controls required to set up the right conversion for your production. By being able to set the HDR and SDR reference anchor points in an HDR to SDR conversion, you can target a SDR program output that suits your markets' SDR display needs. You can target 200 nits SDR resulting in a much more representative image for the camera shader and a more vibrant HDR image for the viewer at home or target a perceptual match at 100 nits SDR. Also, in an HDR to SDR conversion, the unique 2 stage knee offers a pre-conversion compression in HDR only and a post-conversion compression in SDR only providing very effective roll off management control.

NOTE: Watermarks are added to the ColorBox's video output when an unlicensed pipeline is being used. This lets you test the color science in advance of purchase.

This is a licensable upgrade and includes:

- Conversions utilizing floating point math for higher precision results
- SDR, HLG and PQ transforms
- Scene-light and Display-light modes
- 2 stage Knee adjustment for pre and post conversion compression or expansion
- Compression amount control in HDR to SDR conversions
- Expansion amount control in SDR to HDR conversions
- Configurable SDR and HDR reference anchor points
- HDR Peak Nit sets the system gamma for display light conversions
- Gamma Compensation setting to compensate for the subjective change in appearance between SDR and HDR
- Easy to configure pixel perfect round tripping
- Clamping options
- Full bypass node for 12G-SDI and HDMI v2.0
- Support for ITU BT.2408, Operational Practices in HDR Television Production

ORION-CONVERT Configure Pane Description

When the ORION-CONVERT node is selected in that pipeline, the Configure pane shows an array of dynamic controls, which can vary depending on the direction of conversion selected. Parameter controls not appropriate for a selected conversion type will be grayed out. All conversions have an Output/Clamping control.

The following groups of parameters are available for each conversion type:

Table 1. Conversion Direction Parameter Groups

Conversion Direction	Pre-compression	Post-compression	Pre-expansion	Post-expansion
HLG to SDR	X	X		
SDR to HLG			X	X
HLG Compress	X			
PQ to SDR	X	X		
SDR to PQ			X	X
PQ Compress	X			
HLG to PQ			X	X

Conversion Direction	Pre-compression	Post-compression	Pre-expansion	Post-expansion
PQ to HLG	X	X		

ORION-CONVERT Parameters

Pre-compression/Pre-expansion

Knee - This controls the breakpoint where compression or expansion begins on the selected "input" signal for the conversion. Example: In an up-conversion (SDR to HDR), the breakpoint will be applied at this level to boost the SDR into the HDR domain, but may be moved by the subsequent Post-conversion process.

Amount - This controls the amount of compression in down-conversion and expansion in up-conversion. When compressing, a value of zero applies no compression (at which point the value of Knee is irrelevant) and a value of 1 will compress completely, flattening everything above the value of Knee to that value.

Conversion

Direction

Here you choose the direction of the colorimetric conversion needed. Select from:

- HLG to SDR
- SDR to HLG
- HLG Compress
- PQ to SDR
- SDR to PQ
- PQ Compress
- HLG to PQ
- PQ to HLG

NOTE: After finding the settings desired for the conversion (pre-compression and post-compression), if the direction of the conversion is then reversed, the values of pre and post compression are swapped to generate an absolute mathematical inverse. This way, a visually lossless round trip is possible.

Mode

Display light - Display-Light mapping is used when the goal is to preserve the colors and relative tones seen on an SDR BT.709 or BT.2020 display, when the content is shown on a BT.2100 HDR display (or on an SDR display depending on the direction of the conversion). An example of which is the inclusion of SDR graded content within an HDR program. This type of conversion, for example, would be used for graphics insertion. These elements are mostly designed (creative intent) in an sRGB environment, so to preserve this creative intent, we want to represent these elements exactly as they were seen at the time of their creation.

Scene light - Scene-Light mapping is used where the source is a direct SDR camera output or an HDR camera output, and the goal is to match the colors and tones of that camera to another camera source after conversion. We would use these conversions when the appearance of the content, as seen by a camera, is the intended process. For example, when using the SDR output

of a Camera (as camera splits/isos, etc.) that can simultaneously produce SDR and HDR, we want the HDR program (after conversion to SDR) to match in the best way possible. It depends very much on the camera manufacturer as some have creative tools independent for HDR and SDR outputs. Matching configuration settings to the HDR converted signal "look" for the SDR output must be found and locked.

HDR and SDR Reference Points

This controls the HDR and SDR "anchor points". At the default settings of 75 and 100, for example for an HLG to SDR conversion, if no compression or expansion is applied, 75% HLG will be mapped to exactly 100% SDR (direct mapping). If any compression is applied on the pre-compression, then the absolute colorimetric conversion to SDR is performed, scaled based on the selected HLG Ref and SDR Ref. However, if these values are above the pre-compression and/or post-compression points, the correspondence will be shifted.

HDR Peak

The peak luminance (referred to as LW in ITU-R BT.2100) in Nits of the 'virtual HLG display` used in conversion calculations. This is normally left at the default value of 1000, but could, for example, be reduced to 392 which is the value for an HLG display which produces 100 nits at 75% IRE.

This does not affect the relative scaling of HDR and SDR, as that is controlled by the HDR Ref and SDR Ref above. But it does control the gamma of the HLG OOTF as defined in ITU-R BT.2100.

NOTE: This value is not used in scene-light conversions.

Gamma Comp

Gamma Compensation sets a parameter that makes SDR transforms compatible with different transforms philosophies. This is a luminance only gamma modification described in Rep. ITU-R BT.2408-5 and is indicated as "optional". Testing has shown that when SDR gamma is increased as specified, the shadow region is lifted excessively, producing milky shadows, so subsequent shadow compression is needed to revert the shadow region to its original state, and so the gamma adjustment is applied only to the mid-tones.

Post-compression/Post-expansion

Knee - This slider controls the threshold at which compression (for down-conversion) or expansion (for up-conversion) begins. Example: A value of 50 places this at 50% SDR IRE in a down-conversion. The start of the compression will be seen at this value on a waveform monitor because this compression is the last step of the process.

Amount - This controls the amount of compression in down-conversion and expansion in up-conversion. When compressing, a value of zero applies no compression (at which point the value of Knee is irrelevant) and a value of 1 will compress completely, flattening everything above the value of Knee to that value.

Output

Clamping

Internally the result of the conversion is unclamped float, meaning that even HDR values that cannot be represented on an SDR display after conversion, will be converted to SDR values outside the displayable range. When outputting over SDI, it is necessary to limit the range of the output. This control applies a clamp to the output R'G'B' values.

Select from:

- Unclamped (clamping will still occur in the hardware output)
- Clip sub-blacks
- -7 to 109 IRE (SDI permissible range)
- -5 to 105 IRE (EBU R 103 preferred range)
- 0 to 100 IRE

Reset Sliders

Click to reset slider controls to default values.

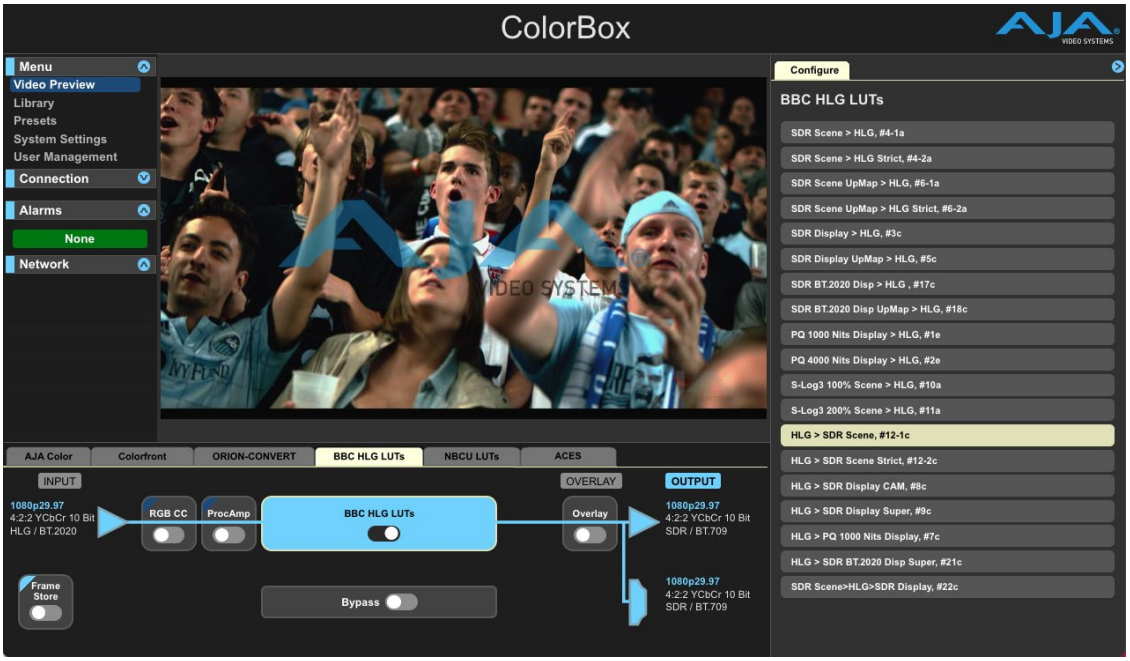
ORION-CONVERT Workflow Example

Round Trip Conversion

Thanks to the core design of the ORION-CONVERT algorithm, it is very easy and fast to create a conversion round trip (up-map and down-map). In the Conversion section of the Configure pane, select the direction of conversion method from the drop down menu. Set all other parameters relevant to your conversion (HDR Peak, etc.).

1. Choose one of the conversions needed (we recommend starting with an HDR to SDR for example) and feed content into the device.
2. Choose on the drop-down menu the direction of the conversion and select the method you would like to use and all other parameters relevant to your conversion (HDR Peak, etc.)
3. Now you are all set to start creating your highlight compression/expansion using the powerful pre and post sliders.
4. Once you've found the desired result, simply invert the direction of the conversion on the drop-down menu and you will get an absolute mathematical invert to ensure a clean round trip.

BBC HLG LUTs Pipeline



NOTE: The Frame Store, Bypass, and Overlay controls are available on all ColorBox pipeline modes, and their settings are applied to all the other pipeline modes. These settings are also saved to Presets.

The BBC HLG LUTs Pipeline offers licensed 3D LUTs that add field proven HDR conversion options, particularly for television broadcasters who are looking for specific conversion criteria. This mode provides a RGB Color Corrector (see *"RGB Color Corrector" on page 33*) and Proc Amp (see *"Proc Amp" on page 33*) to color correct the signal prior to conversion.

