

# AJA FS-HDR Release Notes - v4.2

## Firmware for FS-HDR

### Introduction

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FS-HDR v4.2 firmware is a release that features an all new Colorfront TV Mode providing improved tools for color conversion and highlight management also including a new Sony Slog3 format, the addition of ARRI Log C4 conversion formats to Colorfront Live and Film modes, and updated v1.6 BBC HLG LUTs including a new combination LUT for camera shading in live productions and a new CAM (Color Appearance Model) based LUT.

Be sure to consult the Installation and Operation Guide (user manual) for detailed information about features and configuration guidelines. The most current documentation can always be found on [FS-HDR's Support Page](#).

### Fixes, Changes and Improvements in v4.2

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- New Colorfront Engine - TV Mode
  - Select from 4/5 Dynamic Range & Gamut input/output settings including:
    - New Dyn Range&Gamut IN and OUT
      - Sony Slog3 BT.2020
    - New Dyn Range&Gamut OUT
      - PQ BT.2020 ConstrainP3
  - Brightness: Adjusts the overall brightness of the picture.
  - Highlight: Adjusts the brightness from midtones to highlights of the picture.
  - Super Highlight: Adjusts the extreme highlights in a managed roll off.
  - Colorfulness: Overrides the colorfulness compensation in the perceptual model.
  - Roundtrip: For SDR to HDR and back to SDR to maintain a roundtrip technical match on the extreme gamut edges with a slight reduction in remap quality.
  - Color Corrector: Lift, Gamma, Gain, Saturation
  - Camera Correction: Exposure, Color Temp, Tint
  - Note: FS-HDR presets that include Colorfront TV Mode setting changes are not compatible with previous firmware versions.
- Colorfront Engine - Live and Film Modes
  - New Dyn Range&Gamut IN and OUT

- ARRI Log C4 Wide Gamut 4
- Updates BBC HLG LUTs to v1.6 with two added LUTs and the following benefits:
  - LUT 9 improves the color reproduction and detail of highlights.
  - LUT 8 replaces previous LUT 8 with a new CAM (Color Appearance Model) based down-mapping conversion.
  - LUT 21 is a new HLG to SDR BT.2020 (wide color gamut) display-light downmapping conversion.
  - LUT 22 is a new “combination” LUT for shading SDR BT.709 cameras in live “single stream” HDR production.
- Updates NBCU LUT 1 from v1.0 to v1.1 to include a “fix for negative values”
- Fixes issue with HLG Narrow test pattern where only part of the test pattern was output.
- Fixes issue with ancillary data handling that can cause problems with closed captions.

## Features, Fixes, Changes and Improvements in Prior Releases

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### v4.1.2

- Adds support for an updated version of FS-HDR hardware.

### v4.1.1

- Fixes issue with ancillary data handling that can cause problems with output VPIDs and ancillary data, such as closed captions.
- Improves Override VPID functionality for overriding HDMI EOTF and Colorimetry infoframes.

### v4.1.0

- Increased configurable Frame Delay (frame buffer) depth to support delays of up to 20 frames.
- Updated BBC HLG LUTs to v1.5 with two new LUTs and the following benefits:
  - LUT1 had a 105% output clip to the EBU R103 “preferred” signal range removed.
  - LUT8 has improved color saturation and softer tone-mapping to enhance image highlights.
  - LUT9 has improved color saturation, especially in highlights. Tone-mapping adjusted to avoid clipping of HLG nominal signal range.
  - LUT17 and LUT18 are new LUTs for SDR BT.2020 to HLG BT.2100 conversion.
- New NBCU LUT Transform category which includes:
  - 1-NBCU\_SDR2HLG\_DL\_v1, SDR UpMap to HLG using Display Light
  - 2-NBCU\_SDR2HLG\_SL\_v1, SDR to HLG using Scene Light
  - 3-NBCU\_HLG2SDR\_DL\_v1.1, HLG to SDR using Display Light
  - 4-NBCU\_SDR2PQ\_DL\_v1, SDR UpMap to PQ using Display Light
  - 5-NBCU\_PQ2SDR\_DL\_v1, PQ to SDR using Display Light
  - 7-NBCU\_HLG10002PQ\_v1, HLG 1000 Nits to PQ
- New ability to automatically pass-through SCTE-104 packets for a wide range of formats and conversions.
- New Timecode Xlator to pass-through or translate Ancillary Timecode (ATC) packets for a wide range of formats and conversions.

