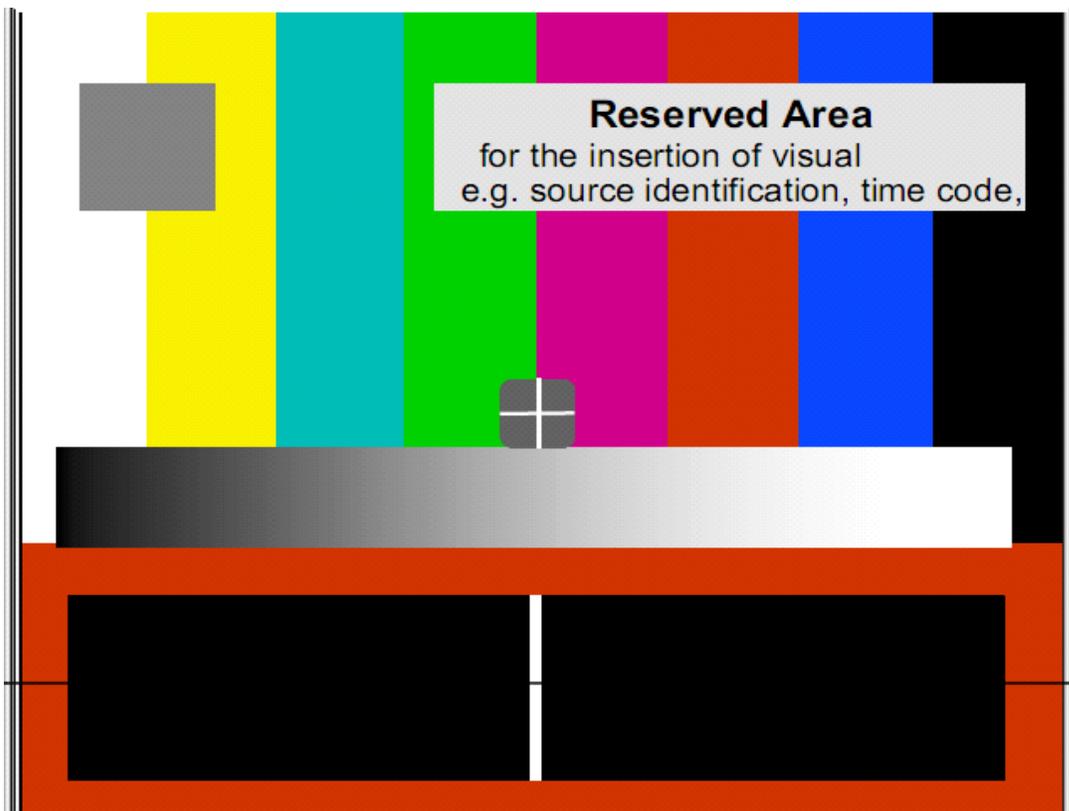


Application Note
Audio Video Delay and
Frame Synchronization
Revision 1.1 April 2014



Introduction

AV-delay is a major issue in broadcast environment, AV-delays are the reason for Lip Sync errors. That is, movement of lips in the video and the corresponding audio do not match to each other, therefore too much lip-sync error can annoy the audience. AV-delay is measured in various ways e.g. the EBU has published a test pattern 3305 as can be seen in the illustration on the cover page of this application note.

Unfortunately frame synchronizing leads coercively to AV-delays as described in this application note. AV-delay is inherent to the task of synchronizing.

LYNX Technik AG resolved this issue by introducing a good compromise for compensating the perceptible AV-delay as described in the following chapters.

Synchronous mode

When the input is already synchronous and locked, it does not have to be re-synchronized. Only a constant offset to the external reference REF has to be corrected as illustrated by "X" in Figure 1. This does not result in any audio artifacts neither in A/V-delay (lip-sync).

But when this mode of operation is being applied to an asynchronous signal (i.e. when the offset between SDI and REF changes constantly), the delay compensation will permanently be re-adjusted. Each such re-adjustment of the audio-delay (which is equivalent to duplication / discarding of some audio-content) results in an audible artifact.

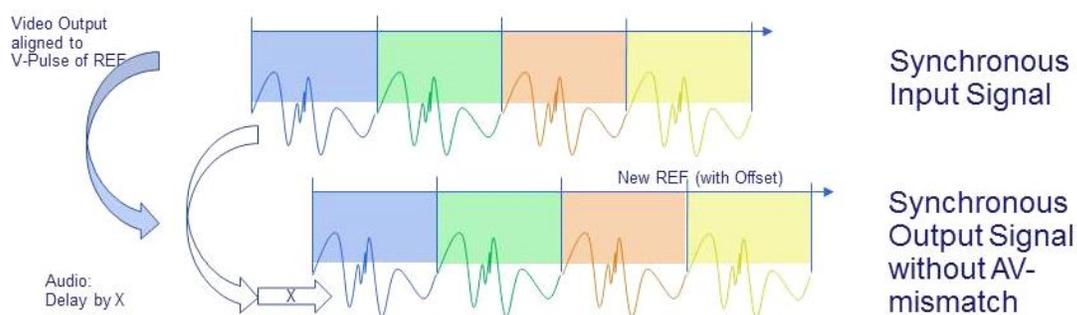


Figure 1 A synchronous SDI Input with Embedded Audio

The frame synchronizer has to be set according to Figure 2 in order to benefit from automatic audio delay adjustment. This setting can be found on the Video Processing tab of the APPolo Control GUI and leads to zero A/V-mismatch. Without this option A/V-delay is observable.

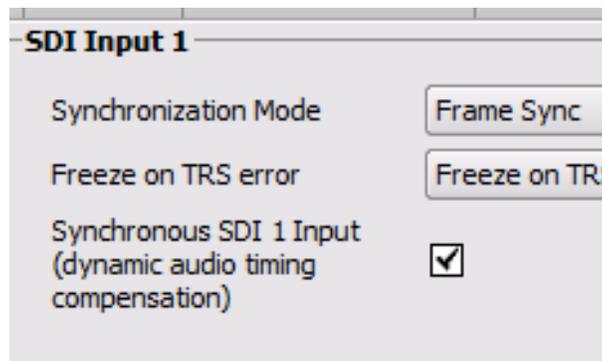


Figure Settings in the APPoloGUI for dynamic audio compensation in the “Video Proc” tab.

Asynchronous mode

The synchronization of an asynchronous video-stream and a PCM-audio stream is done in fundamentally different way:

Non-Synchronous Video is being synchronized by duplicating or discarding complete video frames (= ~40ms worth of content) whenever required. This is illustrated by the “red” dropped frame (third frame in the upper row) in Figure 3. Non-Synchronous PCM-Audio is being synchronized by re-sampling the audio-modulation in the correct frequency with a Sample-Rate-Converter (i.e. no duplication or discarding of any content).

This separate synchronization of video and PCM-audio contents, each through the correct and appropriate process (see above), leads to a result that cannot be without any artifact:

- Either the audio is not modified (perfect in itself). The price is that A/V-delay varies.
- As an alternative, the audio could be dynamically adjusted (compressed / extended over time). This would lead to variation in the frequency of the audio content.
- As another alternative, the audio-content could be duplicated or discarded (like the video). This would lead to audible artifacts.

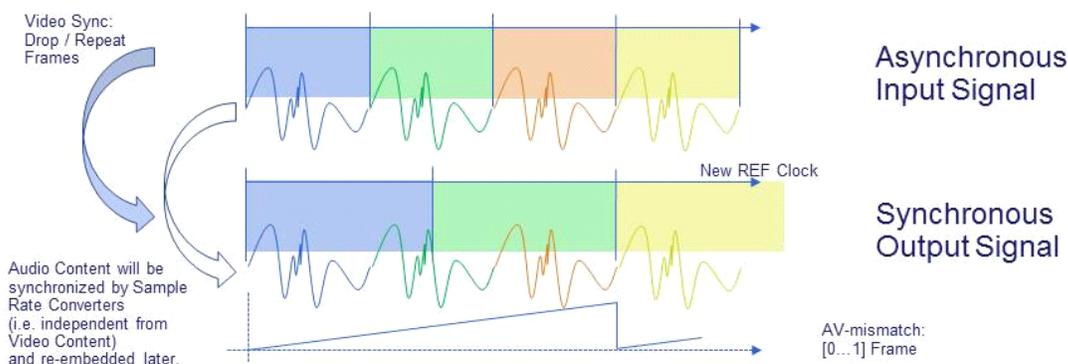


Figure Non-synchronous SDI Input with Embedded Audio leads to AV-mismatch of one ± 1 Frame.

Because it has the lowest impact although lip-sync increases, LYNX Technik AG products use the first method of varying AV-delay. This is also shown in Figure 3 the signal suffers of AV-delay of up to one video frame.

But LYNX synchronizers reduce the problem, by averaging the AV-mismatch to less perceptible AV-delay of ± 0.5 Frames as illustrated in Figure 4. That is why you can observe a delay of e.g. ± 20 ms.

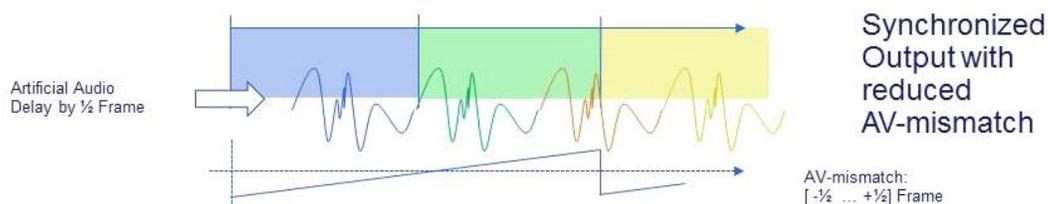


Figure AV-delay of ± 0.5 Frame over time.

Best Practices

So what are the best practices to work in different environments?

Your environment is...

...**synchronous**: enable the checkbox “Synchronous SDI Input” as showed in Figure 2 to achieve 0ms A/V-mismatch.

..**non-synchronous**: disable the checkbox “Synchronous SDI Input” to prevent any audible distortions.

LYNX Technik AG hopes this application note helped to clarify the exciting topic of frame synchronizing and AV-delay and you enjoy working with our products!