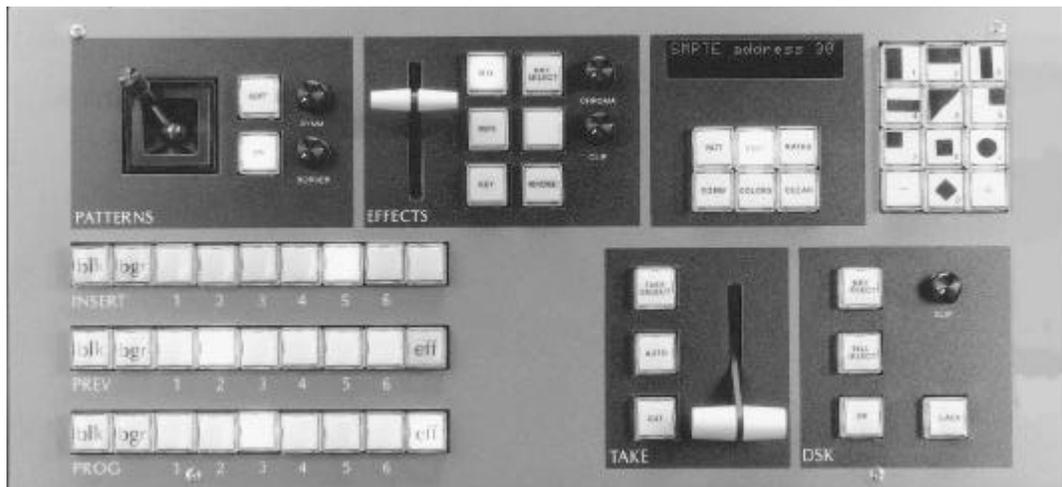# MVS3 Operator's Manual

Revision 1

This manual is intended for use with ECHOlab's model MVS3 broadcast television switcher, with software version 4.x and higher. Last manual revision: 08-30-96

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INTRODUCTION

The MVS3 is a 1-1/2 mix-effects, three-bus switcher, featuring control-panel programming, computer-assisted calibration, and a variety of innovative production features.

Along with the normal control system, the MVS3 includes an expanded control set (Commands) with an alphanumeric display for ease of use. A SMPTE-protocol serial link is available for edit controllers.

The MVS3 is built on two 12 x 14" printed circuit cards. Computer, sync and key generation circuits are on the lower card; the upper card(s) holds all video circuits. A small daughterboard holds the genlock sync card; an optional card is available for chromakey - it is also installed as a daughterboard on the lower card.

The chassis assembly includes a motherboard and a switching power supply. Several trimmer adjustments for gain and phase are accessed by opening this panel.

A remoteable control panel is connected to the electronics chassis through two 75-ohm coax cables and powered by a separate wall-mount transformer. This panel digitizes all switches and potentiometers for serial transmission to the chassis, and has no internal adjustments.

Unpacking

  Included with each unit:

- MVS chassis, with any requested options installed

- Power cord

- Control panel

- Wall-mount transformer for control panel

- One Operations manual

- Extender card (option)

- Warranty card

INSTALLATION

Rack mounting

The MVS3 is packaged in a 5 1/4" H x 14" (13.5 x 35 cm) deep rack mount chassis and a 8 3/4" (22.25 cm) control panel. The chassis is equipped with rear supports which should be used to support the weight of interconnection cables:

The control panel may be installed in 8 3/4" (22.25 cm) of rack space or desktop mounted with the support sides.

Battery Backup

Because stored-sequence programming and all calibration data is stored in battery-powered memory, several precautions should be observed to avoid accidental memory loss:

1. The CPU (lower) card may be removed without memory loss, but do not set it on a metallic surface.

2. Avoid careless probing of memory and computer signals.

3. Two DL1/3N Duracell batteries are used, wired in parallel. These are mounted on the CPU card. They should be changed at two-year intervals, and replaced ONE AT A TIME so no voltage interruption results. If the unit is continuously powered, the batteries can be changed every five years. Battery voltage can be measured between chassis ground and D6/D7 anodes, just above batteries. Initial voltage is about 3.2 v, and batteries measuring less than 3.0 v should be replaced.

Power

The MVS3 uses approximately 85 watts of AC power at 110 or 220 volts. To change from the standard 110 configuration to 220 volt input, remove the AC cable and remove the left side plate of the rack chassis to gain access to the switching power supply. A jumper must be moved from the 110 to the 220v position for European operation.

Sync

A genlock sync generator is built-in to the unit as a standard feature. The genlock input can accept any NTSC (or PAL) video signal. With the genlock card installed, Command 6 can be used to choose between subcarrier, internal, and genlock modes.

Sync modes - Command 6

MODE	OPERATION
Subcarrier	Horizontal and vertical sync are locked to the external genlock input. Subcarrier is free-running, generated from the internal crystal oscillator.
Internal	Color burst and sync generated internally.
Genlock	Burst and sync are locked to an external NTSC (or PAL) signal connected to the GENLOCK input. Burst phase and horizontal phase are adjustable from the front panel using the calibration commands; see COMMANDS in the Production section.

Video Inputs

Ten (6 standard, 4 optional) zero-timed terminating video inputs are available for any synchronous NTSC or monochrome source, composite (preferred) or non-composite. One DSK FILL input is also available for key fill inputs.

Video Outputs

One PREV and two PROG outputs are provided in the selected video mode. Also, a composite PREV and PROG output are available at all times. Three BLACK outputs can be used to synchronize genlockable cameras.

Control Panel connections

Up to 1000' (300M) of 75 ohm coax is used to connect the serial digital data connectors, FA and FB, to the control panel. RS-423 standard data transmission is used for bi-directional communication to the panel. A wall-mount transformer supplies 9-12 volts DC at 1.5 amps to the panel.

Keys

There are two keyers in the MVS3: Effects (upstream), and DSK (downstream). Each keyer can be used with any of the six external key inputs (KEY1 thru KEY5 and CGEN), the optional RGB chromakeyer, as well as with insert bus video as a key input. The gain of the Effects keyer and the Downstream keyer can be continuously adjusted from high-gain to linear by use of the appropriate key gain commands. The Effects keyer and the DSK keyer will accept 1v standard monochrome key signals.

Two different types of key signals are accepted by the MVS3, high-gain and linear keys.

HIGH-GAIN KEY
This is the conventional key signal, which has been in use for many years. An example is the use of a monochrome camera focused on an art card, with the art traditionally being composed of white letters on a black background. This polarity is less sensitive to camera and lens signal falloff at picture edges and corners. For this use, the signal is nominally 1v p-p, but in practice a keyer gain of ten or more is used to clean up imperfections in the black and white areas. This means that the middle ten percent or so of the camera signal is amplified and used to dissolve from background to insert bus.

LINEAR KEY
Electronically generated key signals from equipment such as character generators and digital effects generators usually require a "linear" keyer. The linear keyer has a gain of 1, so a full one volt level will dissolve to the insert bus and a black level will select the background picture. If a high gain keyer is used instead, the key edges will be too hard and cause chroma crawl. Also, if a transparent key is used it will not be reproduced correctly. The Effects keyer can be made linear by pushing the effects KEY GAIN button and using the +/- keys to set the desired softness. The DSK key is similarly adjusted using the DSK KEY GAIN button.

Key Delay

The MVS switcher has a very short overall path delay thru the mixer. Worst case path matching inaccuracies are typically less than 35 ns.

Common installation questions

1. How do I access the MVS commands and calibrations ?

The standard commands can be accessed at almost any point by entering the command number followed by the command key, the state of the command is now changed with the + and - keys. Any changes made will stay in the MVS battery backed up memory until they are modified again or a command reset or master reset is performed.

The calibration commands can only be accessed when calibration mode is turned on (100 COMMAND +). Calibration mode should normally be left off to avoid any accidental change of calibration values although factory and your own user defined calibrations can be recalled at any point with command 200 (restore factory calibration) or command 400 (restore user calibration).

When in calibration mode with a cal. command called up the display will show the current value for that command. For the MVS3 the cal. value(s) can be modified with the appropriate SYMM, BORDER, and CLIP knobs. Alternately the selected cal. value (the active cal. value will have a carat > to it's left) can be trimmed with the + and - keys. For example, command 109 horizontal blank width and phase will look like this in the display.