NOTE: Watermarks are added to the ColorBox's video output when an unlicensed pipeline is being used. This lets you test the color science in advance of purchase.

This is a licensable option and includes:

- SDR, PQ, and S-Log3 to HLG
- HLG to SDR and PQ
- Scene-light and Display-light conversions
- Utilizes 33-point Tetrahedral 3D LUT Interpolation
- Proc Amp and Color Corrector
- Full bypass node for 12G-SDI and HDMI v2.0
- Support for mathematical HLG HDR dynamic range mapping per ITU BT.2408

BBC HLG LUT Conversions

Description abbreviations:

SDR = Standard Dynamic Range

PQ = High Dynamic Range using Perceptual Quantization curve

HLG = High Dynamic Range using Hybrid Log Gamma curve

Scene = Scene Referred

Display = Display Referred

P3 = RGB color space for digital movie projection

Table 2. Convert to HLG, BBC HLG LUT Detailed Information

BBC HLG LUT Number and Name	Description
#4-1a, v1.7 SDR Scene > HLG	For use with most compact SDR cameras that approximate the BT.709 OETF with a square root. BT.709 signals are directly-mapped into BT.2100 HLG at the BT.2408 signal levels using a scene-light conversion. The "look" of the original BT.709 content is changed to match the subjective look of "native" BT.2100 HLG cameras. 100% SDR signal is directly-mapped to 75% HLG ("HDR Reference White"). This LUT is intended to be used with compact SDR cameras with a limited dynamic-range, so no highlight "boost" is applied.
#4-2a, v1.7 SDR Scene > HLG Strict	For use with compact SDR cameras that implement a strict BT.709 OETF. BT.709 signals are directly-mapped into BT.2100 HLG at the BT.2408 signal levels, using a scene-light conversion. The "look" of the original BT.709 content is changed to match the subjective look of "native" BT.2100 HLG cameras. 100% SDR signal is mapped to 75% HLG ("HDR Reference White"). This LUT is intended to be used with compact SDR cameras with a limited dynamic-range, so no highlight "boost" is applied. NOTE: Unlike BT.2100 HLG, SDR cameras that implement a strict BT.709 OETF tend to crush detail in the shadows of a scene. Such detail will become more evident after applying this conversion. It is often better to adjust the SDR camera's native OETF to approximate a square root (which provides a better match to HLG) and then use LUT 4-1 rather than this LUT.
#6-1a, v1.7 SDR Scene UpMap > HLG	For use with SDR cameras that approximate the BT.709 OETF with a square root. BT.709 signals are up-mapped (inverse tone-mapped) to BT.2100 HLG, using a scene-light conversion. The "look" of the original BT.709 content is changed to match the "look" of native BT.2100 HLG cameras. While the ITU-R BT.2408 signal levels are taken into account, a small boost is applied to the SDR highlights so that there is a close match to natively produced HDR content. 100% SDR signal is up-mapped to 79% HLG. 105% SDR signals (EBU R.103 "preferred range" signals) are up-mapped to 83% HLG.
#6-2a, v1.7 SDR Scene UpMap > HLG Strict	For use with SDR cameras that implement a strict BT.709 OETF BT.709 signals are up-mapped (inverse tone-mapped) to BT.2100 HLG using a scene-light conversion. The "look" of the original BT.709 content is changed, so that the native look of BT.2100 HLG cameras is achieved. While the ITU-R BT.2408 signal levels are taken into account, a small boost is applied to the SDR highlights so that there is a closer match to natively produced HDR content. A 100% SDR signal is up-mapped to 79% HLG. 105% SDR signals (EBU R.103 "preferred range" signals) are up-mapped to 83% HLG. NOTE: Unlike BT.2100 HLG, SDR cameras that implement a strict BT.709 OETF tend to crush detail in the shadows of a scene. Such detail will become more visible after applying this conversion. It is often better to adjust the SDR camera's native OETF to approximate a square root (which provides a better match to HLG) and then use LUT 6-1.
#3c, v1.7 SDR Display > HLG	For use with SDR Graphics. BT.709 signals are directly-mapped into BT.2100 HLG at the BT.2408 signal levels using a display-light conversion. The "look" of the original BT.709 content is therefore preserved on conversion. A 100% SDR signal is mapped to 75% HLG ("HDR Reference White").
#5c, v1.7 SDR Display UpMap > HLG	For use with SDR Graded Content. BT.709 signals are up-mapped (inverse tone-mapped) to BT.2100 HLG using a display-light conversion. This LUT is designed to complement LUTs 8 and 9 (BT.2100 HLG to BT.709 down-mapping) so that losses associated with 'round-tripping' (i.e. SDR-to-HDR-to-SDR conversion) are minimized. While the ITU-R BT.2408 signal levels are taken into account, a modest boost is applied to the SDR highlights so that there is a closer match to natively-produced HDR content. The LUT does, however, attempt to preserve the artistic intent of the original BT.709 content. 100% SDR signal is up-mapped to 82% HLG.
#17c, v1.7 SDR BT.2020 Disp > HLG	For use with SDR Graded Content. BT.2020 signals are directly-mapped into BT.2100 HLG at the BT.2408 signal levels using a display-light conversion. The "look" of the original BT.2020 content is therefore preserved on conversion. A 100% SDR signal is mapped to 75% HLG ("HDR Reference White").

BBC HLG LUT Number and Name	Description
#18c, v1.7 SDR BT.2020 Disp UpMap > HLG	For use with SDR BT.2020 Graded Content. BT.2020 signals are up-mapped (inverse tone-mapped) to BT.2100 HLG using a display-light conversion. While the ITU-R BT.2408 signal levels are taken into account, a modest boost is applied to the SDR highlights so that there is a closer match to natively produced HDR content. The LUT does, however, attempt to preserve the artistic intent of the original BT.2020 content. 100% SDR signal is up-mapped to 82% HLG.
#1e, v1.7 PQ 1000 Nits Display > HLG	For use with Graded Content. BT.2100 PQ signals are converted to BT.2100 HLG in the 1000 cd/m2 "bridge" condition, so that 1000 cd/m2 PQ maps to 100% HLG. Please refer to ITU-R report BT.2390 Section 7.2 ("Conversion concepts using a reference condition at 1000 cd/ m2"). With the Type III LUTs, PQ signals above 1000 cd/m2 are mapped into the HLG "superwhite" signal range up to 109% signal, equivalent to 1811 cd/m2 (PQ).
#2e, v1.7 PQ 4000 Nits Display > HLG	For use with Graded Content. 4000 cd/m2 BT.2100 PQ signals are converted to BT.2100 HLG by first tone-mapping to the 1000 cd/m2 "bridge" condition, and then converting to HLG. The tone-mapping is applied to the luminance component so that hue distortions are avoided NOTE: that 4000 cd/m2 PQ maps to 100% HLG. For more information, please refer to ITU-R report BT.2390 Section 7.4 ("Handling PQ signals with greater than 1000 cd/m2 peak-luminance"). With Type III LUTs, PQ signals above 4000 cd/m2 are mapped into the HLG "super-white" signal range.
#10a, v1.7 S-Log3 100% Scene > HLG	For use with Sony S-Log3 cameras in non-live workflows. S-Log3 (BT.2020 color) signals produced using the Sony's "100%" workflow (i.e. 100% IRE input equals 90% reflectance) are converted to BT.2100 HLG with ITU-R BT.2408 signal levels. A 100% IRE input signal (90% reflectance) thus maps to 73% HLG. A scene-light conversion is used, so that the converted S-Log3 signal is a close subjective-match to the "look" of BT.2100 HLG cameras.
#11a, v1.7 S-Log3 200% Scene > HLG	For use with Sony S-Log3 cameras in "SR Live" workflows. S-Log3 (BT.2020 color) signals produced using Sony's "SR Live" "200%" workflow (i.e. 200% IRE input equals 90% reflectance) are converted to BT.2100 HLG with ITU-R BT.2408 signal levels. A 200% IRE input signal (90% reflectance) thus maps to 73% HLG. 200% workflows are commonly encountered whenever the S-Log3 curve has been used in live productions. A scene-light conversion is used, so that the converted S-Log3 signal matches the "look" of BT.2100 HLG cameras.

Table 3. Convert from HLG, BBC HLG LUT Detailed Information

BBC HLG LUT Number and Name	Description
#12-1c, v1.7 HLG > SDR Scene	For matching downstream SDR cameras that approximate the BT.709 OETF with a square root function. BT.2100 HLG signals are down-mapped (tone-mapped) to BT.709, using scene-light conversion. The "look" of the original BT.2100 HLG content is changed to match "native" BT.709 cameras with a square-root approximation of the BT.709 OETF. This LUT is the exact inverse of LUT 6-1 (BT.709 to BT.2100 up-mapping, scene-light), so that the losses associated with 'roundtripping' (i.e. SDR-to-HDR-to-SDR conversion) are minimized. "HDR Reference White" (75% HLG) is tone-mapped to 95% BT.709, allowing for some soft-clipping of highlights. A 79% HLG signal is tone-mapped to 100% BT.709. With Type III LUTs that process sub-blacks and super-whites, the LUT outputs are clipped to EBU R.103 signal levels. The 3D-LUT interpolation errors are greatest for the HDR to SDR down-mapping LUTs, as the output signals reach the extremities of the RGB signal range. For that reason, in addition to the "ideal" output values for the EBU Tech 3373 HLG Color Bars, we also provide the expected output values from a trilinear interpolator. Errors should be smaller with tetrahedral interpolation, the 65-cubed LUTs and also with real pictures.

