CION Technical Notes - v1.2

Exposure Index, Gamma and In-Camera Color Correction Comparison

OVERVIEW

The CION 4K/UltraHD and 2K/HD production camera from AJA offers vivid detail and vibrant colors at any resolution. It's image can be said to be cinematic; technically modern but classic in look. CION offers full 12-bit 4:4:4 recording internally to AJA Pak media to present the image captured at its very best.

The purpose of this technical note is to go into further detail with regard to optimizing the performance of CION in the studio or in the field before delivery to post production.

The AJA CION offers three distinctly different methods for controlling how an image is captured. In the simplest terms, these methods are:

1. One of the several available in-camera gamma curves is applied to the image; post-production image and color correction may be performed, but it is not necessarily required since in-camera color correction has been achieved.
2. An expanded gamma curve is applied to the image; in doing so post-production image and color correction can take place to create any number of custom looks to suit the needs of the delivery.
3. No in-camera gamma curve is applied to the image; again post-production image and color correction can be performed as is required.

Further detail regarding the gamma selections, along with the various possible permutations for the exposure index (EI), white balance (WB), color correction and saturation is outlined in this document. Best-practices guidelines are also provided to assist the user if required.

WHERE TO FIND THE SETTINGS

Exposure index and gamma selections are found within the EI menu - the numbers reference the menu selections within the CION interface; please refer to the CION manual for further information on menu selections and parameters:

- 24.1 EI
- 24.7 Gamma

The WB menu contains:

- 25.1 White Balance
- 25.3 Saturation
- 25.4 Color Correction

GAMMA SELECTIONS

In selecting a specific Gamma mode it is important to try to correctly expose the image to protect the highlights from clipping. While some recovery of detail from the mid-tones is feasible in post, it may not be possible to recover detail from very overexposed portions of the image.

Disabled

If Disabled is selected, no in-camera gamma curve is applied to the image. A Gamma Disabled image will have a very high contrast appearance that is quite different from typical video. Essentially, the only image processing that is applied to the image is the debayering process to transform the raw sensor data to a linear image.

Note: You may elect to additionally disable the color correction and white balance selection when the gamma selection is configured for Disabled.

What are the benefits to selecting Gamma Disabled?

Much like a raw workflow, controlling the gamma, white balance and color correction processing in post-production may be preferable for some situations where complete manipulation of the image in post-production is desired so as to create a specific look. But it is important to remember that because no in-camera gamma curve has been applied, the footage will need to be post-processed. Time restricted shoots where delivery is very soon after shooting or live productions will not benefit from Gamma Disabled as delays will be caused by image correction.

Without a gamma curve applied, the majority of the image will reside in the lower portion of the exposure range. To correct the image, lift/raise/pull-up the mid-tones and the shadows.

Note: It is important to perform lifting gradually within the mid-tones and shadows to achieve optimal image quality.

Note: You should not need to lift the highlights in post when using the Disabled gamma selection; instead you may need to lower them depending on how much you have raised the mid-tones and the shadows.

Normal, Normal Expanded and Video

The Normal, Normal Expanded and Video gamma selections are useful when shooting and exposing for a finished (or near finished) image. When using these gamma selections, you should carefully light and expose for the image you want to produce during your production.

Why choose one of these gamma selections?

Typically you want to choose Normal, Normal Expanded or Video gamma selections when you want to produce an image you can use straight out of the camera, possibly without any further manipulation in post-production. These gamma selections are also preferable for quick turnaround projects or live events

where additional post-production image processing and color correction may not be feasible due to time constraints.

Note: The EI 800 selection does not offer the Video gamma selection and the EI 1000 selection does not offer the Normal Expanded or Video gamma selections.

Expanded 1

The Expanded 1 gamma selection may be useful when dealing with high-key scenes where the majority of the image is quite bright. Using the Expanded 1 gamma selection, the majority of the image will be in the upper portion of the exposure range. To correct the image, lower/drop/push-down the mid-tones and the shadows.

Note: The mid-tones or the shadows will need to be lowered or pushed down far enough to create an optimal image

Note: You may need to lift the highlights using the Expanded 1 gamma selection depending on how much you lowered the mid-tones and shadows.

The Expanded 1 gamma selection is not recommended for scenes where lighting is limited, shadows dominate the scene or the majority of the image is underexposed.

You may use the Expanded 1 gamma selection with either the Unity white balance selection or the preset color temperature values or the auto white balance. Using the Expanded 1 gamma selection with the Unity white balance selection provides a wider dynamic range, but will require more color correction in post to tune the image appropriately when compared to the use of either the preset white balance values or the auto white balance.

Why choose this gamma selection?

In extremely bright, sunlit situations or high-key scenes, the Expanded 1 selection may be particularly useful. In such situations, the ability to maintain the upper portion of the exposure range can be particularly valuable.