Horiz 254 Bdr 784

The SYMM knob will adjust the first cal value in this command (H blank width), the BORDER knob will remain a border control, and the CLIP knob will adjust the remaining cal value (H phase).

Please note:

The numeric entry command should be left off. It allows for quick entry of defined calibration values via the numeric keypad but is of no use in normal calibration procedures.

Turning calibration mode off resets the MVS to it's exact panel setup prior to calibration mode being turned on, it basically performs a panel recall to it's pre calibration mode positions.

2. How do I genlock and time my switcher?

The MVS is extremely easy to time as the subcarrier and horizontal phase adjustments are all accomplished with front panel commands, as well as defeating the sync processor and adjusting horizontal and vertical blanking widths.

The MVS must have a valid terminated composite source connected to its genlock input and a valid test signal (preferably color bars) coming into an input from the same reference source (sync generator).Verify that the MVS sync source command #6 is set to genlock (this is it's factory default).

Select the reference source (color bars) that you are going to time the MVS to on all busses. Turn command 9 off and on to observe the difference between the switchers processed sync and the sources sync.

IMPORTANT: Do not cut between this source and bus black as you may be accustomed to on other switchers, leave your reference source selected on all busses and simply toggle command 9 off and on!

Turn calibration mode on (100 Command +) and select command 107 for NTSC systems adjust the CLIP knob to change burst phase. For PAL systems this will adjust burst angle. To adjust burst phase in PAL the BORDER knob must be adjusted. Using the MVS sync proc command 9 to observe any error match the MVS burst phase to the genlock reference.

Adjust the MVS horizontal with calibration command 109. To adjust horizontal phase adjust the CLIP knob.

The MVS SCH phase is set by the relative position of burst phase and horizontal phase. Assuming the reference is in correct SCH phase if the above calibrations have been performed correctly the MVS should be in correct SCH phase. If it is not recheck the calibrations above and / or move the horizontal phase command slightly to achieve proper SCH phase.

For PAL systems only: The MVS PAL phase can be set one of two ways. The burst vectors can be swapped with command 107 or a jumper on the genlock daughter card on the CPU board can be moved. Adjusting command 107 is the method that maintains the integrity of the 8-field sequence.

After the MVS sync proc has been timed to house reference you may want to save these calibrations to the user calibration register. Command 401 will save these and all current calibration values to the user cal area. You will probably want to record these values. One suggestion is to note them on the inside of the chassis door where the factory calibration printout is located.

3. **Where should I connect my key cuts and fills ?**

The answer to this question, anywhere!, points out some of the outstanding features of the MVS series switcher. The MVS keyers can select any key input, optional chromakey, or bus input for its cut source and any bus input, DSK fill, or internal colorizer for it's fill source. There is no need for any external delays,

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routing, or distribution as all key and bus inputs are essentially zero timed and can be called up anywhere on the switcher.

- All keyers are gain adjustable from linear to high gain from the control panel.

- Once a source and it's associated key signal are timed to the MVS switcher it can be selected anywhere with no other timing considerations.

- For cut selection there are six terminated external luminance key inputs, KEYS 1-5 and CGEN, available as well as the chromakey option key or any insert bus source.

- For fill selection any of the 10 bus inputs, DSK fill, or any internal colorizer can be chosen to fill any keyer.

4. What about signal formats ?

The MVS switcher is upgradeable from composite to Y/C or component or from Y/C to component by adding video board(s) and changing a software command and a few jumpers on the CPU board. It is also possible to change the switcher over from one format to another by changing a command and CPU board jumpers (on revision D and later) providing you have a sufficient number of video boards in the MVS (one for composite, two for Y/C, and three for component). Please note that you should consult ECHOlab prior to making any upgrades or reconfiguration of your system to verify board compatibility and discuss specifics of areas of concern such as preview/program composite encoder adjustments, colorizer saturation calibrations, and miscellaneous items such as the optional RGB to YUV transcoders.

The MVS is not intended to be an inter-format switcher. You cannot intermix formats, only change the switchers overall format with a few exceptions.

- The composite preview and program outputs always provide a composite output regardless of the format of the MVS (provided the MVS is operating in it's original factory format or the correct modification and calibration has been performed). In composite and Y/C these are full broadcast quality, in component these outputs are intended for monitoring only.

- There is an option for inputs 9 and/or 10 in the component version to transcode from analog RGB to YUV.

5. How about options ?

Most options will be displayed when command four is selected. The current software version and major options will scroll on the display. Most of the options are software options, such as SMPTE editing interface, rotary wipe package, memory expansion, etc.,and can be added by entering a code supplied by ECHOlab. Others, such as Chromakeyer are plug in option cards.

Now for some troubleshooting questions.

6. My control panel shows "DISCONNECTED"

So far you know that there is power to the control panel and it is running. If you press the CLEAR button (under the display) on the control panel and it will display switch numbers that you select and their state (on/off) or if you move levers, a joystick, or knobs their value will appear in the display. This means that the panel is functioning (it has it's own processor) but not communicating with the chassis. Let's examine other potential causes.

- Check that the chassis has power. The MVS chassis has a power switch that is accessed by hinging open the chassis door. It should be on and illuminated.

- Check that the chassis CPU board is running. There is a bank of four LED's on the CPU board (revision C and later). The left hand LED should be lit solid (+5 VDC) and the right hand LED should be blinking. This indicates the chassis CPU is running. If the LED is not blinking try powering the MVS down and up again, if that fails try reseating the boards, if that fails contact ECHOlab for assistance.

- Try powering the control panel down and up. The control panel power connector should be strain relieved to make sure it is always making good contact.

- Check that the communication cables are connected correctly and in good working order. Do not hesitate to swap them out for a new set if you suspect they may be bad or intermittent or swap them around if you think they may be reversed (hooking them up backwards will not harm them).

7. The serial editing interface does not work.

This is one of the most common support questions asked and statistically one of the least likely to be caused by a hardware or software fault. The MVS operates

under GVG 100 protocol with an RS 422 edit port and command selectable baud rate, parity, and address. Check the following:

- SMPTE editing interface is an option. Is it installed in the MVS? Check command 4 to see if the option is installed.

- Is the EDIT button lit on the MVS control panel? This turns on and off the interface.

- Is the editor RS422? That is the standard configuration of the MVS edit port.

- Is the MVS and/or the editor selected to the correct baud rate, parity, and address? There is no "correct" setting for this, the editor and MVS must agree. Confirm that the editor is selected to what you believe it is. Often this dicrepancy is the problem.

- Check the cable!!!! About half the interface problems are traced down to a mis-wired or incorrect cable.

- Is the editor GVG 100 protocol. Is it selected to GVG 100 protocol?

- Make sure the MVS SMPTE transmit test command is off.

- Try re-booting the editor after changing any parameter. Some only check for the switcher once on power-up and give up after one try.

- Make sure you are connected to the MVS edit port.

- If all this fails contact ECHOlab or the edit manufacturer for further assistance.

8. How do the GPI's work ?

There are four GPI inputs on the MVS. Three are dedicated and one is command selectable. The first three are used to trigger autotake, DSK and fade-to-black respectively. The fourth GPI input is programmable - see command 15.

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9. How do I adjust subcarrier frequency ?

If an MVS, operating in genlock, fails to subcarrier lock or falls out of lock after warming up, the internal subcarrier frequency may need to be adjusted to match the genlock reference source's frequency.

For optimum adjustment, the following procedure should be performed after the MVS chassis and the genlock reference source have been allowed to reach normal operating temperature.

- Select color bars or any source from (or locked *directly* to) the genlock reference source (typically a sync generator) on **all busses** of the MVS.

- Turn Command 6 to **INTERNAL**. Press 6, Comm, and -. The display should read "Sync = Internal".

- Observe either the preview or program monitor. You should see horizontal sync tearing across the source. This is an easy way to monitor the difference in frequency of the MVS as horizontal frequency, in internal mode, is counted down from internal subcarrier frequency. This procedure works for composite, Y/C, or component systems.

