Production Technology Support

CAMERA PRODUCTION GUIDE | **ARRI ALEXA 35**

Settings and best-practices for capture with the ARRI ALEXA 35 on Netflix 4K Originals.
Based on ALEXA 35 Software Update Package SUP 1.2.0. If you have any questions or comments please contact: prodtech.support@netflix.com. The current ALEXA 35 SUP 1.2.0 User Manual can be found HERE.

CAPTURE SETTINGS | **4K RAW (ARRIRAW)**

SETTING	MENU NAVIGATION	SELECTION
RECORDING CODEC	MENU → RECORDING → RECORDING CODEC →	**ARRIRAW**
SENSOR MODE	MENU → RECORDING → SENSOR MODE →	**4.6K 3:2 Open Gate** **4.6K 16:9** **4K 16:9** **4K 2:1** **3.8K 16:9** **3.3K 6:5** **3K 1:1**
RECORDING RESOLUTION	MENU → RECORDING → REC RESOLUTION →	No options available; for ARRIRAW, sensor mode and recording resolution are the same, without any downsampling or de-squeezing applied

Preferred settings shown in **YELLOW & BOLD** and alternatives in normal text formatting.

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ALEXA 35 ARRIRAW Notes

ARRIRAW Image Scope

ALEXA 35 ARRIRAW files contain the uncompressed and unencrypted raw sensor data without any debayering, exposure index (EI), white balance (WB), Look File (ALF4), conversion to a display color space, up/downsampling or anamorphic de-squeezing applied. However, the Enhanced Sensitivity Mode (ES) noise reduction (if chosen) and the chosen ARRI Texture are baked into the ARRIRAW image. For more information on ARRIRAW, go HERE.

ARRIRAW Processing

ALEXA 35 ARRIRAW images can be viewed and debayered with the ARRI Reference Tool (ART) and many 3rd-party tools. The ARRI Reference Tool can be downloaded HERE. A list of compatible 3rd-party tools can be found HERE.

ARRIRAW Look Metadata

ALEXA 35 ARRIRAW files contain uncompressed Bayer data in a log-like format, without either a look file or a conversion to a display color space applied. However, two 3D LUTs are recorded in ARRIRAW metadata. First, the Log-to-Log 3D LUT that is in the chosen ALF4 look file (MENU > Image > Look > Look) and second a 3D LUT that combines the ALF4 Log-to-Log 3D LUT with a conversion to the Rec 709 display color space. Having these two LUTs in metadata is handy for automated dailies creation, editing with looks and final grading. During ARRIRAW processing it is possible to have these 3D LUTs applied to the image, or choose other settings manually.

ARRIRAW and HDE

ARRIRAW is recorded uncompressed in-camera. The ARRIRAW file size can be reduced during or after the download process by about 40% with Codex High Density Encoding (HDE). HDE is a lossless encoding technique, with the decoded HDE essence being bit-for-bit identical to the original ARRIRAW essence. Many 3rd-parties already support HDE encoded files natively. HDE encoding for ALEXA 35 ARRIRAW files can be done with the Codex Device Manager (use 7.0 or later), which can be downloaded HERE, or with ARRI's ARRIRAW HDE Transcoder app, which can be downloaded HERE.

See "Recording Formats and Suggested Uses" below for a detailed description of all Netflix approved ALEXA 35 recording formats.

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CAPTURE SETTINGS | **4K COMPRESSED**

SETTING	MENU	SELECTION
RECORDING CODEC	MENU → RECORDING → RECORDING CODEC →	Apple ProRes 422 HQ **Apple ProRes 4444** **Apple ProRes 4444 XQ**
SENSOR MODE *- RECORDING RESOLUTION*	MENU → RECORDING → SENSOR MODE → *MENU →* *RECORDING →* *REC RESOLUTION →*	**4.6K 3:2 Open Gate** ***- 4.6K (4608 x 3164)*** **4.6K 16:9** ***- 4K (4096 x 2304, downsampled)*** **4K 16:9** ***- 4K (4096 x 2304)*** *- UHD (3840 x 2160, downsampled)* **4K 2:1** ***- 4K (4096 x 2048)*** **3.3K 6:5** ***- 3.3K (3328 x 2790)*** *- 4K 2.39:1 Ana 2x (de-squeezed & resampled)* **3K 1:1** ***- 3K (3072 x 3072)*** *- 3.8K 2:1 Ana 2x (de-squeezed & resampled)* 2.7K 8:9 *- UHD 16:9 Ana 2x (de-squeezed & resampled)*

Preferred settings shown in **YELLOW & BOLD** and alternatives in normal text formatting.

