

ALEXA XT

Open Gate Sensor Mode (incl. Image Formats)

WHITE PAPER

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1. Version History

Version	Author	Change Note
2013-12-05	Rädlein	First Draft (Merge)
2014-01-20	Rädlein	Typo
2014-12-09	Rädlein	Changing frame line section (including AFLC-3)
2014-12-10	Rädlein	Including Image format section

2. Table of Contents

1. Version History	2
2. Table of Contents	2
3. Introduction	3
4. Technical details	3
4.1 ALEXA XT Sensor Mode Overview	3
4.2 Compatibility	3
4.3 Larger Sensor Area	3
4.4 File Size and Data Rate.....	4
5. Operation	4
5.1 Open Gate Enabling	4
5.2 How to Check if Open Gate is Enabled	4
5.3 Switching to Open Gate Mode.....	4
5.4 Recording	4
5.5 Monitoring	5
5.6 Framelines	6
6. Image Formats for ALEXA Open Gate ARRIRAW Recording	7
6.1 Image Areas	7
6.2 Native Formats (Uncropped)	7
6.3 Film Formats.....	8

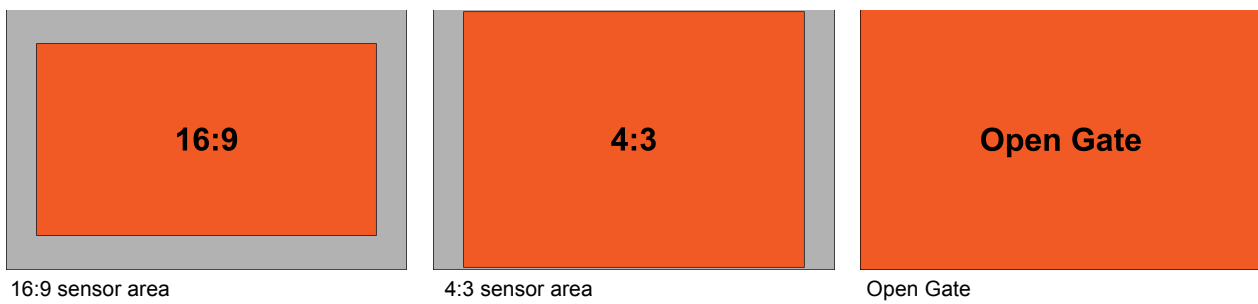
3. Introduction

ALEXA XT cameras with SUP 9.0 (except ALEXA XT M, which will be updated in a future software upgrade) are capable of a new sensor mode called Open Gate, which uses the entire sensor area for recording in ARRIRAW. This document reflects the technical details, the operation and post production of this new mode.

4. Technical details

4.1 ALEXA XT Sensor Mode Overview

- ALEXA's 16:9 mode covers a 16:9 image area in the center of the ALEXA sensor.
- ALEXA's 4:3 mode adds photo cells at top and bottom, making it perfect for working with anamorphic lenses. Or, when shooting with spherical lenses, 4:3 mode provides extra room for VFX markers or up/down repositioning.
- While 16:9 and 4:3 modes will remain the standard for most ALEXA capture, some specific situations will benefit greatly from recording in Open Gate mode, including wide angle establishing shots, image repositioning, resizing, rotating or stabilizing, native 3.4K VFX work, special venue projects (IMAX) or for up-scaling to 4K.



4.2 Compatibility

- Open Gate mode is only possible with ALEXA XT cameras except ALEXA XT M. Open Gate mode for ALEXA XT M is planned for a future Software Update Packet.
- Open Gate mode is neither supported by ALEXA Classic cameras, nor by ALEXA Classic cameras that have received the XR Module upgrade or any other upgrade. This means it is not supported by ARRIRAW T-link and thus is not supported by external ARRIRAW recorders. There is no upgrade that can give an ALEXA Classic camera Open Gate mode, since only starting with the ALEXA XT cameras have we qualified the entire sensor area in manufacturing.
- Anamorphic lenses don't make a lot of sense in Open Gate mode since the available sensor area is about as tall as the camera's 4:3 mode and so almost no extra image area is gained.
- Please note that when the physical mirror shutter of the ALEXA XT Studio is on, at frame rates above 30 fps the open angle of the mirror shutter will be reduced by the camera so there is enough time to read out the sensor.