- Adjust CV1 on the MVS chassis CPU (bottom) board to slow the drift rate of horizontal sync as much as possible. CV1 is the only adjustable component mounted on the bottom of the CPU board. It can be accessed through a hole in the bottom of the chassis or it may be necessary to put the CPU on an optional extender board. This adjustment can also be made by turning off power to the chassis, removing the CPU board until CV1 can be accessed, turning CV1 very slightly one direction or the other, re-inserting the CPU board, turn on power to the chassis, and repeat several times until movement is slowed.

- Turn Command 6 to GENLOCK. Press 6, Comm, and +. The display should read "Sync = Genlock" and the MVS should now be subcarrier locked. This adjustment typically only needs to be performed one time and should remain stable.

Tally Connector

Tally connections for camera's 1 through 8 are brought out on the nine-pin D connector marked TALLY. The pinout for this connector is shown below. Also shown is a typical wiring topology for using the MVS open-collector tally outputs. The tally connections function by providing an open collector output that provides a short to ground when selected (1/2 amp, 30V max.).

TALLY CONNECTOR INTERNAL WIRING:

CAM4 CAM3 CAM2 CAM 1

⑤ ④ ③ ② ①

⑨ ⑧ ⑦ ⑥

CAM8 CAM7 CAM6 CAM5
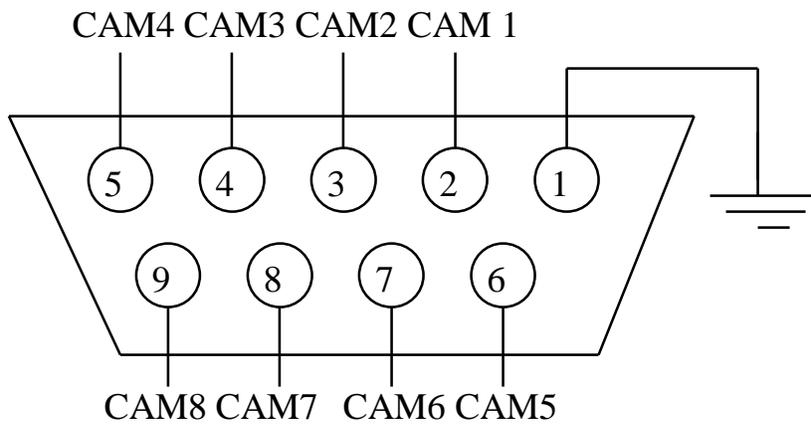
TYPICAL TALLY CAMERA WIRING

Typical Camera Connection

CAM4 CAM3 CAM2 CAM 1

DC+

⑤ ④ ③ ② ①

Camera
DC
Supply
30V .5 A MAX

⑨ ⑧ ⑦ ⑥

CAM8 CAM7 CAM6 CAM5

DC-
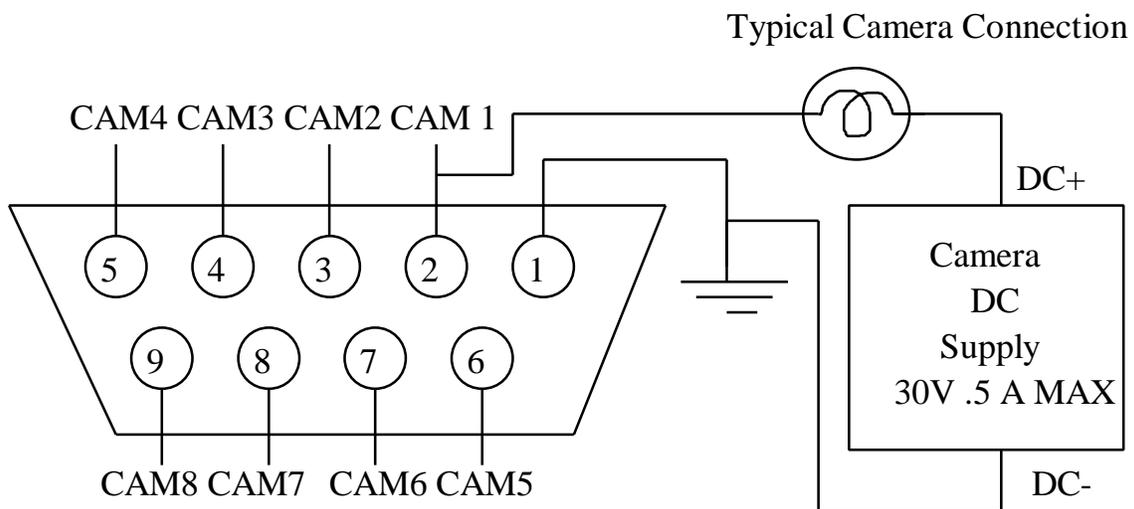
GPIO Connector

Connections for GPI's 1 through 4, GPO's 1 and 2, as well as tally connections for cameras 9 and 10 are brought out on the nine-pin D connector marked GPIO. The pinout for this connector is shown below. The GPO and tally connections function by providing an open collector output that provides a short to ground when selected (1/2 amp, 30V max.). The GPI inputs can be triggered by either a short to ground, or a trigger from a TTL or bipolar level signal (+/- 12v max).

GPI4 GPI3 GPI2 GPI1

⑤   ④   ③   ②   ①

⑨   ⑧   ⑦   ⑥

GPO2 GPO1 CAM10 CAM9
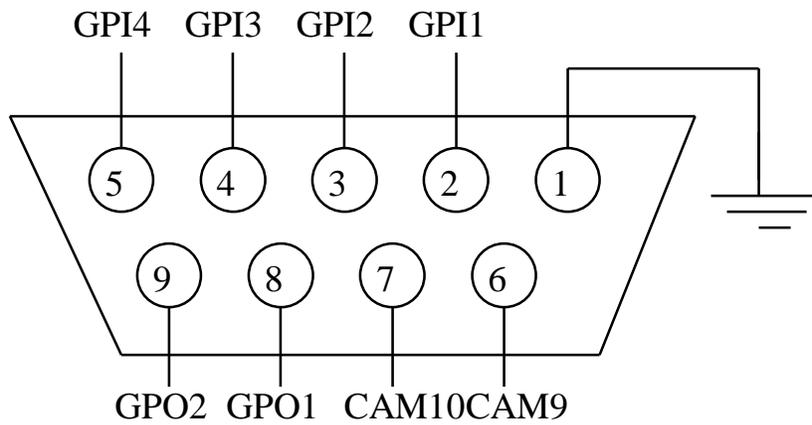
Error lights and messages

Four LED lights can be seen at the CPU card edge by lowering the chassis front panel. These monitor, from left to right:

ERROR   1. +5v
LIGHTS   2. unused
               3. unused
               4. diagnostic, flashes

Also, several system malfunctions are reported in the control panel display:

DISPLAY MESSAGE	MEANING
* WARNING * The original factory calibration has been lost.......	See **Battery Backup**, above. This message means that the battery power to the memory has been lost, or the batteries are dead. The calibration register contents have been lost. Replace the batteries if required, restart, and recalibrate if necessary. Calibration register settings as shipped can be found inside the chassis panel.
* Warm Restart *	AC power was lost, but memory was not affected. The system has recovered to its previous setting.
* SYSTEM RESET *	Accidental program crash, possibly due to brownout. Sometimes displayed when power removed and re-applied. No adverse effects will be seen other than interrupting stored sequence playback.
* DISCONNECTED *	The control panel has lost communication with the chassis. Check the two control panel cables and the chassis power.

Options

Several hardware and software options are available for the MVS3. Most options are detectable by the CPU. A list of currently installed options is displayed by command 4 (press 4 COMM). The only hardware option is the chromakeyer. It is installed by removing the lower card and inserting the option card. If specified with the initial order, options will be already installed.

Software options include the rotary wipes, editor interface, and expanded switcher memory. Software options not installed by the factory can be added in the field. Have your dealer call ECHOlab with the ID number of your MVS3 and a purchase order number. Command 24 displays your unique ID number. ECHOlab will then give you a nine digit number that will install your desired option...key this number into the display and press COMM. This installation command number is not valid for any other MVS3.

