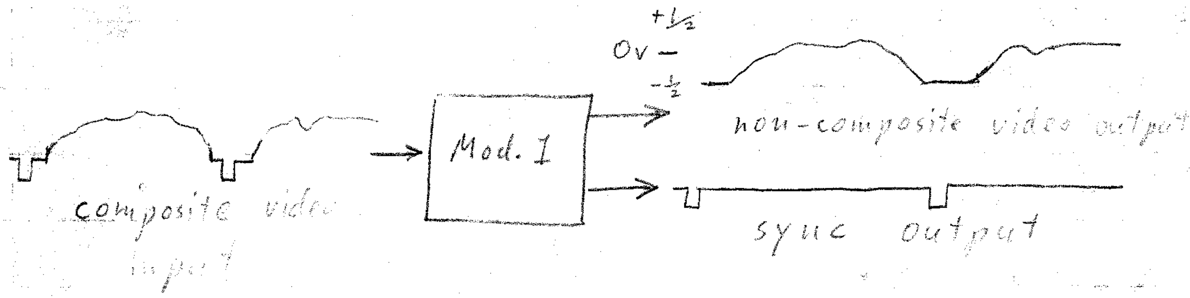
Video Processors - First Round

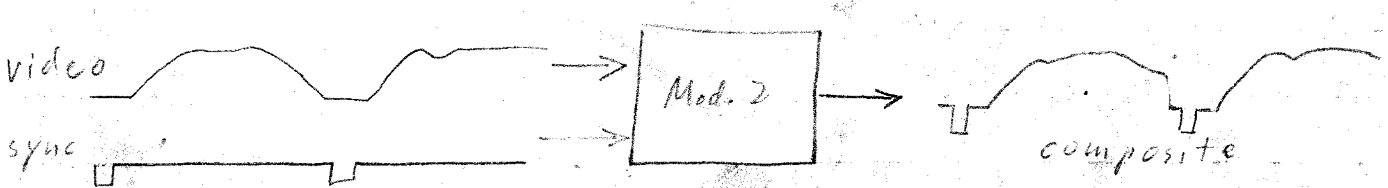
Bookkeeping: For the simplest system using 1 camera or 1 VTR in playback mode, the processor should accept composite video input and deliver composite video output in the same 1.4 volt format.

Module 0: DC power supply.

Module 1: sync stripper

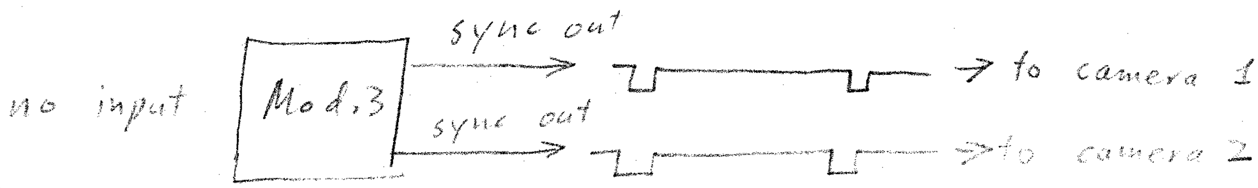


Module 2: sync compositer

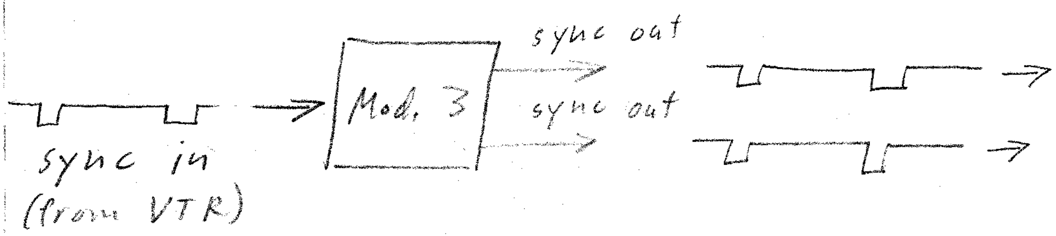


If more than one camera is to be used, then sync must be provided separately to each camera from an external source. If a VTR is involved, it will probably have to provide sync for other system parts. The specific design of Mod. 3 will require a little more research on my part into sync signals from VTR's and how to make editing possible in a ½ inch format. (I presuming we are aiming at use by ½ inch amateurs more than 1 inch and 2 inch professionals.) In general, though, Mod 3 should look like this:

Module 3, mode 1 (no VTR) sync generator

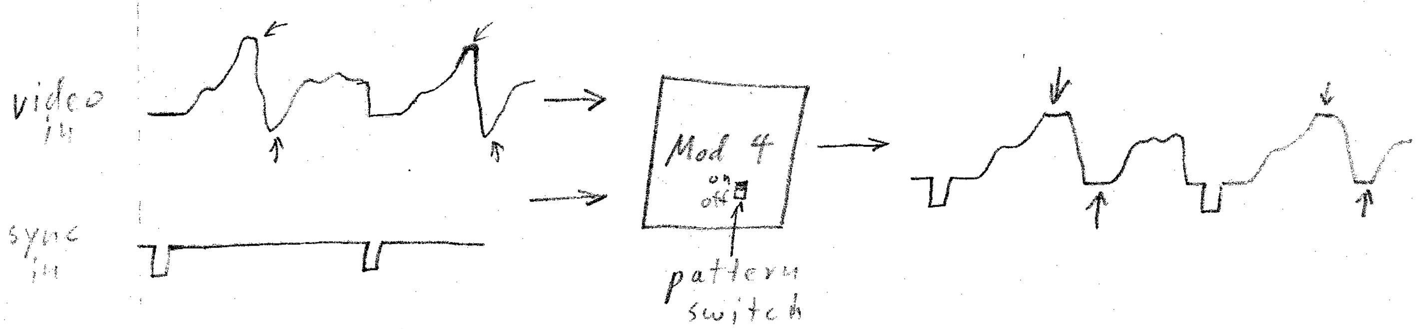


Module 3, mode 2 (with sync from VTR) sync relay

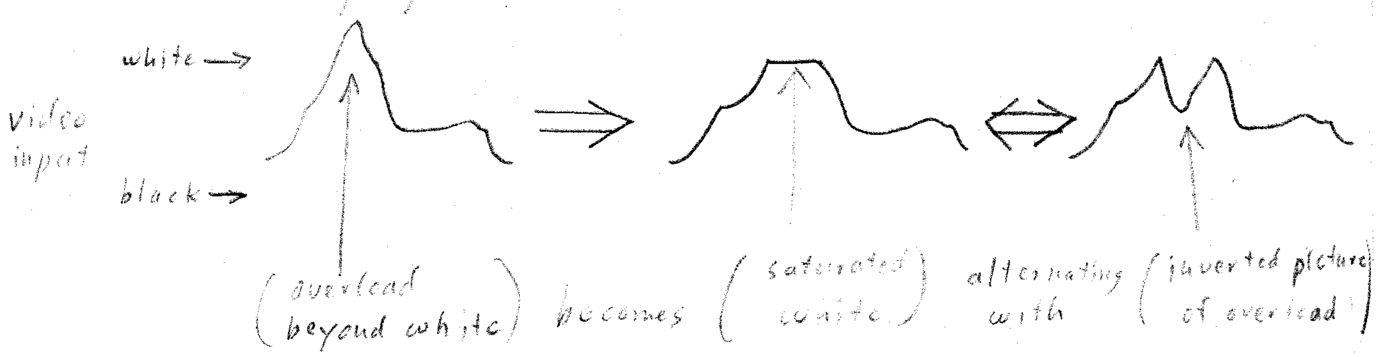


I will likely delay designing Mod. 3 until I have completed the other modules for a minimal 1 camera system.

