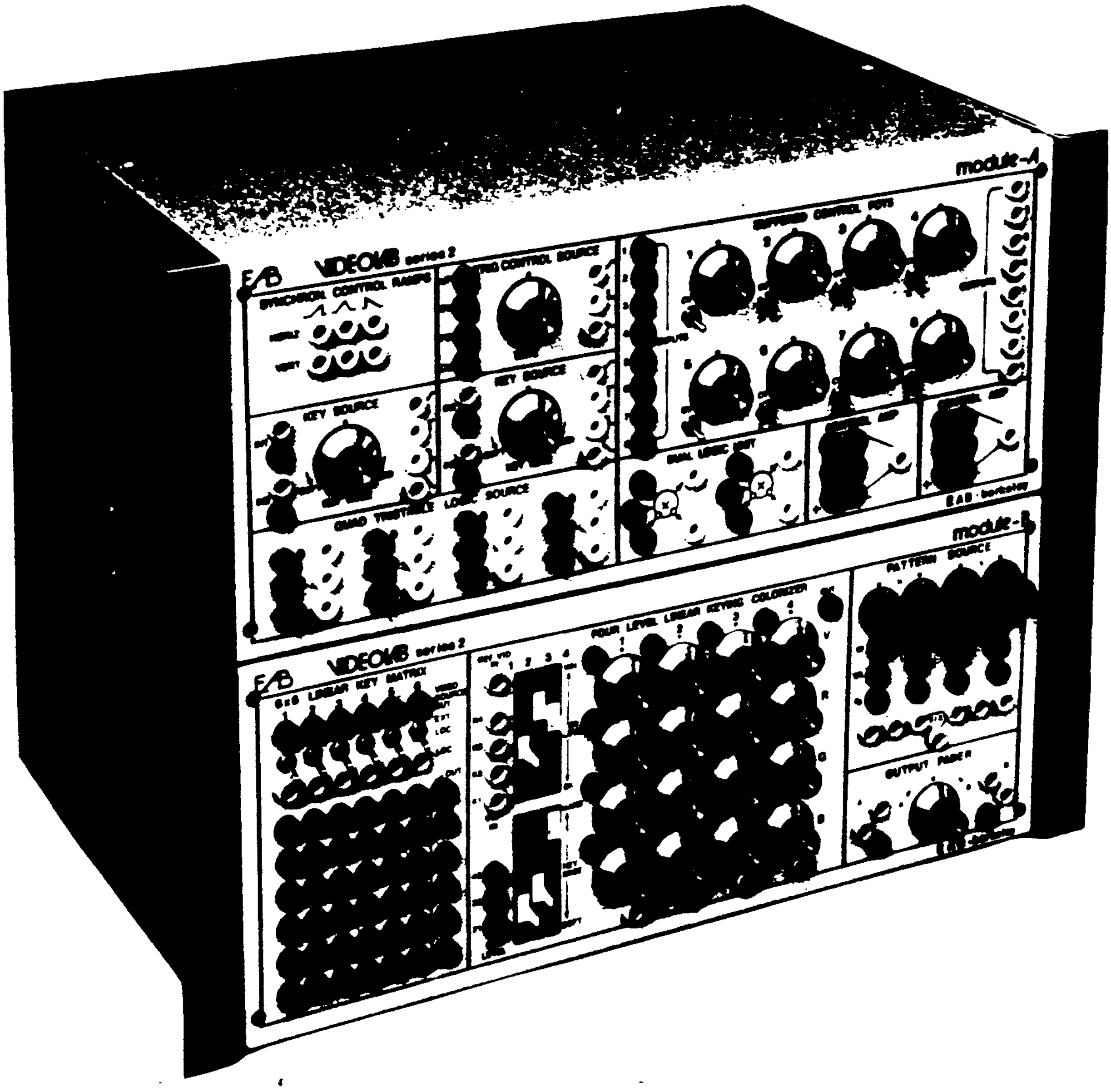
EAB VIDEOLAB



THE PERSONAL TOOL FOR VIDEO PRODUCTION

EAB VIDEO ****** 2940 Grove ST. ****** Berkeley CA. 94703 ****** 415-848-6121

THE EAB VIDEOLAB

*****

SERIES 2

For service or other information on EAB Videolab or other EAB products please contact W. Hearn or David Pearson at EAB, 2940 Grove St., Berkeley, CA 94703.

EAB VIDEOLAB OPERATORS' MANUAL

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THE VIDEOLAB: THEORY OF OPERATION

INTRODUCTION

The Videolab Series 2 is a highly-flexible third generation video synthesizer. The Videolab accepts up to six video sources and provides for switching, combining, and modifying of video images in a wide variety of ways. Some of the techniques available for image modification include multi-level keys, mattes, fades, dissolves, wipes, multi-level split screens, colorizing and chroma-keying. In addition, a digitally stabilized pattern generator produces complex synthetic color images and shapes. All special effects including colorizing can be done with linear keying and under voltage control. Patch cords are used to allow the artist maximum creative freedom in the production and sequencing of images.

Most Videolab systems include Modules A and B and the EAB 601 Chroma Keyer. This arrangement is capable of producing all of the special effects listed above. Many custom modules have been offered by EAB to supplement the A and B modules. The scope of this manual is restricted to theory and operation of the Videolab A and B modules. The front panels of these modules are shown in fig. 1.

SIGNALS IN THE VIDEOLAB

Operation of the Videolab consists of manipulating real and synthetic images by means of Control and Logic Signals. There are three types of basic signals in the Videolab. First, there are Video Signals, which carry picture information, or video images. Secondly, there are Control Signals which route and manipulate video images. Control Signals are variable, with an infinitely graded range of settings between limiting values and therefore capable of producing a wide range of effects. The third type of signals are Logic Signals. These signals occupy the same range as control signals except that logic signals are only "on" or "off." Logic signals, therefore, may be thought of as control signals with only the capability of being at full maximum or minimum. Control signals have approximately three times the range of video signals, or 0 to 2.1v (nominal).

JACKS IN THE VIDEOLAB

All banana jacks on the front panel of the EAB Series 2 Videolab are either inputs or outputs and color-coded according to their function:

RED JACKS are VIDEO OUTPUTS
BLUE JACKS are VIDEO INPUTS
YELLOW JACKS are control signal OUTPUTS
GREEN JACKS are control signal INPUTS
WHITE JACKS are logic signal OUTPUTS
BLACK JACKS are logic signal INPUTS

There are a few exceptions to the above list, to be discussed later. Improper interconnecting of the jacks on the Videolab will not result in any damage to either equipment of operator, but no connections are to be made to the front of the Videolab from non-Videolab sources, as there are numerous possibilities of damage.

L.E.D'S IN THE VIDEOLAB

There are light-emitting diodes in the vicinity of some jacks. These level indicator diodes always light up when the signal is appearing at that jack whether it is an input or an output. These indicators provide useful visual feedback to the operator.

VIDEOLAB MODULE B I/O
(MATRIX SWITCHER AND OUTPUT KEYER/FADER)

Module B is the main input and output of the Videolab for video signals. Each of the possible six video signals which enter the Videolab at the rear panel appear, after conditioning, at the six red jacks at the top of the 6X6 linear matrix. These signals may be patched down to any column in the matrix. A video signal from the external world is made available at any column by throwing its EXT/LOC switch to the "EXT" (up) position. When this is done, the entire column of jacks below this jack becomes a sorce of that video image. All that is necessary to cause the video signal to appear at one of the red output jacks is to apply a control or logic signal at the cross point of the column and row.

When a control or logic signal is fed into any of the green jacks, the video signal will appear at the red jack immediately to the right of the patch. The amplitude (or brightness) of the signal output will be proportional to the control level of the logic or control signal.

The Linear Key Matrix passes images without significant color shift and has the capability of passing at least two re-entries before image quality is affected. Many of the special effects mentioned earlier, including keying, are best done by using the linear matrix. All signals coming into the lab can be controlled and gated by applying control and logic signals to the linear matrix.

The Output Keyer/Fader, which is at the lower right hand corner of Module B, is the output of the Videolab. In the upper right and left are a set of two blue jacks. Each set of blue jacks will sum equally any two video signals. So one could patch two disticnt image mixes into each bank of the Keyer/Fader and fade between them by means of the knob labeled "fade." This fade can be controlled electronically by means of applying control signals. (More about this later).

For the technically inclined it should be mentioned that there are two important design concepts which apply to the Videolab I/O specifically and to the Videolab in general. These are:

1) Color shift of video signals through each section of the Videolab is to be adjusted to zero. This is done either by utilizing circuitry with delays in the low tens-of-nanoseconds plus incremental phase compensation or by delaying the signal for a net delay of one full subcarrier cycle.