BBC HLG LUT Number and Name	Description
#12-2c, v1.7 HLG > SDR Scene Strict	For use with SDR cameras that implement a strict BT.709 OETF. BT.2100 HLG signals are down-mapped (tone-mapped) to BT.709, using a scene-light conversion. The "look" of the original BT.2100 HLG content is changed to match "native" BT.709 cameras, with a strict implementation of the BT.709 OETF. This LUT is the exact inverse of LUT6-2 (BT.709 to BT.2100 HLG inverse tone-mapping, scene-light), so that the losses associated with 'round-tripping' (i.e. SDR-to-HDR-to-SDR conversion) are minimized. "HDR Reference White" (75% HLG) is tone-mapped to 95% BT.709, allowing for some soft-clipping of highlights. 79% HLG signal is tone-mapped to 100% BT.709. With Type III LUTs that process sub-blacks and super-whites, the LUT outputs are clipped to EBU R.103 signal levels. NOTE: Unlike BT.2100 HLG, SDR cameras that implement a strict BT.709 OETF tend to crush detail in the shadows of a scene. Shadow-detail visible in the HDR image will, as a result, become less evident after applying this conversion. The 3D-LUT interpolation errors are greatest for the HDR to SDR down-mapping LUTs, as the output signals reach the extremities of the RGB signal range. For that reason, in addition to the "ideal" output values for the EBU Tech 3373 HLG Color Bars, we also provide the expected output values from a trilinear interpolator. Errors should be smaller with tetrahedral interpolation, the 65-cubed LUTs and also with real pictures.
#8c, v1.7 HLG > SDR Display CAM	BT.2100 HLG signals are down-mapped (tone-mapped) to BT.709 using a model of the human visual system (CAM). The LUT attempts to preserve the artistic intent of the original HDR content. As the LUT is based on a CAM, the appearance of colors, mid-tones and lowlights after conversion are significantly improved. This disadvantage if this approach is that it does not cascade as well as LUT9c does, with the SDR to HLG direct-mapping and up-mapping LUTs (3 & 5). LUT8 is, therefore, not currently recommended for live production, where it is usually important to minimize 'roundtripping' losses (i.e. SDR-to-HDR-to-SDR conversion). "HDR Reference White" (75% HLG) is tone-mapped to 88% BT.709, facilitating signal headroom for compressed highlights. 100% HLG signal is tone-mapped to 100% BT.709. With Type III LUTs that process sub-blacks and super-whites, the HLG super-white signals are tone-mapped to SDR super-white signals. The LUT outputs are clipped to EBU R.103 signal levels. The 3D-LUT interpolation errors are greatest for the HDR to SDR down-mapping LUTs, as the output signals reach the extremities of the R'G'B' signal range. For that reason, in addition to the "ideal" output values for the EBU Tech 3373 HLG Color Bars, we also provide the expected output values from a tetrahedral interpolator. Errors should be smaller with tetrahedral interpolation, the 65-cubed LUTs and also with real pictures. NOTE: Neither the EBU Tech 3373 HLG color bars nor the ITU-R BT.2111 HLG color bars will look like standard BT.709 color bars after conversion, as the BT.2100 color-primaries are quite different to those of BT.709. Furthermore, the converted color bars will not look like BT.2111 color bars displayed on a current reference display as their color-primaries tend to be closer to DCI-P3 than BT.2100. Most noticeable might be the BT.2100 green, which is much more cyan in color than the DCI-P3 and BT.709 greens.

BBC HLG LUT Number and Name	Description
#9c, v1.7 HLG > SDR Display Super	BT.2100 HLG signals are down-mapped (tone-mapped) to BT.709 using a display-light conversion. Colors and the appearance of mid-tones and lowlights are maintained after conversion. The LUT, therefore, attempts to preserve the artistic intent of the original HLG content. "HDR Reference White" (75% HLG) is mapped to 95% BT.709 and HDR highlights extend into the SDR super-white region; for that reason, only "Full-Range Mode" Type III LUTs are made available. 100% HLG signal is mapped to the EBU R103 preferred maximum of 105% BT.709. HLG signals above 100% are clipped. This LUT is recommended for use in scenarios where minimizing SDR>HDR>SDR "round-trip" losses is of the utmost importance. Minimal round-trip losses are achieved when used with the display-light up-mapping LUT5. Where the program delivery and distribution chain preserves the SDR super-white signal range, this LUT9 usually gives better results than LUT8 as its output color volume is larger. Where there is a risk of the SDR super-white signal range being clipped, LUT8 should be used instead. The 3D-LUT interpolation errors are greatest for the HDR to SDR down-mapping LUTs, as the output signals reach the extremities of the RGB signal range. For that reason, in addition to the "ideal" output values for the EBU Tech 3373 HLG Color Bars, we also provide the expected output values from a trilinear interpolator. Errors should be smaller with tetrahedral interpolation, the 65-cubed LUTs and also with real pictures. NOTE: Neither the EBU Tech 3373 HLG color bars nor the ITU-R BT.2111 HLG color bars will look like standard BT.709 color bars after conversion, as the BT.2100 color primaries are quite different from those of BT.709. Furthermore, the converted color bars will not look like BT.2111 color bars displayed on a current reference display, as their color primaries tend to be closer to DCI-P3 than BT.2100. Of these, the most noticeable might be the BT.2100 green. This contains more cyan content than the DCI-P3 and BT.709 greens.
#7c, v1.7 HLG > PQ 1000 Nits Display	BT.2100 HLG signals are converted to BT.2100 PQ at the 1000 cd/m2 "bridge" condition, so that 100% HLG maps to 1000 cd/m2 PQ. See ITU-R report BT.2390 Section 7.2 ("Conversion concepts using a reference condition at 1000 cd/m2"). For Type III LUTs, HLG signals above 100% are mapped to PQ signals greater than 1000 cd/m2, up to a maximum of 1810 cd/m2 (corresponding to 109% HLG 'super-white', i.e. 10-bit code value 1019).
#21c, v1.7, HLG > SDR BT.2020 Disp Super	BT.2100 HLG signals are down-mapped (tone-mapped) to BT.2020 using a display-light conversion. Colors and the appearance of mid-tones and lowlights are maintained after conversion. The LUT, therefore, attempts to preserve the artistic intent of the original HLG content. "HDR Reference White" (75% HLG) is mapped to 95% BT.709 and HDR highlights extend into the SDR super-white region; for that reason, only "Full-Range Mode" Type III LUTs are made available. 100% HLG signal is mapped to the EBU R103 preferred maximum of 105%. HLG signals above 100% are clipped. This LUT is recommended for specialist applications such as on-set monitoring, where a high brightness wide color gamut SDR display may be preferred over an HDR display. The 3D-LUT interpolation errors are greatest for the HDR to SDR down-mapping LUTs, as the output signals reach the extremities of the R'G'B' signal range. For that reason, in addition to the "ideal" output values for the EBU Tech 3373 HLG Color Bars, we also provide the expected output values from a tetrahedral interpolator. Errors should be smaller with tetrahedral interpolation, the 65-cubed LUTs and also with real pictures.

Table 4. Convert SDR to HLG to SDR, BBC HLG LUT Detailed Information

BBC HLG LUT Number and Name	Description
#22c, v1.7, SDR Scene>HLG>SDR Display	Combination LUT for shading SDR BT.709 cameras in live "single stream" HDR production. Combines LUT4-1 (scene-light BT.709 to HLG) and LUT9 (display-light HLG to BT.709) into single conversion, thereby allowing camera shaders to directly view the SDR signal seen by audiences.

NBCU LUTs Pipeline

NOTE: The Frame Store, Bypass, and Overlay controls are available on all ColorBox pipeline modes, and their settings are applied to all the other pipeline modes. These settings are also saved to Presets.

NBCU LUTs, developed by NBCUniversal Media, LLC in collaboration with Cromorama, enable a workflow for single-master live production of simultaneous HDR and SDR content. Designed for television broadcasters, NBCU LUTs include SDR, HLG and PQ LUTs that maximize the dynamic range and color volume in HDR, without compromising core SDR broadcasts.

NBCU pipeline features include:

- Imperceptible round-tripping of SDR BT.709
- Conversions designed with a knee that is natural with latitude for live video shading
- Scene-light and Display-light conversions
- SDR, HLG, and PQ conversions
- Utilizes 33-point Tetrahedral 3D LUT Interpolation
- Proc Amp and Color Corrector
- Full bypass node for 12G-SDI and HDMI v2.0
- Support for ITU BT.2408, Operational Practices in HDR Television Production

NBCU LUTs LUT Conversions

Description abbreviations:

SDR = Standard Dynamic Range

PQ = High Dynamic Range using Perceptual Quantization curve

HLG = High Dynamic Range using Hybrid Log Gamma curve

SL = Scene Light

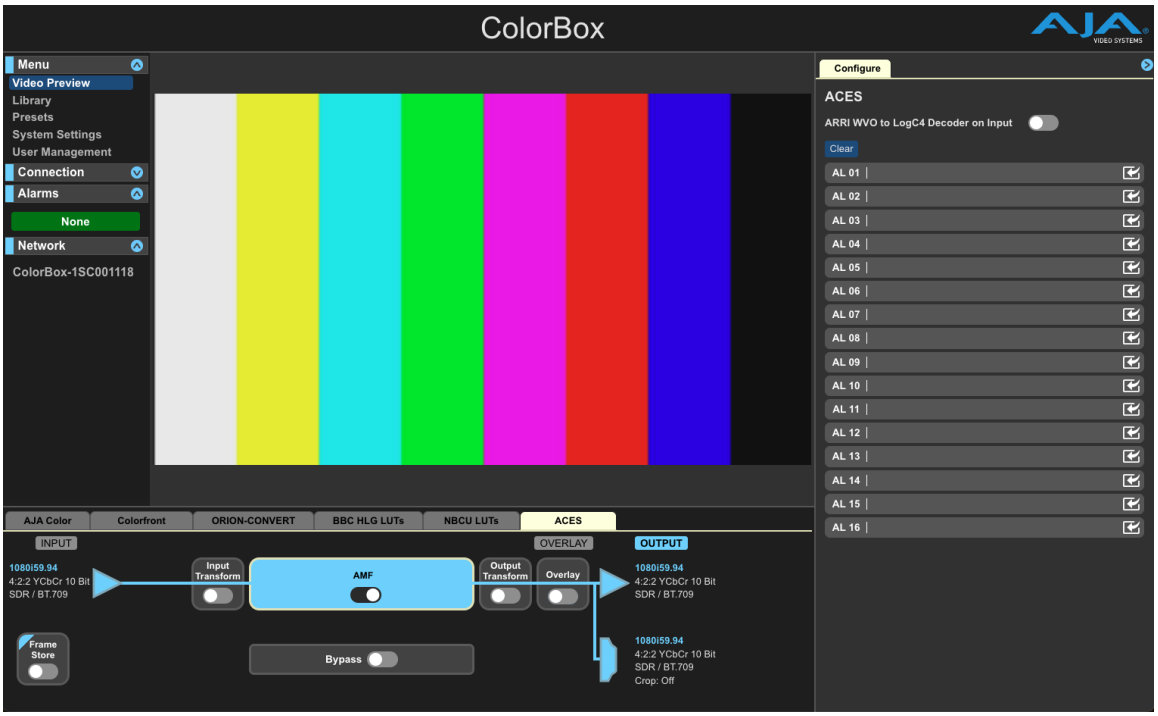
DL = Display Light

Table 5. NBCU LUT Conversions Detailed Information

SDR > HLG DL, #1	SDR UpMap to HLG using Display Light. For use with SDR playback sources. NBCU LUT 1 up-maps legacy SDR signals into a native HLG production using display-light conversion.
SDR > HLG SL, #2	SDR to HLG using Scene Light. For use with SDR camera sources. Tonemaps and matches SDR cameras with the HLG "Look" for a native HLG production using scene-light conversion.
HLG > SDR DL, #3	HLG to SDR using Display Light. For SDR camera shading and production output. Down-maps native HLG BT.2100 signals to SDR as a predictive LUT for legacy SDR-BT.709 transmission.
SDR > PQ DL, #4	UpMap to PQ using Display Light. For SDR to PQ conversion preserving the artistic intent or "SDR look." Up-Maps legacy SDR signals into a native PQ production or transmission.
PQ > SDR DL, #5	PQ to SDR using Display Light. For PQ to SDR conversion for transmission. Down-maps native PQ-BT.2100 signals to SDR-BT.709 as a predictive LUT or for legacy SDR transmission.
HLG 1000 > PQ, #7	HLG 1000 Nits to PQ. For HLG to PQ conversion. BT.2100 HLG signals are converted to BT.2100 PQ at the 1,000nits "bridge" condition so that 100% HLG maps to 1,000nits PQ. This is a transparent conversion.