Module 4: limiter + overload indicator



Mod. 4 is a sync compositer, like Mod. 2, but adds a feature not present in Mod. 2. First, a module that combines video (non-composite) and sync should limit the range of the video in its outputs to the allowable limits of the device to receive that composite. Arrows in the diagram indicate where limits were exceeded on video input, and how the excess amplitude was clipped off by Mod.4, as it should be for Mod.2 as well. The user of this equipment would want to know what parts of a picture are being clipped, and an indication of limiting would appear on his monitor when he had the pattern switch on. The pattern switch would do something like this: parts of the picture off-scale beyond white would appear on the monitor to switch rapidly between saturated white and an inverted pattern returning toward black in proportion to the overload.



The same type pattern would appear for overload off the black end. Thus, the operator could discover what parts of any picture, after any process, went offscale on either end, and by how much.

This overload indicator would be more useful than an oscilloscope for most users, in that it would show overload on the monitor itself, in the frame of reference of the picture.

The following modules accept non-composite video input and give non-composite video output.

Mod. 5: special effects - mixture of 2 effects:

A) input picture, modified in frequency response so as to either reduce bandwidth (filter out high frequencies) or increase relative amplitude of high frequencies. The effect is to either blur out detail (reduced bandwidth) or enhance fine detail. The picture, thus modified, is mixed with B), the amount entering the mix being adjustable both in amplitude and polarity (positive or negative)

B) left to right derivative of picture, available on two separately controllable output, one of positive excursions from zero, the other of negative excursions. Parameters under control are frequency response of the picture before differentiation (same kind of control as for A) in the module, but independent of the setting for A)) and hysteresis of differentiation process, so that small changes in the picture can be made to have no effect, and only large features will appear. This picture is mixed, and the gain and polarity of positive going and negative going derivative variations are separately controllable.

Mod. 6: comparator - maps input into two discrete levels, one level if input is below some reference level, the other output level if input is above the reference level. The input and reference levels may both be provided by external inputs, or the reference level may be set by a potentiometer. The comparator is simple enough that two comparators should probably be combined in one module. The output of each half of the two comparator module would be a mixture of the input to the comparator and the output of that comparator, the mixture being controlled by a balance potentiometer. An additional output would be a mixture of the outputs of the two halves, again controlled by a balance pot.

Mod 7: logarithmic to linear to antilogarithmic response curve. A logarithmic response to picture information will increase contrast on the dark-gray to black end of the picture scale, while decreasing relative contrast toward the white end. The antilogarithmic scale will do the opposite. The logarithmic scale will bring out detail in less well illuminated portions of a picture, while preventing brightly illuminated objects from being so prominent. Thus, the total detail observable in a picture from the viewer's standpoint will appear to be greater on a logarithmic scale than on a linear scale. If a picture is first mapped to a logarithmic scale and then differentiated, the resultant picture will not look different in well-illuminated and poorly illuminated regions, except in places where illumination is so poor that camera responce is swamped by noise in the camera.

Mod 8: mixer - adds its inputs with adjustable scale factors.

Mod. 9: analog multiplier - multiplies two voltages. When used with a comparator and a mixer, a multiplier can function as a keyer, but that would be a very difficult approach to something as simple as keying. A keyer switches discontinuously from one picture to another depending on the level at a third input, where that level can be the same as one of the first two inputs or pictures. Thus, given two pictures to be switched, and a picture of a checkerboard as control input, white on the checkerboard causes picture 1 to be displayed under white squares. Black "cuts holes" in picture 1, allowing you to see through to picture 2. Using a multiplier instead of a keyer, you could defocus the picture of the checkerboard, and then the centers of black squares would still be picture 1 and centers of white squares picture 2, but the blurred gray transitions from black to white in the checkerboard would show a mixture of pictures 1 and 2 superimposed. Clearly, the multiplier can serve as a voltage controlled mixer, so that a voltage derived from an audio source can program mixes of video effects on a continuous scale. When the multiplier comes into wide use, it will undoubtedly be considered an indispensable tool for interfacing between audio, visual, and tactile media.

Note concerning frequency response controls in Mod 5: it should be fairly easy to control video frequency response by a control voltage as well as a hand-setting of a potentiometer. Thus, with voltage control over both frequency response and gain or blend (with a multiplier) it should be possible to control all the effects the video circuits can achieve by an electronic control source, either audio, touch sensors, analog computer, or digital computer.