Analog video sync issues

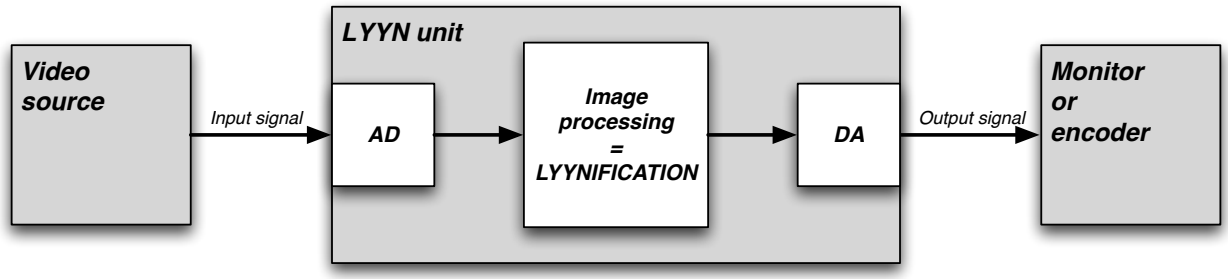
Composite video signal background

A composite video signal is a rather complicated synthesis of a frame/field synchronization, line synchronization, color signal and luminance signal. The relevant international standard is *RECOMMENDATION ITU-R BT.470-6* from the International Telecommunications Union[1].

The signal contains several very specific synchronization pulses for frame/field synchronization as well as a high frequency color-burst that is used for color decoding in a receiver. The size and placement of the synchronization pulses is critical for a high-quality video signal and the standard's timing tolerances are very small. In addition, the standard's frequency tolerance for the color-burst signal is in the order of 1 ppm.

LYYN block diagram

The basic block diagram of all LYYN units is presented below.



In the LYYN unit the following blocks, with respective functionality, are present

1. The AD block digtizes the signal and outputs a modified BT.656[2] digital stream with 4 separate sync signals: vertical sync (V_s), horizontal sync (H_s), field id sync and a pixel clock (f_{pixel}). The data stream and the sync signals are passed to an FPGA where the actual processing takes place. V_s and H_s are used internally, in the AD, to compute a color-burst frequency that is used to decode the color information in the input video signal. Global standards for vertical sync frequency, horizontal sync frequency and color-burst frequency f_{color} are documented in BT.470-6.
2. The image processing FPGA enhances the video and outputs a modifed BT.656 digital stream to the DA block.
3. The DA block uses f_{pixel} to calculate an output f_{color} as well as output values for vertical sync and horizontal sync. The DA block converts the digital data stream to the correct analog format, including the relevant sync signals.

Potential problem

All cameras deviate from the standards slightly. High quality equipment normally has smaller errors than inexpensive equipment does. Typically a camera has 1 high frequency, e.g. 27 MHz, reference clock, that is divided into multiple different clocks. One way of saving money in a HW design is to NOT have a temperature stabilized reference clock thus causing frequency drift during startup of the camera.

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[1] www.itu.int

[2] See http://www.itu.int/rec/R-REC-BT.656/en

Due to the nature of the LYYN image processing algorithm and the HW design of LYYN products a small error in either H_s or f_{color} is amplified by the DA block. This means that

An error (frequency drift) in the reference clock $\Rightarrow$ an error in the line frequency (H_s) in from the camera source $\Rightarrow$ an error in f_{pixel} from the AD block $\Rightarrow$ an error in the computed f_{color} from the DA block $\Rightarrow$ an f_{color} that is outside the tolerances of the monitor/encoder $\Rightarrow$ **a B&W image** or a generally bad image**.**

Symptoms

- Normally a color image but B&W image after the LYYN unit is connected and active
- Normally a stable image but flickering non-stable image after the LYYN unit is connected and active

Possible cure

If the video source cannot be replaced then the typical solution is to connect a TBC (Time Base Corrector) before the LYYN unit. Use your preferred web search engine to find a source of TBCs close to you. At LYYN we have successfully used a TBC from Kramer Electronics.

A Time Base Corrector is a device which takes a video input and does any or all the following before outputting the signal:

- Make adjustments to the technical parameters of the signal, e.g. voltage level, horizontal and chroma phase, etc.
- Synchronize video parameters with other equipment.
- Correct defects in a video signal, e.g. replace a weak synch pulse with a more stable one.

The above definition is found at http://www.mediacollege.com/video/calibration/tbc/

For more information see http://en.wikipedia.org/wiki/Time_Base_Corrector or http://www.google.com/search?q=time+base+corrector&ie=UTF-8&oe=UTF-8

Comments

Why can't the LYYN unit just work like the monitor

A not uncommon situation is that the complete system, i.e. source + monitor appeared to work OK until the LYYN unit was connected. This obviously makes the user wonder what's wrong with the LYYN?

A high-end monitor and all LYYN products use high-quality AD blocks that accept signals with rather large deviations from the standard. Since the monitor does not process the image before presenting it on the screen, large deviations are acceptable.

The LYYN units, on the other hand, process the signal before generating a new output signal. The processing is computationally intensive and sensitive to errors/deviations and can, as explained above, cause error amplification, thus generating an erroneous output signal.