NOTE: NBCU LUT numbering goes from #5 to #7. LUT #6 is skipped intentionally.

ACES Pipeline



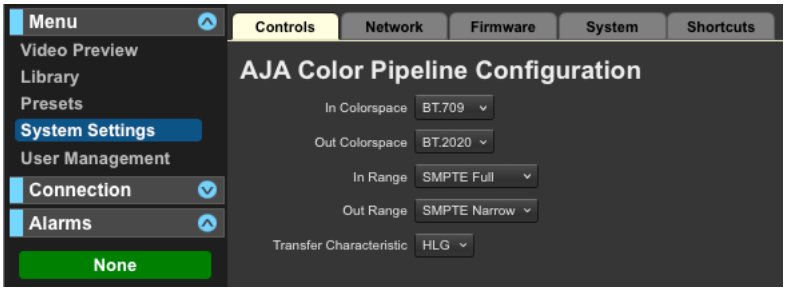
NOTE: The Frame Store, Bypass, and Overlay controls are available in all ColorBox pipeline modes, and their settings are applied to all the other pipeline modes. These settings are also saved to Presets.

The ACES Pipeline enables look monitoring via ACES Metadata File (AMF) processing. AMF workflows support an exchange of information that allows for better interoperability of color throughout the filmmaking process. An AMF includes information needed for ACES based transforms such as input transform, look transform, and output transform into a single XML file that can be easily distributed to others working on the project from on-set to post to final grade.

NOTE: AJA's ACES Pipeline is built on OpenColorIO (OCIO) that has a new implementation of AMF. AMFs can be created by various tools and not all AMF's are supported by the ACES Pipeline. If an AMF file is imported that is not compatible, a warning will pop-up in the UI containing helpful information about the incompatibility. AJA will continue to improve the ACES Pipeline with AMF support over time.

Using the Controls Tab with the ACES Pipeline

Figure 30. ACES Pipeline Configuration Settings



The settings on this screen allows you to configure the input and output range (SMPTE/Full), Colorspace (BT.709/BT.2020), and the HDR output Transfer Characteristic (SDR/PQ/HLG) that will be used with the ACES Pipeline.

NOTE: The settings on this tab must match those specified in your AMF file. This setting is persistent when switching between AJA Color and ACES pipelines.

In Colorspace - Select either BT.709 or BT.2020 as the input color space.

Out Colorspace - Select either BT.709 or BT.2020 as the output color space.

In Range - Select either SMPTE Full or SMPTE Narrow.

- SMPTE Full selects a full input scaling/range, which includes sub-blacks and super-whites. Input video values of 0-1023 (10 bit) or 0-4095 (12 bit) are scaled to 0-1 before being sent to the LUT processor.
- SMPTE Narrow selects a narrow input scaling/range, such that an input video value of 0 represents black, and an input video value of 1 represents white. Input video values of 64-940 (10 bit) or 256-3760 (12 bit) are scaled to 0-1 before being sent to the LUT processor.

Out Range - Select either SMPTE Full or SMPTE Narrow.

- SMPTE Full selects a full output scaling/range, which includes sub-blacks and super-whites. Output values from 0-1 are scaled to 0-1023 (10 bit) or 0-4095 (12 bit).
- SMPTE Narrow selects a narrow output scaling/range. Output values from 0-1 will be scaled to 64-940 (10 bit) or 256-3760 (12 bit).

Transfer Characteristic - Select either SDR, HLG or PQ.

- This setting indicates the transfer characteristic that will be signaled in the SDI Output VPID, as well as the EOTF that will be signaled in the HDMI Output HDR Infoframe. This setting has no effect on the pixel values.

AMF Node

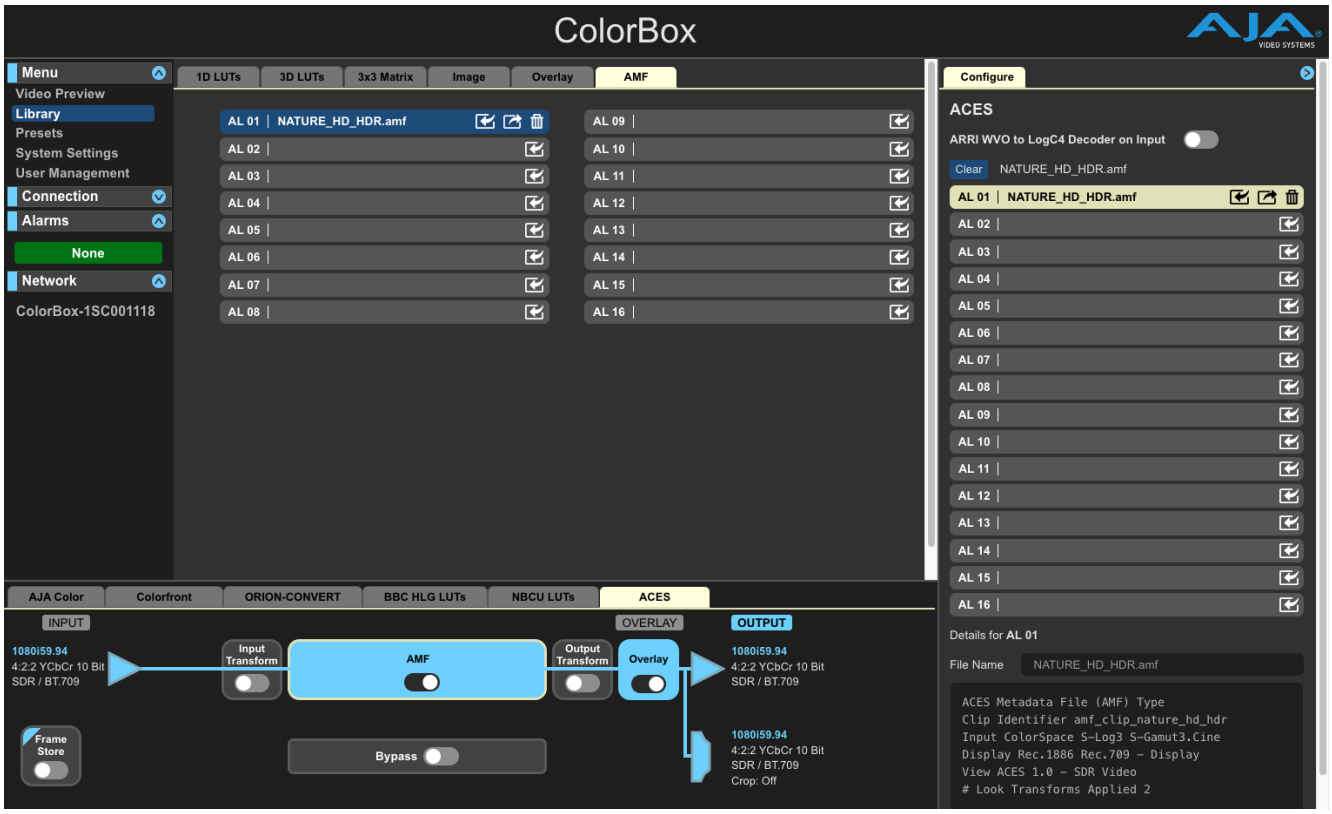
Import AMFs to the Library using the Library AMF tab or the Configure pane in the ACES pipeline.

Click the Import button and navigate to the location of your AMF files.

NOTE: You will not see any files in the location of your AMF files during this step. Click Upload to proceed to the file selection dialog.

Proceed through the dialogs to select the AMF file you want to upload. The file will appear in the AL Library and will be selectable in the ACES Pipeline Configure Pane.

Figure 31. ACES AMF Import



Options, selected in that node's Configuration pane, include:

ARRI WVO to LogC4 Decoder Control

To enable ARRI WVO to LogC4 decoding in the ACES Pipeline, enable the ARRI WVO to LogC4 Decoder on Input control in the Configure pane on the right (see *"ARRI WVO to LogC4 Decoder in the ACES Pipeline" on page 60*).

