Synchronization of ARRI Cameras
with 3rd Party Devices

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Version History

Version	Author	Change Note
2020-11	David Zucker	First Draft as "Recommended Practice"
2021-02-16	Jan Heugel	Revision as TI

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Introduction

Various situations require to synchronize a group of devices to properly work together in order to avoid errors, artefacts or disturbances. This can include devices ranging from lighting fixtures, cameras, special effects to motion control devices or the example we will use in this document: a LED wall within a virtual set, where a camera needs to operate in sync with the wall setup.

To synchronize a camera to an external device, such as the LED wall processor, one needs to ensure all devices are synchronized to one another. This is facilitated by trigger signals sent from a single source.

Our guide describes how to configure your ARRI camera and external devices to operate in a synchronized fashion. A common method to achieve synchronization amongst video devices is Genlock (Tri-Level and BlackBurst).

1 ALEXA Classic Cameras (ALEXA XT, SXT, LF and ALEXA 65)

1.1 Overview

Since ALEXA Classic cameras are not equipped with a Genlock input, one needs to get creative. It is possible to trigger ALEXA Classic cameras with an external timecode feed while also providing synchronization to 3rd party equipment over Genlock.

1.2 System Setup

It is imperative that both sync signals originate from the same source clock. The source clock would need to generate both signals at the same time:

- Genlock (Tri-Level Sync): External devices – such as an LED wall processor and other devices in your environment.

- Timecode: ALEXA Classic camera – the camera is fed a timecode via LTC; the sensor will be triggered according to that timecode signal.

An example of a device that is capable of generating both timecode and Genlock from the same master clock is the Ambient ACL Lockit box.

We have successfully used two Ambient Lockits during our tests: ACL 204 and ACL 203 or 202 (older models).

Ambient is of course not the only brand offering devices with this or a similar functionality but rather were the devices at our disposal.

The Tri-level sync signal is an analog video signal. If you send it to multiple stations, we recommend using an analog video distribution amplifier. Otherwise, T-pieces would work for relatively short cable runs. Do not forget to terminate where necessary!

1.2.1 Device timecode tuning

It is a standard and highly recommended practice to tune all your timecode devices, including the camera and timecode devices, from a master timecode device capable of tuning external devices. If this step is not performed a sync drift could occur while the camera is recording.

1.2.2 Phase shifting

Some external devices, such as a LED wall processor, allow for phase shifting the incoming Genlock signal (Sidenote: Ambient ACL 204 also allowes phase shifting the Genlock signal internally).

On a regular LTC signal, phase shifting is not possible. But you can apply a pseudo-phase-shift by feeding the timecode through an audio delay device on its way to the camera.

In the device setup scheme below this has been marked 'optional' due to phase shifting abilities in the rest of the signal chain.

1.3 Camera setup

- Perform a factory reset via MENU > User Setups > Factory reset
- Setup your project in MENU > Project > Project frame rate; set it to e.g. 24 fps

- Use the dedicated 'TC' button to access the timecode menu. Change the timecode settings in the timecode menu (access via the "Options" button).
- Set the parameters accordingly:
  - o Source: EXT LTC
  - o Mode: Free Run
  - o Generastor: Regen

1.3.1 Home screen

The timecode on the home screen will blink if no external timecode is fed to the camera. Also the 'info' button will tell that an external LTC is missing.


- Connect the 5-pin Lemo if you haven't already done so.
- Wait a few seconds

The timecode should stop flashing and take on the new clock that is being supplied by the timecode generator oder the LTC input.

As long as the sensor is set to the same rate as the project rate (in our example: 24fps), the camera will reference the incoming LTC timecode and trigger the sensor based on that clock.

