



LTV-1 Light to Voltage Converter User's Guide

The LTV-1 converts a light burst to a voltage pulse. LTV-1 is an analyzer accessory that enables precise audio-to-video delay (A/V sync) measurements.



Overview

In both professional and consumer television and A/V systems, divergent audio and video signal paths and the delay inherent in digital processing provide many opportunities for the program sound and picture to fall out of synchronization.

An experienced professional may be able to manually adjust a signal delay until proper synchronization (lip sync) is achieved, but a method of accurately measuring the sync offset is clearly useful for adjustment, cause analysis and satisfying system performance requirements.

LTV-1

We needed a method to satisfy the A/V synchronization tests that are part of both the Dolby and DTS licensee compliance requirements. Dolby and DTS each provide test streams and discs to their licensees that include an A/V sync test, which consists of an audio pulse or “beep” that is synchronized to a white flash in the video.

The LTV-1 uses a light-to-voltage converter mounted in the center of a suction cup, connected to a coaxial

cable terminated in a BNC connector. The LTV-1 converts the white flash on the video screen to a voltage pulse that can be acquired by an audio analyzer or oscilloscope. A second input on the analyzer or scope is connected to the device’s audio output to acquire the beep.

The arrival of the two pulses are plotted against time, and the synchronization offset is easily viewed and measured.



LTV-1 mounted on an LCD television monitor. The black bar at the top to the screen will flash white for sync.

Connection

Connection is simple: for the video pulse input, attach the LTV-1 sensor on the screen in the area where you expect to see the video flash from the test stream. Connect the BNC to an unbalanced analog input on the analyzer or scope.

For the audio pulse input, connect an analog audio output from the playback/streaming device to a second channel on the analyzer or scope. If you are required to test a digital output, you must convert the signal to analog using a reference decoder with a known signal delay, and account for that delay in your measurement.

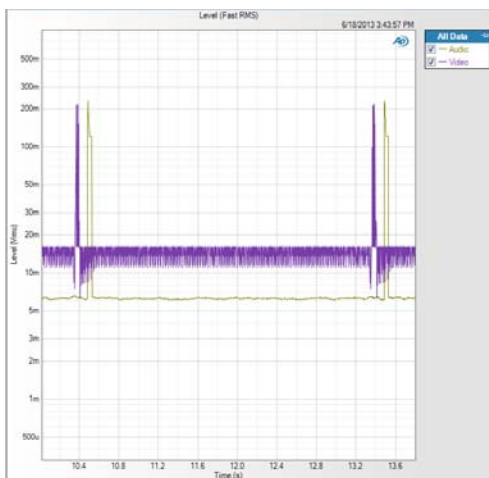
Making the Measurement with APx

First you must configure the analyzer analog inputs. We are using an APx525 analyzer, but the instructions are the same for any APx analyzer.

Set the **Output Configuration** to **None**.

For channel connected to the LTV-1 (typically channel 2), set the **Input Configuration** to **Analog Unbalanced**. Be sure to choose the highest impedance selection; for the APx525, that is **100 kΩ**. Deselect **AC Coupling**, so that the input is DC coupled. For the audio channel (typically channel 1), the settings are usually the same.

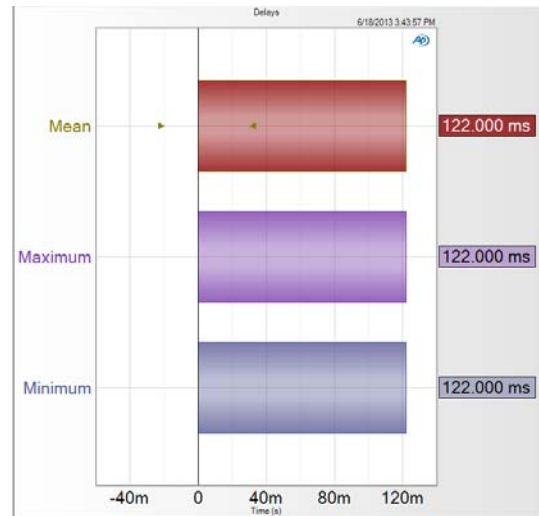
The APx500 **Measurement Recorder** measurement allows you to plot signal inputs against time. However, the maximum **Reading Rate** (20 readings per second) is much too low to provide the time resolution necessary for A/V sync measurements.



Video (purple) leads audio (green) in this Waveform Computes Utility output.

The **APx Waveform Computes Utility** loads the complete acquisition from **Measurement Recorder** and runs a fast RMS measurement (1000 readings per second) on the data. These results and other computa-

tions for delay calculations are returned as additional **Measurement Recorder** results. You can download the utility from www.ap.com/display/file/703.



The **Waveform Computes Utility** displays the video lag or lead time Mean, Maximum and Minimum across the acquisition. In this result the video leads by 122 ms.

Third-party test discs

Any test disc or test stream that includes a synchronized audio pulse and video flash can be used with the LTV-1 for A/V sync measurement. The Dolby and DTS test streams and discs are excellent, but are only available to licensees.

There are several commercial discs with such tests available for general purchase, but we have found that the video pulse area is either too close to the screen edge to mount the LTV-1, or is of insufficient contrast to provide a reliable signal. Our best results with a third-party test disc has been using *HD Benchmark 2nd Edition* from Spears and Munsil.

Specifications

Cup diameter: 1.625" (4.123 mm)

Cable length: 6' (1.8 m)

Sensitivity: Typically greater than 100 mV output with full white screen image.



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