Production Technology Support

CAMERA PRODUCTION GUIDE | **ARRI ALEXA LF**

Settings and best-practices for capture with the ARRI ALEXA LF (Software Update Package SUP 4.0 and later) on Netflix 4K Originals.

If you have any questions or comments please contact: prodtech.support@netflix.com
Current ALEXA LF Ops Manual: HERE (scroll down to “Downloads”).
ARRI LF Frequently Asked Questions (FAQ): HERE.

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

SETTING	MENU NAVIGATION	SELECTION
SENSOR MODE	MENU → PROJECT → SENSOR MODE →	**LF 16:9** **LF Open Gate** **LF 2.39:1**
RECORDING FORMAT	MENU → RECORDING → FORMAT →	**ARRIRAW**

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

Note 1: ARRIRAW contains the uncompressed and unencrypted raw sensor data without any debayering, sensitivity setting (Exposure Index - EI), white balance (WB), image processing (Log C, Rec 709 or ARRI Look File ALF-2), noise reduction, image transforms (mirror horizontally, rotate 180°), up/downscaling or anamorphic de-squeezing applied to the recorded image. For more information on ARRIRAW go HERE.

Note 2: The settings chosen for the monitor path (see settings listed in Note 1), including the full ARRI Look File ALF-2, are stored in metadata within the ARRIRAW file. Having the look file attached to the essence is handy for automated dailies creation, editing with looks and as a reference for final grading. During the debayering process

(creating a full color image from ARRIRAW) it is possible to have all these settings automatically applied to the image, or to choose alternate settings manually.

Note 3: ARRIRAW images can be viewed and debayered with the free-of-charge ARRIRAW Converter (ARC). The ARC is based on the same ARRI debayering engine that is also used by most third party software for ARRIRAW. The ARC can be downloaded HERE.

Note 4: The ARRIRAW image specifications are published as SMPTE Registered Disclosure Documents RDD 30 and 31.

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CAPTURE SETTINGS | **4K COMPRESSED**

SETTING	MENU	SELECTION
SENSOR MODE	MENU → PROJECT → SENSOR MODE →	**LF 16:9** **LF Open Gate** **LF 2.39:1**
RECORDING FORMAT	MENU → RECORDING → FORMAT →	**ProRes**
RECORDING SETTING	MENU → RECORDING → SETTING →	**ProRes 4444 XQ** **ProRes 4444** ProRes 422 (HQ)
RECORDING RESOLUTION	MENU → RECORDING → RESOLUTION →	**For sensor mode LF 16:9: 4K UHD** **For sensor mode LF Open Gate: OG 4.5K** **For sensor mode LF 2.39:1: Scope 4.5K**
REC PROCESSING	HOME → COLOR → REC PROCESSING →	**LOG C**

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

Note 1: Apple ProRes is a compressed full color image format that has debayering, sensitivity (Exposure Index - EI), white balance (WB), image processing (Log C, Rec 709 or ARRI Look File ALF-2), noise reduction (if turned on), image rotation (if chosen) and up/downscaling (if chosen) permanently applied to the image. For more information on Apple ProRes go HERE.

Note 2: When shooting Apple ProRes with Log C processing, the full ARRI Look File ALF-2 that is applied to the monitoring paths is stored in metadata of the recorded Apple ProRes file for automated dailies creation, editing with looks and as a reference for final grading.

Note 3: Noise Reduction is off by default and can be turned on in MENU > SYSTEM > IMAGING > NOISE REDUCTION. Netflix prefers to not use noise reduction in-camera, since more sophisticated algorithms can be used in post.

