



USING DD2100 VIDEO DELAY DETECTOR WITH VIDEO PRODUCTION SWITCHERS

As the cost of digital video processing decreases it becomes possible to integrate devices such as video frame synchronizers, noise reducers, color correctors, and digital effects to produce high performance and cost effective production switchers and systems.

Since many switchers integrate video frame synchronizers in their inputs, a variable video delay which ranges from almost none to one frame is added to the video. In addition, many DVE circuits add an additional delay of one frame, and this delay is changed as the DVE is switched in and out of operation. It is not uncommon for these production systems to add variable delays to the video which range from a few hundred microseconds to over 4 frames, depending on the path the video signal takes through the switcher.

Obviously, a delay of 4 frames will create a lip sync problem. Even delays of 1 frame can be noticeable and will detract from the program quality. In order to prevent this problem, the audio program which is associated with the video signal being output from the production system must be delayed to match the video delay, but how is this to be accomplished when the delay is constantly changing? When a typical video production installation is analyzed, it will often be the case that there is a separate audio source associated with each video input. For example, Video1 might be a network feed from a Satellite and Video2 and Video3 might be from two VTRs. It is important that as each video feed is passed through the production switcher that it's corresponding audio be delayed to match the video delay. This can be accomplished by using a DD2100 to measure the delay and AD3100 to delay the audio.

Each video input is connected to the undelayed input of a DD2100 delay detector, with the output of the production switcher coupled to the delayed inputs of all of the DD2100s. The delay detector can then measure the delay of each video signal and provide a steering signal to a companion AD3100.

For example, when the network video signal is selected by the video switcher, the DD2100 will compare the undelayed network video which is input to the switcher to the delayed network video which is output from the switcher. The DD2100 compares the two video signals with a powerful correlation technique to measure the delay between them.

The delay steering pulse from the delay detector then causes the companion AD3100 to delay the network audio by a matching amount. The delayed network audio is then passed on to the program switcher where is selected and sent on to the transmitter or recording tape machine. Similarly, when VTR1 or VTR2 is selected, its corresponding audio from that source is delayed by the proper amount. The operation of the DD2100 is specifically designed for applications such as these, and has several design enhancements which make it highly desirable for such use.

Some of the questions which frequently come to mind are answered below.

Q. What happens when the video delay undergoes an instant change, such as when the DVE is switched in, or when the input video synchronizer undergoes a pointer crossing?

A. Instant delay changes, especially pointer crossings in four field synchronizers, can cause delay changes up to 66ms. This large change places a difficult burden on the audio synchronizer since it must acquire the new delay value without losing audio, causing pops and clicks or pitch artifacts. Older types of audio synchronizers handled the problem by simply jumping to the new delay value in small 1ms or so steps, but this created pops and clicks. Fortunately these artifacts only lasted for a few seconds, at best and up to a minute in extreme instances.

Most audio synchronizers control pitch artifacts by combinations of limiting the rate of delay change and/or making changes during silence periods. As a consequence of this action, when rapid or instant video delay changes occurred, the audio synchronizer would take several seconds to chase the new delay. If the audio program contained music or other continuous audio, this slowed the rate of change so that it could take a few minutes for the audio synchronizer to catch up to the new delay. During that period the lip sync would be out by a noticeable amount. The AD3100 has a pitch correction circuit which makes it capable of making delay changes of over 2 frames in less than 1 second without any missing audio, pops, clicks, pitch change or other artifacts. This capability allows extremely fast response to instant changes, keeping audio in sync at all times.

Q. What if there are video feeds from character generators or other sources when no delay is needed?

A. There is a two wire remote control dump which forces the delay to zero. This can be wired to the tally system, or other switch contacts to provide this capability.

Q. What happens to the DD2100 when it does not have the same video present at the delayed and undelayed inputs?

A. In this instance, the DD2100 instantly recognizes that there is no correlation at all between the two video signals, and the delay output is held at the last valid value. This value is held until the DD2100 senses matching delayed and undelayed video signals again at which time it again calculates the proper delay.

Q. What happens if a color corrector, noise reducer or proc amp is switched into the production system to make video corrections?

A. As long as the delayed video signal is reasonably similar to the input video signal, the DD2100 correlation is capable of determining the delay. Changes to the delayed video such as noise reduction, color correction, hue, saturation, luma gain and luma offset frequently have no negative effect on the correlation capability of the DD2100.

Q. What happens if a key or matt is created in the delayed video?

A. Again, as long as the delayed video signal is similar to the input video signal, the DD2100 correlation is capable of determining the delay. Normal keying & matting of station logos and titles frequently have no negative effect on the correlation capability of the DD2100.

Q. What happens when the video signal is altered by rotation or other special effects?

A. Effects which spatially alter the video, such as rotations, flips and compression are detected as gross changes to the video and the last valid delay value before the effect is held by the DD2100 until the video returns to its normal state. It might be noted here that such gross changes rarely last for more than a few seconds and the change of video delay during that time is usually quite small. In addition, it is difficult for viewers to detect any lip sync error on video images which have experienced these effects.

Q. Will the DD2100 operate with live camera feeds that are chroma keyed, such as with weather caster which is chroma keyed over a weather map?

A. With effects such as chroma keys the DD2100 is capable of detecting delays providing a significant portion of the undelayed signal is keyed into the delayed signal. If it is desired to guarantee operation of the DD2100 under all key conditions, such as when only a small amount of the undelayed video is keyed into the delayed video, it is suggested to use a switcher ME output or a preview output which is upstream of the chroma keyer and the delayed video input to the DD2100. If necessary, a fixed offset can be added to the AD3100 to compensate for any delay which the chroma key adds to the video, however chroma key delays are usually very small.

Q. Why can't one delay detector be used for all the video signals?

A. Each video signal is asynchronous, and undergoes a unique delay in its frame synchronizer. Consequently, a delay detector is needed for each source. It is however possible to lock a single AD3100 to a tally driven delay pulse generator DG1200 to compensate for the average delay of each video signal through the production system. Contact Pixel's sales personnel for further information on this system.

It is possible to reduce the number of audio synchronizers which are used in the system by detecting which of the delay detectors is active from a status signal provided thereby, and switching the output of the active delay detector to the input of a single audio synchronizer. This system of course requires that the current audio signal be coupled through the audio synchronizer.