Hardware options

Name: Description:

RGB-356   RGB chromakeyer

YUV356   YUV chromakeyer

EXT-356   MVS extender board

XCODE-356   RGB transcoder on inputs 9 and/or 10 (component systems only)

TRB-356   Tally relay box

Software options

SMPTE-356   SMPTE Serial Interface to Editors (GVG-100 protocol)

MEX-356   Memory expansion (takes panel setups from 9 to 99)

RWP-356   Rotary wipes (adds patterns 49-60)

POP-356   Programmable output option for PROG2

SHIFT-3   Shifted input option (adds access to inputs 7-10)

PRODUCTION

Video Functional Diagram
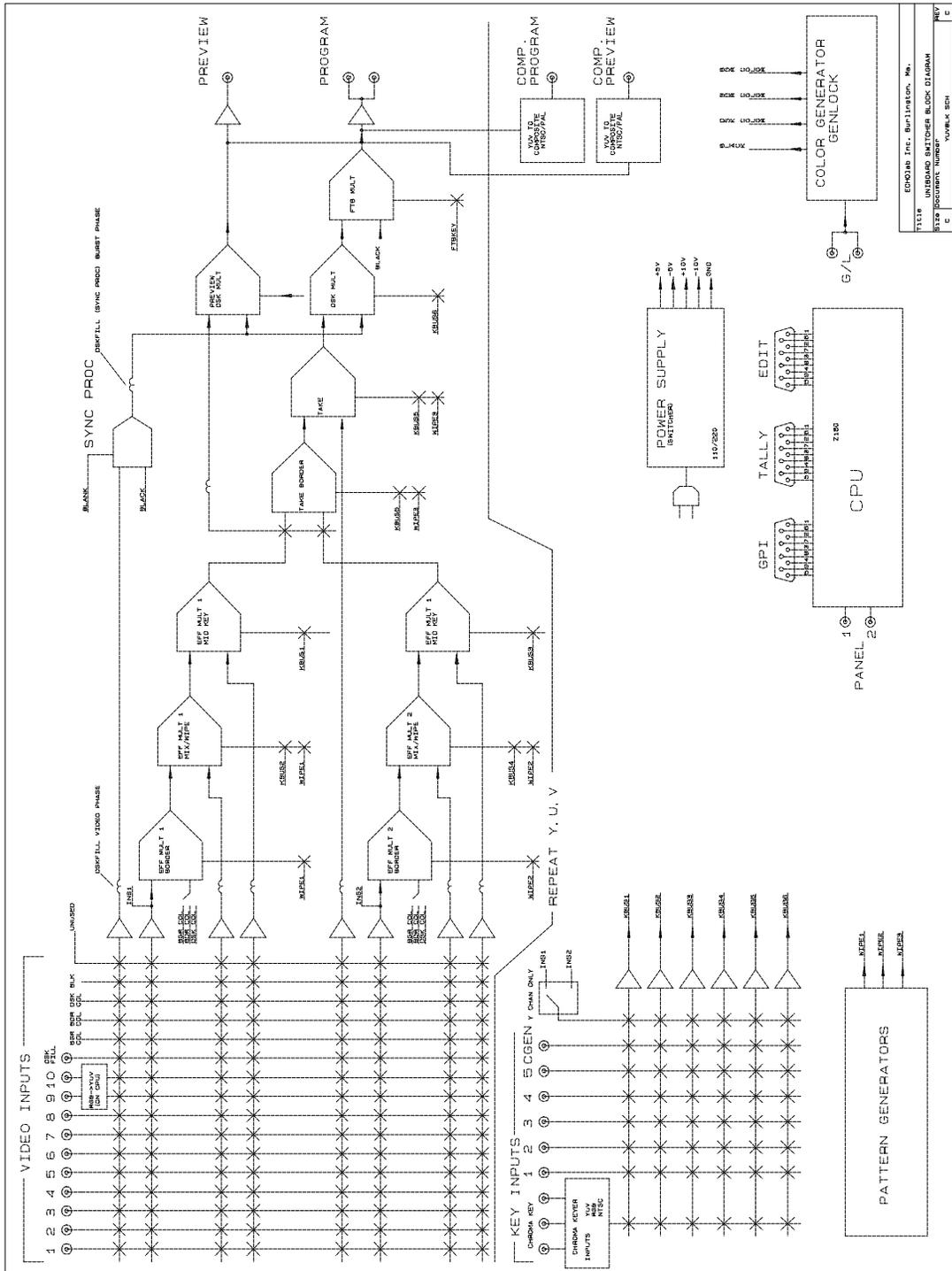
Overview

Refer to the Video Functional Diagram.

The MVS3 is a 12-input, three-bus switcher with an insert mix-effects-key system, a take mix-effects system, and a previewable downstream keyer with fade to black.

Most operations are handled by selecting a video source on the Preview bus and taking it to the Program bus by means of the TAKE control group. A third source can be selected on the Insert bus and wiped or keyed into either preview or program picture. A previewable downstream keyer is included to add titles or other keys over all other switching or effects.

A 16 character display is included to assist in both production and programming operations. A numeric keypad is used for entering wipe patterns, digital rates, colors, and other data.

Control Panel

With video signals connected to at least inputs one and two and appropriate sync signals connected (see **Installation**), and with key sources such as a character generator connected to KEY1 and CGEN, set up the panel:

EFFECTS LEVER................down, WIPE illuminated

KEY...off

DSK.................................all lights off

INSERT bus................................source 2

PREVIEW bus............................BGR and EFF

PROGRAM bus...............................source 1

The program monitor should show source 1, and the preview monitor should show the background color. As the EFFECTS lever is moved, source 2 will wipe into the preview picture.

In normal use, the MVS3 control panel will display all operations on its display. Refer to this display for setting functions such as TAKE SELECT, and to check the value of a transition rate or pattern number.

DSK

The downstream keyer can be used to fade the output picture to black, or to add titles. Press BLACK to fade the to and from black. Press DSK to fade the downstream key.

KEY
SELECT

To add a key to the program picture with the DSK, first select an active key signal using the KEY SELECT button. As this button is pressed, the display will cycle through the inputs:

DskCut	Key1	:1	Key 1
DskCut	Key2	:2	Key 2
DskCut	Key3	:3	Key 3
DskCut	Key4	:4	Key 4
DskCut	Key5	:5	Key 5
DskCut	Cgen	:6	Cgen
DskCut	Ckey	:7	Chromakeyer
DskCut	Insrt	:8	Insert bus

Note that if the cut select choice is not in the display, the first push of the cut select button will display the current source without changing it. The second push will then cycle ahead.

To access a cut source directly without cycling through all choices, key the number after the colon into the display and press the KEY SELECT button once. This same procedure works for all other select functions. Adjust the CLIP control to make the key size correct. Command 12 will reverse the key. Command 37 will adjust the key softness. Key gain can be adjusted digitally from 0 to 127 using command xx.

FILL
SELECT
                    Press the FILL SELECT button to cycle through:

                        DskFil Blk   Black
                        DskFil Bgr   Background color
                        DskFil Cam1   Camera 1
                        DskFil Cam2   Camera 2
                        DskFil Cam3   Camera 3
                        DskFil Cam4   Camera 4
                        DskFil Cam5   Camera 5
                        DskFil Cam6   Camera 6
                        DskFil Cam7   Camera 7
                        DskFil Cam8   Camera 8
                        DskFil Cam9   Camera 9
                        DskFil Cam10 Camera 10
                        DskFil DskF   External DSK fill
                        DskFil Bdr   Border color
                        DskFil Col   DSK color

                    Press ON in the DSK block. With the DSK set to DskCut Cgen and DskFil
                    Col, change the clip control to bring in a matted CGEN key. Note that the
                    clip level selected is stored by the computer, so that subsequently each
                    time this key is selected the clip level will be correct.

DSK   To change the color used for the DSK matte fill, press the COLOR button
COLOR   located beneath the display until the DSK color is displayed. The display
                    will show saturation, luminance, and hue as:

                    Dsk   ss ll hh

                    Change the DSK color by adjusting the SYMM/BORDER/CLIP knobs
                    while the COLOR button is lit and the current DSK color is being
                    displayed.