- Supports LTC, VITC1, or VITC2
- Expanded set of conversions that support pass-through of Closed Captioning ancillary data.
- Improved usability of Web UI Status page:
  - Displays source colorimetry and transfer characteristic in Video Input Status.
  - In Enhanced Single Channel Mode, added display of configurable Monitor Output format.
- Improved Maintain A/V Sync:
  - Fixed issue with embedding MADI audio.
  - Improved usability of the feature.
- Improved Monitor Out support when using Override VPID:
  - SDI Monitor Out VPID now matches the selected Video Processor's VPID when using the Override VPID feature.
  - In Enhanced Single Channel Mode, the SDI Monitor Out has its own Override VPID control.

#### v4.0.1

- Fixes a potential issue that can interfere with Color Transform conversions.

#### v4.0.0

- New Colorfront Engine - TV Mode
  - Streamlined User Interface
  - Conversions from SDR to HDR, HDR to HDR, and HDR to SDR
  - Knee Point and Knee Slope controls
  - Color Corrector
  - Camera Corrector
- Updated BBC 3D HLG LUTs to v1.4 with the following benefits:
  - Minimization of losses during round trips from various LUT pairs
  - Reduction of hue shifts on very bright saturated colors
  - A new LUT 9 for HLG to SDR conversions
- Configurable SDI output HDR VPID settings
- Added ability to remotely reboot FS-HDR from the Web UI
- Improved ancillary data management to pass-thru embedded ARRI camera metadata
- Added PQ P3D65 1000 Nits to Colorfront Engine Live and Film Mode Output Transforms
- Fixed SDI input issue that could result in some source signal types not being received and processed
- Note: FS-HDR presets are forward compatible with v4.0 firmware, but v4.0 presets are not backward compatible with previous firmware versions.

#### v3.2.2

- Fixed the RGB Color Corrector introduced in v3.2.0, and carried into v3.2.1, that was found to have an intermittent issue which could produce abnormalities on the output video.

#### v3.2.1

- The User LUT and Dynamic LUT menus have new parameter names that are more consistent with industry terms and user expectations. Specifically, the names for SMPTE and Full settings used for In Scale and Out Scale have changed. These settings are required by the FS-HDR's RGB 4:4:4 3D LUT processor to properly scale the input and output 4:2:2 YCbCr video. See table below for details:

User LUT Designed for	Current Term	New Term	Notes
SMPTE Narrow range video, 64-940	Full	SMPTE – Narrow	In this case the User LUT is designed such that 0 represents black and 1 represents white. With the In Range parameter set to SMPTE-Narrow, the input video values of 64-940 will be scaled to 0-1 to feed the LUT processor. Likewise, with the Out Range parameter set to SMPTE-Narrow, the LUT processor output values from 0-1 will be scaled to 64-940.
SMPTE Full range video, 0-1023	SMPTE	SMPTE – Full	In this case the User LUT is designed such that sub-blacks and super-whites are included. With the In Range parameter set to SMPTE-Full, the input video values of 0-1023 will be scaled to 0-1 to feed the LUT processor. Likewise, with the Out Range parameter set to SMPTE-Full, the LUT processor output values from 0-1 will be scaled to 0-1023.
N/A	In Scale	In Range	Starting with the v3.2.1 release, this parameter will be called In Range.
N/A	Out Scale	Out Range	Starting with the v3.2.1 release, this parameter will be called Out Range.

- Improved usability of Web UI Status page when selecting BBC HLG LUTs. The selection window has been widened so that the LUT names fit on one line and no longer wrap.