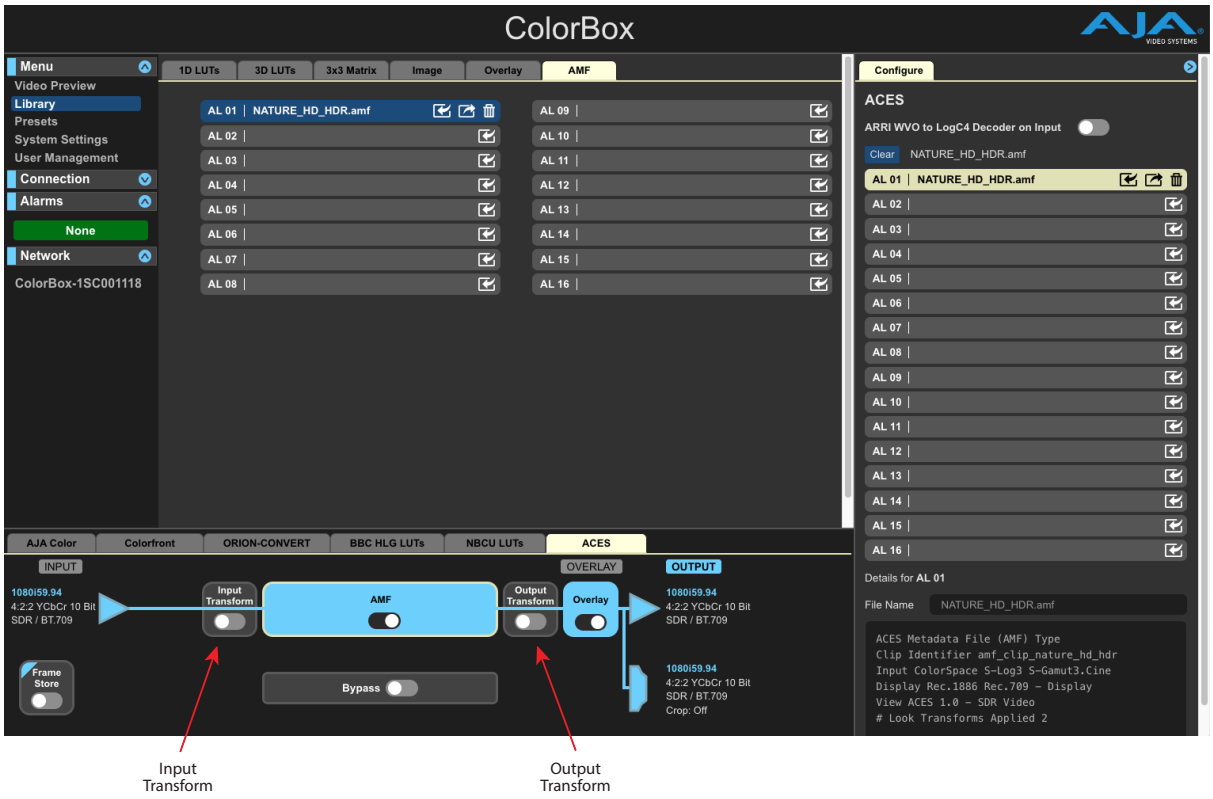
ACES Input and Output Transform Nodes

ColorBox supports user overrides of input and/or output transforms for ACES AMF pipelines. See *"Input and Output Transforms" on page 57*. Typical use cases include:

- An AMF file is generated with a specific camera Log input but the onsite camera is of a different format. Enable Input Transform node and select the appropriate ACES input transform that matches the onsite camera to override the input transform value in the AMF file while still maintaining other AMF transforms indicated in the file. Output transforms may be modified in a similar fashion.
- No AMF file is in use, but compliant ACES input and output transforms are required. With AMF node disabled, specify input and output transforms.

NOTE: When AMF node is disabled, both input and output transforms must be selected and enabled.

Figure 32. Input and Output Transforms



The following transforms are supported:

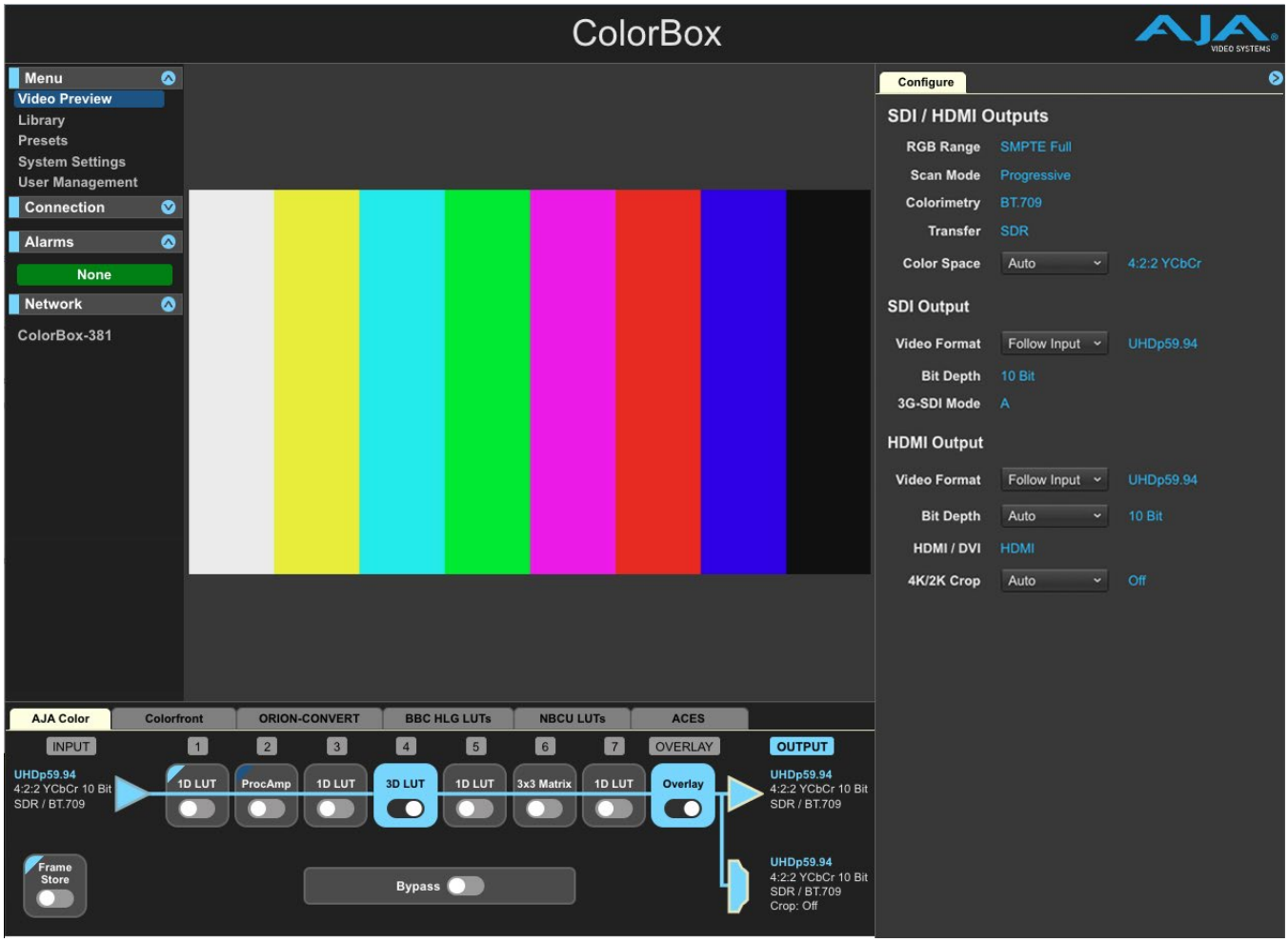
Input Transforms

ARRI LogC3 (E1800)
ARRI LogC4
CanonLog2 CinemaGamut D55
CanonLog2 CinemaGamut D65
V-Log V-Gamut
Log3G10 REDWideGamutRGB
S-Log3 S-Gamut3
S-Log3 S-Gamut3.Cine
S-Log3 Venice S-Gamut3
S-Log3 Venice S-Gamut3.Cine

Output Transforms

Rec.1886 Rec.709 - Display/ACES 1.0 - SDR Video
Rec.2100-HLG - Display/ACES 1.1 - HDR Video (1000 nits & Rec.2020 lim)
Rec.2100-PQ - Display/ACES 1.1 - HDR Video (1000 nits & Rec.2020 lim)
Rec.2100-PQ - Display/ACES 1.1 - HDR Video (2000 nits & Rec.2020 lim)
Rec.2100-PQ - Display/ACES 1.1 - HDR Video (4000 nits & Rec.2020 lim)

SDI/HDMI Output Configurations



4K/UltraHD Down-Conversion of SDI/HDMI Outputs

ColorBox supports independent down-conversion of SDI and HDMI outputs. This allows users to down convert 4K video to 2K video or UltraHD video to HD video.

Click on SDI and HDMI Outputs in any Pipeline. The SDI/HDMI Configure Pane will display with separate SDI and HDMI Outputs. The following parameters may be configured:

Video Format

Follow Input - Default setting. Passes input formats through without any down-conversion processing.

2K/1080p - When enabled, down converts 4K to 2K or UltraHD to 1080p.

NOTE: If source format is other than 4K or UltraHD, no conversion will be performed even if control is enabled.

4K/2K Crop of HDMI Output

ColorBox supports cropping of 4K to UltraHD or 2K to HD for the HDMI output. This allows users to center crop the image and provide an unscaled image on the HDMI output that is compatible with a wider range of consumer UltraHD and HD displays

Click on SDI/HDMI Outputs in any Pipeline. The SDI/HDMI Configure Pane will display with separate SDI and HDMI Outputs. For HDMI outputs, the following parameters may be configured:

4K/2K Crop

Choose Auto, Off, or On. Provides the option of center cutting 4096x2160 signals to make 3840x2160, or center cutting 2048x1080 video signals to make 1920x1080.

Auto - (Default) Performs crop based on EDID and connected display's capabilities.

NOTE: When set to Auto, if the input is 2K, ColorBox will automatically crop to HD (1920x1080). If the input is 4K, ColorBox will use the EDID to determine if the display supports 4K if it doesn't, ColorBox will crop to (3840x2160).

Off - No cropping is performed.

On - Cropping is performed.

NOTE: If source format is other than 4K or 2K, no cropping will be performed even if control is set to On or Auto.

Color Space and Bit Depth

Color Space

Output Color Space is configurable for supported video formats. Changing this setting sets the Color Space for both SDI and HDMI outputs.

NOTE: Setting the Color Space also sets the Bit Depth for the SDI output, YCbCr 4:2:2 sets it to 10-bits and RGB 4:4:4 sets it to 12-bits.

Auto - (Default) Automatically selects color space based on the input video parameters and payload ID.

4:2:2 YCbCr

4:4:4 RGB

Bit Depth

For HDMI Outputs, bit depth is configurable for supported video formats.

Auto - (Default) Automatically selects the bit depth based on the input video and the attached device's capabilities.

8-bit

10-bit

12-bit

ARRI WVO to LogC4 Decoder

ColorBox supports decoding of ARRI Alexa 35's Wireless Video Optimized LogC4 (WVO) encoded camera outputs with the AJA Color, Colorfront, and ACES Pipelines. Wireless Video Optimized LogC4 (WVO LogC4) is an intermediate encoding for ALEXA 35 SDI outputs that is designed to improve monitoring image quality when transmitting LogC4 over wireless video transmitters. The WVO encoding is an option built into the ALEXA 35. A matching ARRI WVO decoding LUT must be used after signal reception to reconstitute regular LogC4.