                    The DSK color can be entered digitally, also. With the DSK color in the
                    display, key in a new six-digit color number, ssllhh, and press COLOR.
                    Short cuts are available: key in two digits with DSK displayed and press
                    COLOR to change just the hue (99 49 hh), or four digits to change just sat
                    and hue (s9 l9 hh).

                    All colors are limited to NTSC or PAL legal values: if luminance is
                    adjusted to maximum, saturation will be proportionately limited to zero.

DSK   Press the RATE button twice to see the rate at which the DSK key will be
RATE   faded on and off the screen. The display is normally in seconds and frames:

            Dsk   01:00

            The rate can be changed when in the display by use of the + and - buttons.
            Or, key in a new rate in seconds and frames using the numeric keypad and
            press the RATE button again. If a rate is keyed in as frames only (in the
            range 1-99) it will be converted to seconds and frames. For example, 45
            will appear as 01:15, or Command 2 can be used to display in frames
            directly. BLACK RATE works similarly to the DSK RATE.

PREV   The DSK keyer can be previewed by using command 40. See more about
DSK   this in the section on Commands.

Take

The take controls perform a transition between the picture currently on the program monitor and the picture on the preview monitor. A variety of transitions can be used.

AUTO   With the DSK turned off, press the AUTO button to perform a one-second take to the preview picture. At the end of the take, the old program picture will appear on the preview monitor. Another AUTO TAKE will switch the pictures back. If AUTOTAKE is pressed while a take is in progress, the take is paused and the AUTOTAKE lamp blinks. The take may be resumed by pressing AUTOTAKE again, or it may be completed manually.

MANUAL   The manual lever can be used instead of the AUTO TAKE. If a manual
TAKE   take is completed with an AUTO TAKE while the lever is left mid-way, the lever can be returned to either limit to begin the next take.

CUT   Press CUT for a one-frame cut to the preview picture. The positions of program and preview will flip-flop as above.

RATE   To adjust the TAKE RATE, press the RATE button (under the display) three times. The current TAKE rate will be shown in the display. Use the + and - keys to change it, or set a new rate in the numeric keypad and press RATE again.

BORDER   Use command 39 to add a border to the take. The default border color
           used is border color, but either of the other two colorizers can be selected
           for use with Command 32. See details in the **Commands** section of the
           manual.

TAKE   Press TAKE SELECT to display all the options available for take style:
SELECT

           Take Pat 1 :1

           Take Pat 2 :2

           Take Pat 3 :3

           Take Pat 4 :4

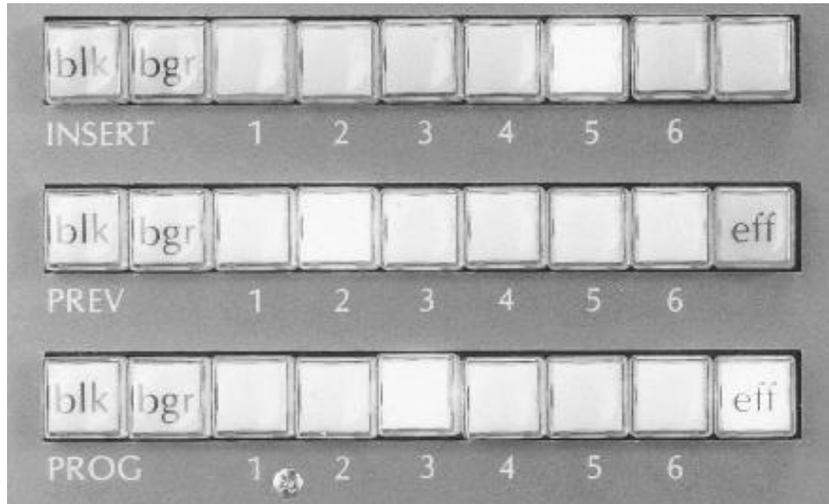   Take Fade :5   dissolves

           Take Patt :6   uses EFFECTS pattern

Busses

PROGRAM BUS
Pressing any PROGRAM bus button (except EFF) places that source on air and illuminates its button.

PREVIEW BUS
The preview bus selects the "background" picture for the preview monitor. This can be either black, the "BGR" color background generator, or a video source. Pressing any of these buttons selects that source, and illuminates the bus button. The EFF button is used to add effects to the background source.

INSERT BUS & EFFECTS
If a different source is selected on the INSERT bus and the EFFECTS lever is moved up, that source will appear as an insert on the preview screen. The EFF button will light on the preview bus to indicate that the effects section is being used on the preview screen.

If AUTOTAKE is used to bring the preview picture to the program screen, the EFF button on the preview bus will go out and the EFF button on the program bus will illuminate. Now if EFF on preview is pressed, the display will say * EFFECTS ON AIR *. To use effects on preview, first push EFF on the program bus to extinguish it.

SHIFT
If the shifted inputs option is installed, the SHIFT button may be used to select inputs 7,8,9 and 10 on the INSERT, PREVIEW or PROGRAM bus. To select an extended (shifted) input, hold down the SHIFT button and press cameras 3,4,5 or 6. With the shift button held down, inputs 7,8,9 and 10 will be selected and the selected input source will blink to indicate that a shifted input has been selected.

Patterns

The pattern controls specify the shape and position of wipe patterns and the border color and width. The SYMM and BORDER knob are also use along with the CLIP knob in the effects section to adjust colorizers when the COLORS button is illuminated.
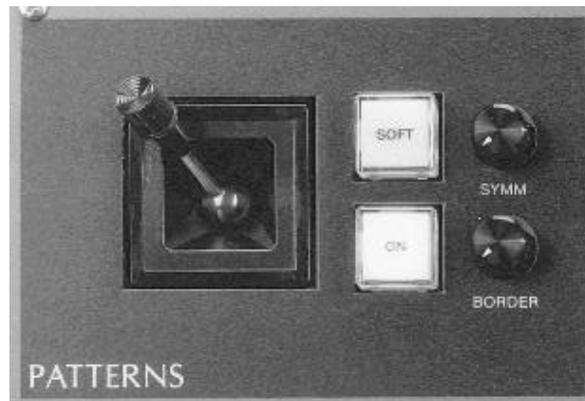
PATTERNS

BORDER   To change the color used for borders, press the COLOR button in the
COLOR   Pattern group until the BORDER color is displayed. The display will
                show saturation, luminance, and hue as:

                Bdr   ss ll hh

                Change the border color by holding down the COLOR button with BDR
                displayed and adjusting the three SYMM/BORDER/CLIP knobs in the
                Pattern and Effects section.

DIGITAL   The border color can be entered digitally, also. With BDR in the display,
COLOR   key in a new six-digit color number, ssllhh, and press COLORS. Short
                cuts are available: key in two digits with BDR displayed and press
                COLORS to change just the hue (99 49 hh), or four digits for a coarse
                specification (s9 l9 hh).

An example of pattern selection:

1. Select a positionable pattern, such as pattern 6, by keying 6 into the numeric keypad and pressing PATT. Make sure the EFFECTS lever is set to WIPE, and move the effects lever up to bring in a square pattern. The pattern will first appear in the center of the screen, and can be repositioned with the joystick. If you want the pattern to appear at the joystick position instead of centered, use 7/COMM/-.

2. Adjust the SYMM control to vary the pattern's symmetry, and adjust the BORDER control to add a border. The border color can be seen in the display by pressing COLORS twice. The first push will light the button to indicate that the three knobs are being used to adjust colors and will show the BGR color in the display. Subsequent pushes will show the BDR and DSK colors. With the border color in the display, try adjusting HUE, SAT, and LUM with the SYMM, BORDER and CLIP knobs. To stop adjusting colors, press the COLORS button until the light goes out, or simply adjust any other control on the panel. (For instance, press CLEAR.)

3. In NORMAL mode, the bordered pattern will appear first as a small square and grow to fill the screen if the REVERSE button is dark. Pressing the REVERSE button will cycle through:

N/R	:1	Normal/Reverse alternate
N	:2	Normal; Square pattern appears small and grows
R	:3	Reverse; Square pattern appears large and shrinks

   The Reverse mode will cause the button to be illuminated. Note that when programming panel setups, leaving this button in one position (say, N/R) will make setup recall more predictable.