### v3.2.0

- Added RGB Color Corrector for general use and to color correct a source signal prior to HDR LUT processing.
- A Maintain A/V Sync feature couples video and audio delay controls to maintain audio-sync when adjusting Video Timing.
- Audio Delay now displayed in milliseconds and audio samples.
- Processor channel names can now be edited for easier identification.
- Improved channel-to-channel timing relationship for high frame rate (HFR) video formats.
- Fixed incorrect SDI Monitor output VPIDs in Single Channel mode with 4K/UHD output.
- Fixed numerous Test Pattern Generator bugs.
- Removed incompatible alarms for supported 4K/UHD conversions.
- The input VPID is now passed through to the output when BBC HLG LUTs or USER LUTs are set to Unity or Transform is off.
- BBC HLG LUT names changed to include LUT number and version.

- Updated to use the latest v1.3.1 BBC HLG LUTs.

## v3.0.0

- New Colorfront Engine - Film Mode adds:
  - ACES colorspace transforms.
  - ASC CDL (Color Decision List as defined by the ASC) controls.
  - Built-in LOOK selection including film stock emulation and popular aesthetic looks.
  - Variable Output Mastering Nit Levels for PQ to tailor for delivery and display needs.
- New additions for Colorfront Engine - Live Mode (previously named Colorfront Engine Transform):
  - Input Dynamic Range & Gamut
    - Hybrid Log Gamma BT.709
    - HLG Extended BT.2100
  - Output Dynamic Range & Gamut
    - Hybrid Log Gamma BT.709
    - HLG Extended BT.2100
  - SDI Monitor Dynamic Range & Gamut
    - Hybrid Log Gamma BT.709
    - HLG Extended BT.2100
  - Nit Level control for PQ output
    - Variable adjustments from 48-4000 Nits
  - DCI P3 Colorspace Clamp for HDR output
- Updated BBC 3D HLG LUTs to v1.3 with the following benefits:
  - Reduces hue shifts in the HLG to SDR BT.709 conversion.
  - Adds scene-light LUTs for different types of SDR cameras (square root and strict BT.709 OETFs).
  - Reduces scene-light inverse tone-mapping signal level to cope with a wider range of SDR signals in live production.
- Dynamic LUT mode is now supported in both Four Channel Mode and Single Channel Mode.
- 1080i Output Filter control improves down-converted image quality to 1080i output.
- An update to the free AJA FS-HDR Control Link v1.2 application supports controlling the FS-HDR v3.0 Colorfront Engine - Live Mode parameters. Control of the FS-HDR v3.0 Colorfront Engine – Film Mode parameters will be supported in a future release.
  - The FS-HDR Control Link v1.2 app is available on the AJA website under FS-HDR's Support page: <https://www.aja.com/products/support/fs-hdr>
- Fixed v2.6 bug for low frame rate PsF video format (input and output).
- Fixed incorrect SDI Monitor output VPIDs in Single Channel mode with 4K/UHD output.
- Fixed Colorfront Engine BT.2408 slider control to not allow negative values.
- 0 = standard Colorfront transform for best picture, 1 = ITU BT.2408 mapping on transform.
- Improved ancillary data support by passing HANC and VANC packets when input and output video formats and frame rates match, i.e. no format or frame rate conversion.
- Improved BT.2111 HDR Test Patterns to correctly signal HLG or PQ through VPIDs (for SDI outputs) and Infoframes (for HDMI output).
- Changed current Colorfront Engine Transform name to Colorfront Engine - Live Mode.

- Changed Colorfront Engine Color Temp scale:
  - In v2.x firmware, the scale is 2000.0 to 11000.0 with a default of 4300.0. In v3.0 the scale is -10.000 to +10.000 with a default of 0.
  - When upgrading from v2.x to v3.0, the Color Temp value will be set to default (0). Any existing presets that set the Color Temp value will need to be loaded, a new Color Temp value set, and saved.
  - When downgrading from v3.0 to v2.x, the Color Temp value will be set to 2000.0. The image will be dramatically affected. The Color Temp value will need to be reset to 4300.0, or set to the desired value either manually or with a preset.