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

INTERNAL RAW RECORDER	MAX FPS	MAX RESOLUTION
Internal	150 fps	**Sensor mode LF 2.39:1 (4448 x 1856)**
	90 fps	**Sensor mode LF 16:9 (3840 x 2160)**
	90 fps	**Sensor mode LF Open Gate (4448 x 3096)**

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

INTERNAL RECORDER	MAX FPS	MAX RESOLUTION
ProRes 422 (HQ) & ProRes 4444	100 fps	**Sensor mode LF 2.39:1 (4448 x 1856)**
	60 fps	**Sensor mode LF 16:9 (3840 x 2160)**
	60 fps	**Sensor mode LF Open Gate (4448 x 3096)**
ProRes 4444 XQ	60 fps	**Sensor mode LF 2.39:1 (4448 x 1856)**
	60 fps	**Sensor mode LF 16:9 (3840 x 2160)**
	40 fps	**Sensor mode LF Open Gate (4448 x 3096)**

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

Note: ARRIRAW and Apple ProRes frame rates are given for recording to SXR Capture Drives. Recording to SxS PRO+ 256GB cards can yield lower maximum frame rates in some cases.

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OPTIMIZING PERFORMANCE | **MAINTENANCE PROCEDURES**

Online Tools and Applications
A number of useful ARRI tools, including the Frame Line & Lens Illumination Tool, Camera Simulators, Formats & Data Rate Calculator, ARRIRAW Converter, ARRI Color Tool and ARRI Meta Extract are available in the TOOLS & APPS section of the ARRI website.

Lens Coverage - General
While the sensor areas of the LF Open Gate and LF 2.39:1 sensor modes require a full frame lens (or a Super 35 lens with an appropriate expander), the LF 16:9 sensor area can be covered by the illumination area of many Super 35 PL mount lenses. These lenses can be attached to the ALEXA LF or ALEXA Mini LF by using the PL-to-LPL Adapter. To check which lens covers which sensor mode, see the next note and/or look in the online **ARRI Frame Line & Lens Illumination Tool** (click HERE). ARRI is continuously expanding the tool's library of lenses. 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.

Lens Coverage - ARRI Super 35 Lenses for LF 16:9 Sensor Mode
The following ARRI Super 35 lenses have an illumination area that covers the LF 16:9 sensor mode:
- Ultra Primes ≥ 20 mm
- Master Primes ≥ 35 mm
- Master Macro 100
- Ultra Wide Zoom 9.5 – 18 ≥ 10 mm
- Alura LWZ 15.5 – 45 with Alura Extender 1.4x
- Alura LWZ 30 – 80 mm
- Alura Studio zoom 18 – 80 from 40 mm on without extender
- Alura Studio zoom 18 – 80 with Alura Extender 1.4x

- Alura Studio zoom 45 – 250 from 100 mm on
- Alura Studio zoom 45 – 250 with Alura Extender 1.4x

Note: Netflix recommends that lenses not specifically designed for large format should be thoroughly tested for adequate sensor coverage, and for the satisfaction of the production's creative intent.

Lens Coverage - ALEXA LF, Mini LF and Anamorphic Lenses
While full frame anamorphic lenses are slowly entering the market, shooting with existing 35 format anamorphic lenses is also possible by using LF Open Gate and cropping the desired area from the image in post-production. A Netflix approved ARRI white paper with details can be downloaded from the ALEXA LF webpage HERE (scroll down to the DOWNLOADS section and click on the document "ALEXA LF & Anamorphic Lenses White Paper").

Amongst other topics, the white paper covers two methods for shooting with anamorphic lenses compatible with Netflix' 4K mandate:

- When shooting with 35 format 2x anamorphic lenses for a 2:1 aspect ratio result, Netflix accepts the use of a 2880 x 2880 area on the ALEXA LF and ALEXA Mini LF sensor. All Master Anamorphic lenses cover this area. To use this method, create a 2880 x 2880 custom frameline in the **ARRI Frame Line & Lens Illumination Tool** (click HERE), shoot LF Open Gate and crop 2880 x 2880 in post.

