TELESTREAM

APPLICATION NOTE

ClipMail PRO™ ClipExpress™ ClipView™ ClipRemote™

External Filter Requirements for Reducing DC Offset on the Analog Video Outputs of Telestream ClipMail Appliances

Introduction

This application note is for users of ClipMail Pro and older ClipExpress, ClipRemote, or ClipView systems who must reduce the DC offset present on analog video outputs for compatibility reasons. This modification is completely optional and only targeted at users who are experiencing or anticipate compatibility problems when connecting the video outputs of the Telestream appliance to a DC-coupled router that does not allow for up to 1Volt DC offset on its inputs.

Affected Systems

If you have a ClipExpress, ClipRemote, or ClipView system and the component outputs are BNC style connectors, then the analog video signals will have approximately 1Volt of DC offset. This is also true for all ClipMail Pro systems. If your ClipExpress, ClipRemote, or ClipView system has green, blue and red plastic RCA-style connectors for the component outputs, there will be no DC offset present, and this application note does not apply.

To make certain that this applies to you, please read this entire document before making any changes to your system setup. For further help and advice, please contact Telestream Customer Support at 877-257-6245 or send email to **info@telestream.net**.

Background

Due to the fact that a video signal's average DC level varies with its luminance content, a DC reference is required to properly process any analog video signal. Since video is typically routed through a studio using single-ended 75 ohm coaxial cable, it is possible for external noise voltages to couple onto both the shield and center conductor of the cable. A process known as "DC restoration" or "DC clamping" is required before the signal can be processed. This eliminates unwanted DC or low frequency AC voltages that may have coupled into the signal. It also puts the "back porch" section on the video waveform at ground so that the luminance may be interpreted properly.

Because of this requirement, it has become common for video equipment manufacturers to output an analog video signal with a small amount of positive DC offset. This is the result of using more sophisticated video integrated circuits to directly drive the outputs. Typically, these ICs operate from a single 5 or 3.3 Volt power supply, so they are not capable of producing a signal whose voltage swing goes negative with respect to chassis ground. Compensating for this adds cost and complexity to the system, and in most cases, provides no benefit due to the requirement for any receiving equipment to perform DC restoration anyway.

Potential Incompatibilities

Some analog video routers are designed with DC coupled inputs and outputs, but do not perform DC restoration. In this scenario, any unwanted DC or low frequency AC noise is simply passed through the router, with the assumption that the receiving equipment will perform the necessary DC restoration. The incompatibility occurs when a DC coupled router is connected to the analog video outputs of a system with DC offset. Unless the inputs of the router are designed to accept signal amplitude of the video *plus* the DC offset (+1.7Vpeak minimum for the Telestream appliances), clipping can occur. When passing NTSC 75% color bars through a system like this, the result on the composite video output is attenuated luminance in at least the white, yellow and cyan bars, and attenuated color saturation in the yellow and cyan bars. Naturally, this varies with the exact amount of DC offset present and the maximum signal amplitude the router can pass without distortion.

Possible Solutions

1. The best solution is to provide the DC restoration at the input to the router using a clamping distribution amplifier (D.A.). Although this adds cost to the system, it is the most effective way to ensure good signal quality at all points in the signal path.

2. Another possibility is to configure the router to AC couple the inputs. This has the effect of completely eliminating DC in the signal, and passing only the AC content. This leaves the burden of DC restoration with the destination equipment but will eliminate the DC offset, thus eliminating the compatibility problem. NOTE: The outputs of the Telestream appliances must be connected with a DC load of 400 ohms or less. This means that the 75-ohm DC termination must be placed *before* the AC coupling capacitor inside the router. Please check the specifications of the router carefully before assuming that internal AC coupling will work.

3. If solutions 1 and 2 are not feasible, it is possible to construct a small inexpensive in-line filter circuit and install it at the output of the Telestream appliance. The output of the filter will have a very small DC offset, and the video signal will be AC coupled. The advantage is that the peak positive voltage output is less than 1 Volt DC total, so it will be compatible with most DC coupled routers.