## v2.6.0

- Additional Colorfront Engine™ Transform options:
  - Added two Output Dynamic Range & Gamut selections:
    - Sony SLog3 BT.2020
    - ARRI Log C Wide Gamut
- Enhanced BBC LUT transform options:
  - Upgraded the v1.1 LUTs to the BBC's latest v1.2 LUTs
  - Added four additional BBC LUTs:
    - BBC SDR SR UC to HLG v1.2
    - BBC SDR DR UC to HLG v1.2
    - BBC PQ 4000 nit to HLG v1.2
    - BBC Slog3 200% (SR-Live) to HLG v1.2

Note:

SR = Scene Referred

DR = Display Referred

UC = Up-Conversion (SDR to HDR)
- New User LUT feature:
  - Upload and store up to ten custom 3D LUTs (33 point .cube format)
  - User LUTs can be used in Single Channel and Four Channel modes
  - Configurable LUT processor controls include:
    - Input Colorspace (709/2020)
    - Output Colorspace (709/2020)
    - Input Scale (SMPTE/Full)
    - Output Scale (SMPTE/Full)
    - Output HDR Transfer Characteristic (SDR/PQ/HLG)
- New Dynamic LUT feature:
  - Dynamic LUT operation allows a third party device/application to transfer 3D LUTs (33 point .cube format) to the FS-HDR 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 FS-HDR's 3D LUT processor.
  - Dynamic LUT operation is only supported in Single Channel Mode.

- The following third party applications support FS-HDR Dynamic LUTs:
  - TVLogic WonderLookPro v4.0
  - Pomfort LiveGrade Pro support in 1Q2019
- Updated VPID support for Transfer Characteristic (HLG/PQ) and Colorimetry (BT.2020) per recently published SMPTE SDI standards, including 1080i.
- New Colorfront Engine Ganging feature:
  - An update to the free AJA FS-HDR Control Link application supports ganged operation of the Colorfront Engine in multiple FS-HDRs.
  - Ganging operation is only supported in Single Channel Mode.
  - This feature can be used to enable 8K workflows by simultaneously controlling four FS-HDRs.
  - The FS-HDR Control Link v1.1 app is available on the AJA website under FS-HDR's Support page: <https://www.aja.com/products/support/fs-hdr>.
- Fixed a v2.5 bug for Freeze or Black on loss of input signal. This bug causes video artifacts when operating in Single Channel mode and using a 4K/UltraHDp25/50 signal.

### v2.5.0

- Additional Colorfront Engine™ Parameter Controls for:
  - ITU-R BT.2408 SDR to HDR and HDR to SDR mapping
  - Color Temperature
  - Tint
  - Exposure
- An Enhanced Single Channel mode for 4K/UltraHD workflows provides simultaneous 4K/UltraHD and 2K/HD outputs with independent format and HDR settings
- HDMI Monitor Output now supports HDR Infoframe generation
- BBC HLG LUTs provide additional HDR conversion options conforming to ITU-R BT.2408
- HDR Color Bar Test Patterns per ITU-R BT.2111
- An additional free AJA software application to interface a Tangent Kb panel to an FS-HDR for remote control of the Colorfront Engine parameters. This FS-HDR Control Link app is available on the AJA website under FS-HDR's Support page: <https://www.aja.com/products/support/fs-hdr>
- Video output is improved to remove possible artifacts when downscaling.
- Video output is improved for motion when converting from progressive to interlaced formats. The GPI control for SDR Preview Mode has changed from edge triggered to level triggered.
- The Hidden Menu control has been removed. This function is used for menu development and debugging purposes, and can be confusing for normal operation.

### v2.0.0

- A key new feature is parametric control of the Colorfront Engine™ transform algorithm. Seventeen individual controls have been added that enable the following:
  - Adjusting R,G,B, and Master color controls for Lift, Gamma, and Gain
  - Adjusting Saturation
  - Guiding the algorithm's color volume expansion from SDR to HDR
  - Adjusting for the Ambient Light in the mastering or viewing environment

- Managing how SDR highlights and speculars are expanded into HDR
  - Controlling the overall look of camera log inputs between cinematic and television
- Added two new S-Log camera input formats in addition to the existing S-Log3 S-Gamut3 selection, these include:
  - S-Log3 S-Gamut3 Cine
  - S-Log3 BT.2020
- Fixed a video quality issue that occurs when down-converting to 625i or 525i. This issue occurs when down-converting from source video formats of 4K, UltraHD, 2K, or HD at low frame rates; p25 and p29.97.
- The SDI Output Payload IDs (ST 352 VPIDs) always indicate BT.709 colorimetry, even when BT.2020 or S-Gamut3 output is selected. This has now been fixed.
- Fixes some incorrect Output Payload IDs (ST 352 VPIDs) for 4K/UltraHD PsF formats.