2) Control inputs are to have the fastest possible response. This will be typically limited to the minimum necessary to produce clear and effective control signals for video keying. Certain other control inputs, such as those used for pattern generation, will necessarily be much slower.

LINEAR KEY COLORIZER *B*

The Colorizer is located between the Matrix Switcher and the output Keyer/Fader in B Module. (Fig). This unit has many more features than conventional colorizers and is the most creatively important single unit in the Videolab.

To understand the 4-level linear key colorizer it is necessary to have a concept of the significance of gray scale in a picture. The gray scale of a picture is directly related to its luminance (brightness). In zone system photography, the gray scale is broken into ten fixed zones. The Vidoelab Colorizer divides the gray scale into four variable zones.

The four gray scale slices of an image are selected with the slides labeled "Key Level." In this way the incoming picture is sliced in =three places by means of the three pots. Slicing an image three times in this way yields four discrete sections of the image:

1)The "lowest" level of luminance--the background, the darkest element of the image, or any black,

2)The two "intermediate" or "gray" levels--the two separations within the gray levels, and

3)The "highest" level of brightness--the brightest elements on the image, or any whites.

Now each gray section of the image may be individually modified by means of settings on the Colorizer. Each gray slice is colorized by using the column of control knobs under its number, 1 through 4. The vertical column under number "1" corresponds to the lowest level of luminance, column 2 and 3 apply to the intermediate grays, and column "4" controls the brightest element of the image. So each vertical column of knobs corresponds to one gray slice of the image.

For proper operation of the Colorizer, the control slide pots which slice the gray scale must always be in ascending order with the left pot at the lowest setting.

Once the gray scale slices are chosen, any gray slice of the picture can be given an arbitrary color, luminance and hue. This is accomplished by means of the R, G, and B knobs. When the R, G, and B knobs are centered (set at "5") they contribute no color. Clockwise rotation adds the primary color (R, G, or B). Counter clockwise rotation will subtract the color. (More about this later).

The uppermost knob is labeled "Video." This allows for the insertion of another video image within the confines of each slice. For example, if you feed image 1 into the Colorizer and slice it into four sections, you can now enter a different video image into any one of the four gray slices. One can take image 2 and place it in the lowest level of gray by patching it into the blue jack labeled K1.

Then one can adjust the brightness, or level, of image 2 by adjusting the knob labeled "video"--the top of the 4 knobs of the Colorizer. So the Colorizer, besides being able to assign arbitrary colors to any video image, can also key other video images within each of the four slices of the original video image. This ability of inserting an image within the outline of another is an important creative technique.

The hardness of the visual "edge" between the four gray slices is variable. It may be set to make the transition "hard," or "soft." This is accomplished by adjusting the 3 slide control pots labeled "key edge." When colorizing an image, the soft settings allow for a much more subtle range of color gradation than the usual fixed hard edges found in the conventional colorizers. This soft/hard feature is also apparent when inserting additional video into one of the 4 gray slices. So the Colorizer allows for soft edge image keying as well as soft edge colorizing. Here, as elsewhere in the Videolab, an important use of the soft edge technique is its great effectiveness in dealing with "noisy" images without producing the quantizing effects common to digital video processing.

The linear edge processing of the Colorizer is not achieved by reducing signal band width or video definition, but is the result of a novel and unique architecture.

Each of the 16 control knobs on the Colorizer has a green control signal input jack adjacent to the knob. When a control or logic signal is applied to the jack, it will have an effect identical to that of turning that knob (except, of course, that it is instantaneous). The net effect is that of the combination of the knob setting and the input cotrol. The knobs are have sufficient range to fully override the input signals.

In the left corner the three green jacks labeled "key level" will accept a control signal which will override the settings of the key level slide pots. In either keying or colorizing this allows for instantaneously altering the key outline as a function of another signal generated anywhere in the videolab. (This is a powerful creative technique).

The input of the Colorizer is the blue jack labeled "IN" at the upper left hand corner of the colorizer section in Module B, and this is where a video signal is connected. The Output is directly across from the input and is a red jack labeled "OUT." The output of the colorizer may be re-entered into the linear matrix or routed anywhere else in the Videolab. The process of "patching" signals will be described later.

PATTERN SOURCE *B*

The B Module Pattern Source consists of four independent digitally stabilized spatial oscillators, each producing three synthetic monochrome video signals, and a voltage controlled video mixer. The most important application of this unit is the creation of simple or complex, moving or stationary, video patterns. These patterns are formed by combining the oscillator outputs and can be used as the basis of hundreds of different custom Key or Wipe shapes. Or patterns may be colorized and used as background images. Many other uses are possible.

The four spatial oscillators of the Pattern Source are each controlled by a dual pot. The "frequency", or number of repetitions, of each oscillator is set by the center knob. and the rate and direction of motion is set by the outer ring. As an example, the "square wave" video output of eiher "H" oscillator would be a variable number of vertical "bars," set by the center knob. The bars will be stationary when the ring control is set at its center, and will move uniformly to the left or right as the ring is adjusted. Operation of the "V" oscillators is similar.

The Video Mixer in the Pattern Source is used to combine video signals. Six video inputs are provided. One input is inverting, and "negative video" will be produced when this input is used. As with all video modules in the Videolab, the effective color shift through the module is zero, except that when the inverting input is used colors are complemented. This can be a very useful effect. The control input (green jack) on the Video Mixer is used to control the overall gain. When it is unconnected, the mixer has unity gain on all inputs.

Production of effects using the pattern source will be described in the Application Section of this Manual.

MODULE A VIDEOLAB

The A Module of the Videolab is a source of control and logic signals. Some of these signals originate in the A Module; others may be derived from operating on video signals originating in the B Module. Nearly all are eventually used to switch and manipulate video in the B Module. The A Module also houses the Videolab Power Supply

SYNCHRONOUS CONTROL RAMPS *A*

In the upper left hand corner are six yellow jacks labeled "Synchronous Control Ramp" (See Figure). These are signals which are synchronized with the horizontal and vertical frame rates of the video signal. These ramps are used in conjunction with the key control sources to generate control signals which will produce split screens, wipes, corner inserts, etc. They can also be used with the control amps to produce control signals used to manipulate images within certain discrete sections of the screen.

TRIGGERED CONTROL SOURCE *A*

To the right of the Synchronous Control Ramps is the Triggered Control Source (See Figure). The Triggered Control Source supplies a slowly changing control signal ("ramp") which may be used to generate automatic fades, dissolves or wipes. The rate of change or the output is set by the knob. The input jacks of the Triggered Control Source are green jacks, indicating they will accept either a logic or control input. The outputs are the white and yellow jacks on the right hand of the submodule. The yellow outputs are complementary, meaning that as one output goes from zero to full scale, the other output does the reverse. The white output jack produces a fast pulse which may be fed back to the reset or clear input for repetitive action.

The control output signal outputs will go "up" or "down" (i.e. towards full scale or towards zero) depending on which of the green inputs receives a signal. Inputs in the upper and lower jacks will have a proportional effect on the rate of change of the output of the control source. Inputs to those in the center produce an instantaneous "reset" or "clear."

KEY SOURCE *A*

Each of the "Key Sources" located below the Triggered Control Source, is used to produce a high-speed control signal the amplitude of which is proportional to the difference between the signals apearing at its inputs. An important feature of the key control source is that the output levels are complementary, i.e., when one output is at maximum control signal output, the other is at zero. Keys between two images may be simply performed by applying these complementary control signals to two points on the matrix switcher.

One use of the Key Source is to generate "wipes." The standard technique to generate a wipe is to apply a slowly changing control signal to one of the key inputs of the Key Control Source (green jacks) and a reference signal from the Synchronous Control Ramps to the other. The complementary outputs of the Key Source are then fed back into two cross points on a row of the Linear Key Matrix to provide the control signals for the wipe. The resultant video from the Matrix is the "wiped" image.

The Key Control Source may also be used to key two video images. In this process, a constant control signal is applied to one of the inputs and a video signal in the other input. This will cause a second control signal to be generated which will contain the "outline" of the video. This outline is then fed back to the linear key matrix. The ability to produce this type of key, which may (in conventional video terms) be either "internal" or "external" is an extremely useful feature of the Videolab. By this method the Videolab produces extremely high quality variable hardness luminance keys which in many applications may be better than chroma keys.

Image Keying in the Videolab may be done in many ways. The Videolab can, for example, be patched to perform a fully linear edge, "smart" RGB chroma key (see the Videolab Advanced Applications Manual).

BUFFERED CONTROL POTS *A*

Immediately to the right of the Key Sources are the Buffered Control Pots. Each of these units have a dual function. When the "cv" switch is in the "up" position they are a source of manually variable control signals, available on the yellow jacks numbered 1 through 8. When the "cv" switch is in the "down" position, the Buffered Control Pots attenuate any signal applied to the green input jacks at the left. Useful applications of this feature which will be apparent later.