1.4 Setup diagram
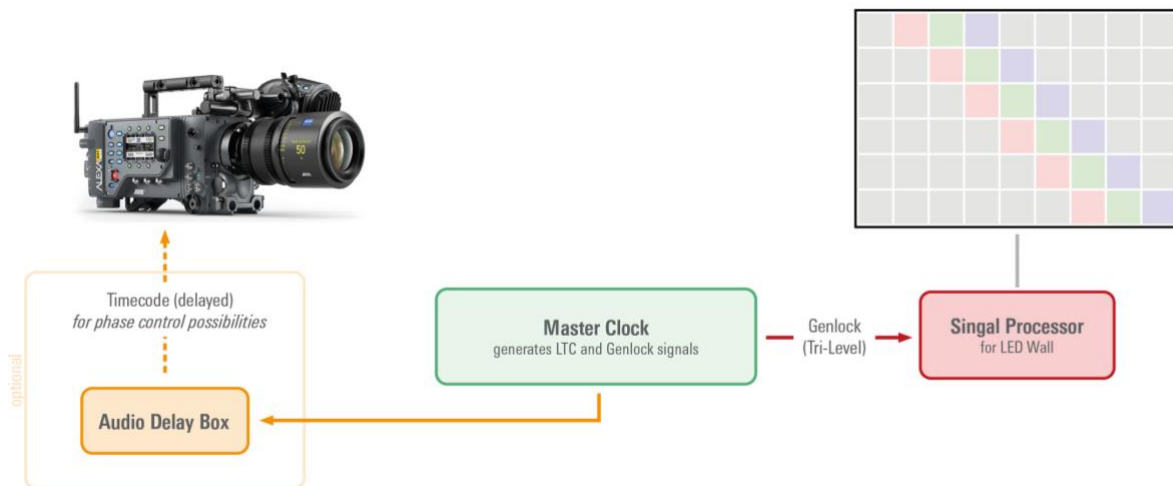
2 ALEXA Mini LF, AMIRA and ALEXA Mini

2.1 Overview

With ALEXA Mini LF and AMIRA things are a little easier as you can feed the camera directly with a Genlock Signal, the sensor will be triggered according to that signal.

ALEXA Mini needs to be modified by ARRI Service to accept a Genlock signal. SDI-2 will be converted to "SYNC IN".

The camera's sensor needs to run at equal or double the framerate of the reference signal to establish synchronization. With a ALEXA Mini LF, please keep in mind the framerate limitation over the regular LF.

2.2 System Setup

Genlock

Using an Ambient ACL 204 or a similar device, the output can be configured to feed a Tri-Level Genlock. For "Tri-Level" set the ACL 204 to 1080p and make sure to match the frame rate of all connected devices. 23.976 fps is NOT 24 fps!

One can use other devices to generate a Tri-Level signal like the AJA Gen10 to replace the Ambient ACL 204 and video distribution amplifier.

In testing, we have had mixed and quite unreliable results when using a Blackmagic Mini Converter Sync Generator as a Genlock source.

Again, do not forget to terminate this analog video signal where necessary if you are working with T-pieces!

2.3 Camera setup

Enable the cameras Genlock input via MENU > System > Sensor > Genlock Sync. Set it to "SYNC IN". The camera can still run at double the incoming Genlock rate while maintaining sync reference with its input.

2.3.1 Phase shifting

If you find the camera and external device are not in sync, you can adjust the Sync Shift in the camera to apply an offset to the incoming Tri-level Sync trigger. This value is likely to depend on the LED wall technology and framerate you are using. It is not uncommon to use a value of around 1.000.000 as that equates to 6.7ms.

2.4 Setup diagram
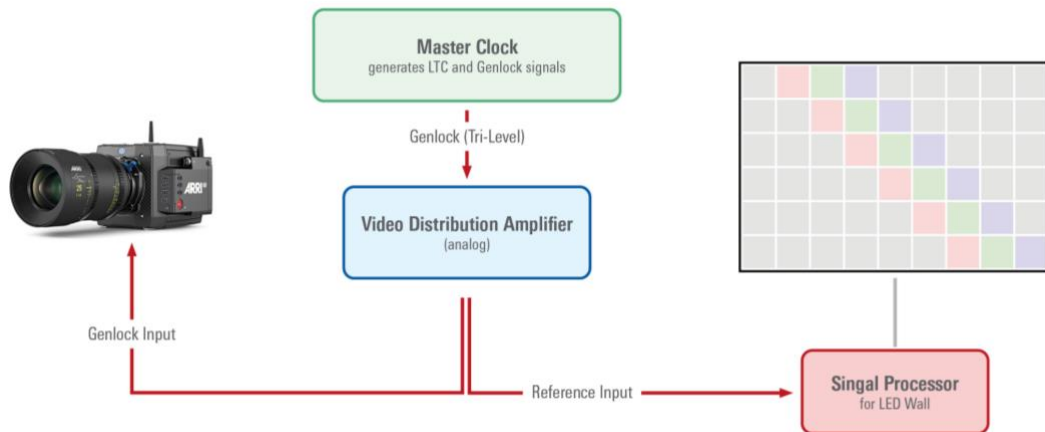
Contact

In case you have questions or recommendations, please contact the Digital Workflow Solutions group within ARRI via email: digitalworkflow@arri.de