## Additional Information

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For additional information, please refer to the FS-HDR section of the AJA website:

<https://www.aja.com/products/fs-hdr>.

## Updating FS-HDR Firmware

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Although the FS-HDR comes from the factory pre-installed with the latest firmware as of the time of manufacture, it may be necessary to re-flash the factory firmware or update to new firmware that has been posted on our AJA website. The following topics in these notes describe the steps required to upgrade the firmware in your AJA FS-HDR.

### Download the Latest Firmware

- Current and past releases of FS-HDR firmware are available on AJA's website.
  - To get the firmware, point your browser to: <https://www.aja.com/products/support/fs-hdr>.
- Once you see the update page, FS-HDR firmware files can be selected for downloading to your Mac or PC for upgrading your local machine.

## Unpack the Firmware

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The firmware update files are “ZIP” files, which you can open with a number of standard and third party uncompressor applications. The firmware image that you’ll install on the FS-HDR is a file with a name like FSHDR\_ver\_2.0.0.0.bin or similar. Depending on your Mac or Windows operating system settings, the “.bin” extension may not be visible to you in a file directory.

## Uploading and Installing the Firmware to the FS-HDR

Uploading and installing the firmware update only requires a Mac or Windows computer that can “see” the FS-HDR via its Ethernet connection. Follow this procedure to install the firmware:

1. Point your browser at the FS-HDR's upgrade page by clicking on the “Firmware” menu link at the bottom of the navigation box on the left-hand side of any FS-HDR web page. The FS-HDR web pages are discussed in the FS-HDR User Manual.
2. Click the “Browse...” button to select the file you previously downloaded.
3. After you have selected a valid FS-HDR image file, click the “OK” button in the “Upload Firmware” prompt. The file you select will upload to the FS-HDR and be tested for validity. Incomplete, corrupted, or non-FS-HDR firmware files are rejected.
4. Click “Commit Uploaded Firmware” on the FS-HDR Update Firmware web page after the upload is finished.
5. Wait for the procedure to complete. When done, the FS-HDR Update Firmware web page will prompt you to restart your FS-HDR. Click the “Restart FS-HDR with New Firmware” button to begin the restart. Restart progress is shown on the front panel of the FS-HDR only. After the restart completes, the FS-HDR front panel “Status” menu is displayed, and the FS-HDR will be running the new firmware.
6. Once these steps are complete, the FS-HDR will be running the firmware you just uploaded until the next time you upgrade it. The configuration of the FS-HDR prior to the upgrade will be preserved. Ensure the new firmware is running by bringing up the FS-HDR web page again; the firmware version is displayed at the top of all FS-HDR web screens. If for some rare reason it didn’t update, you can then run through the update steps again.

*Important Note: If there is a power outage or glitch during the firmware download, the FS-HDR will boot the older version and the upgrade process can then be re-started by the user. This happens because the FS-HDR has been designed with a safety feature where an internal “safe” copy of the previous firmware is retained in the event of any error in the updating.*

*Important Note: If upgrading from v2.5 (or older firmware) to v2.6 (or newer firmware), the ten USER LUT slots can be pre-loaded with a Unity LUT. This is a simple operation that can be performed in the FS-HDR web GUI. In the “User LUT” menu, select “Overwrite All” in the “Overwrite with Unity” parameter at the bottom of the page.*

*Important Note: If upgrading from v2.6 (or older firmware) to v3.0 (or newer firmware), the Colorfront Engine Color temp scale will change. The scale was 2000.0 to 11000.0 with a default of 4300.0. In v3.0 the scale is -10.000 to +10.000 with a default of 0.*

## Technical Support

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AJA Technical Support is free and available to help you answer questions or resolve issues with any of your AJA products.

**To contact AJA Technical Support:**

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