4. Remove the border and use the SOFT button to soften the edges of the wipe. The button will illuminate to indicate that softness is enabled. Adjust the softness of the wipe using the + & - buttons. A lower number will make a softer wipe.

The MVS3 has a unique feature to minimize wipe deadband. Other switchers will exhibit wipe lever deadbands of up to 50% with some types of wipes such as repositioned square and circle wipes. The MVS3's computer looks at pattern, border, soft, and position settings and recalculates the wipe lever travel correction each frame. Deadband is typically 10% or less.

Effects

The effects generator controls the way the insert bus is combined with the preview or program bus picture. The three basic ways that the pictures can be combined are mix, wipe, and key. Also, combinations of these effects are possible.
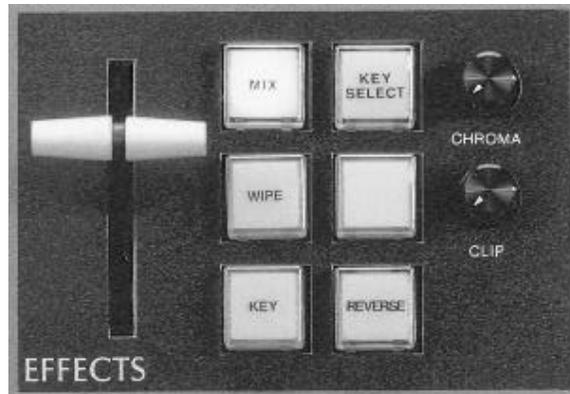
MIX   To mix to the insert picture, press MIX to illuminate it and use the lever as a mix control lever.

WIPE   When the WIPE button is pressed, the MIX button goes out and the lever wipes in the selected pattern. If the mix lever was in an intermediate position, that level of mix remains on the screen as the wipe progresses. The mix button will flash indicating that the mix action was not completed.

KEY   Activates the key function. The keyer is independent of the mix/wipe function. A key is revealed by a wipe or faded in by a mix. The key transition rate is set by the RATE button (see RATES in the section "Buttons under the display").

REVERSE   The REVERSE button is used to select the direction of the wipe pattern:

               NORMAL (N) : Patterns will start in the center of the screen and wipe
               to the edges

               REVERSE(R) : Patterns will start at the edges of the screen and wipe
               into the center

               N/R: Wipe patterns will alternate between the two styles

               Press the REVERSE button to cycle between the three styles. Note that
               the button is illuminated when the REVERSE style is selected.

KEY   Press KEY SELECT to select key sources:
SELECT

Display	Key Source
KEY1 :1	KEY1 BNC
KEY2 :2	KEY2 BNC
KEY3 :3	KEY3 BNC
KEY4 :4	KEY4 BNC
KEY5 :5	KEY5 BNC
CGEN :6	CGEN BNC
CKEY :7	RGB BNC's
INSRT :8	INSERT BUS

For instant access to, say, Key3, press 3 on the numeric keypad and press the KEY
SELECT button.

The clip level for all keys is set using the CLIP control. This setting is stored, so each
time a chroma key, for example, is selected, the clip level last set with that key is restored.

The CHROMA control is used to select the desired hue for the chromakey.

RECALL   The RECALL PANEL button is used in conjunction with the SHIFT
PANEL   button to save and recall setups of the switcher control panel. Refer to
               the PROGRAMMING section later on this manual to see about its use.

Buttons under the display

PATT   Press the PATT button to display the currently selected pattern number used for the effects pattern. Or alternately, to change the currently selected pattern, key in a new pattern number (1-60) into the display and press the PATT button.

EDIT   Press SMPTE ENABLE to enable the RS-422 editing interface. The button will illuminate to indicate that editor commands will be accepted (if the option is installed.)

RATES   The RATES button is used to display and change the five transition rates on the panel. If a rate is not currently in the display when the button is pressed, the rates will be cycled through, starting with fade-to-black, DSK, autotake, effects key rate, and lastly, the recall panel rate. To change a rate, use the + and - keys, or simply key in a new rate and press the RATE button while the rate to be chnaged is in the display.

COMM   To modify a specific command, select the desired command number using the numeric keypad and press the COMM button. With the desired command in the display, use the + or - keys to make a selection.

COLORS   When lit, any of the three colorizers can be adjusted with the SYMM/BORDER/CLIP knobs, or a new color can be entered digitally.

CLEAR   Blanks out the display. Useful when keying in a number and an incorrect value is entered.

Commands

Commands are performed by entering the command number into the numeric keypad, and pressing COMM. Enter the command number on the numeric keypad, then press COMM, then + or - to make selection.

0	System Reset	clears sequences and setups and do Comm 1
1	Command Reset	reset commands to **boldface**
2	Time Display Mode	**SSFF**/FFFF(SS=secs,FF=fields)
3	Set Source Names	default: **Cam 1** thru **Cam 10**
4	Display software revision and installed options	
5	Lines of vertical blanking	16 thru 23 (default **20**)
6	Set Sync Source	subcarrier/internal/**genlock**
7	Automatic Pattern Centering	off/**on**
8	Set Video Mode	Composite/Y-C/Component
9	Set Sync Processor	off/**on**
10	Engineering use only	
11	Set DSK Blink Rate	**off**/5/10/15/30 fields
12	Set DSK Reverse	**off**/on
13	Set controls to panel values	
14	Unused	
15	Set GPI4 mode	autotake/dsk/black/**recall panel**
16	Set chromakeyer highlighting	00 thru **99**
17	Set SMPTE protocol	**38400**/9600 bps, **odd**/even/no parity
18	Set SMPTE device address	00 thru FE (default **30H**)
19	Set SMPTE port to use GVG-100 pattern numbers	**off**/on
20	Display SMPTE state	press any key to stop
21	SMPTE port transmit test	**off**/on
22	Set SMPTE key to redirect to DSK	**off**/on
23	Unused	
24	Display ID number for software option installation	
25	Set GPO1 mode	on/**off**/pulse
26	Set GPO2 mode	on/**off**/pulse
27	Unused	
28	Unused	
29	Digital command re-entry	**off**/on
30	Effects soft limit	0 thru **63**
31	Take soft limit	0 thru **63**
32	Take border fill	Blk/Bgr/**Bdr**/Dsk
33	Program 2 output	**Prog**/ClnFd/Cam1 thru Cam10
34	Effects key reverse	**off**/on
35	Take pattern reverse	**off**/on
36	Effects key gain	0 thru **127**
37	DSK key gain	0 thru **127**
38	Take pattern soft	0 thru **127**
39	Take border size	**0** thru 100
40	DSK preview	**off**/on

A more detailed explanation follows:

Comm #	Command name	Command description
0	System reset	Erases setups, sequences, and do command 1 (for protection, CLEAR must also be held down)
1	Command reset	Reset commands to <u>boldface</u> and <u>underlined</u>
2	Time display mode SSFF/FFFF (SS=secs, FF=frames)	Rates can optionally be displayed in frames. Two and a half seconds would appear as 2:15 if displayed as seconds and frames, or as 75 if displayed as frames (assuming NTSC).
3	Set source names default: Cam1 - Cam10	When, for example, input 1 is pressed on any bus, "Cam 1" is displayed. This display can be changed to any four characters by use of Command 3. Enter 3 COMM, select the input source to be renamed with the numeric keypad, use the + and - keys to change the current character, and use the 0 key to step to the next character. Press the CLEAR button to terminate the process.
4	Display revision and options	Software revision number and options installed. Option cards will be interrogated by the computer and displayed.
5	Lines of vertical blank 16 thru 23 (default 20)	This can be adjusted to allow vertical interval test signals to pass through the switcher.
6	Set sync source	This command controls the genlock sync board. **Internal** uses the internal RS-170A sync generator. **Subcarrier** mode locks this generator to an external subcarrier reference plugged into the genlock input, with internal horizontal and vertical used, and **Genlock** locks all signals to the video signal plugged into the Genlock input.
7	Auto pattern centering	Patterns are normally brought in centered; they can also be brought in at the joystick position.