- When shooting with 35 format 2x anamorphic lenses for a 2.39:1 aspect ratio result, Netflix accepts the use of a 3148 x 2636 area on the ALEXA LF and ALEXA Mini LF sensor (if you have gotten Netflix approval for delivering 2.39:1). Master Anamorphic lenses from 40 mm on cover this area, and the ARRI Anamorphic Ultra Wide Zoom AUWZ 19-36 covers this area from 21 mm on for wide angle shots. To use this method, create a 3148 x 2636 custom frameline in the **ARRI Frame Line & Lens Illumination Tool** (click HERE), shoot LF Open Gate and crop 3148 x 2636 in post.

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Using HDE for smaller ARRIRAW Files
While ARRIRAW is recorded uncompressed in-camera, the ARRIRAW file size can be reduced during the download process by about 40% through Codex High Density Encoding (HDE). HDE is part of the free-of-charge and license-free Codex Device Manager 5.0 or later software that must run on the Mac receiving the files. HDE is a lossless encoding technique, so the original ARRIRAW files are bit-identical to an ARRIRAW files after HDE decoding. Many third parties already support HDE natively in their software. To learn more about HDE, have a look at ARRI's ARRIRAW FAQ HERE and choose "HDE / High Density Encoding" from the "Select your option" pull-down menu. To download the latest Codex Device Manager, go HERE.

Sensor Modes

Sensor mode LF Open Gate provides the maximum sensor area (36.70 mm x 25.54 mm) and maximum resolution (4448 x 3096 photosites) for maximum flexibility in post. This sensor mode is covered by full frame lenses, the ARRI Master Macro 100 and by some Super 35 lenses with expanders. The maximum frame rate is 90 fps. Since the entire sensor is recorded, surround view is not available and this mode has the highest data rate.

Sensor mode LF 16:9 covers the smallest area (31.68 mm x 17.82 mm) that still meets Netflix 4K deliverable standards with its 3840 x 2160 photo sites. Full frame lenses cover this, of course, but the use of Super 35 lenses is also possible, maximizing lens options. LF 16:9 has surround view available. The maximum frame rate is 90 fps.

Sensor Mode LF 2.39:1 combines a cinematic widescreen image (36.70 mm x 15.31 mm - 4448 x 1856) with high frame rates of up to 150 fps for sensuous slow motion. This sensor mode has the lowest data rate. In order to maximize frame rate, no surround view is available.

Calculating Crop Factors
The crop factor is the factor by which a focal length has to be multiplied to get the same angle of view on a larger sensor. Crop factors are easy to calculate if both sensors have the same photosite size, as is the case with all ARRI digital cameras. It is important to use the photosite count for the actual framelines one will use.

Crop factor = larger horizontal photosite count divided by smaller horizontal photosite count

Example 1: LF Open Gate (4448 photosites wide) and S35 ALEXA SXT 16:9 2.8K (2880 photosites wide)
4448 / 2880 = 1.54
To get the same angle of view that a 50 mm lens produces on a S35 ALEXA SXT in 16:9 2.8K recording format, you need a 77 mm lens on the ALEXA LF in LF Open Gate recording format (50 * 1.54 = 77).

Example 2: LF Open Gate (4448 photosites wide) and S35 ALEXA Mini Open Gate (3424 photosites wide)
4448 / 3424 = 1.3
To get the same angle of view that a 50 mm lens produces on a S35 ALEXA Mini in Open Gate recording format, you need a 65 mm lens on the ALEXA LF in Open Gate recording format (50 * 1.3 = 65).

Monitoring HDR
In order to properly monitor ALEXA image on a High Dynamic Range (HDR) monitor, you can either load one of the HDR ARRI Look Files (ALF-2) provided in the camera or create your own. By default, there are a number of look files stored in the camera for either Dolby PQ (Perceptual Quantizer) or HLG (Hybrid Log Gamma) tone mapping. This works with the HD and UHD MON OUT settings. For more information on High Dynamic Range (HDR) go HERE.

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), as described in the ALEXA LF manual under “14.1.5.5 System”.

Recording Media
ALEXA LF cameras with the initial software release LF SUP 2.0 only supported recording to 1TB and 2TB SXR Capture Drives. SxS PRO+ 256 GB cards have been supported since the LF SUP 3.0 release in August 2018.