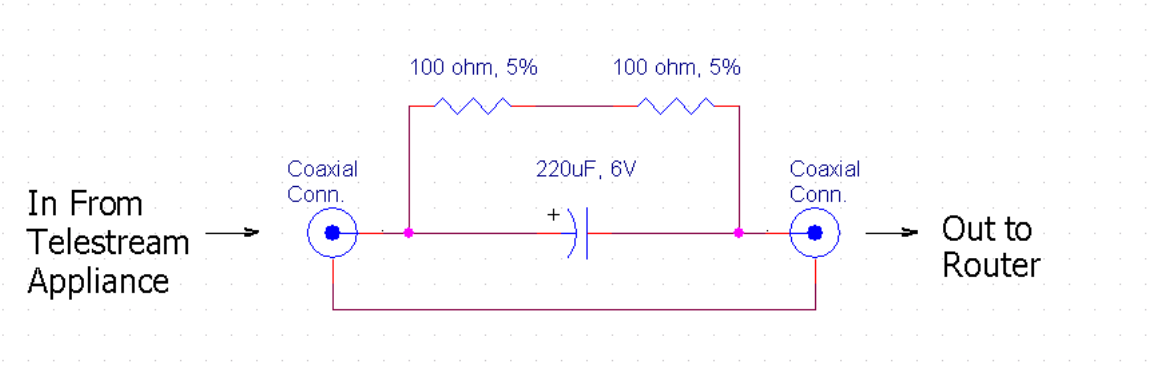

Fig.1: DC Reduction Filter Schematic Diagram.
Note: a single 200-ohm resistor may be used in place of the two 100 ohm resistors in series, if available.

Circuit Description

The filter network shown above consists of a high pass filter (series 220uF capacitor) which will only pass frequencies above 23Hz. This passes all components of the video signal, but

eliminates any DC reference information. DC restoration circuitry at the receiving equipment will restore this.

In addition to the series capacitor, a series resistance of 200 ohms is required to provide the proper DC bias level to the cable driver IC used on the Telestream appliances. When connected to a router with a 75-ohm termination to ground, this resistance along with the internal series termination of 75 ohms, will provide a total of 350 ohms to adequately bias the device. This means that the filter cannot completely eliminate the DC component, but it does reduce it from 1V to 214 mV at the receiving end. This puts the signal within the input specifications of DC coupled routers.

Performance

The filter shown above was connected to 10 feet of coaxial cable and terminated with a 75-ohm resistor to ground. The signal was measured on a Tektronix TDS754D digital storage scope and a 1755A waveform monitor. The table below shows the minimum and maximum voltage levels observed both with and without the filter. These values should be compared to the input specifications of the router being used to determine which signals, if any, will require the filter. Allow for at least +/- %10 variation due to component tolerances and temperature drift.

Video Output	Levels without Filter		Levels with Filter	
	Max. (Volts)	Min. (Volts)	Max. (Volts)	Min. (Volts)
Composite	1.68	0.68	1.0	0.0
Component (Y)	1.65	0.65	1.0	0.0
Component (R-Y)	1.37	0.84	0.73	0.21
Component (B-Y)	1.37	0.84	0.73	0.21
S-Video (Y)	1.65	0.65	1.0	0.0
S-Video (C)	1.55	0.75	0.84	0.1

Table1: Minimum and Maximum voltage levels for NTSC 75% color bars. This signal approximates the worst-case scenario due to equal presence of bright and dark colors.

Three screen captures are included below which show the DC level of the back porch section of the composite signal both with and without the filter. Figure 3 shows the effect of AC coupling the video signal: Peak white (100 IRE) was at 1.0V DC in Figure 2 and moves down to 0.81V DC in an all-white video image. This illustrates the effects of AC coupling the video signal. The average level is held at a constant voltage so the minimum and maximum voltages will vary as a function of the luminance content.