4.3 Larger Sensor Area

- The larger sensor area results in a slightly shallower depth of field and no surround view.
- The active frame size of this format is 28.17 x 18.13 mm, or 3414 x 2198 pixels with an aspect ratio of 1.55:1. (For comparison, a 4:3 2880 x 2160 ARRIRAW frame is 23.76 x 17.82 mm). The captured frame extends beyond the surround view area, that can be seen in the electronic viewfinder. Thus the term "Open Gate". Please note that these numbers are slightly different from numbers given earlier.
- The larger sensor area requires lenses that cover an image circle of 33.5 mm. You should, of course, always test your lenses before using Open Gate mode. Our initial tests have shown Open Gate mode to be compatible with:
 - most spherical primes longer than 20 mm,
 - spherical zooms at the longer end of their range,
 - the Alura Lightweight Zoom 15.5 - 45/T2.8 from 17 mm to 45 mm and

- the new ARRI Ultra Wide Zoom UWZ 9.5 - 18 at all focal lengths. It is perfect for all Open Gate wide angle work.

4.4 File Size and Data Rate

- An Open Gate ARRIRAW frame is approximately 11.30 MB.
- At 24 fps, this results in a bit rate of 2.17 Gbit/s and a data rate of 271 MB/s or 976 GB/h.

5. Operation

5.1 Open Gate Enabling

ALEXA XT cameras manufactured after December 1, 2013 have Open Gate mode enabled straight out of the box. Most ALEXA XT camera manufactured before December 1, 2013 will have to be sent to an official ARRI Service Center for a number of adjustments before Open Gate mode can be used. This is necessary since these cameras have been manufactured before the SUP 9.0 software was finished, and thus it was not possible to make the necessary adjustments for Open Gate mode. Please note that this offer is good for one year after the purchase date of the ALEXA XT camera in question.

5.2 How to Check if Open Gate is Enabled

First make sure that you have an ALEXA XT (except ALEXA XT M) and that SUP 9.0 or later is installed. Then select MENU > SYSTEM SENSOR > SENSOR MODE on the display. If "Open Gate" is shown, Open Gate is enabled. If "Open Gate" is not shown, it is not enabled, and you have to send the camera to ARRI service if you want the necessary adjustments made so Open Gate can be used.

MENU>SYSTEM>SENSOR	
Sensor mode	16:9
Sensor temperature	4:3
Mirror image horizontal	Open Gate
User Pixel Masking	>

ALEXA XT with Open Gate enabled

MENU>SYSTEM>SENSOR	
Sensor mode	16:9
Sensor temperature	4:3
Mirror image horizontal	Off
User Pixel Masking	>

ALEXA XT with Open Gate not enabled

5.3 Switching to Open Gate Mode

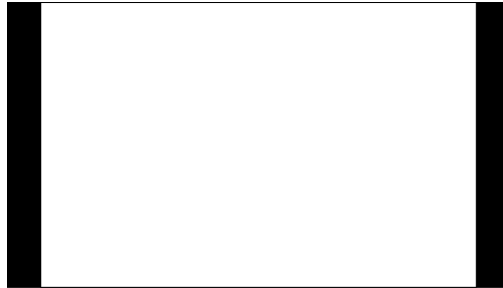
- When the camera is switched to Open Gate mode it has to be restarted; please note that this first restart after switching will take significantly longer than restarts with a camera that is already in Open Gate mode.

5.4 Recording

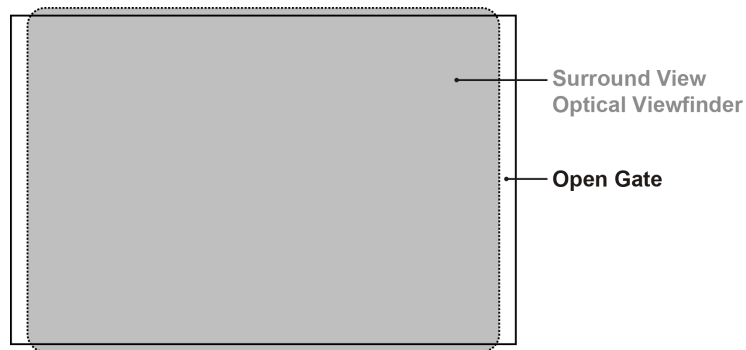
- Open Gate mode recording is in ARRIRAW to XR Capture Drives up to 75 fps. Switching from regular ARRIRAW to ARRIRAW Open Gate requires a camera restart. Open Gate is not supported for ProRes or DNxHD recording.
- Please note that even though the menu seems to allow to enable audio recording, the camera will not record audio while it is set to Open Gate mode.