The matching ARRI WVO decoding LUT is built into the 1D LUT options in the AJA Color Pipeline and is an option in the Colorfront Pipeline Live Mode, and ACES Pipeline.

ARRI WVO to LogC4 Decoder in the AJA Color Pipeline

The WVO to LogC4 Decoder is built into the 1D LUT options in the AJA Color Pipeline allowing the use of the remaining 6 nodes for additional processing.

In the AJA Color Pipeline, select the first 1D LUT node. In the Mode drop down, select ARRI WVO to LogC4 Decoder (see AJA Color Pipeline section under *"1D LUT Nodes" on page 32*).

ARRI WVO to LogC4 Decoder in the Colorfront Pipeline

In the Colorfront Pipeline Live Mode, select the Dyn Range&Gamut Input and select ARRI LogC4 Wide Gamut 4 WVO in the Configure pane on the right. See *"Colorfront Live Mode" on page 38*).

ARRI WVO to LogC4 Decoder in the ACES Pipeline

The WVO to LogC4 Decoder is built into the options in the ACES Pipeline.

In the ACES Pipeline, enable the ARRI WVO to LogC4 Decoder on Input control in the Configure pane on the right (see *"ARRI WVO to LogC4 Decoder Control" on page 56*).

Chapter 4 – eMini-Setup

Overview

The AJA eMini-Setup application enables configuration of ColorBox network settings via a USB cable connected from the host computer to the ColorBox's OTG USB connector. App versions for Windows and MacOS are available for free on the AJA website.

ColorBox is shipped from the factory with DHCP enabled. If your network has a DHCP server, by simply connecting ColorBox to your network with an Ethernet cable, the DHCP server will assign ColorBox a compatible IP address. However, you will need to know that IP address before you will be able to access ColorBox's internal web server for initial configuration.

NOTE: You must use eMini-Setup v2.3 or higher with ColorBox to ensure full compatibility.

AJA's eMini-Setup is an easy way to set up your AJA device's network settings for AJA products that lack a front panel display, which prevents easy observation of the device's current IP address.

The eMini-Setup application, available as a free download from the AJA website, lets you identify an AJA device's IP address and, if necessary, configure its network settings so the unit can operate in your work environment.

NOTE: The eMini-Setup application is only used to setup selected Ethernet capable AJA devices. This application is not used to operate those devices.

Once configured, your AJA device can be accessed via an Ethernet network using a web browser, and can then be reconfigured over that network, using the AJA device's IP address and built in web server.

Acquiring eMini-Setup

AJA's eMini-Setup application is available for download from the AJA website:

https://www.aja.com/family/software#eminisetup

Click the **Download** button for the OS (macOS or Windows) you will use with eMini Setup.

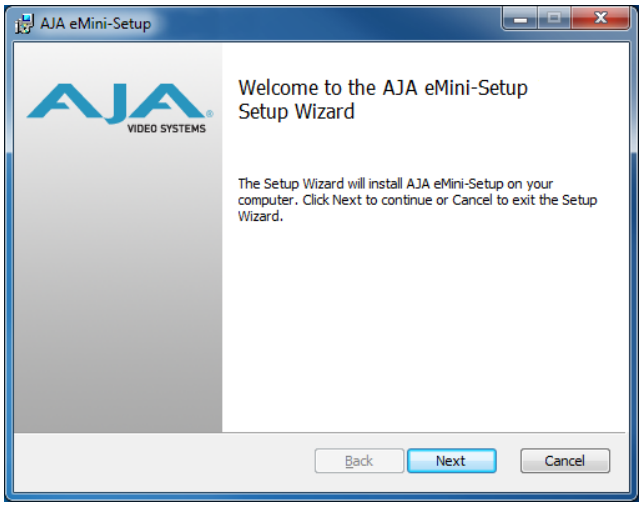
Installing eMini-Setup

PC Installation

To install eMini-Setup on a Windows PC:

1. Download the application from the AJA website. See *"Acquiring eMini-Setup" on page 61*.
2. Open the AJA_eMini-Setup_win.zip file.
3. Double-click on the AJA_eMini-Setup.msi file.
4. The Setup Wizard will guide you through the installation.

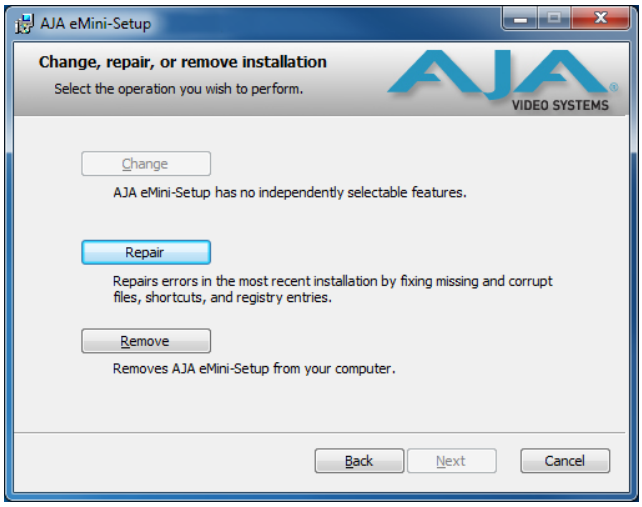
Figure 33. eMini-Setup PC Wizard



5. Click Next to begin. Answer the questions in the subsequent dialogues, including device software installation if displayed. When finished, an AJA eMini-Setup shortcut will be installed on the desktop, and you will be able to locate the eMini-Setup application in the AJA folder in the Programs listing.

NOTE: If the eMini-Setup application already exists on the PC, a different Setup Wizard appears. (In some instances, Windows may require uninstalling an earlier version of eMini-Setup before installing a new version.)

Figure 34. eMini-Setup Wizard, Re-installation



With this screen you can **Repair** (reinstall) or **Remove** (uninstall) eMini-Setup on the PC.

NOTE: Windows OS application icons can sometimes become hidden on the desktop. Several possible solutions exist, perhaps the easiest being to right click on the desktop, select View, and checkmark Show Desktop Icons.

Mac Installation

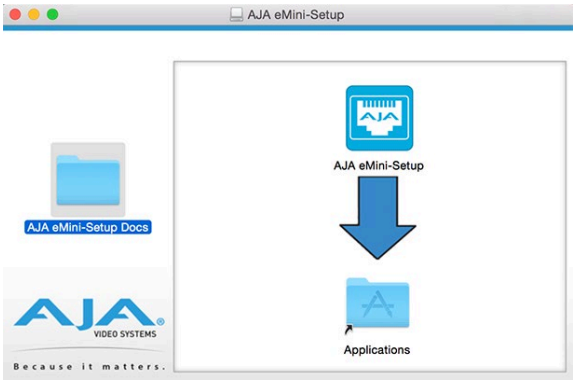
To install the application on a Mac:

NOTE: Intel and Apple Silicon based CPUs are supported for use with eMini-Setup.

1. Download the application from the AJA website. See *"Acquiring eMini-Setup" on page 61*.

2. Unzip the file.
3. Double-click on the AJA eMini-Setup.dmg file.
4. Answer the prompt and a utility program will be launched.

Figure 35. eMini-Setup Mac Installer



5. To complete the installation, drag the "AJA eMini-Setup" icon to the Applications folder.

Running eMini-Setup

Connect your Ethernet capable AJA device to your PC or Mac via the supplied USB cable, and then connect the external power supply (supplied) to that AJA device.

PC Startup

To run eMini-Setup on a PC, double-click on the AJA eMini-Setup icon on your desktop, or open the AJA folder in the program list and click on the AJA eMini-Setup application located inside the eMini-Setup folder.

NOTE: Windows OS application icons can sometimes become hidden on the desktop. Several possible solutions exist, perhaps the easiest being to right click on the desktop, select View, and checkmark Show Desktop Icons.

Mac Startup

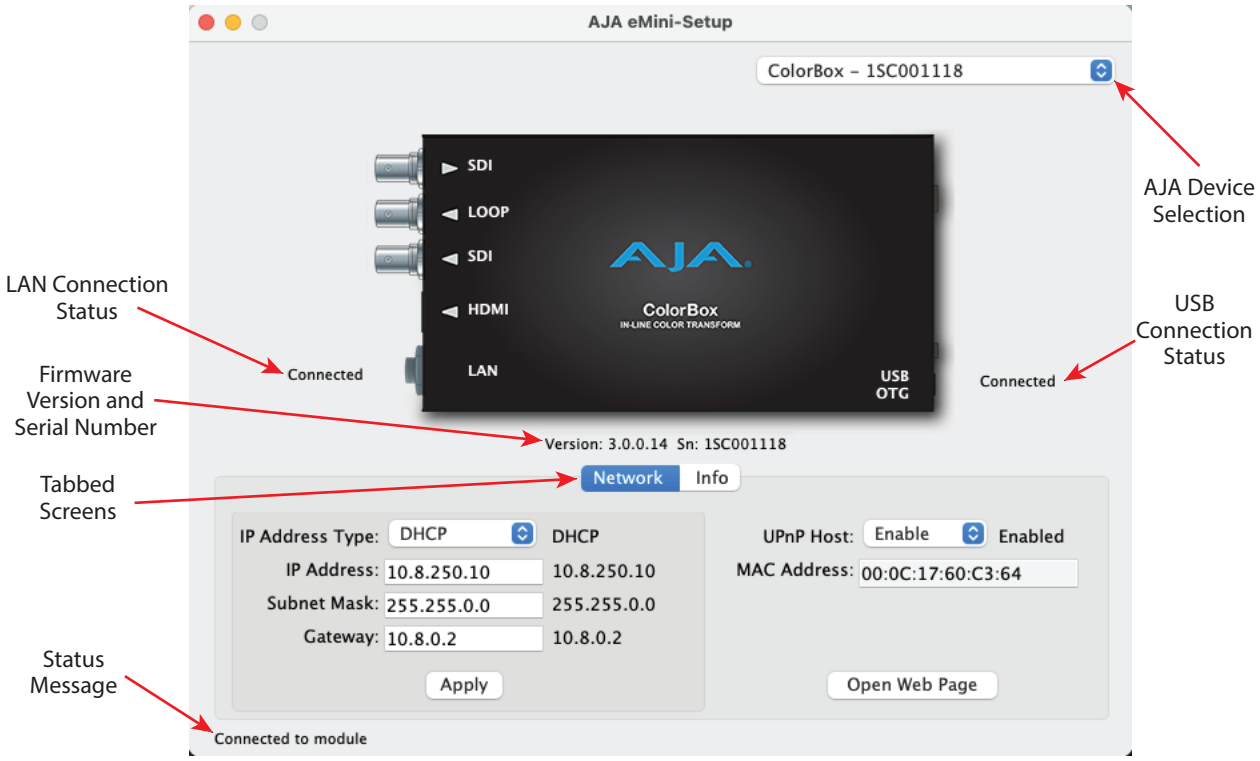
To run eMini-Setup on a Mac, open the Applications folder and locate the AJA eMini-Setup application. Double-click the application to launch it.

eMini-Setup User Interface

General Description

A status field at the bottom of the screen shows if the eMini-Setup application is connected and communicating with an AJA device.