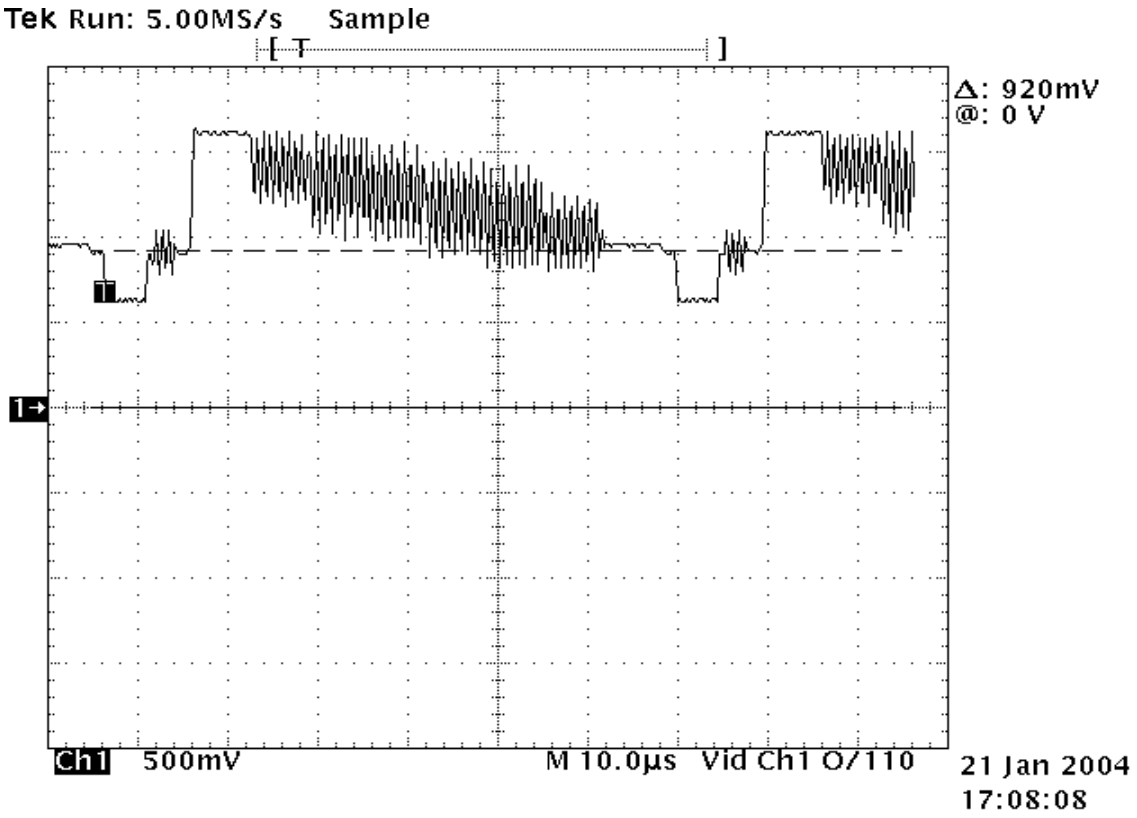

Fig.1: DC offset present on the Composite video output of the appliance (un-modified)