5.5 Monitoring

- The electronic viewfinder, MON OUT and REC OUT provide a preview image that shows the full sensor area in a pillar box. Since we are recording the full sensor area, there is no surround view.



- When shooting Open Gate with the ALEXA XT Studio, we recommend using the Electronic Viewfinder EVF-1. The EVF-1 can be attached to the ALEXA Studio with the Electronic Viewfinder Adapter EVA-1 (K2.72063.0). If you don't have an Electronic Viewfinder EVF-1 and viewfinder cable, you can get the Electronic Viewfinder Set for ALEXA Studio/ALEXA XT Studio (K0.71220.0) which contains everything needed to equip an ALEXA XT Studio with the Electronic Viewfinder EVF-1.
- Alternatively, it is possible to use Open Gate with the ALEXA XT Studio and the optical viewfinder with the Ground Glass Blank, 4:3 (K2.72079.0). Please note, though, that you will see slightly more than is captured above and below the image, and slightly less to the left and right. In that case we recommend to check the sides on the MON OUT, which will show the full width of the image.



5.6 Framelines

5.6.1 Presets

- When shooting Open Gate with an Electronic Viewfinder EVF-1, we recommend using the preset Framelines or User Rectangles (MENU > MONITORING > FRAME LINES > USER RECTANGLES) to set your framing.

5.6.2 Frameline Composer

- The online webtool ALEXA Frameline Composer AFLC-3 does now support also ALEXA Open gate sensor mode:

SENSOR

Camera: ALEXA
Sensor Mode: Open Gate (ALEXA XT only)

FORMAT A

Aspect Ratio: none
Custom Ratio: :1
Marker Style: Full box
Outside shading: none
Scale Format: 100 %
Format Name: Format A

FORMAT B

Aspect Ratio: none
Custom Ratio: :1
Marker Style: Full box
Outside shading: none
Scale Format: 100 %
Format Name: Format B

FORMAT C

SETTINGS

Position/Alignment: centered
Center Marker: none
Line Width: normal
Scale Formats: 100 %

PREVIEW

OpenGate ALEXA XT only

Reset Formats
Calculate Dimensions
Create URL

FRAMELINES

File name: MyFramelines
Download Preview as Image: Download.png
Download Frameline File: Download.xml

FRAMELINE LIBRARY OPEN GATE (ALEXA XT ONLY)

1.78:1 crop out 25% shading
1.33:1 crop out 25% shading
1.78:1 thin lines 25% shading
1.85:1 25% shading
2.39:1 25% shading
2.39:1 1.78:1 inside

version info: AFLC-3 version 3.0 build 1001

If you need assistance, have questions or comments, please contact digitalworkflow@arri.de.

6. Image Formats for ALEXA Open Gate ARRIRAW Recording

This section of the document describes the Open Gate Sensor Mode format that can be selected in ALEXA XT cameras running Software Update packet SUP 9.0 (or later) firmware.

When posting ARRIRAW images in the Open Gate format there are three photosite dimensions you might be confronted with: Stored Open Gate (3424 x 2202), Open Gate Full Image (3420 x 2198) and Clean Open Gate (3414 x 2198). This paper explains these and why you should be using the Clean Open Gate format.

6.1 Image Areas

Open Gate ARRIRAW recording captures all existing photosites of the ALEXA sensor, producing a 'Stored Open Gate image' with 3424 x 2202 photosites. However, the outermost two columns and two rows of the sensor potentially contain damaged photosites. Unlike other areas of the sensor, any damaged photosites in these rows and columns cannot be repaired by the automatic in-camera correction algorithm.

Moreover, these rows and columns lack outside neighbors and 'neighbors of neighbors'. Quality debayering algorithms require consideration of data from the nearest and next-to-nearest photosites, in all directions, and these outermost two rows and two columns cannot meet that requirement.