8	Set video mode	This command determines how the switcher will generate its internal sources for distribution to the video board(s). Choices are composite, Y/C, and component. Make sure this selection matches the video format you are working with.
9	Set sync proc on/off	This command determines whether the switcher re-inserts blanking and sync onto its outputs. This command is normally left on, though it can be toggled on and off to help set horizontal system timing.
10	Engineering use only	This command is used for internal test purposes to help align the switcher at the factory. It should normally be left off.
11	Set DSK blink rate	Allows the downstream keyer to blink on and off with various rates from 5 to 30 frames.
12	Set DSK reverse	Allows keying on white letters instead of black.
13	Set controls to panel settings	After some operations such as replaying stored sequences, the front panel knobs are in a different position than the operation that they are controlling. Command 13 is used to neaten things up.
14	UNUSED	
15	Set GPI4 mode	The fourth GPI input trigger is command selectable to trigger autotake, DSK fade, BLACK fade, or a panel memory recall.
16	Set chromakeyer hilite inhibit	Used to clean up highlite noise on a chromakey
17	Set SMPTE protocol	SMPTE commands, 17-22, are for use when the optional serial interface has been installed. Command 17 sets bit rate and parity. Most edit controllers use the SMPTE bit rate specification of 38Kbps; some use 9.6Kbps.
18	Set SMPTE address	Most edit controllers address a switcher as device 30.

19	SMPTE GVG patterns	With command 19 off, the edit controller can choose all of the MVS3s patterns by number. With command 19 on, the switcher is exactly GVG-100 compatible but only 10 patterns can be selected.
20	Display SMPTE state	Equipment using the SMPTE protocol will have three states of communication activity, idle, active, and selected. Idle means no data has been sent for a few seconds. Active means data is being transmitted, but the switcher hasn't recognized its address. Selected means the switcher has received a valid address and is communicating with the master. Command 20 displays the SMPTE state of the switcher as an aid to communications troubleshooting.
21	SMPTE transmit test	Transmits test signals out the edit port when Command 21 is turned on. Useful for debugging a serial comm link. Make sure to turn it off when finished!
22	Set SMPTE key re-direct to DSK keyer	Redirect editor of effects keyer to use DSK keyer. This allows some editors to mix or wipe behind a key event.
23	UNUSED	
24	Display ID number	Each MVS3has a unique ID number to permit field installation of software options. This command displays this number.
25	Set GPO1 mode	There are two general purpose output triggers on the MVS3 Each output trigger can be programmed to be on, off, or pulsed on (approx. 150 ms pulse.) This command sets the desired mode for the 1st output trigger.
26	Set GPO2 mode	See command 25 above. This command sets the desired mode for the 2nd output trigger.
27	UNUSED	
28	UNUSED	

29	Digital cal re-entry	This command is used to facilitate the manual digital re-entry of the calibration values.
30	Effects soft limit	The MVS switchers have an extremely wide range of wipe softness control that can sometimes cause operational confusion. To alleviate this problem, this command has been designed to allow the user to limit the maximum softness of the wipe. The larger the number, the more the softness is limited. Try adjusting it for supersoft effects wipes.
31	Take soft limit	Like the effects wipe softness command described above, this command limits the maximum softness of the take wipes. Try adjusting this command for supersoft take transitions.
32	Take border fill	The MVS3 can use any of its three color generators for TAKE border fill. This command is normally left set to the border color, but background or DSK color can be alternatively selected.
33	Program 2 output	If the POP (programmable output option) is installed, this command will allow the user to select the function of the PROG2 output BNC's. The available outputs are program, clean-feed, or any of the external input sources. This programmable output is useful for feeding a DVE or monitoring a specific input source.
34	Effects key reverse	Allows keying on white letters instead of black
35	Take pattern reverse	Use this command to reverse the take direction on take pattern transitions
36	Effects key gain	Use this command to soften the edges on effects keys. A lower number indicates lower gain.
37	DSK key gain	Use this command to soften the edges on DSK keys. A lower number indicates lower gain.
38	Take pattern soft	Use this command to soften the edge of take transitions. A lower number is more soft. Note that this command is limited by command 31 (take soft limit). If you want this command to have more range, lower the value set in command 31.

39	Take border size	Use this command to add border to a take transition. Note that the desired border color source is set using command 32.
40	DSK preview	Turn this command on to preview a DSK key on the DSK monitor. This will allow a DSK key to be adjusted for clip and gain even if the DSK keyer is off on the program monitor.

Calibration commands

The MVS3 has about 40 computer-generated voltages which substitute for conventional trimmers. The commands below can be used to recalibrate the unit from the front panel. There are four sets of calibration registers. The <u>current</u> set is permanently changed when a calibration command is adjusted, and can be saved in the <u>user</u> set with Command 401. Recall the user set with Command 400. To recall the <u>factory</u> set, use command 200. If the batteries have been discharged, these sets have been lost, and a fourth set will be automatically loaded from ROM.

To perform a calibration, turn calibration ON with 100 COMM +. Then enter the command number and press COMM again. Use SYMM/BORDER/CLIP controls and +- to make changes. CLEAR when finished, and turn calibration OFF with 100 COMM - if you want to prevent accidental recalibration.

Comm	Circuit	SYMM	BORDER	CLIP
101	BGR color	Null R-Y	Null B-Y	---
102	BDR color	Null R-Y	Null B-Y	---
103	DSK color	Null R-Y	Null B-Y	---
104	Wipe DC	Wipe size	---	---
105	Dac center	Offset	---	---
106	Black offset	Offset	---	---
107	Burst	Amplitude	PAL phase	NTSC phase
108	Circle	Patt 32	Pat 8 (H)	Pat 8 (V)
109	Horzizontal	Phase	---	Blank width
110	H ramp	Effects	Take	---
111	V ramp	Effects	Take	---
112	H 5x	5x horz freq	---	Pat 5 cross
113	V 5x	5x vert freq	---	---
114	Zero phase	BGR	BDR	DSK
115	Luminance	BGR	BDR	DSK
116	Saturation	BGR	BDR	DSK
117	Rotary wipes	pivot/closure	---	---
118	Take	bord size (n)	bord size (r)	---
119	H charge	Pat 57 (H)	Pat 57 (V)	Pat 59
120	V charge	Pat 58 (H)	Pat 58 (V)	Pat 60
121	Wipe	Eff bord n/r	---	Eff bord n/r

    200   Reload original factory calibration.
    400   Restore user calibration registers
    401   Save user calibration registers
    ---   indicates that control has its normal function

A more detailed explanation follows:

Colorizers

101	BGR color	Null R-Y	Null B-Y	---
102	BDR color	Null R-Y	Null B-Y	---
103	DSK color	Null R-Y	Null B-Y	---
114	Zero phase	BGR	BDR	DSK
115	Luminance	BGR	BDR	DSK
116	Saturation	BGR	BDR	DSK

The three color generators can be very accurately set to provide precise colors. Use 115 COMM with all three colors on the preview monitor, set all color luminances to 100 %, and use an oscilloscope and the SYMM/BORDER/CLIP knobs to set all luminances to 100 IRE. Using a vectorscope, use command 101 to null out any chroma offset in the R-Y or B-Y component of BGR color. Command 102 is for BDR color. Command 103 is for DSK color. Then set all colors to roughly 99 50 0. With a vectorscope on preview, adjust all three colors to full saturation and zero degree phase with commands 114 and 116.

Wipe center

104	Wipe DC	Wipe size	---	---

To adjust the command, set up a diamond wipe on the monitor (pattern 7), and with the wipe in the N/R mode, set the wipe lever to a value of 40. Now adjust this calibration value until the diamond just disappears. Now check the wipe travel at the other end of the lever. The wipe should finish at a count of somewhere between 925 to 975.

Dac DC

An oscilloscope is required for this calibration. Scope U25 pin 7 on the CPU board with the scope triggered at a vertical rate. Adjust this calibration until the DAC waveform is within +/- 5 mv of ground during the active raster.

Black level

106	Black offset	Offset	---	---

While viewing any of the three black burst outputs, adjust command 106 to set the blanking level of the black output to ground.