Note: The Expanded 1 gamma selection is not available when using either the EI 800 or EI 1000 selections.

EI VALUES

Lighting and exposing properly is an important part of producing a desirable image with any of the EI value selections. Typically, you will want to use the lowest EI value possible to produce the best results. Of course, some shooting situations are not optimal so you may need to use the higher EI values in these situations. As the exposure index value increases, the likelihood of producing a less than optimal image increases; this is especially true if the image is underexposed.

Why choose a certain EI value?

Typically, you will be able to use the EI 320 selection for outdoor shooting and in controlled lighting situations. EI 500 is also useful when working with controlled lighting situations. The EI 800 selection can be useful when only lower light levels are available. The EI 1000 selection can be useful in situations where the lighting choices are limited.

EI 320 and EI 500

A wider array of choices for the gamma, white balance and color correction selections are available when using the EI 320 and the EI 500 selections. You may use all of these parameters in combination to create your desired in-camera "look". Of course additional post-production image and color correction are also possible, giving a wide range of options should you need them.

EI 800 and EI 1000

The EI 800 and EI 1000 selections have a lower latitude than the other EI values that are offered. They should primarily be used when there is insufficient lighting to achieve a proper exposure for either the EI 320 or the EI 500 selections.

WHITE BALANCE SELECTIONS

The white balance selections allow you to properly balance the camera for the various color temperature situations you may encounter.

Why choose a certain white balance value?

- The 3200K selection is useful when working with tungsten lighting.
- The 4500K selection is useful when working with mixed lighting or fluorescent lighting.
- The 5600K selection is useful when shooting in open daylight.

Note: In outdoor shaded situations, the 5600K selection may not be appropriate.

For situations where the color temperature of the lighting does not fall into one of these preset values, use the auto white balance feature to white balance to a white card or gray card.

Note: If you do not use a white card or a gray card during an auto white balance procedure the image may have a color shift or skew if you attempt to white balance from the scene alone.

COLOR CORRECTION SELECTIONS

Several in-camera color correction selections are offered. These color correction selections are designed to help you create and further tune an in-camera "look". You may also elect to perform additional color correction in post-production.

Why choose a certain color correction selection?

Depending on the creative decisions made, a project may call for a muted, desaturated look while another may require a rich, vibrant look. Some projects will require the most natural and realistic color rendition possible. The in-camera color correction matrices allow you to tailor an image to exactly suit your needs.

Flat

The Flat selection essentially disables any in-camera color correction. The Flat selection assumes that you may be performing color-correction in post-production to achieve a specific look. The image will appear "washed out", pale and desaturated when compared to the other selections.

Skin Tones

The Skin Tones color correction selection is a color correction matrix that produces less saturated skin tone values when compared to the Normal color correction selection. You may find this selection useful in situations where people with varied skin tones appear together in the same scene.

Note: The "look" produced by this color correction matrix may vary considerably depending upon the corresponding gamma selection used.

Normal

The Normal selection favors skin tones as opposed to overall color accuracy. It tends to produce rich and vibrant color rendition.

Note: The "look" produced by this color correction matrix may vary considerably depending upon the corresponding gamma selection used.

Video

The Video color correction selection may be used to produce color values more typically associated with traditional video cameras. This selection can be particularly useful for live events such as sports.

Note: The "look" produced by this color correction matrix will vary depending upon the corresponding gamma selection used.

SATURATION SELECTION

The saturation selection is offered throughout all of the various possible combinations of EI, gamma, white balance and color correction selections. The saturation control operates across the entire image and may be used to completely desaturate the image if so desired. Varying the level of saturation alongside a color correction selection allows you to produce a myriad of possible in-camera looks.

POSSIBLE COMBINATIONS (23.98 FPS TO 60 FPS)

EI	Gamma	White Balance	Color Correction
320	Disabled	Unity	Flat, Skin Tones, Normal, Video
		3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal Expanded	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Video	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Expanded 1	Unity	Flat, Skin Tones, Normal, Video
		3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video

EI	Gamma	White Balance	Color Correction
500	Disabled	Unity	Flat, Skin Tones, Normal, Video
		3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal Expanded	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Video	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Expanded 1	Unity	Flat, Skin Tones, Normal, Video
		3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video

EI	Gamma	White Balance	Color Correction
800	Disabled	Unity	Flat, Skin Tones, Normal, Video
		3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal Expanded	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video

EI	Gamma	White Balance	Color Correction
1000	Disabled	Unity	Flat, Skin Tones, Normal, Video
		3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video
	Normal	3200K	Flat, Skin Tones, Normal, Video
		4500K	Flat, Skin Tones, Normal, Video
		5600K	Flat, Skin Tones, Normal, Video
		AWB	Flat, Skin Tones, Normal, Video