Avoiding these rows and columns leaves an array of photosite data with dimension 3420 x 2198. Some image containers have metadata that refers to these dimensions as the Open Gate 'full image'. Although this may be appropriate metadata, it is not a dimension that should be presented to end users. As noted below, the only dimensions that users should see are those of what we term the 'Clean Open Gate image'.

We have found the best results in resizing up to UHD-1 or to 4K resolution, or down to 2K resolution, are achieved when the source resolution is 3414 x 2198 pixels ('Clean Open Gate image'). This width and height are used in the ARRIRAW SDK, as well as the GUI and command-line ARC.

The differences between the 'full' Open Gate image dimensions and the 'Clean Open Gate image' dimensions are so small (3 columns at each of the left and right edges; no difference at top or bottom) and the benefit in resizing quality is so significant that we recommend presenting only one 'Open Gate' resolution; this must be the 'clean', center-cropped version which is optimized for later resizing.

Neither the uncropped 3424 x 2202 'Stored Open Gate' images nor the 3420 x 2198 'full' images should be made available to users.

The characteristics of the 'Stored' and 'Clean' regions are recapitulated below.

6.1.1 Stored Open Gate Image Area

- 3424 x 2202 resolution matches that of photosite array
- Contains data from possibly-damaged photosites in outer two rows and columns.
- Would require special reconstruction of outermost edge RGB pixels, as these are not completely surrounded by neighboring photosites that could provide interpolation endpoints.
- Not supported as a source image size in ARRI-provided tools offering optimized resize.
- If for some reason must be seen by user, should be labeled as 'Stored Open Gate Image' area.

6.1.2 Clean Open Gate Image Area

- 3414 x 2198 resolution optimized for resizing, especially for upscaling to UHD-1 or 4K.
- No special casing required in RGB reconstruction algorithm as all delivered pixels have a complete set of valid neighboring photosites.
- Should be referred to as 'Clean Open Gate Image' area.

6.2 Native Formats (Uncropped)

Format	Aspect Ratio (referred to Clean Open Gate Image Area)	Scaling Factor	Stored Open Gate Image Area (do not use)	Clean Open Gate Image Area (This format is recommended, and it is used in ARRIRAW SDK, ARC and CMD)
Native	1.55:1	1:1	3424 x 2202	3414 x 2198

6.3 Film Formats

(cropped to desired aspect), based on 3414 x 2198 'Clean Open Gate' image

Format	Scaling Factor	Scaled (before cropping)	Output (after cropping)	Used Active Sensor Area
1.78:1@ HD	9:16	1920 x 1236	1920 x 1080	3414 x 1920
1.78:1@ 2k	3:5	2048 x 1318	2048 x 1152	3414 x 1920
1.78:1@ 4k	6:5	4096 x 2637	4096 x 2304	3414 x 1920
1.78:1@ UHD-1	9:8	3840 x 2472	3840 x 2160	3414 x 1920
1.85:1 @ HD	9:16	1920 x 1236	1920 x 1038	3414 x 1846
1.85:1 @ 2k DCI	24:41	1998 x 1286	1998 x 1080	3414 x 1845
1.85:1 @ 2k	3:5	2048 x 1318	2048 x 1108	3414 x 1847
1.85:1 @ 4k DCI	48:41	3996 x 2573	3996 x 2160	3414 x 1845
1.85:1 @ 4k	6:5	4096 x 2637	4096 x 2214	3414 x 1845
2.39:1 @ Flat HD	9:16	1920 x 1236	1920 x 804	3414 x 1430
2.39:1 @ Flat 2K/2K DCI	3:5	2048 x 1318	2048 x 858	3414 x 1430
2.39:1 @ UHD-1	9:8	3840 x 2472	3840 x 1608	3414 x 1430
2.39:1 @ Flat 4k/4k DCI	6:5	4096 x 2637	4096 x 1716	3414 x 1430

Note 1: The formats above are supported in both the SDK and the ARRIRAW Converter 3.0.

Note 2: All formats are for spherical lenses. If shooting with anamorphic lenses is required it is better to use the 4:3 sensor mode, as it is as tall as the Open Gate mode, but avoids some of the restrictions of Open Gate, e.g. it has a higher frame rate.

Note 3: Using Open Gate mode requires ALEXA SUP 9.0 or later.

Note 4: Using Open Gate mode with the Codex VFS, requires Codex VFS UI 2013.r1.2509 or later.