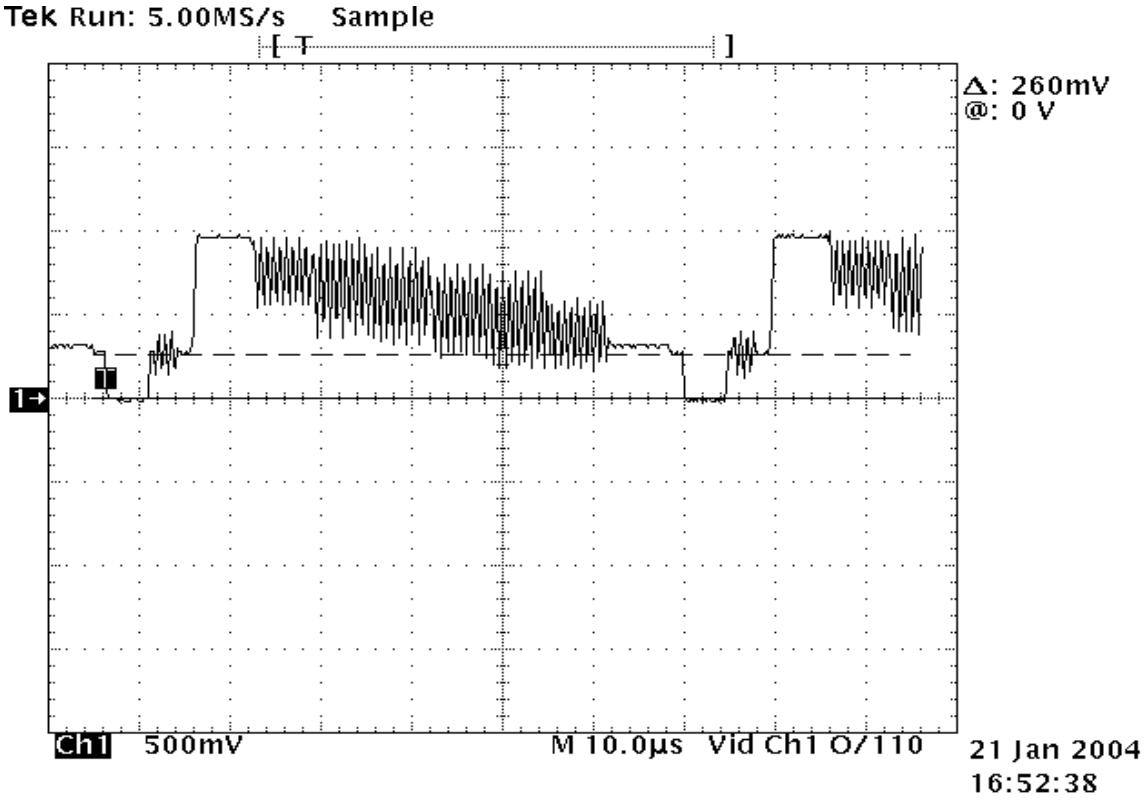

Fig.2: DC offset present on the Composite after passing through the filter.