Figure 36. Example eMini-Setup Screen



AJA Device Selection

Selecting an AJA device with the pull down menu on the upper right connects eMini-Setup to that AJA device.

AJA Device Identification

- Version - The version of firmware installed in the AJA device is displayed below the graphic.
- Sn - This is the factory set unique serial number of your AJA device. If you ever call AJA Support for service, you may be asked for this number.

File Menu

The File drop-down menu on the eMini-Setup application bar has a Revert to Factory Settings menu item that allows you to change the settings back to the AJA device's factory defaults.

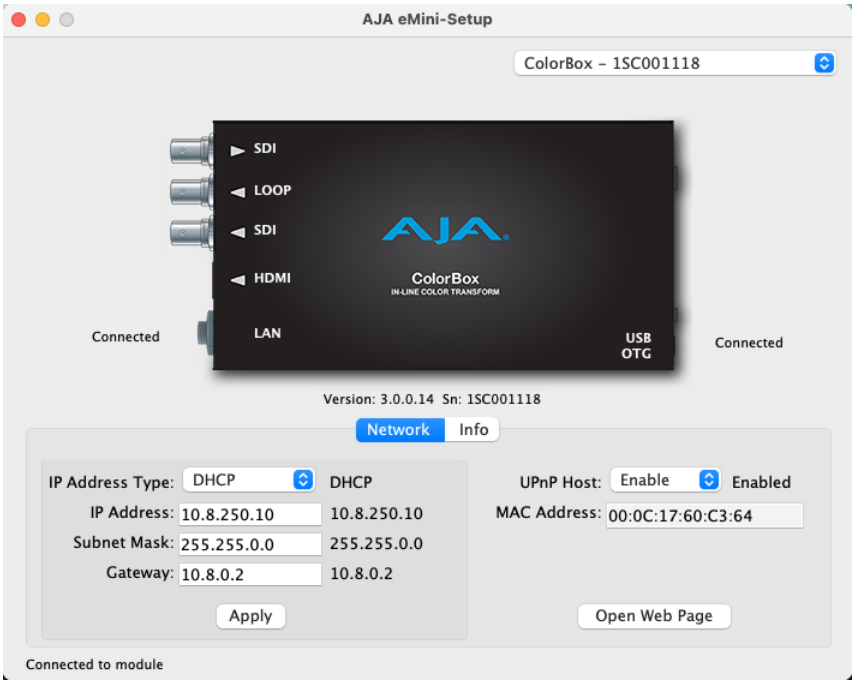
Edit Menu

The Edit drop-down menu has standard Cut, Copy and Paste functions for editing text.

Help Menu

The Help drop-down menu has a link to the AJA device's manual.

Network Tab Screen



This tab lets you change the network setup on the connected AJA device. You must click the **Apply** button to initiate any IP address changes.

IP Address Type

Choose from:

- DHCP
- Static IP Address

IP Address

The current IP address is displayed when an IP Address Type of **Static** is selected. A different static IP address can be entered.

Subnet Mask

The current Subnet Mask is displayed. A different netmask can be entered.

Gateway

The current Gateway address is displayed. A different IP address can be entered.

If your ColorBox needs to communicate to servers on another LAN or WAN, you have to enter the address of the computer/router that is making that external connection. If all of your devices, and the systems they need to talk to, are on a single LAN, then you can enter any unused LAN address as the Gateway here.

UPnP Host

Select **Enable** or **Disable** to control whether the AJA device makes itself visible for Windows network browsing.

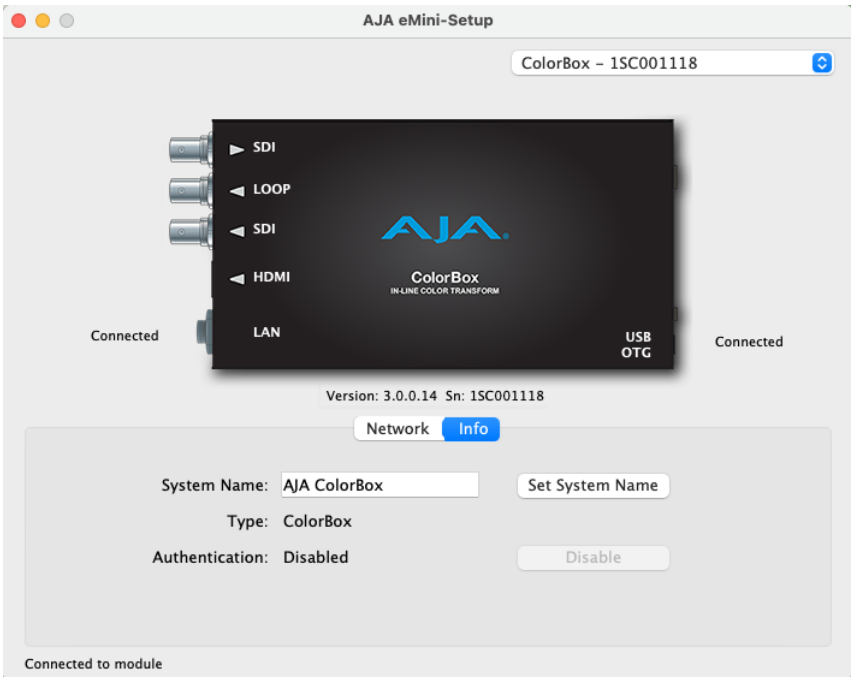
MAC Address

This is the permanent MAC address of the AJA device.

Open Web Page

After successful configuring the ColorBox's network settings and while connected to the network, clicking on this button opens the ColorBox's internal web page, allowing complete remote control of the device.

Info Tab Screen



This tab provides basic information about the connected AJA device. This information is useful when calling AJA Support for service or technical support.

System Name

This field allows you to give your AJA device a unique name. This can be useful if you have several ColorBox devices attached to a Mac/PC via USB so you can distinguish between them easily. Enter the desired name, then click Set System Name to apply.

NOTE: International characters are fully supported in the system name.

Type

This is the factory set model name of the AJA device.

Authentication

If Authentication has been Enabled on the web browser Access tab, you can disable the security feature by clicking on the Disable button.

Appendix A – Specifications

ColorBox Tech Specs

HDR/WCG Real Time Processor

- HDR Conversions
  - HDR to HDR
  - HDR to SDR
  - SDR to HDR
- Colorimetry
  - BT.709 and BT.2020

Video Formats

- (4K) 4096x2160p
- (UltraHD) 3840x2160p
- (2K) 2048x1080p
- (HD) 1920x1080p
- (HD) 1920x1080i
- (HD) 1280x720p

Color Processing Pipeline

- Processes in 12-bit RGB
- 6x pipelines; AJA Color, Colorfront, ORION-CONVERT, BBC HLG LUTs, NBCU LUTs, ACES
- 7x processing nodes plus Overlay in AJA Color; 4x 1D LUTs, 2x 3x3 Matrices, 1x 3D LUT

AJA Color Pipeline (ACP)

- 7x nodes in order of processing:
  - 1D LUT, 3x3 Matrix, 1D LUT, 3D LUT, 1D LUT, 3x3 Matrix, 1D LUT, Overlay
- 3D LUT configurable as LUT or Dynamic
  - Supports custom 33-point.CUBE, .SPI3D, .3DL format 3D LUTs, .CLF and .CTF
- 1D LUTs configurable as LUT, Dynamic, or Color Corrector
  - Supports custom 10 and 12-bit .CUBE and .SPI1D format 1D LUTs
- 3x3 Matrices configurable as Matrix, Dynamic, or Proc Amp
  - Supports custom .SPIMTX format matrices
- Tetrahedral 3D LUT interpolation
- Configurable Color Space, Range, and Transfer Characteristic
- ARRI Alexa 35's Wireless Video Optimized LogC4 (WVO) Decoder
- Nonvolatile storage of 16x 3D LUTs, 16x 1D LUTs, and 16x 3x3 Matrices
- Overlay

*Various 3D LUT sizes are supported, but will be converted to 33-point for processing

Dynamic LUT Processing

- Supports third party apps for automatic loading and display of 3D LUTs
- Reflects dynamic changes in real time from source software
- Full frame LUT processing

- Supported by
  - Pomfort Livegrade Pro and Studio
  - Assimilate Live Looks and Live Assist
  - QTAKE Video Assist

Colorfront Pipeline

- Processing Based on Human Perception Model
- Perceptually optimized color volume remapping
- Preserves the original creative intent
- TV Mode for applications such as television broadcast
- Live Mode for applications such as broadcast, OTT, A/V
- SDR to Dolby Vision Preview Mode for applications such as broadcast and postproduction
- Input Video Dynamic Range/Color Gamut (varies by mode)
  - SDR BT.709 100 Nits
  - SDR Extended BT.709
  - PQ BT.2020 1000 Nits
  - PQ P3D65 1000 Nits
  - Hybrid Log Gamma BT.2100
  - HLG Extended BT.709
  - HLG Extended BT.2100
  - Sony S-Log3 S-Gamut3
  - Sony S-Log3 S-Gamut3 Cine
  - Sony S-Log3 BT.2020
  - ARRI Log C Wide Gamut
  - ARRI LogC4 Wide Gamut 4
  - ARRI LogC4 Wide Gamut 4 WVO
  - Panasonic V-log
  - RED Log3G10 Wide Gamut
  - Canon Log 2
  - Canon Log 3
- Output Video Dynamic Range/Color Gamut (varies by mode)
  - SDR BT.709 100 Nits
  - SDR Extended BT.709
  - PQ BT.2020 1000 Nits
  - PQ BT.2020 ConstrainP3
  - PQ P3D65 1000 Nits
  - Hybrid Log Gamma BT.2100
  - HLG Extended BT.709
  - HLG Extended BT.2100
  - Sony S-Log3 S-Gamut3
  - Sony S-Log3 BT.2020
  - ARRI Log C Wide Gamut
  - ARRI LogC4 Wide Gamut 4
- TV Mode controls
  - Highlight management: Brightness, Highlight, Super Highlight
  - Colorfulness control for managing the Hunt Effect
  - Color Correction: Lift, Gamma, Gain, Saturation
  - Camera Correction: Exposure, Color Temp, Tint
  - Roundtrip control ensures technical match
  - Clamp to Legal