System timing

107	Burst	Amplitude	PAL phase	NTSC phase
109	Horzizontal	Phase	---	Blank width

Command 107 sets the phase and amplitude of the internally generated black burst which is used for sync re-insertion. The burst can be coarsely calibrated by eye, but for accurate results a vectorscope should be used on the preview output with a colorbar test signal selected on the preview bus. Pal phase sets the zero degree axis of internal color generators to match external sync, and will need a vectorscope for alignment.

Command 109 is used to set horizontal phase and blanking width. Compare the genlock input to the program output with an oscilloscope, and align the leading edges of horizontal sync using the phase (SYMM) knob. Set horizontal blank width using the blank (CLIP) knob; 10.7 uS is a typical value.

Circles

108	Circle	Patt 32	Pat 8 (H)	Pat 8 (V)

View a circle wipe to adjust these offsets. A small circle should be used.

Ramp generators

110	H ramp	Effects	Take	---
111	V ramp	Effects	Take	---
112	H 5x	5x horz freq	---	Pat 5 cross
113	V 5x	5x vert freq	---	---

An underscan monitor should be used.

Command 110 is used to center the horizontal ramps. Select effects pattern 3 and adjust the effects ramp frequency (SYMM knob) so that the pattern goes out equally on the left and right sides of the monitor. Select take pattern 3 and do the same for the take ramp while adjusting the BORD knob.

Command 111 is used to center the vertical ramps. Select effects pattern 4 and adjust the effects ramp frequency (SYMM knob) so that the pattern goes out equally on the top and bottom of the monitor. Select take pattern 4 and do the same for the take ramp while adjusting the BORD knob.

Rotary wipes

117	Rotary wipes	pivot/closure	---	---
119	H charge	Pat 57 (H)	Pat 57 (V)	Pat 59
120	V charge	Pat 58 (H)	Pat 58 (V)	Pat 60

Command 117 is used to calibrate all rotary patterns. Command 117 stores one calibration value for each pattern; the value is set in the steps below.

Commands 119 and 120 store four additional small adjustments for all patterns. These are set in step 2c, 2d, 3a, and 3b, and should be in the range 499-512. When beginning calibration from scratch, start with a setting of 505 for each value.

1. Adjust patterns 49-52 to center wipes:

   a) Select pattern 49 in N/R mode. Set the wipe lever to 500.

   b) Press 117 COMM, adjust the SYMM knob for centering; note that the +/- keys help fine trim.

   c) Select pattern 50 and adjust SYMM for centering. The display, Rtry xxx Bdr Clp, will show you the contents of the calibration setting for pattern 50.

   d) Select pattern 51 and adjust SYMM for centering.

   e) Select pattern 52 and adjust SYMM for centering.

2. Adjust patterns 57, 58:

   a) Select pattern 57 and adjust wipe lever to 500.

   b) Select Command 117 and adjust SYMM so points just close.

   c) Move lever down to a count of about 50, select COMM 119, and adjust the BORDER knob so the pattern is symmetrical (sets horizontal amplitude offset).

   d) Move lever up to a count of about 950, select COMM 120, and adjust the BORDER knob so the pattern is symmetrical (sets vertical amplitude offset).

   e) Select pattern 58 and adjust wipe lever to 500.

---

f) Select Command 117 and adjust SYMM so points just close.

g) Retest 3b and 3f and adjust if needed.

3. Adjust remaining offsets:

   a) Select pattern 59 and set wipe lever to 50. Select Command 119. Adjust SYMM to center pattern (horizontal start offset)

   b) Select pattern 60 and set wipe lever to 50. Select Command 120. Adjust SYMM to center pattern (vertical   start offset)

4. Adjust patterns 53, 54, 55, 56, 59, 60 (NOT 57 or 58!)

   a) Select pattern 53 in N/R mode, set the wipe lever to 005 (NOT 0), select Command 117 and adjust the SYMM knob until the wipe just disappears.

   b) Repeat with patterns 54, 55, 56, 59, and 60.

When you have finished with these calibrations, test them with all rotary wipes. If all wipes are good, save user calibration values using Command 401. If calibration is disturbed later, you can restore this set with Command 400.

Calibration registers

200   Reload original factory calibration

The factory saves a set of calibration values in battery- backed-up RAM. It can be restored with Comm 200 if improper calibration is suspected.

400   Restore user calibration registers
401   Save user calibration registers

If you would like to experiment with a calibration setting without risk of making it worse, first save the current calibration registers with Command 401. Then the 100 series commands are used to recalibrate, and if the result is unacceptable the user set can be recalled with Command 400.

Post-production

The MVS3 is optionally available with a serial editing interface system. This system allows bi-directional data transmission to edit controllers and other broadcast equipment.

A SMPTE-specification link is used, including a 9-pin ribbon cable connector and RS-422 drivers.

The link protocol has been designed for compatibility with the Grass Valley GVG-100 video switcher protocol, so any edit controller with GVG-100 drive capability can be used.

Operating the switcher from the edit controller is simple:

1. Connect a 9-wire cable with DB-9 connectors between MVS3 and edit controller. Pin use is shown on p. 13 of Installation.

2. Enable edit controller for serial interface operation.

3. Edits should now be performed on the MVS3. Note that manual front panel operations can be done at the same time. If trouble:

4. Check bit rate and parity used by edit controller and use Command 17 to reset if necessary.

5. Check device address used by edit controller and use Command 18 to reset MVS3 address if necessary.

6. Use Command 20 to check that MVS3 cycles through Idle to Active and Selected. This checks out the data path from edit controller to MVS3, and the device address.

7. Use Command 21 to transmit from MVS3 to edit controller to allow tracing data path.

PROGRAMMING

The MVS3 has a non-volatile memory system that allows the user to save and recall all the controls on the panel. The panel memory saves are known as **Setups**.

Setups   Nine full panel setups can be saved by the MVS3. The memory expansion option raises this number to 99. A setup stores the state of all controls on the panel, as well as the state of any of the commands that can affect the on-air picture or the preview picture.

SAVING
SETUPS   Set up the switcher for the desired picture, and while holding down the SHIFT button, press the RECALL PANEL button. The picture is saved with the next available number, which is displayed. A setup can be assigned a specific number by entering the number before pressing RECALL PANEL. Note that the SHIFT key must be held down before entering the setup number into the display.

RECALLING
SETUPS   To recall a setup, enter its number 1-9, (or 1-99 with memory expansion option) and press the RECALL PANEL button. To recall several setups back in order, press RECALL PANEL repeatedly. Alternatively, the + and - buttons can be used. The display shows the setup being recalled.

RECALL
RATE   A recall rate is used to specify how long the recall will take. The default rate is 1 frame.

                When a rate other than 1 frame is used, the switches stored in the setup are recalled in the first frame, while lever and knob controls will change linearly from their current positions to the new position at the rate specified.

                To view the current recall rate, press the RATE button til the recall rate is in the display. To change the recall rate, enter a number and press the RATE button again.


EDITING   Recall the setup to be edited by pressing # and RECALL
SETUPS   PANEL, where # is the setup number, make the changes desired,
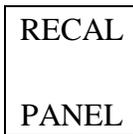   and resave the setup.

SETUP   Save and recall panel setup 1 and 2 as a square and a circle:
EXAMPLE

1. Select a background source on PREV. Select pattern 6 and press EFF
   on the PREV bus, then select an insert bus fill source.

2. Hold down the SHIFT key, and then press:

```
┌─────────┐   ┌─────────┐
│         │   │ RECALL  │
│    1    │   │         │
│         │   │ PANEL   │
└─────────┘   └─────────┘
```
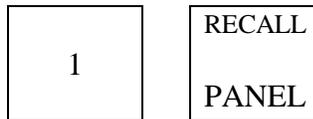
   This will save the square as panel 1.

3. Select Pattern 8, hold down the SHIFT key and press:

```
┌─────────┐
│ RECAL   │
│         │
│ PANEL   │
└─────────┘
```

   This will save the circle as panel 2. Note that if you press (SHIFT)
   RECALL PANEL without a number, it will be saved in the next
   available empty address.

4. Press

```
┌─────────┐   ┌─────────┐   ┌─────────┐
│         │   │ RECALL  │   │ RECALL  │
│    1    │   │         │   │         │
│         │   │ PANEL   │   │ PANEL   │
└─────────┘   └─────────┘   └─────────┘
```

   to bring both setups back.