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ALEXA 35 Apple ProRes Notes

Apple ProRes Image Scope

ALEXA 35 Apple ProRes files contain compressed full color images recorded as LogC4 data, without either a look file or a conversion to a display color space applied. However, the following image processing steps are baked in: debayering, exposure Index (EI), Enhanced Sensitivity Mode (ES) noise reduction (if chosen), white balance (WB), image rotation (if chosen), up/downsampling (if chosen) and ARRI Textures. Some recording formats include an in-camera anamorphic de-squeezing. For more information on Apple ProRes go HERE.

Apple ProRes Look Metadata

ALEXA 35 Apple ProRes files contain compressed full color images recorded as LogC4 data, without either a look file or a conversion to a display color space applied. However, two 3D LUTs are recorded in Apple ProRes metadata: First, the Log-to-Log 3D LUT that is in the chosen ALF4 look file (CAMERA MENU > Image > Look > Look) and second a 3D LUT that combines the chosen ALF4 Log-to-Log 3D LUT with a conversion to the Rec 709 display color space. Having these two LUTs in metadata is handy for automated dailies creation, editing with looks and final grading.

See “Recording Formats and Suggested Uses” below for a detailed description of all Netflix approved ALEXA 35 recording formats.

Please note that Apple ProRes files recorded with the ALEXA 35 use the new LogC4 tonal curve and AWG4 camera color space. See “New Tonal Curve and Camera Color Space” below for more information.

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HIGH SPEED | **4K RAW (ARRIRAW)**

INTERNAL RAW RECORDER	MAX FPS	SENSOR MODE - RECORDING RESOLUTION
Internal	75 fps	**4.6K 3:2 Open Gate - 4.6K (4608 x 3164)**
	75 fps	**4.6K 16:9 - 4.6K (4608 x 2592)**
	120 fps	**4K 16:9 - 4K (4096 x 2304)**
	120 fps	**4K 2:1 - 4K (4096 x 2048)**
	120 fps	**3.8K 16:9 - UHD (3840 x 2160)**
	100 fps	**3.3K 6:5 - 3.3K (3328 x 2790)**
	100 fps	**3K 1:1 - 3K (3072 x 3072**

HIGH SPEED | **4K COMPRESSED (Apple ProRes)**

INTERNAL RECORDER	MAX FPS	SENSOR MODE - RECORDING RESOLUTION
All Apple ProRes flavors	60 fps	**4.6K 3:2 Open Gate - 4.6K (4608 x 3164)**
	75 fps	**4.6K 16:9 - 4K (4096 x 2048)**
	100 fps	**4K 16:9 - 4K (4096 x 2304)**
	120 fps	**4K 16:9 - UHD (3840 x 2160)**
	120 fps	**4K 2:1 - 4K (4096 x 2048)**
	75 fps	**3.3K 6:5 - 3.3K (3328 x 2790)**
	90 fps	**3.3K 6:5 - 4K 2.39:1 Ana 2x**
	90 fps	**3K 1:1 - 3K (3072 x 3072**
	100 fps	**3K 1:1 - 3.8K 2.1 Ana 2x**

Preferred settings shown in **YELLOW & BOLD** and alternatives in normal text.
Note: All fps are given for Compact Drive 2TB. Maximum fps in ARRIRAW are lower when using Compact Drive 1TB.

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OPTIMIZING PERFORMANCE | **MAINTENANCE PROCEDURES**

Online Tools, Applications and Downloads
A number of useful ARRI tools, including the Camera Companion App, ARRI Reference Tool, ARRIRAW HDE Transcoder, Frame Line & Lens Illumination Tool and Formats & Data Rate Calculator can be found HERE. The ALEXA 35 online Simulator can be found HERE. The ARRI Look Library LogC4 LUTs and LogC4 display LUTs for the conversion to a color space (ALEXA 35 - 3D LUT-Package) can be found in the DOWNLOADS section HERE.

Recording Format Names

The names of ALEXA 35 recording formats consist of two parts:

1. **Sensor Mode** defines the area and the number of photosites used on the sensor; this is important to know to see if the lens' image circle covers the chosen sensor mode. For a quick check, use the ARRI Frame Line & Lens Illumination Tool HERE.

2. **Recording Resolution** defines the number of pixels recorded in the ARRIRAW or Apple ProRes file. For ALEXA 35 ARRIRAW, sensor mode area/photosites and recording resolution area/pixels are the same. For ALEXA 35 Apple ProRes, they can be different as some recording resolutions include in-camera de-squeeze or in-camera down-sampling.

Recording Formats and Suggested Uses

Listed here are only Netflix approved ALEXA 35 recording formats. ALEXA 35 has four more recording formats that are

not Netflix approved, which can be found in the “Recording Formats Overview Table” after this section.

Sensor Mode 4.6K 3:2 Open Gate works great for spherical and anamorphic lenses.
If you can afford it, this gives you the most options and the greatest freedom in post production. Many shows create a custom frame line inside Open Gate and use the rest as padding; this is great for VFX, resizing, repositioning, rotating, stabilizing or tracking in post. Open Gate has a relatively large sensor area, so make sure your lens image circle covers it. Since the entire sensor is recorded, surround view is not available and this sensor mode has the highest data rate. Available in ARRIRAW or Apple ProRes.

Sensor Mode 4.6K 16:9 uses the full width of the sensor but reduces the height.
If you are shooting with spherical lenses (where you do not need the height necessary for 2x anamorphic lenses) for a 16:9, 1.85:1 or 2.39:1 deliverable, this format gives you all the advantages of 4.6K 3:2 Open Gate, but with a lower data rate. Available in ARRIRAW or Apple ProRes. Note that for Apple ProRes a downsampling is applied from the 4608 x 2592 photosites on the sensor to 4096 x 2304 pixels in the Apple ProRes file to reduce the data rate even further.

Sensor Mode 4K 16:9 is for projects using spherical lenses for a 16:9, 1.85:1 or 2.39:1 deliverable.
This format has a smaller sensor area than sensor mode 4.6K 3:2 Open Gate or 4.6K 16:9, which ensures that all Super 35 format lenses cover, reduces the data rate and allows 120 fps maximum fps. Available in ARRIRAW or Apple ProRes. For Apple ProRes, two Netflix approved recording resolutions are available:
- 4K (4096 x 2304): The same pixel count in the recorded file as in ARRIRAW
- UHD (3840 x 2160): in-camera downsample to reduce data rate if 4096 is not needed

Sensor Mode 4K 2:1 is for projects using spherical lenses for a 2:1 deliverable.
This format has a smaller sensor area than sensor mode 4.6K 3:2 Open Gate, 4.6K 16:9 or 4K 16:9, which ensures that all Super 35 format lenses cover, reduces the data rate and allows 120 fps maximum fps. Available in ARRIRAW or Apple ProRes.

Sensor Mode 3.8K 16:9 is for projects using spherical lenses for a 16:9, 1.85:1 or 2.39:1 deliverable.
This format records UHD (3840 x 2160) and has the lowest data rate of all formats for spherical lenses while still fulfilling 4K mandates. It has a smaller sensor area than sensor mode 4.6K 3:2 Open Gate or 4.6K 16:9, which ensures

that all Super 35 format lenses cover and allows 120 fps maximum fps. Available only in ARRIRAW.

Sensor Mode 3.3K 6:5* is for projects using anamorphic 2x lenses for a 2.39:1 deliverable.
Available in ARRIRAW or Apple ProRes. For Apple ProRes, two recording resolutions are available:
- 3.3K (3328 x 2790): The same pixel count in the recorded file as in ARRIRAW, recording the squeezed image
- 4K 2.39:1 Ana 2x (4096 x 1716): an in-camera de-squeeze and re-sample to record a 4K 2.39:1 image to save the de-squeeze step in post.

Sensor Mode 3K 1:1* is for projects using anamorphic 2x lenses for a 2:1 deliverable.
Available in ARRIRAW and Apple ProRes. For Apple ProRes, two recording resolutions are available:
- 3K (3072 x 3072): The same pixel count in the recorded file as in ARRIRAW, recording the squeezed image
- 3.8K 2:1 Ana 2x (3840 x 19206): an in-camera de-squeeze and re-sample to record a 3.8K 2:1 image to save the de-squeeze step in post.

Sensor Mode 2.7K 8:9* is for projects using anamorphic 2x lenses for a 16:9 deliverable. Only available in ProRes, with a recording resolution of an in-camera de-squeezed and re-sampled UHD 16:9 Ana 2x (3840 x 2160).

* The Netflix requirement for shooting with anamorphic lenses is that there must be the same number of photosites on the sensor as you have in 4K UHD. 4K UHD is 3840 by 2160, so 3840 x 2160 = 8.29 Mpixel. As long as you capture 8.29 Mpixel or more on the sensor, you are within Netflix's anamorphic 4K mandate. The 3.3K 6:5 sensor mode (9.3 Mpixel), the 3K 1:1 sensor mode (9.4 Mpixel) and the 2.7K 8:9 sensor mode (8.5 Mpixel) all fulfill this requirement.

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Recording Format Overview Table

Recording Format				Sensor Photosites					Recorded Pixels		Compact Drive Max. fps		Recording Time*	
Codec	Sensor Mode	Recording Resolution	Recording File Setting	H	V	H mm	V mm	⌀ mm	H	V	1TB	2TB	1TB	2TB
ARRIRAW	4.6K 3:2 Open Gate	4.6K (4608 x 3164)	ARRIRAW	4608	3164	27.99	19.22	33.96	4608	3164	35	75	00:28	00:56
	4.6K 16:9	4.6K (4608 x 2592)	ARRIRAW	4608	2592	27.99	15.75	32.12	4608	2592	45	75	00:34	01:08
	4K 16:9	4K (4096 x 2304)	ARRIRAW	4096	2304	24.88	14.00	28.55	4096	2304	55	120	00:43	01:26
	4K 2:1	4K (4096 x 2048)	ARRIRAW	4096	2048	24.88	12.44	27.82	4096	2048	65	120	00:48	01:37
	3.8K 16:9	UHD (3840 x 2160)	ARRIRAW	3840	2160	23.33	13.12	26.77	3840	2160	65	120	00:49	01:38
	3.3K 6:5	3.3K (3328 x 2790)	ARRIRAW	3328	2790	20.22	16.95	26.38	3328	2790	55	100	00:44	01:28
	3K 1:1	3K (3072 x 3072)	ARRIRAW	3072	3072	18.66	18.66	26.39	3072	3072	55	100	00:43	01:26
Apple ProRes	4.6K 3:2 Open Gate	4.6K (4608 x 3164)	422 HQ, 4444, 4444 XQ	4608	3164	27.99	19.22	33.96	4608	3164	60	60	01:08	02:16
	4.6K 16:9	4K (4096 x 2304)	422 HQ, 4444, 4444 XQ	4608	2592	27.99	15.75	32.12	4096	2304	75	75	01:45	03:30
	4K 16:9	4K (4096 x 2304)	422 HQ, 4444 4444 XQ	4096	2304	24.88	14.00	28.55	4096	2304	100 90	100	01:45	03:30
		UHD (3840 x 2160)	422 HQ, 4444 4444 XQ	4096	2304	24.88	14.00	28.55	3840	2160	120 105	120	01:59	03:58
		2K (2048 x 1152)	422 HQ, 4444, 4444 XQ	4096	2304	24.88	14.00	28.55	2048	1152	120	120	06:40	13:20
		HD (1920 x 1080)	422 HQ, 4444, 4444 XQ	4096	2304	24.88	14.00	28.55	1920	1080	120	120	07:32	15:05
	4K 2:1	4K (4096 x 2048)	422 HQ, 4444 4444 XQ	4096	2048	24.88	12.44	27.82	4096	2048	120 100	120	01:58	03:55
	3.3K 6:5	3.3K (3328 x 2790)	422 HQ, 4444, 4444 XQ	3328	2790	20.22	16.95	26.38	3328	2790	75	75	01:46	03:33
		4K 2.39:1 Ana 2x	422 HQ, 4444, 4444 XQ	3328	2790	20.22	16.95	26.38	4096	1716	90	90	02:20	04:40
	3K 1:1	3K (3072 x 3072)	422 HQ, 4444, 4444 XQ	3072	3072	18.66	18.66	26.39	3072	3072	90	90	01:45	03:30
		3.8K 2:1 Ana 2x	422 HQ, 4444, 4444 XQ	3072	3072	18.66	18.66	26.39	3840	1920	100	100	02:13	04:27
	2.7K 8:9	UHD 16:9 Ana 2x	422 HQ, 4444, 4444 XQ	2743	3086	16.66	18.75	25.08	3840	2160	100	100	01:59	03:58
	2K 16:9 S16	2K (2048 x 1152)	422 HQ, 4444, 4444 XQ	2048	1152	12.44	7.00	14.27	2048	1152	120	120	06:40	13:20

* Recording times in hours:minutes at 24 fps. Times for Apple ProRes given for ProRes 4444

ARRI Textures
ARRI Textures set the amount and character of grain in the image, and the amount of contrast at different levels of detail, perceived as sharpness. Previous ALEXA cameras were pre-programmed with a default texture, but ALEXA 35 lets you choose from a menu of ARRI Textures, like selecting a film stock. The four-digit code for the currently selected ARRI Texture is shown on the SDI status overlays in the CAM section and on the HOME screen. The choice of Texture should be discussed with VFX and post production ahead of time and creative decisions regarding Texture selection should be made using a proper reference monitor and viewing condition in pre-production. More information about Textures and new Textures for download can be found HERE.

Enhanced Sensitivity Mode
EI settings from 2560 to 6400 can optionally be chosen with an Enhanced Sensitivity Mode (ES). This engages a noise reduction which provides cleaner images in low light. Note that ES is baked into ARRIRAW and Apple ProRes and that there are fps and shutter limits when ES is enabled. These will be displayed in the EI menu (HOME SCREEN > EI).

Log C, LogC3 and LogC4 Naming
What has been called “Log C” in previous ARRI digital cameras is really the third generation of ARRI Log file format, so ARRI is retroactively renaming “Log C” to “LogC3”. The new Log format used in the ALEXA 35 is the fourth generation and therefore named “LogC4”.

New Tonal Curve and Camera Color Space
ALEXA 35 images use a new tonal curve (LogC4) and a new camera color space (ARRI Wide Gamut AWG4) in order to improve image quality, streamline post production and contain the camera’s dynamic range. This has a couple of practical consequences. For simplicity’s sake, we will write “LogC4 images” instead of “AWG4/LogC4 images” in the following.

- When you look at LogC4 images displayed on a monitor without a display LUT, 18% gray will look darker than it used to in LogC3. That is normal.

- The LogC4 workflow requires LogC4 LUTs. LUTs designed for LogC3 images can't be used with LogC4 images, neither in LUT boxes on set nor in post production. This has two reasons. First, LogC4 images are different from LogC3 images, and a LUT that is expecting a LogC3 image will not provide the proper processing when fed a LogC4 image. And second, the role that LUTs play in the ARRI look management has changed. LogC3 LUTs are Log-to-Display, incorporating both the creative intent and the conversion to a display color space into one LUT. In the LogC4 workflow this has been divided into two separate LUTs: a creative LUT, which is Log-to-Log, and a display LUT, which is Log-to-Display. The camera look file (ALF4) contains the LogC4 creative LUT, and for proper display, it must be followed by a LogC4 display LUT (which the camera provides). LogC4 display LUTs are part of the ARRI Reference Tool (available for download from the ARRI website HERE), are available for download HERE (ALEXA 35 - 3D LUT-Package), and have been distributed to all third parties in the ARRI Partner Program, so they will be part of the new Resolve, Daylight, Baselight and other tools.

Monitoring HDR via the SDI Outputs

The creative look can be set in-camera with the ALF4 look file (containing the LogC4 creative LUT). The camera can output the image with that look to a number of display color spaces by applying LogC4 display LUTs. Go to CAMERA MENU > Image > Look > SDI 1 Color Space. The settings for SDI 1 and SDI 2 can be different, allowing simultaneous monitoring of the SDR and HDR version of a given look.

Wireless Video Optimized (WVO) LogC4

In some instances, when using wireless video transmitters and color grading on set, banding artifacts have been observed. These are caused by an interaction between the LogC4 tonal curve and either 8-bit wireless video transmitters or 10-bit transmitters, which can show 8-bit-like symptoms when signal quality deteriorates. If you are not experiencing these issues, there is no reason to use WVO LogC4. If you ARE experiencing these banding issues, you can set the SDI output that feeds the wireless transmitter to WVO LogC4, which is an intermediate signal encoding (CAMERA MENU > Image > Look > SDI 1 Processing > Wireless Video Optimized LogC4). Please note that you MUST then also decode the WVO signal with a special WVO to LogC4 LUT at the receiving end, to convert that special WVO signal back to LogC4. Do not use the WVO LogC4 signal without the WVO to LogC4 LUT! You can find a technical note

on WVO LogC4 HERE, and the decoding WVO to LogC4 LUTs HERE.

Monitoring HDR in the Viewfinder

The MVF-2 viewfinder, when used on the ALEXA 35, allows monitoring of an HDR image in the eyepiece. This is the fastest and most convenient way to quickly check if a lighting setup works in HDR without an extra HDR monitor on set (use the VF Check HDR user button or the menu at CAMERA MENU > Image > Look > VF Processing > Look (EVF: HDR, Mon: SDR)). Please note that while the image in the eyepiece (VF) is in HDR, the image on the flip-out monitor (Mon) is in SDR.

ARRI Look Library LogC4

The ARRI Look Library LogC4 is included free-of-charge in each camera and in the ARRI Reference Tool. In addition, the ARRI Look Library LogC4 can be downloaded free-of-charge HERE. Please note that the ARRI Look Library LogC4 contains LogC4 creative LUTs (Log-to-Log) that require an additional LogC4 display LUT (Log-to-Display) for the conversion to a display color space. LogC4 display LUTs can be downloaded HERE (ALEXA 35 - 3D LUT-Package).

Lens Coverage

Most spherical Super 35 lenses cover at least the 4K 16:9 sensor mode, and most anamorphic Super 35 lenses cover at least the 3.3K 6:5 sensor mode. For an overview of which lens covers which sensor mode, see the online ARRI Frame Line & Lens Illumination Tool, which is available HERE. Please note that this tool shows how much light is available in the corners of the image but makes no claim as to the image quality. As always, we strongly recommend shooting your own tests with the lenses and cameras in question.

Recording Media

ALEXA 35 cameras record to Codex Compact Drives 1TB and Codex Compact Drives 2TB. Compact Drive 1TB and 2TB have almost the same maximum frame rates for Apple ProRes. Compact Drives 2TB have a higher recording data rate and therefore allow higher maximum frame rates in ARRIRAW with the ALEXA 35 (but not with the ALEXA Mini

LF). Most Compact Drives 1TB need a firmware update before initial use with the ALEXA 35, which can be applied by the ALEXA 35 in-camera.

Black Balance
It is neither necessary nor possible to manually black balance an ARRI digital camera as their sensors are temperature stabilized and therefore do not need black balancing.

Defect Pixels
All sensors exhibit some defect pixels. ARRI digital cameras deal with them via three methods. First, a static pixel correction map is created during manufacturing and during each re-calibration of the sensor. Second, the camera continuously monitors each pixel and masks defect pixels with the Dynamic Defect Pixel Correction (DDPC). And third, in the rare case where there are still unruly pixels, customers can create their own User Pixel Mask (UPM) with the ARRI reference Tool, as described in the ALEXA 35 manual under “17.2 User Pixel Masking”. You can find the manual HERE.