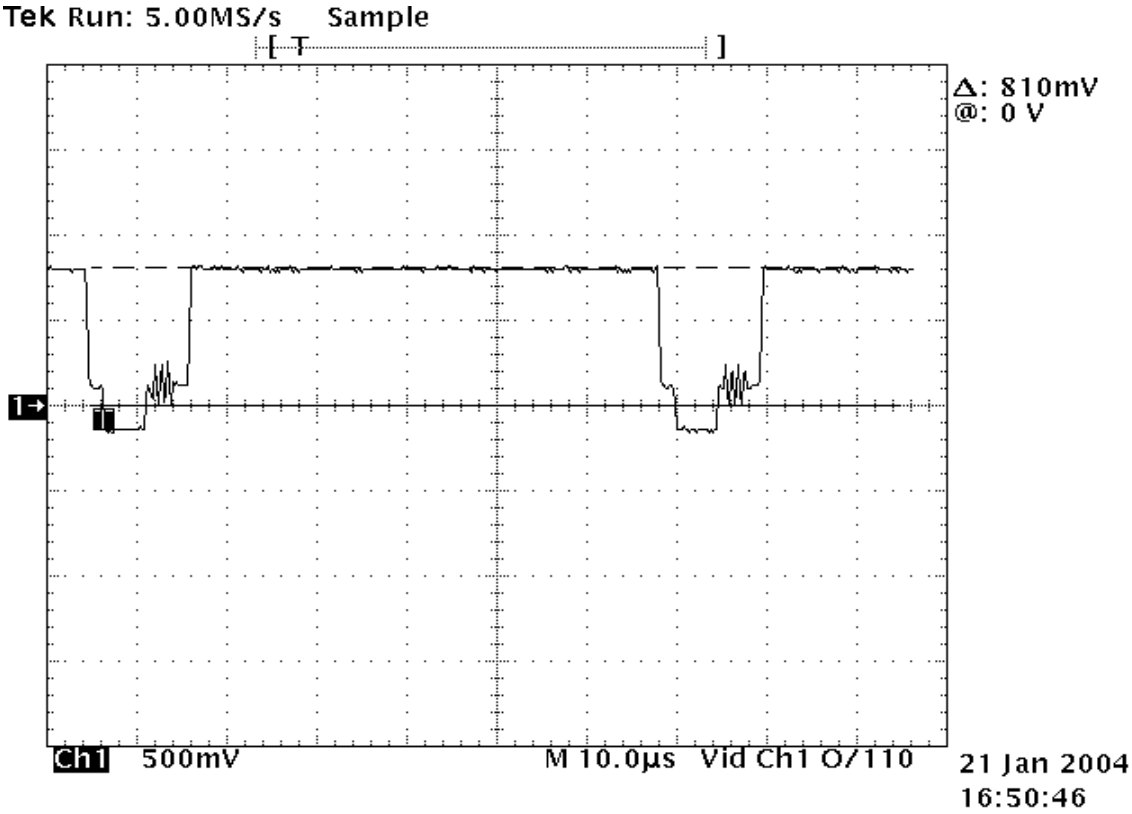

Fig.3: DC Levels on a 100IRE “white field” test signal when passed through the filter. Note the effects of AC coupling.

Physical Construction

The actual filter used to make the above measurements is shown in the photographs below. A ClipExpress was used in this testing, so the connectors are RCA type. BNC style connectors are used on the component outputs of some ClipExpress, ClipRemote, and ClipView systems, as well as all video outputs on the ClipMail Pro.

To reduce reflections, it is recommended that the filter be located no more than 6 inches from the output connectors on the Telestream appliance. It is also important to keep the component lead lengths to a minimum. This filter was tested with 300m of Belden 8281 type coaxial cable and no appreciable distortion or loss was detected.

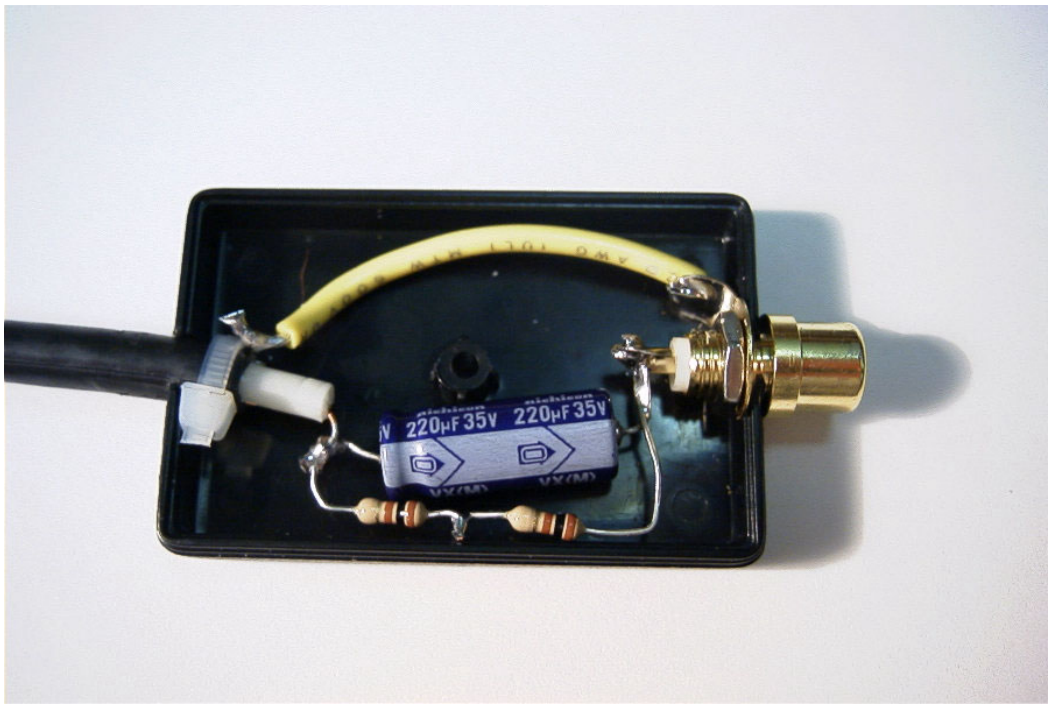

Fig.4: Photograph of actual filter circuit used for testing. Note the polarity of the electrolytic capacitor (input is on the left, output on the right) and the short component lead lengths.

Fig.5: The enclosed filter attached to the composite video output of the ClipExpress.