- Live Mode controls
  - SDR Preview
  - HDR Amount
  - Ambient Light Compensation control
  - HDR Log Look
  - SDR Softness control
  - Color Correction: Lift, Gamma, Gain, Saturation
  - Camera Correction: Exposure, Color Temp, Tint
  - PQ Output Nit level: 48-4000 Nit
  - PQ Output P3 Colorspace Clamp
  - ITU-R BT.2408 Mode control
- SDR to Dolby Vision Preview controls
  - Highlights: Low, Mid, High
  - Contrast: Low, Mid, High
- Overlay

ORION-CONVERT Pipeline

- Conversion algorithm that uses floating point math
- Pre and post transform Knee and Amount controls
- Display-Light and Scene-Light Modes
- Configurable HDR and SDR IRE Reference anchor points
- Configurable HDR Peak Nits sets system gamma for display light conversions
- Gamma Compensation
- Configurable Output Clamping
- Input Video Dynamic Range/Color Gamut
  - SDR BT.709
  - PQ BT.2020
  - HLG BT.2100
- Output Video Dynamic Range/Color Gamut
  - SDR BT.709
  - PQ BT.2020
  - HLG BT.2100
- Overlay

BBC HLG LUTs Pipeline

- Mathematical dynamic range mapping per ITU-R BT.2408
  - SDR/BT.709 Scene Referred to HLG/BT.2100 v1.7
  - SDR/BT.709 Scene Referred to HLG/BT.2100 Strict v1.7
  - SDR/BT.709 Scene Referred UpMap to HLG/BT.2100 v1.7
  - SDR/BT.709 Scene Referred UpMap to HLG/BT.2100 Strict v1.7
  - SDR/BT.709 Display Referred to HLG/BT.2100 v.1.7
  - SDR/BT.709 Display Referred UpMap to HLG/BT.2100 v1.7
  - SDR/BT.2020 Display Referred to HLG/BT.2100 v1.7
  - SDR/BT.2020 Display Referred UpMap to HLG/BT.2100 v1.7
  - PQ 1000 Nits Display Referred to HLG/BT.2100 v1.7
  - PQ 4000 Nits Display Referred to HLG/BT.2100 v1.7
  - S-Log3/BT.2020 100% Scene Referred to HLG/BT.2100 v1.7
  - S-Log3/BT.2020 200% Scene Referred(SR-Live) to HLG/BT.2100 v1.7
  - HLG/BT.2100 to SDR/BT.709 Scene Referred v1.7
  - HLG/BT.2100 to SDR/BT.709 Scene Referred Strict v1.7
  - HLG/BT.2100 to SDR/BT.709 Display Referred Color Appearance Model v1.7

    - HLG/BT.2100 to SDR/BT.709 Display Referred Super White v1.7
    - HLG/BT.2100 to PQ 1000 Nits Display Referred v1.7
    - HLG/BT.2100 to SDR/BT.2020 Display Referred Super White v1.7
    - SDR/BT.709 Scene Referred UpMap to HLG/BT.2100 to SDR/BT.709 Display Referred v1.7
  - RGB Color Corrector and ProcAmp
  - Overlay

NBCU LUTs Pipeline

  - NBCU LUTs developed by NBCUniversal Media, LLC
    - 1-NBCU_SDR2HLG_DL_v1.1, SDR UpMap to HLG using Display Light v1.1
    - 2-NBCU_SDR2HLG_SL_v1, SDR to HLG using Scene Light v1.0
    - 3-NBCU_HLG2SDR_DL_v1.1, HLG to SDR using Display Light v1.1
    - 4-NBCU_SDR2PQ_DL_v1, SDR UpMap to PQ using Display Light v1.0
    - 5-NBCU_PQ2SDR_DL_v1, PQ to SDR using Display Light v1.0
    - 7-NBCU_HLG10002PQ_v1, HLG 1000 Nits to PQ v1.0
  - RGB Color Corrector and ProcAmp
  - Overlay

ACES Pipeline

  - ACES Metadata File (AMF) processing
  - Implementation using ACES v1.3
  - Built using OpenColorIO (OCIO)
  - ARRI Alexa 35's Wireless Video Optimized LogC4 (WVO) Decoder
  - Nonvolatile storage of 16x AMFs
  - Overlay

Video Input and Output SDI

  - 1x 12G-SDI Input BNC, SMPTE-292/424/2081/2082
  - 2x 12G-SDI Output BNCs, SMPTE-292/424/2081/2082
  - YCbCr 4:2:2/4:4:4
  - RGB 4:4:4, SMPTE or Full level
  - 10 or 12-bit
  - 1x 12G-SDI
    - (4K) 4096x2160p 23.98, 24, 25, 29.97, 30, 47.95, 48, 50, 59.94, 60
    - (UltraHD) 3840x2160p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
  - 1x 6G-SDI
    - (4K) 4096x2160p 23.98, 24, 25, 29.97, 30
    - (UltraHD) 3840x2160p 23.98, 24, 25, 29.97, 30
  - 1x 3G-SDI (Level A or B-Dual Link)
    - (2K) 2048x1080p 23.98, 24, 25, 47.95, 48, 50
    - (2K) 2048x1080PsF 23.98, 24, 25
    - (HD) 1920x1080p 23.98, 24, 25, 29.97, 30, 50, 59.94, 60
    - (HD) 1920x1080PsF 23.98, 24, 25, 29.97, 30
    - (HD) 1920x1080i 50, 59.94, 60
    - (HD) 1280x720p 50, 59.94, 60

- 1x 1.5G-SDI
  - (2K) 2048x1080p 23.98, 24, 25, 29.97, 30
  - (2K) 2048x1080PsF 23.98, 24, 25
  - (HD) 1920x1080p 23.98, 24, 25, 29.97, 30
  - (HD) 1920x1080PsF 23.98, 24, 25, 29.97, 30
  - (HD) 1920x1080i 50, 59.94, 60
  - (HD) 1280x720p 50, 59.94, 60

Note: Raster and Frame Rate Dependent, please see ColorBox Video Formats in Documents

Video Output HDMI

- 1x HDMI Type A connector*, HDMI v2.0b
- HDR infoframe generation with pass-through for Colorimetry and Transfer Characteristic
- YCbCr 4:2:2
- RGB 4:4:4, SMPTE or Full level
- 8, 10, or 12-bit (HFR 4K/UltraHD 4:4:4 limited to 8-bit)
- 4K/UltraHD/2K/HD
- 4K/2K Crop to UltraHD or HD

*If a connected monitor doesn't support HDMI protocol, the unit automatically switches to DVI protocol (which does not pass audio)

Note: Raster and Frame Rate Dependent, please see ColorBox Video Formats in Documents

Video Processing

- Nominal video delay is less than 0.5 of a video line and less than 4.5 video lines when down-converting
- Motion adaptive deinterlacer
- Proc Amp controls
- Color corrector
- Legalizer

Down-Conversion

- Hardware 10-bit
- Independent down-conversion for SDI and HDMI outputs
  - 4K to 2K or UltraHD to HD (1920x1080)

Frame Store

- Capture and Recall up to 4K/UltraHD 16-bit .TIFF
- Capture and Recall .TIFF, .PNG, .JPEG
- Capture input or output
- Nonvolatile storage of 16 images

Test Pattern Generator

- 10 or 12-bit
- 14x patterns built-in
- SDR and HDR test patterns

Ancillary Data

- All embedded ANC packets pass-through, including camera ancillary data

Overlay

- User Text
- Input and Output ancillary information, including VPID
- Timecode presence
- Closed captioning presence
- Pipeline Configuration
- User Overlay, Recall .PNG overlay images up to 4096x2160
- Nonvolatile storage of 16 overlays

Audio Input Digital

- SDI embedded audio, 24-bit, 16-channel

Audio Output Digital

- SDI embedded audio, 24-bit, 16-channel
- HDMI embedded audio, 24-bit, 8-channel

Network Interface

- 1x RJ-45, 10/100/1000 Ethernet
- Embedded web server for remote control
- REST Interface
- WiFi control available via third party WiFi USB adapter*

*Linksys AC1200 WUSB6300 and Netgear AC1900 A7000

USB Interface

- 1x Mini-USB for IP configuration using AJA eMini-Setup

Presets

- 10 Pipeline Presets per mode (AJA Color, Colorfront, ORION-CONVERT, BBC HLG LUTs, NBCU LUTs, ACES)
- Startup Preset

Size (w x d x h)

- 4.10" x 7.54" x 1.66" (104.1 x 193 x 42.1 mm)

Weight

- 1.0 lb (0.5 kg)

Power

- External power supply required
- Enclosure: 10-18VDC regulated, 4-pin mini-XLR, 16W typical 3G-SDI, 21W typical 12G-SDI, 25W max.
- AC Adapter, included: 100-240VAC, 50/60 Hz, universal input, 60W
- Optional spare AC adapter sold separately, AJA-PWR-12-60W

Environment

- Safe Operating Temperature: 0 to 50 C (32 to 122 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)

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, European Free Trade Association (EFTA) and United Kingdom Regulatory Compliance

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

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

Declaration of Conformity

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

This equipment meets the following conformance standards:

Safety

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

IEC 62368-1: 2014 (CB Scheme Report/Certificates

Additional licenses issued for specific countries available on request.

Emissions

EN 55032: 2015 + A11: 2020, CISPR 32: 2015,

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

Immunity

EN 55035: 2017, EN 61000-4-2:2009, EN 61000-4-3: 2006 + A1:2008 + A2:2010,

EN 61000-4-4: 2012, EN 61000-4-5: 2014 +A1: 2017, EN 61000-4-6: 2014,

EN 61000-4-8: 2010, EN 61000-4-11: 2020

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 가정 용 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.

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! 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! 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 corriente 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.

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! 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 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! 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! 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.

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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.

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