VIDEO FIBER TRANSMISSION PROBLEM SOLVING WHEN VIDEO GOES IN GOOD AND COMES OUT BAD

THE PROBLEM:

Have you ever installed a fiber optic video transmitter / receiver and discovered that you were not getting a good signal output and you knew you were putting in a good video signal but you were not getting the same good signal out. The video image would roll or appear darker than expected. Then when you used the AGC (Automatic Gain Control) or the Iris on the camera to make the picture brighter, the response was not what you expected. If you have you are not alone, many installers have experienced this problem and struggled to solve it without understanding the cause. Knowing what causes bad pictures in a fiber optic transmission system will save you many hours of trial and error repair time.

HOW FIBER SYSTEMS WORK:

To understand the problem it will help you to know how a video fiber optic transmitter and receiver work. When you connect your video signal onto the fiber transmitter that signal is first put through a buffer amplifier to control the input impedance and then the video signal is clamped to the tip of White, the most positive part of the video signal. After that the signal can be directly modulated onto the fiber using the AM (Amplitude Modulated) system or it can be introduced onto the fiber using the FM (Frequency Modulated) system.

Both systems will work quite well in most applications, but both systems use a "TIP OF WHITE CLAMP" which can create a problem. In most video equipment normal clamping is accomplished by using the "Back Porch" part of the video signal. This type of clamp holds the minimum luminance or black level in one place so that overall video level changes do not affect the relationship between the Sync Pulse and the Luminance level in the video signal. Next the signal goes through shaping circuitry and then on the light source. This is usually a Light Emitting Diode LED or LASER diode.

The receiver works in very much the same way but in the reverse order, with light from the fiber hitting a light sensitive receiver element or photo detector which converts the light signal into an electrical signal, then the signal goes into an AGC (Automatic Gain Control) to offset any light amplitude losses incurred in the fiber run. The AGC is a required part of the system but it combined with the Tip of White clamp creates a problem. Next the signal is demodulated using either the AM or FM process back into a video signal.

THE CAUSE OF THE PROBLEM:

Remember the "tip of white clamp" in the transmitter, it uses electronic circuitry to make the most positive part of the video waveform stay at a particular voltage no matter what size or shape of the waveform. This type of "clamp" is used to keep the maximum white level of the video at the maximum illumination point for the LED or LASER light source.

Then in the receiver there is an AGC to make up the loss of light in the fiber, this is necessary to improve the signal to noise ratio in the fiber optic system, but it also creates a problem. The AGC raises or lowers the video signal to keep it at 140 I.R.E. units peak to peak regardless of the input level. This type of clamp and AGC is quite effective at maintaining good operation of the fiber optic system, but it requires a correct input video signal to operate properly. If the input video signal deviates from the established standards, the tip of white clamp will change the relationships within the video signal according to how much the video input level is off of the standard level.

The standard level expected by the fiber equipment is 140 I.R.E. units, specifically 100 I.R.E. units of White (Luminance) and 40 I.R.E. units of Sync Pulse (Synchronization Pulse). The manufactures of fiber equipment rely on this standard and expect the video source to be correct in order to deliver the video correctly.

The equipment manufactures will tell you that “what you put in is what you get out” and this is true, but only if you put in exactly a 100/40 video signal, any other signal will give you a "non-unity" altered signal output. The relationship between the input and output will vary depending on the relationship between the Luminance and the Sync signal input.

Example #1: If your input Luminance starts out as 130 I.R.E. units a 30% increase over a normal level, and the Sync level is a normal 40 I.R.E., this ads up to 170 I.R.E. units, the clamp will reduce the total signal to 140 I.R.E. units, this will change the Luminance signal to 107 I.R.E. and the Sync signal to 33 I.R.E. This condition reduces the Sync level and could produce picture rolling if the condition gets worse.

Example #2: If your input Luminance is 70 I.R.E. units a 30% decrease from normal video level and the Sync is 40 I.R.E. normal, equaling 110 I.R.E. The clamping system will convert these levels to 89 I.R.E. units of Luminance and 51 I.R.E. units of Sync. This condition will produce a darker than expected video image. The higher Sync level can cause synchronization problems as well.

As you can see both the Luminance and the Sync levels are altered by the fiber system if the Luminance level is not an exact 100/40 = 140 I.R.E. level. This is the reason that your video input level may vary from your output level when traversing a fiber optic system. You can test this process and see it for your self. In a fiber optic system, cap the camera so that the luminance level is zero. Then measure the Sync level, it can be as high as 140 I.R.E. units depending on the range of the AGC in the fiber receiver. The normal level of Sync is 40 I.R.E. units. This black out effect can cause Sync Pulse overdrive in the DVR or monitor. This effect can be seen as rolling or tearing of the picture at night when the picture is extremely dark.

There is another condition that can occur that will have devastating effects on a fiber systems output. This problem is one that effects older established systems, if the system was working and begins to cause problems, look at the levels at the output of the fiber system.

If the Sync signal is unusually high (over 50 I.R.E. units) it may be possible that the internal 75 Ohm termination has been damaged by a lightning storm or other high voltage ground-loop related occurrence. Lightning storms can cause a permanent increase in the termination resistance or a removal of the termination completely. This will cause the video level to go up radically and if the camera cannot deliver a total of 240 I.R.E. units or the clamp and AGC (automatic gain control) inside the fiber unit cannot handle the increased level then the output level of video will be corrupted.

THE SOLUTION:

Careful measurement and setting of the video levels originating from the camera is the best way to solve the problem caused by the clamp in the fiber optic equipment. You should have a way of measuring video levels of both the Sync and Luminance levels to properly determine the extent of the problem and to set the camera correctly.

TOOLS:

If you do not currently have a way of measuring video levels a meter that allows you to measure the Sync and Luminance is a must. One meter that meets this goal is called a CM-2 Camera Master. It will measure the Sync, Luminance, Composite, Color Burst, Focus, and Ground Loop on any video signal. It is battery operated and portable. It is also small enough to take up a the ladder to set up any camera. It is manufactured by FM SYSTEMS, INC. Santa Ana, CA. 800-235-6960.