QUAD TRI-STABLE LOGIC SOURCE

The submodule on the bottom right corner of the A Module is the Quad Tristable Logic Source (See Figure). The white jacks generate logic signals which change only during the vertical blanking interval. In each of the four sections any one of the three logic outputs can be made to go "high" by depressing the red button. Only one can be active at any given time. Vertical interval switching of various video signals is easily done by applying these logic signals to the linear matrix. When the logic output is applied to a cross point on the matrix, it will cause the video signal present at that column in the matrix to appear at the output of that row. The resultant video from the matrix is the "switched" image.

DUAL LOGIC SOURCE *A*

The Dual Logic Source is a Boolean Logic unit. Each unit accepts up to three logic signal inputs and produces two complementary logic outputs. This unit is used for advanced applications and for special wipes and inserts. Each of the Dual Logic units may be logically described as a two-input and gate with an inhibit input and complementary outputs. As with all signals in the Videolab, when outputs are tied together, the highest predominates (positive "wire or").

CONTROL AMP *A*

To the right of the Dual Logic Output are the Control Amplifiers.

These units are designed to operationally sum control signals. They are useful in a variety of Videolab applications. Outputs of these amplifiers are clamped to be within the control voltage range.

REMARKS

The preceeding material, while it is hardly exhaustive, provides the beginning Videolab operator with a basic theoretical overview of his instrument. In the material following, some practical Videolab applications of key importance will be discussed and the use of patching diagrams is described.

In all Videolab work, EAB encourages the user to make use of a NTSC Waveform Monitor and when possible, an NTSC Vectorscope to monitor the signal produced by the Videolab. These instruments are an important aid in ensuring the production of a quality image.

THE VIDEOLAB: APPLICATIONS

The material in this section issustrates some basic applications of the Videolab. Further applications appear in the Videolab Advanced Applications Manual. A descriptive text is included explaining the ideas behind the patching of each of the effects.

The effects shown here by no means fully show the variety of effects available with the Videolab. They are designed to illustrate the most basic principles of patching and utilizing various submodules of the Videolab. It is hoped that the Videolab user will, starting with these basic principles, build his own library of patching diagrams.

THE PATCHING DIAGRAM

All Videolab special effects are produced by an arrangement of patchcords, or "patch." The patching diagrams shown in this section are a convenient means of documentation. A number of blank patching diagram forms are provided with each Videolab for the conveniece of the user. These blank forms may be reproduced and used a needed.

In the examples which follow, a connection between two jacks is shown by a line drawn between the two points. Also, note that all important switch positions are recorded by means of a mark. Control positions are documented by a number in the knob circle. Slider positions are shown by a mark. Also, in marking a patch diagram the user should take care to include a correct title, and sufficient information to adequately document the purpose of the patch.

It should be mentioned that it is not, in general, necessary to re-patch the Videolab for each and every effect desired. Nearly all Videolab owners develop, for their use, multi-purpose patches which are capable of executing several effects without changing patchcords. Some of these patches are shown in the Videolab Advanced Applications Manual.

VIDEO SWITCHING

This is an example of switching between two video images (Fig 1). The Quad Tristable Logic Outputs 1 and 3 are fed into the linear matrix column 1 and 3, Row 1. The output of row 1 is connected to the Output Keyer/Fader. Pressing pushbutton P1 and P3 cause channels 1 and3 to be cleanly switched (i.e., during the vertical interval). This patch may be expanded to include more images. How?

VIDEO FADE

Figure 2 illustrates a cross fade between two images. There are other, simpler ways to accomplish a cross fade, but this patch illustrates several basic techniques.

A control signal from the Bufferred Control Pot 1 is sent to the Control Amps, driving one positive as it drives the other negative. One section of the Quad Tristable Logic Source is used as a zero-to full scale control signal source and it drives the right hand section of the Control Amp to full scale when no other input is present. This arrangement produces complementary control signals which are applied to the Row 1 crosspoints as in example 1. The difference between this example and example #1 is that the control signals are changing slowly instead of instantaneously, producing a fade instead of a switch.

AUTOMATIC CROSS FADE

In figure 3 the previously shown crossfade is accomplished automatically by depressing the Tristable Logic Source pushbuttons P7 and P8.

Two important aspects of Figure 3 are:

1) A slowly changing control signal may be created by means of the Triggered Control Source.

2) An existing source of manually changed control signal (in this case the Buffered Control Pot 1) may be replaced by another source (without disturbing any patch) by merely connection the new control source to the input of the Buffered Control Pot and throwing the switch to the "down" position.

SPLIT SCREEN

Figure 4 is a horizontal split-screen produced by applying a complementary control signal to Row 2 of the linear matrix (note the similarity to Figure 2). This patch configuration differs from the last three figures in the method of producing the control signal.

The control signal which produces the "split-screen" is produced by a Key Control Source. It generates a slicing signal by comparing the horizontal ramps with a constant level. The hardness of the edge of the split-screen is varied by the setting of the knob on the Key Source submodule. Some important variations of this patch are:

1) Manually changing the Buffered Control Pot 1 will result in a horizontal wipe.

2) Altering the Ramp Outputs will change the shape and direction of the wipe. Horizontal and verical wipes as well as corner inserts may be created by connecting to different Ramp Outputs.

3) The patch may be automated as in Figure 3. Try this.

4) The signal to the upper input of the Key Source need not be a Ramp signal. (This is discussed in th next example).

EXT/INT LUMINANCE KEY

Figure 5 illustrated Gray Level Keying. Here an external key is produced by using the video image of channel 6 as a Key Source input and using the resultant high speed control signal to switch between channels 1 and 3. This produces an image which contains the images of channels 1 and 3 separated by the <u>outline produced by channel 6</u>. Channel 3 appears in th higher luminance (brightness) portions of channel 6; and channel 1 occurs in the lower luminance portions of channel 6. Note that the only difference between this patch and Figure 4 is that the "slicing" control signal is generated from a video signal instead of a Synchronous Ramp.

The key produced here need not be the "external" key shown. If the Key Source input is channel 3 for instance, the key produced will be of the internal type (i.e., self-keying) where image 3 appears "over" image 1, showing its higher luminance values only.

NEGATIVE VIDEO

Figure 6 demonstrated the use of the Video Mixer. This patch produces a video signal which is that of channel 1 with its gray scale and colors completely inverted. The Video Mixer has other applications, which will be seen later.

VIDEO COLORIZING

Figure 7 demonstrates the use of the Colorizer. Here a totally synthetic video image having the outlines of the original video is produced by slicing the gray scale of a video signal and assigning arbitrary values of Red, Green, and Blue to each "slice." Figure 8 shows a mix of colorized video with original video. In Figure 9, only the highlights of the original video image are retained.

COMPLEX PATTERNS

Fig. 18 shows the use of the Pattern Source. Video images 1 and 6 are keyed into slices 2 and 4. The patterns formed here will be angular because triangle waves are used. Try using the sine wave outputs. What about a mix of sine and triangle? Hint: set the ring controls to center on the pattern generator for stationary patterns.

CONCLUSIONS

The above are but a few of the possible combinations of effects using the Videolab. The Videolab owner is encouraged to experiment and produce his own patches. If you discover something interesting, send us a patch diagram and we'll publish it in our new magazine "PATCH," which is available to all Videolab owners. Feel free to call us any time: and remember:

<u>ALWAYS USE THE SHORTEST POSSIBLE PATCHCORD!</u>

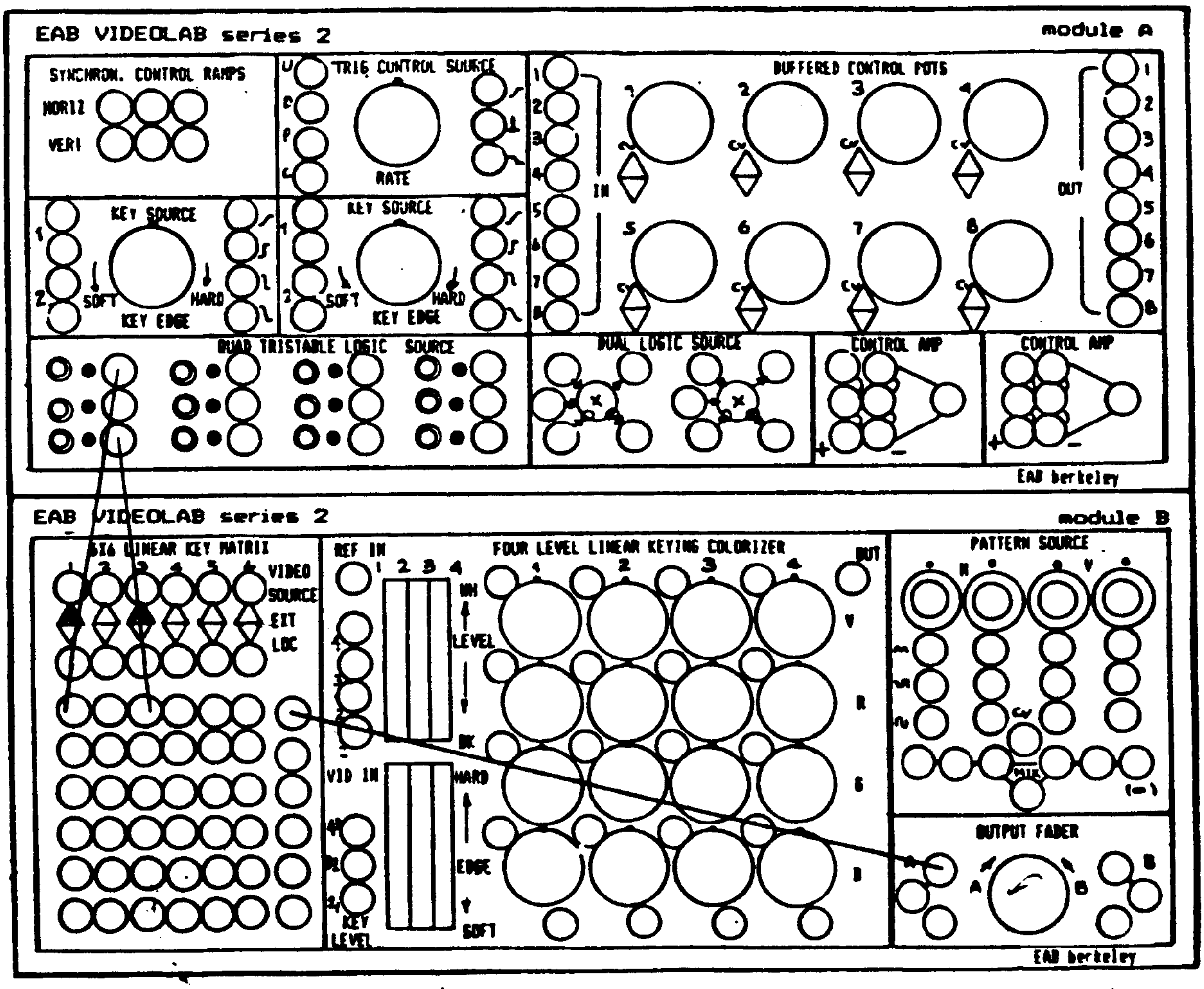
Bill Hearn and Dave Pearson

EAB Video, 2940 Grove ST., Berkeley, CA 94703

EFFECT: VIDEO SWITCHING

INSTRUCTIONS: PUSH P1 + P3

Date	By:	File	Frames	Authorization:
12-14-83	WH	VL 2 OPM		

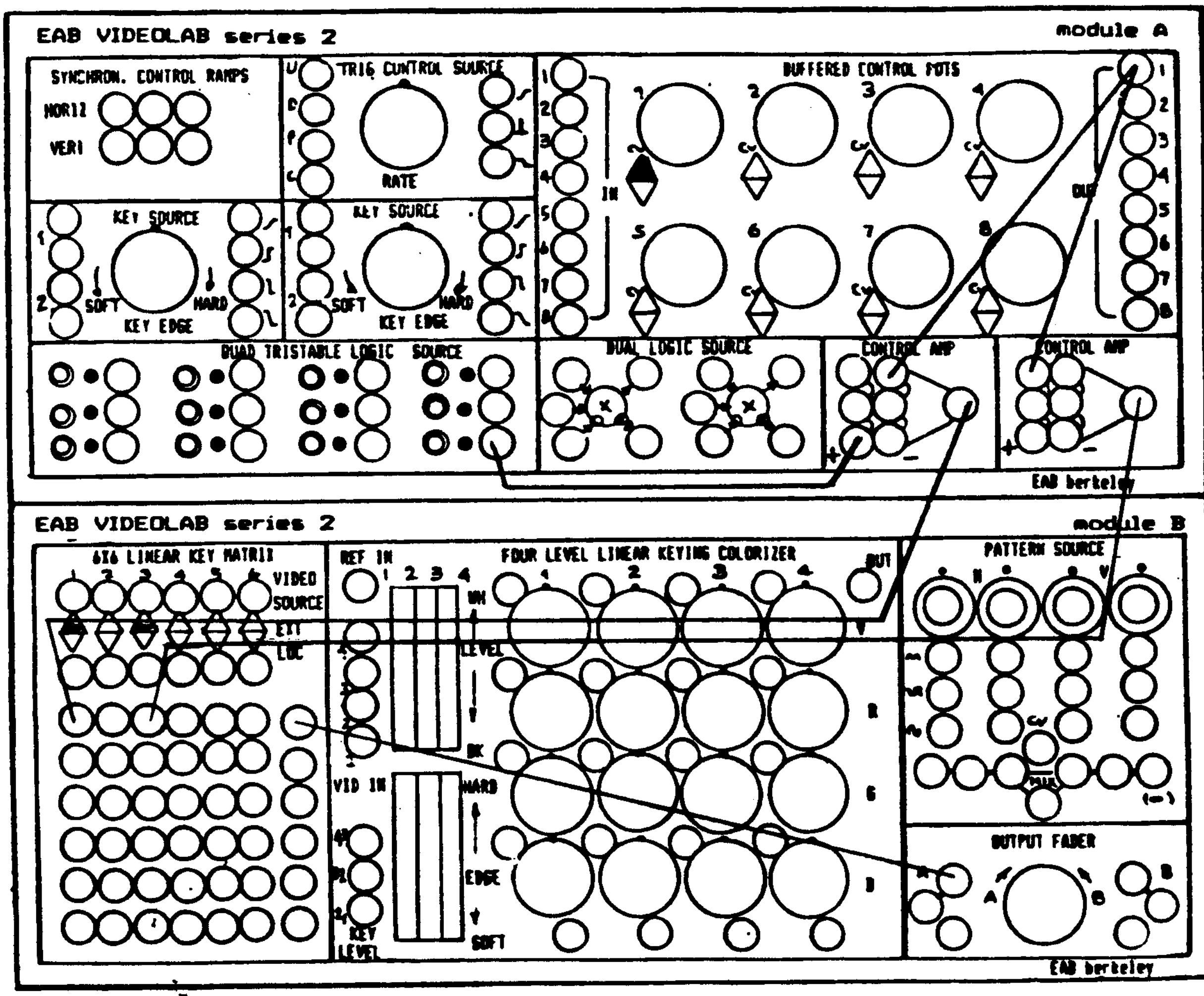


REMARKS:

EFFECT: VIDEO FADE (MANUAL)

INSTRUCTIONS:

Date	By:	File	Frames	Authorization:
12-14-83	WH	VL22FM		

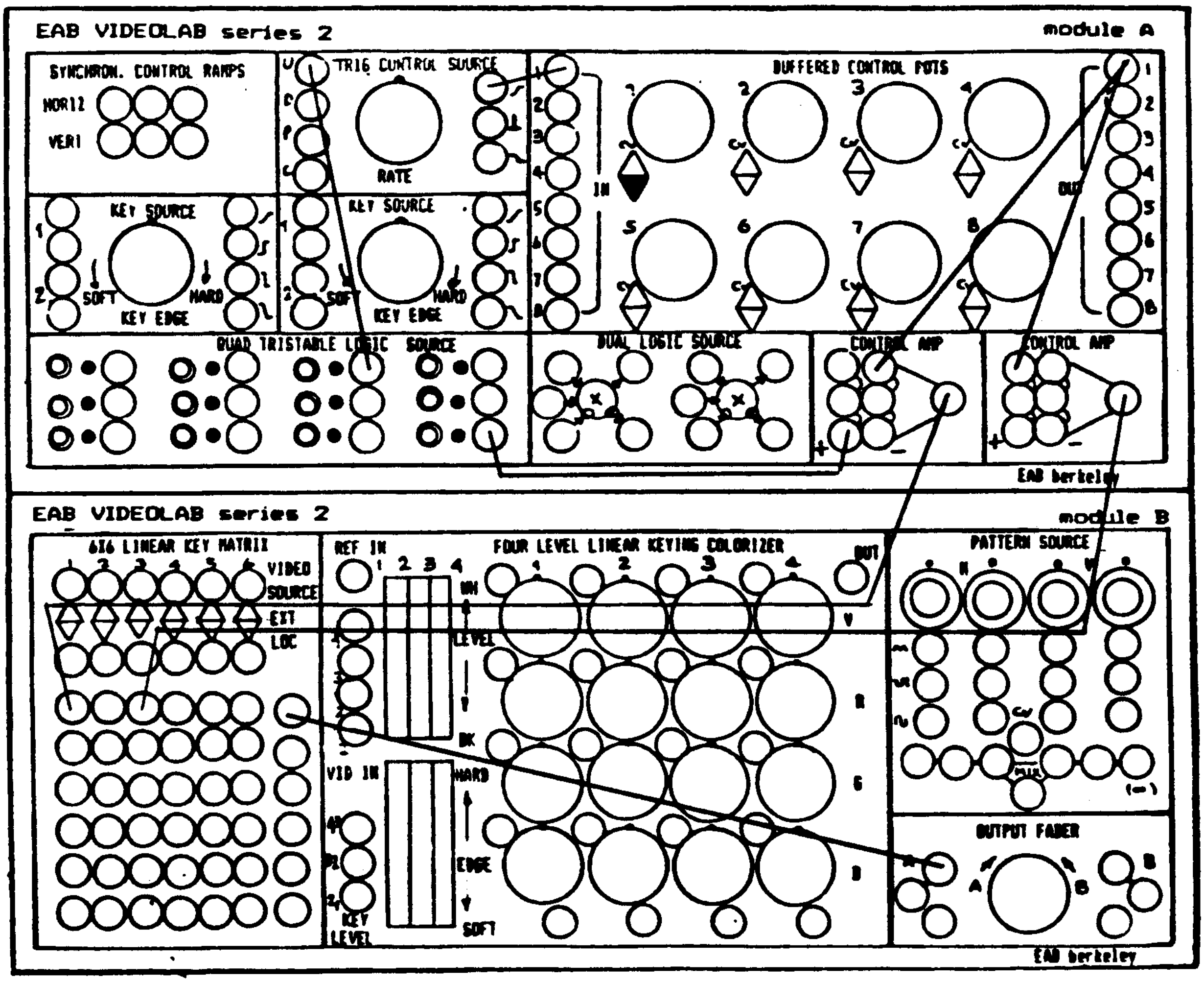


REMARKS:

EFFECT: VIDEO FADE (AUTO)

INSTRUCTIONS:

Date	By:	File	Frames	Authorization:
12-14-83	WH	VL2 OPM		



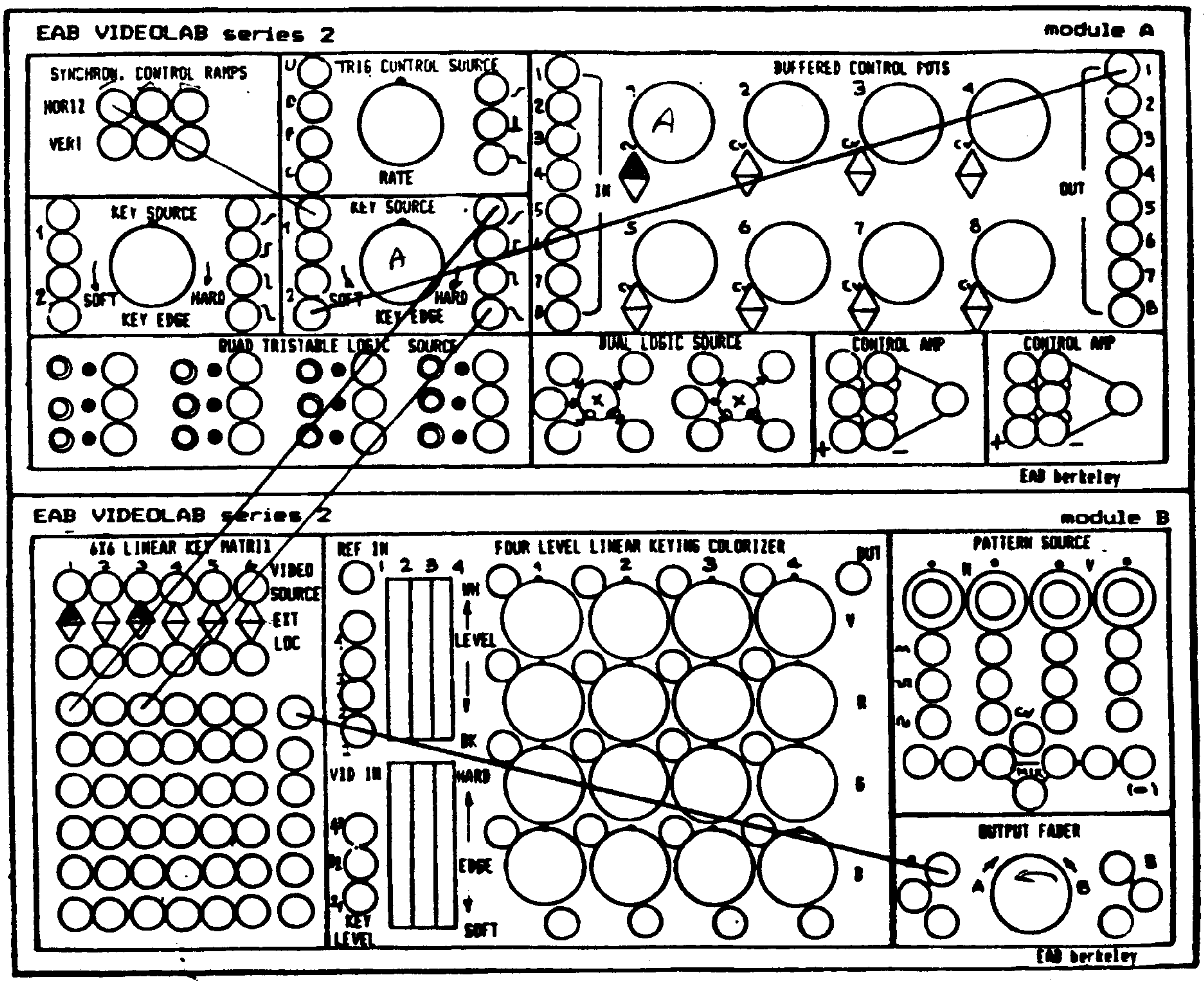
REMARKS:

Figure 4

EFFECT: SPLIT SCREEN

INSTRUCTIONS: ADJUST B.C.P 1

Date	By:	File	Frames	Authorization:
12-16-93	W-	V120PM		



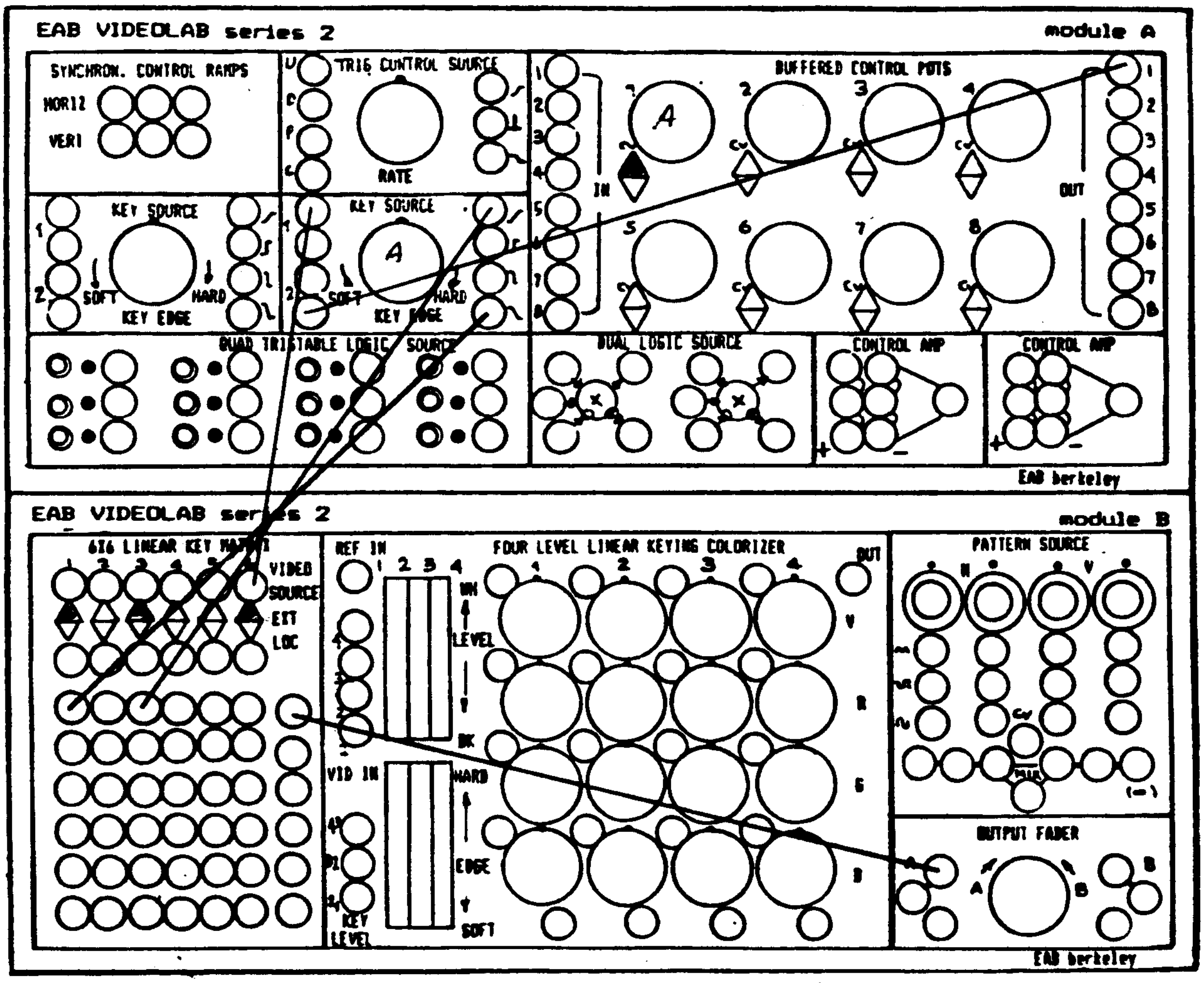
REMARKS:

Figure 5

EFFECT: LUMINANCE KEY

INSTRUCTIONS: BCP #1 IS Key level

Date	By:	File	Frames	Authorization:
12-14-83	WF	VL20FF1		



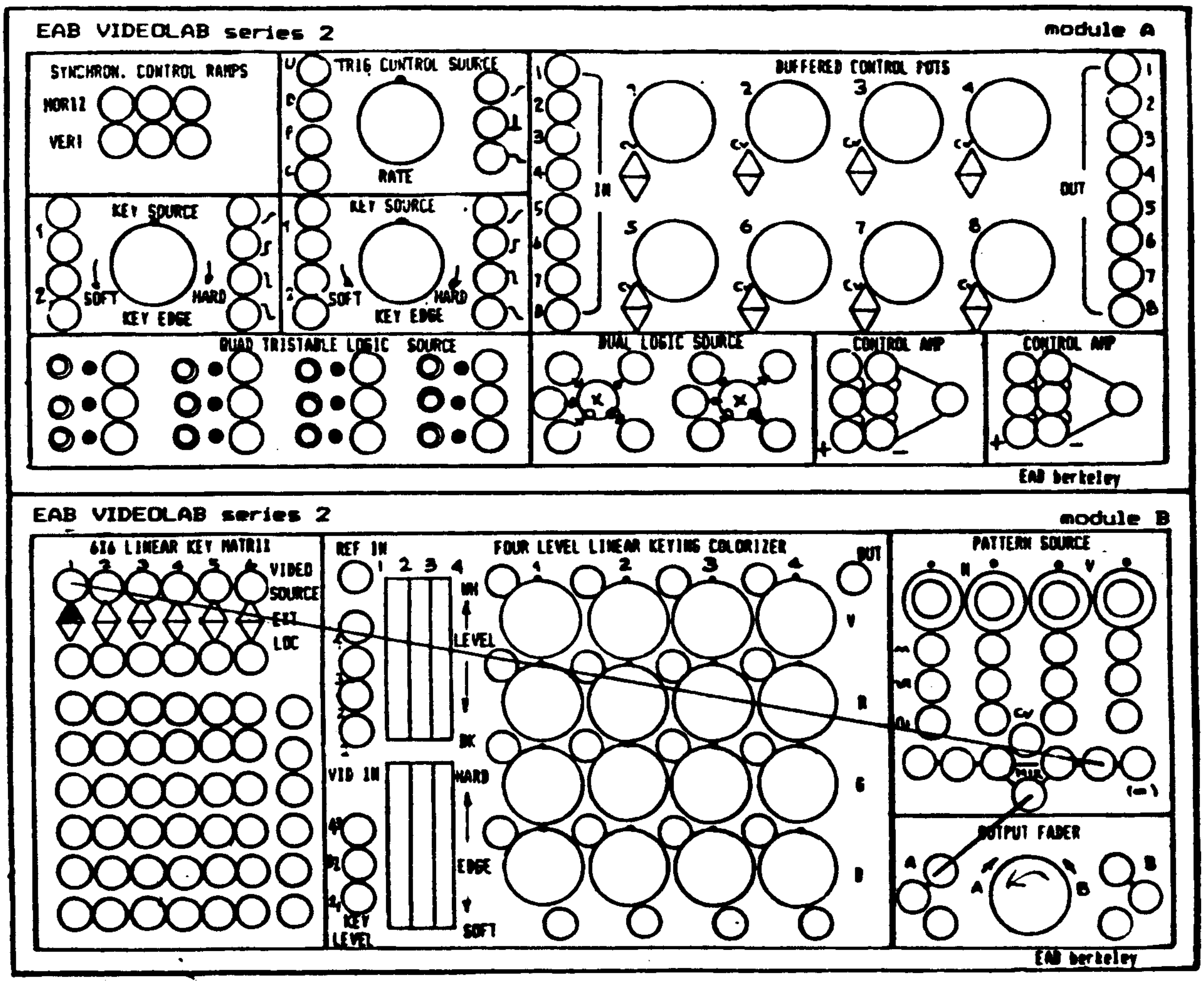
REMARKS:

Figure 6

EFFECT: *NEGATIVE VIDEO*

INSTRUCTIONS:

Date	By:	File	Frames	Authorization:
12-14-83	WH	VL2DPM		

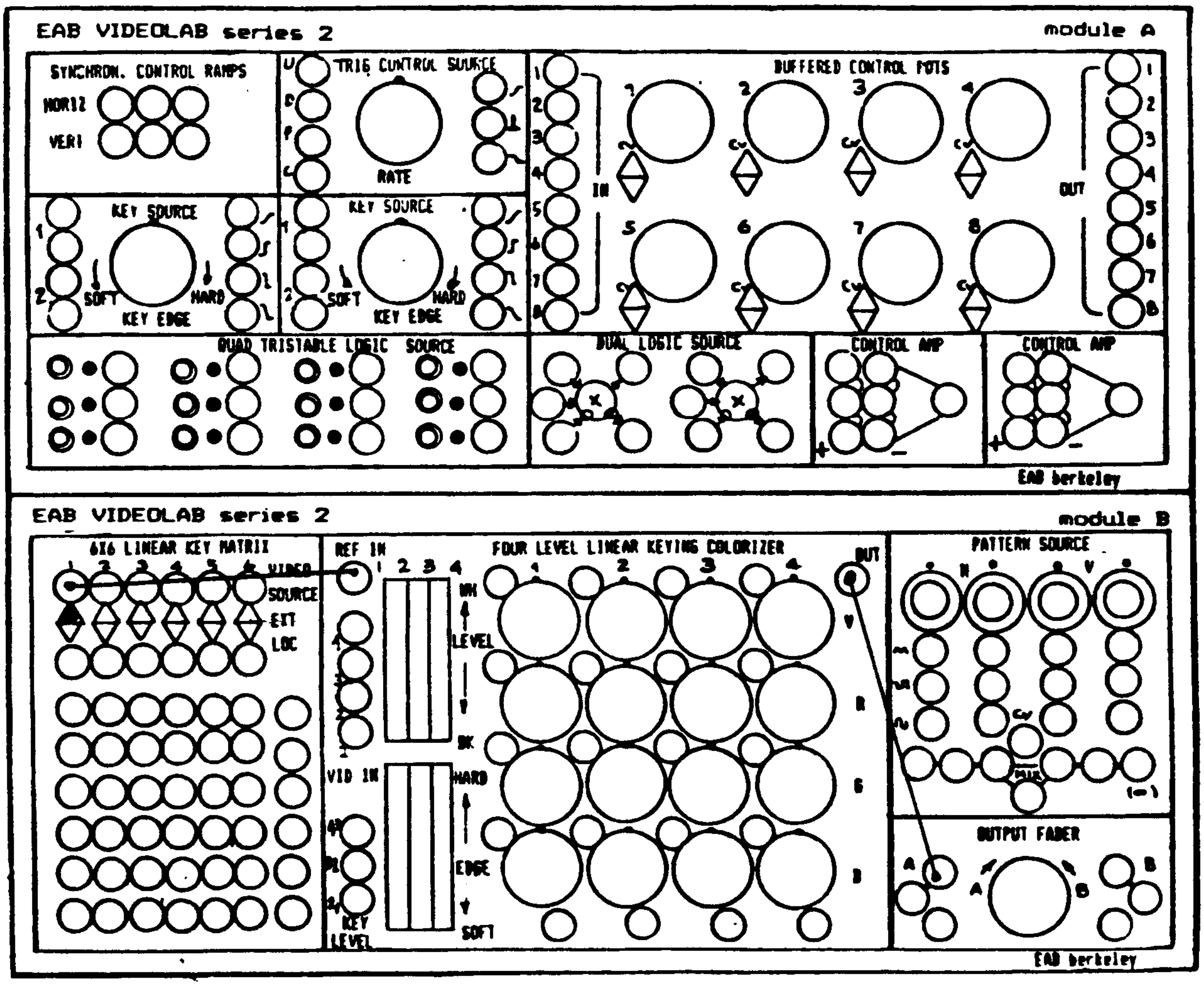


REMARKS:

EFFECT: COLORIZING

INSTRUCTIONS:

Date	By:	File	Frames	Authorization:
12-14-83	VJ	VL2 CH		



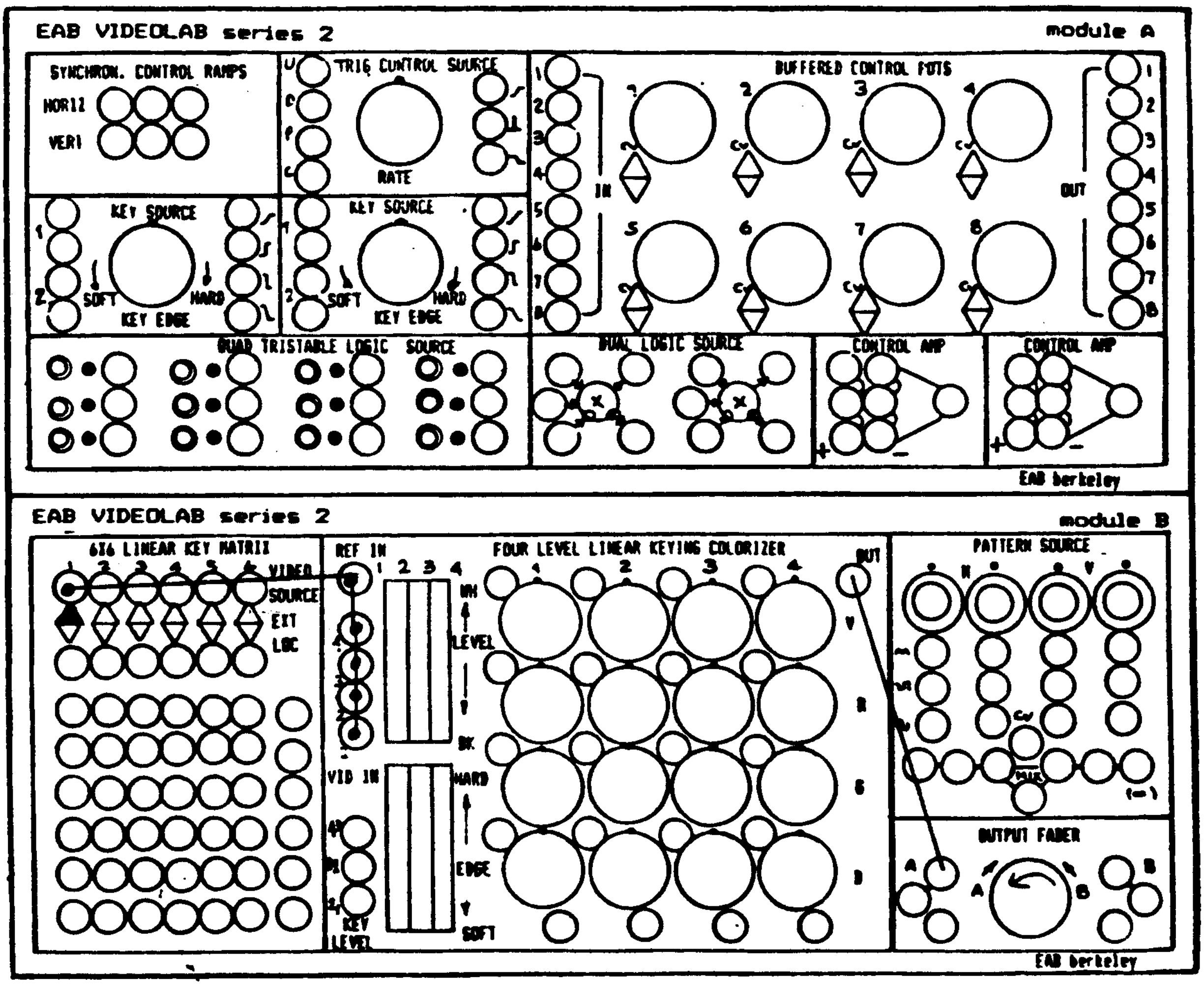
REMARKS:

Figure 8

EFFECT: COLORIZED PLUS ORIGINAL

INSTRUCTIONS: SET VIDEO LEVELS W/ "V" POTS

Date	By:	File	Frames	Authorization:
12-14-83	WH	VL20-M		



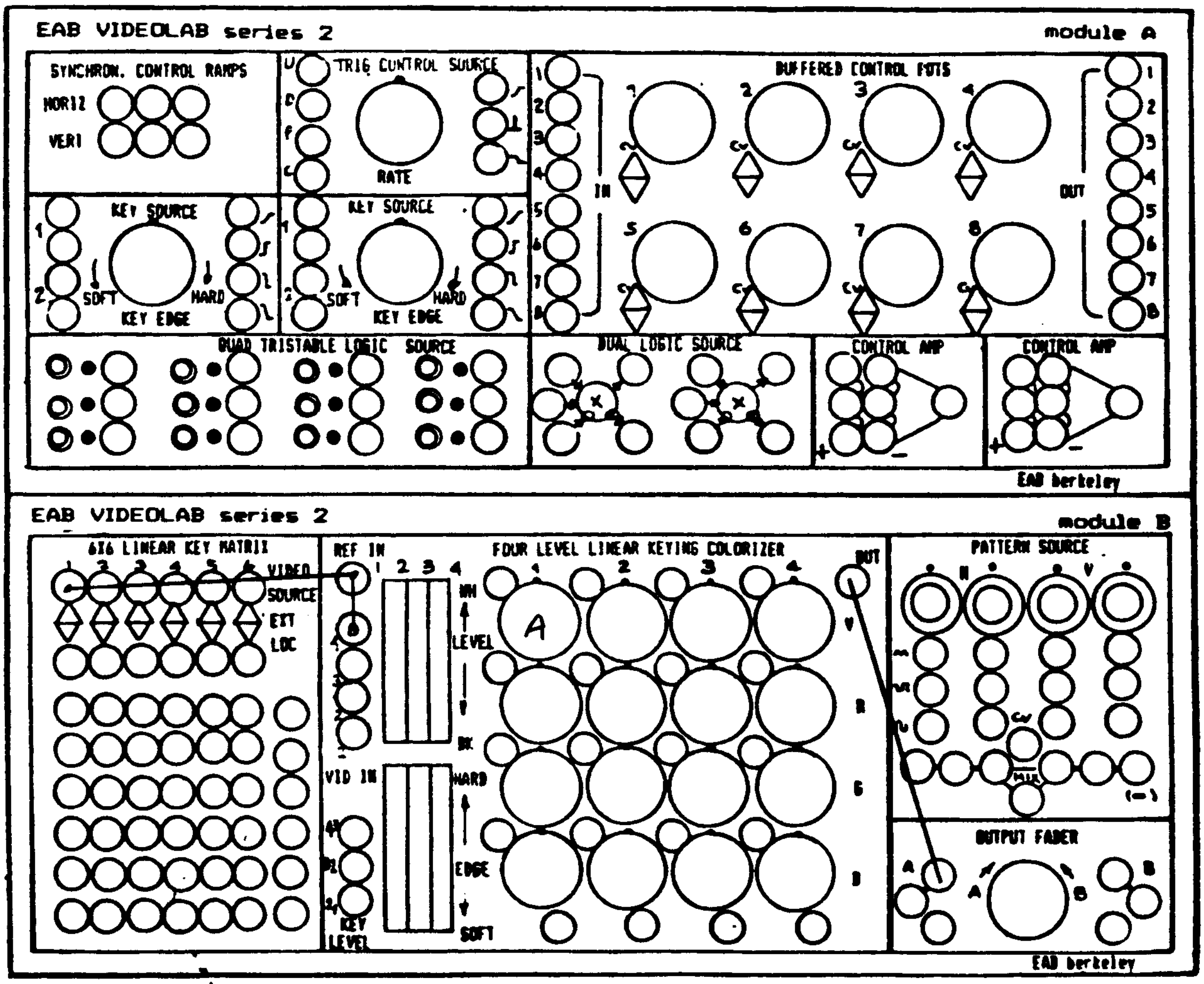
REMARKS:

Figure 9

EFFECT: COLORIZING WITH ONLY HIGHLIGHTS
OF ORIGINAL IMAGE ADDED

INSTRUCTIONS:

Date	By:	File	Frames	Authorization:
12-1?-8?	[illegible]	V-2 OFM		



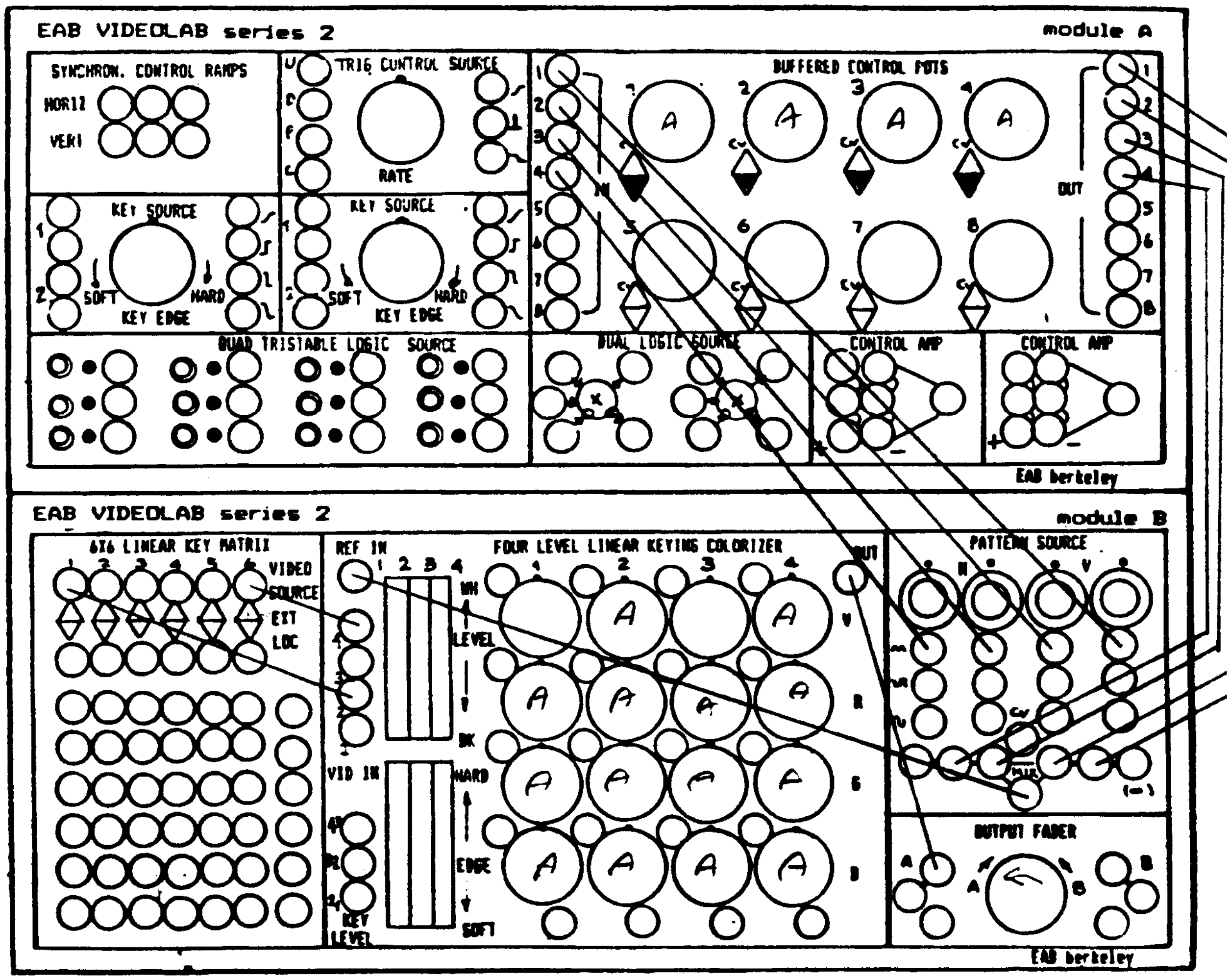
REMARKS:

Figure 10

EFFECT: COLORIZING OF COMPLEX PATTERNS

INSTRUCTIONS: ADJUST PATTERN SOURCE POTS, BUFFERED CONTROL POTS 1-4 ; KEY VIDEO ON CH. 1 & 6.

Date	By:	File	Frames	Authorization:
12-14-83	WH	VL2PAM		



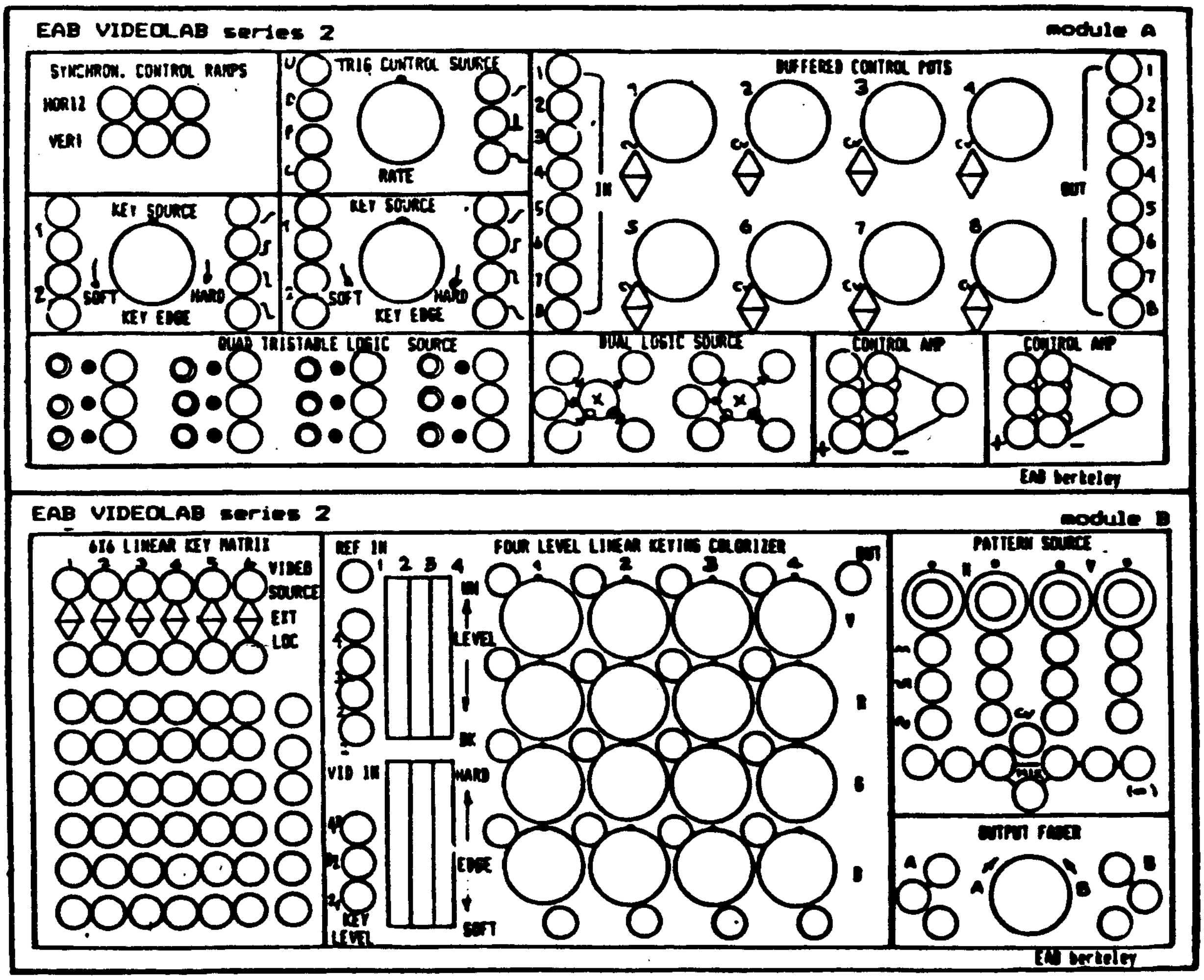
REMARKS:

NOTE IMAGES 1 & 6 ARE KEYED INTO PATTERN AS DESIRED.

EFFECT:

INSTRUCTIONS:

Date　　By:　　File　　Frames　　Authorization:



REMARKS: