3240 VIDEO PROCESSING AMPLIFIER

NTSC

Service Manual

Manual Number A90-083637-01,
083638-02

TP Number 06-003

Issue Number 6

The Grass Valley Group Inc.
PO Box 1114 Grass Valley California 95945 USA
Tel (916) 478-3000 TRT 160432

A TEKTRONIX COMPANY

TABLE OF CONTENTS - SERVICE MANUAL

INTRODUCTION

Figure 4-1, at the end of this section, is a block diagram of the basic 3240 Video Processing Amplifier (processor). The basic processor consists of the Input Module, Color Lock Module, NTSC Sync Generator Module, Output Module, and a 3200A Power Supply Module (not shown). The video signal to be processed is applied to the input amplifier on the Input Module.The processed VIDEO OUTPUT signals are provided by the output amplifier on the Output Module.

The SUBCARRIER OUTPUT signals are provided by the subcarrier voltage-controlled crystal oscillator (VCXO) on the Color Lock Module. Additional processing is discussed in the appropriate module descriptions listed below.

Detailed functional and circuit descriptions, parts lists, and drawings for any standard and optional modules are contained in individual data packages in Section 8 (data packages for optional modules are located in Part 2).

FUNCTIONAL DESCRIPTION

Refer to Figure 4-1 at the end of this section for the following discussion.

Input Module

Introduction

The Input Module equalizes the incoming video signal, controls the system video gain, and separates the chrominance, luminance, and sync components of the video signal.

Circuit Overview (Input Module)

The Input Amplifier operates as a common-mode, balanced, inverting video amplifier.

The Variable Cable Equalizer provides adjustable compensation for the dc and high-frequency losses of the input cable. Equalization is adjustable from zero (no equalization) to the maximim equalization provided by the equalizer submodule, which plugs into the Input Module.

The Variable Gain amplifier is virtually identical to the equalizing amplifier, and is used to control the overall gain of the signal. In addition to providing gain control, this amplifier also serves as a combining point for the feedforward correction signal from the clamp circuit.

The Chroma Separator is an active transversal filter consisting of two delay lines and two inverting buffer amplifiers. The buffer amplifiers are configured to compensate for the slight dc loss, and equalize the high frequency loss of the delay line. Total delay through one delay line and one of the amplifiers equals the period of one half-cycle of color subcarrier. The outputs of the buffer amplifiers are combined with the output of the Variable Gain Amplifier through a resistor matrix to provide comb filter separation of high frequency (chroma) and low frequency (luminance) signals.

The video output of the equalizing amplifier is also applied to the clamping and sync separation circuitry. The Color Lock Module uses Separated Sync #1 as a timing signal. The second Separated Sync output is used by the Sync Generator Module for genlocking.

The Clamp circuit, driven by a third output of the Sync Separator, clamps at the tip of sync, supplying correction signals to the Input Amplifier and the Variable Gain Amplifier.

Sync Generator Module

Introduction

The NTSC Sync Generator Module regenerates the incoming sync signal supplied by the sync separator stage on the Input Module, or derives sync from subcarrier generated by the Color Lock Module. The Sync Generator Module produces all pulses necessary for operation of the video processing amplifier, and for the accessory functions available as part of the processing amplifier system. It may also be used as the pulse generator in a sync generator system. Separated sync from input video or external reference is used to phase lock the Sync Generator Module.

Circuit Overview (Sync Generator Module)

The Sync Generator Module is a phase-locked loop which may lock to sync separated from the external video (genlock mode) or subcarrier generated on the Color Lock Module (freerun mode). Pulses produced by the Sync Generator IC are processed by the Timing Circuits to produce outputs which conform to the required width and timing constraints of the system. The Sync Generator IC is clocked by the 5 MHz VCO.

The H. Drive output of the Sync Generator is phase compared with the selected reference input, in the H Phase Detector. The H Phase Detector output is a dc voltage, the value of which corresponds to the measured phase difference; this voltage is applied through the 2-speed Loop Filter (an integrator) as a VCO control signal.

In the freerun mode the Sync Generator Module locks to the H/2 signal, which is produced by dividing the Color Lock Module Subcarrier Output by 455.

Excessive time-base error will cause the Sync Generator to switch to fast loop filter operation, to enable the Sync Generator to follow the rapid changes in Sync phase. The UNLOCK indicator will light when the time-base error is too great for slow loop-speed operation. The FAST/AUTO jumper may also be used to force the loop into the fast mode. This also forces the two-speed loop on the Color Lock Module into the fast mode. The UNLOCK indicator operates independently of the FAST/AUTO switch.

Vertical phasing is provided by the Vertical Separator, which discriminates vertical sync by detecting six vertical serrations within a three and one-fourth lines period. The resulting reset pulse is delayed a number of lines by the Vertical Phase circuit, to bring the pulse into the same vertical phase as the input video.

Operating Modes and Adjustments (Sync Generator Module)

Default Modes

The generator will lock to input video containing a wide variety and severity of input signal impairments. However, if the time-base error or the input signal-to-noise ratio is excessive, it will automatically switch to default modes.

No Video

If input video is not present, or if input noise is excessive, the video presence detector will not recognize vertical sync and will switch the sync generator to the freerun mode; i.e., it will frequency lock to the freerunning subcarrier oscillator on the Color Lock Module, and the NO VIDEO indicator will turn on. The Output Module will revert to either color black or direct mode, depending on the position of the COLOR BLACK/DIRECT jumper, S4.

Two-Speed Loop

If input time-base error is greater than approximately 1 microsecond within a one-field period, the sync generator will automatically switch to fast horizontal loop and follow the rapid changes in sync phase. The UNLOCK indicator will light when time-base error is excessive for the slow loop speed condition. Loop speed also may be forced into the fast mode by the FAST/AUTO jumper. The UNLOCK indicator will operate independently of this switch function. This switch also will force the two-speed loop on The Color Lock Module into the fast mode.

Phase Adjustments

The fine H phase control has a range of approximately ± 150 ns. If more range is necessary, COARSE PHASE programming jumpers are provided for adjusting horizontal phase in increments of 200 ns. The jumpers program digital phase information into horizontal counters. As the number programmed in is incremented or decremented, the horizontal phase will delay or advance respectively. The vertical phase may be advanced one line by jumper S3.

Subcarrier Clocking

Subcarrier clocking causes the output sync to move in increments of 140 ns (1/2 subcarrier cycle) if input sync phase drifts relative to subcarrier. This mode of operation will maintain the proper relationship of sync and subcarrier as established by the fine H phase control and the burst phase control. It is activiated by jumper S2.

H Blanking & Burst Flag

Each edge of horizontal blanking is adjustable independently. The range of adjustment is > 300 ns each edge. Burst (flag) also has delay and width controls. They are each adjustable > ± 400 ns.

Freerunning SC/H Phase

When the video processor has no input video, the Sync Generator Module locks to subcarrier from the Color Lock Module. The phase relationship between the leading edge of sync and subcarrier in the Free Run mode is adjustable > ± 50 ns (R70). The front panel fine H phase control has no effect under freerunning conditions.

Vertical Blanking

Vertical blanking width may be set to either 20 or 21 lines. Whole lines on both fields from lines 10 through 20 may also be unblanked via switch selections on the Sync Generator Module.

Output Module

Introduction

Basically, the Output Module interfaces the local and remote controls, and combines the subcarrier signal (from the Color Lock Module) and the blanking, sync, and burst flag signals (from the Sync Generator Module) with the chrominance and luminance signals from the Input Module. This provides the desired video output with regenerated blanking, sync and burst components.

Circuit Overview (Output Module)

The luminance signal from the Input Module, the variable Remote Setup voltage signal, and an error-correction voltage from the Feedback Clamp are applied to the Luminance Amplifier. These inputs are summed so that blanking is clamped to 0 volts at the output of the Luminance Amplifier.

The Feedback Clamp consists of two samplers and integrators which produce the required error voltage.

The Soft Clipper consists of a soft black clipper and a soft white clipper. The soft black clipper serves to force setup on a signal by clipping any luminance levels below a preset value. The soft white clipper removes any luminance levels above a preset value. In the DIRECT mode, both clippers are moved more negative and positive as required to prevent clipping. Also, the soft black clipper is moved negative during vertical blanking to prevent clipping on the base line of vertical interval test signals. The Soft Clipper may be controlled externally.

The Variable (Chroma) Gain amplifier provides a means for remotely controlling the amplitude of the color portion of the video signal.

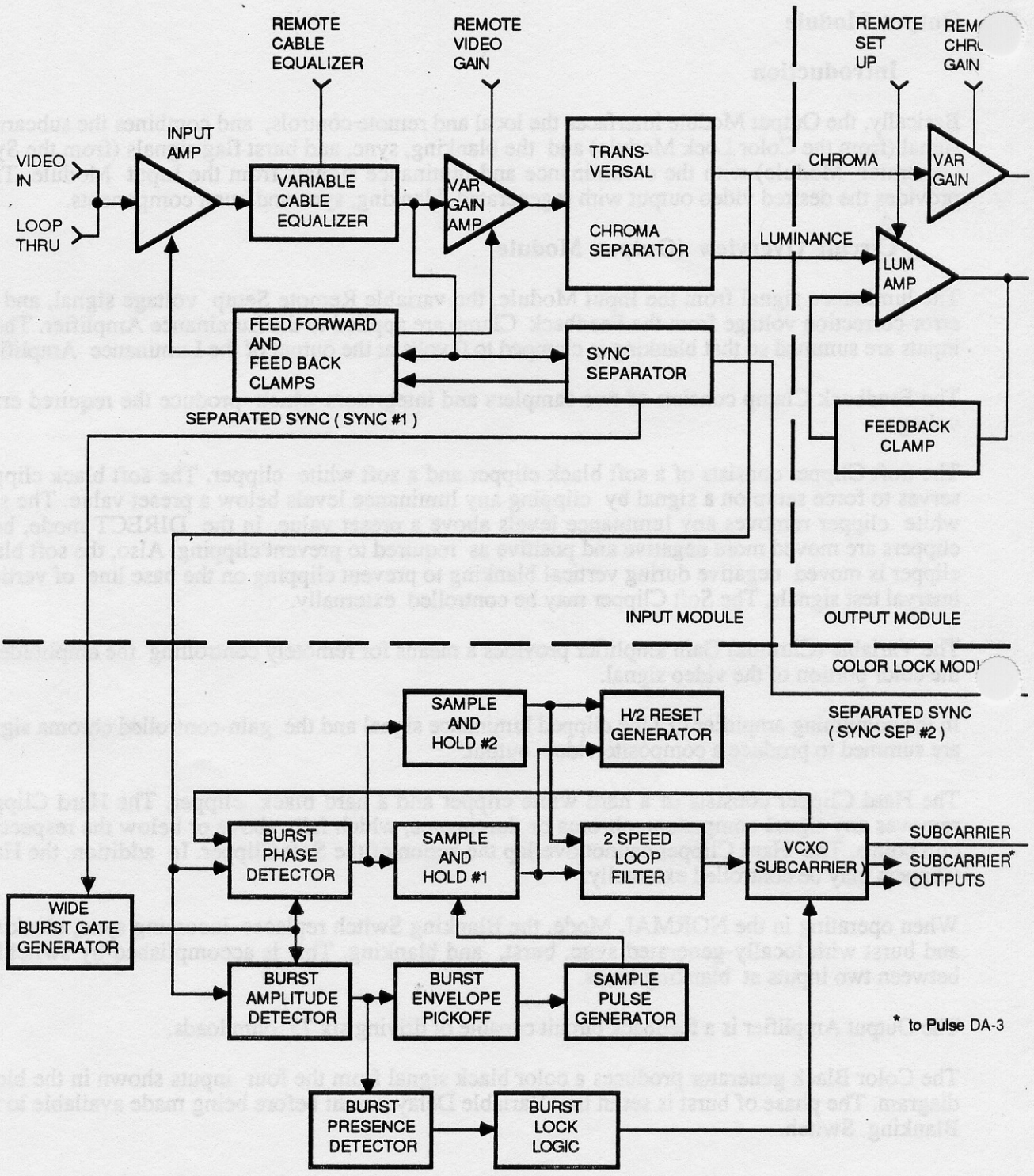
In the combining amplifier (Σ) the clipped luminance signal and the gain-controlled chroma signal are summed to produce a composite video output.

The Hard Clipper consists of a hard white clipper and a hard black clipper. The Hard Clipper removes any signal component, chroma or luminance, which falls above or below the respective clip points. The Hard Clipper cannot overlap the action of the Soft Clipper. In addition, the Hard Clippers may be controlled externally.

When operating in the NORMAL Mode, the Blanking Switch replaces incoming sync, blanking, and burst with locally-generated sync, burst, and blanking. This is accomplished by switching between two inputs at blanking times.

The Output Amplifier is a feedback circuit capable of driving six 75 ohm loads.

The Color Black generator produces a color black signal from the four inputs shown in the block diagram. The phase of burst is set in the Variable Delay circuit before being made available to the Blanking Switch.


REMOTE CABLE EQUALIZER
REMOTE VIDEO GAIN
REMOTE SET UP
REM CHR GAIN
INPUT AMP
VIDEO IN
LOOP THRU
VARIABLE CABLE EQUALIZER
VAR GAIN AMP
TRANS-VERSAL
CHROMA SEPARATOR
CHROMA
VAR GAIN
LUMINANCE
LUM AMP
FEED FORWARD AND FEED BACK CLAMPS
SYNC SEPARATOR
SEPARATED SYNC (SYNC #1)
FEEDBACK CLAMP
INPUT MODULE
OUTPUT MODULE
COLOR LOCK MOD
SEPARATED SYNC (SYNC SEP #2)
SAMPLE AND HOLD #2
H/2 RESET GENERATOR
BURST PHASE DETECTOR
SAMPLE AND HOLD #1
2 SPEED LOOP FILTER
VCXO SUBCARRIER
SUBCARRIER
SUBCARRIER* OUTPUTS
WIDE BURST GATE GENERATOR
BURST AMPLITUDE DETECTOR
BURST ENVELOPE PICKOFF
SAMPLE PULSE GENERATOR
* to Pulse DA-3
BURST PRESENCE DETECTOR
BURST LOCK LOGIC

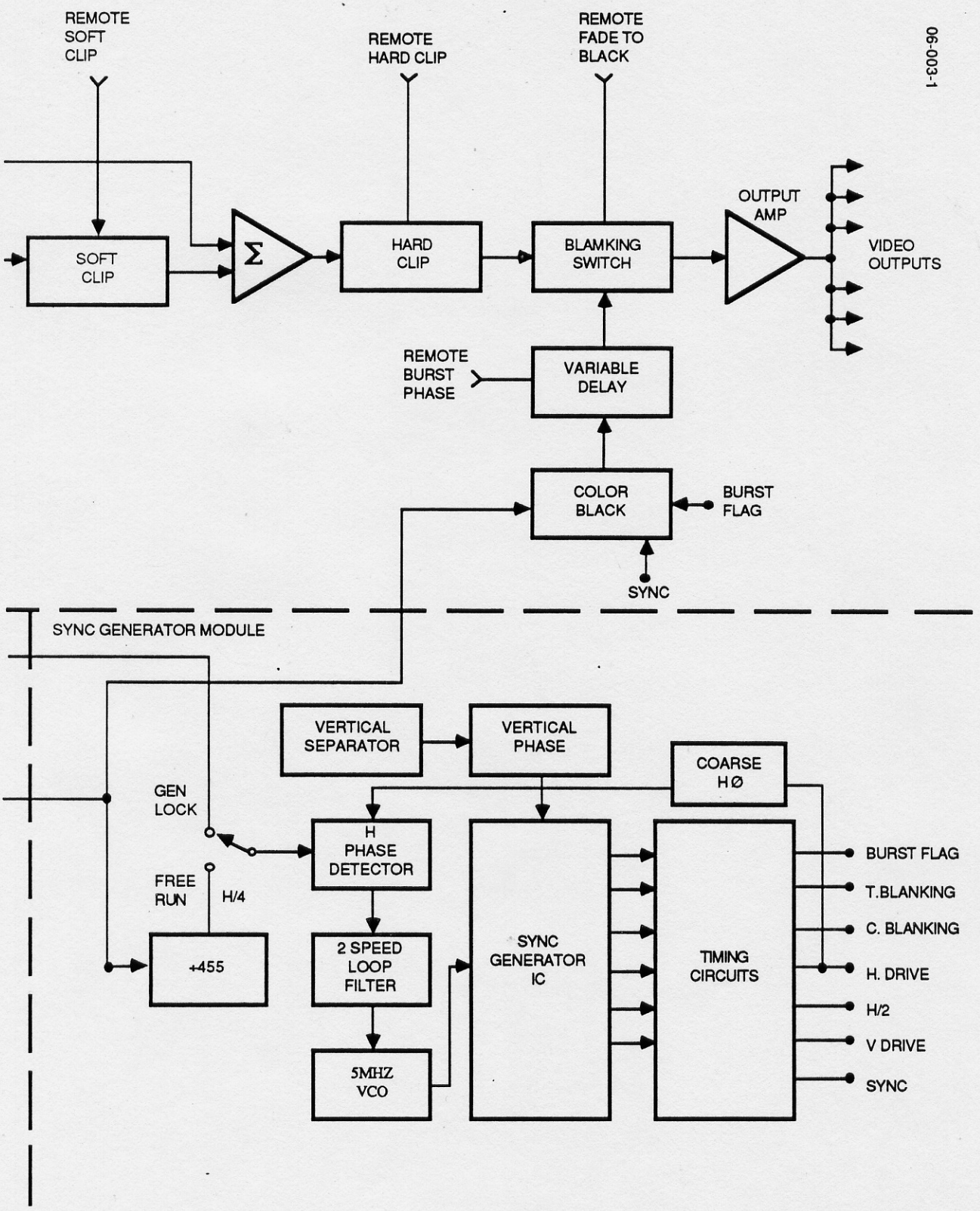


Figure 4-1. Functional Diagram, 3240 Video Processing Amplfier

ADJUSTMENTS

Test Equipment Required

B & W TV Monitor	Tektronix 632 or equivalent
Wide Band Oscilloscope	Tektronix 465 or equivalent
Wide Band Sweep Generator	Hewlett Packard 8601A
Digital Voltmeter	Weston 4440
TV Test Generator (NTSC) (with 1 V p-p ramp linearity, color bars and black picture signals)	Tektronix 1410
Vectorscope	Tektronix 520A
Test frame with Power Supply	

ADJUSTMENT PROCEDURE

This procedure assumes that each PC module has been previously aligned as described in the data packages for the individual modules included in the basic 3240 system (refer to Section 8).

Preliminary Adjustment

On the Input Module (066337):

1) Select NORMAL mode.

2) Select LOCAL control.

3) Remove (if present) straps from turrets A-B and C-D.

4) Set the VIDEO GAIN, CHROMA GAIN, SETUP, SYNC LEVEL, and BURST PHASE controls to mid-setting.

5) Set the SOFT CLIP and HARD CLIP controls to full cw.

6) Set the VAR EQ control fully counterclockwise.

7) Strap terminals E to G.

On the Output Module (066338):

1) Set S1, FORCED SETUP, to (+).

2) Set S2 to NORM.

3) Strap terminals A to B.

On the Sync Generator Module (066341):

1) Set S1 to AUTO.
2) Set S2 to OFF.
3) Set S3 to NORM.
4) Set S4 to COLOR BLACK.
5) Set S5 to all open.
6) Set S6 to all open except number 1.
7) Set the COARSE PHASE straps to MSB 0111 LSB.
8) Set the WIDE WINDOW strap to 3.
9) Set the NARROW WINDOW strap to 1 (not ground).

General Procedure

Step 1. Apply a modulated ramp test signal to the input.

Step 2. Check that the signal appears at the output. Sync and burst should be present in both the NORMAL and DIRECT modes.

Step 3. Remove the input signal. The output signal should be color black.

Remote/Local Controls

Step 1. Adjust the following controls, one at a time, and check for proper operation as follows:

	Set to:
VIDEO GAIN-approx. range ± 6 dB	Unity
CHROMA GAIN-approx. range ± 6 dB	Center of rotation
SETUP-approx. range ± 15 IRE	Zero
BURST PHASE-approx. range ± 13 degrees	Center of rotation
SYNC LEVEL-approx. range -6, +3 dB	0.286 V (40 IRE)
BURST LEVEL-approx. range -6, +3 dB	Center of rotation

SOFT CLIP-approx. range 0.4 to 1 V white	0.7 V (100 IRE)
0.02 to 0.07 V black	.052 V (7.5 IRE) (with forced setup at 7.5 IRE or 0.052 V)
HARD CLIP-approx. range 0.8 to 1.1 V white	0.8 V (112 IRE) (limited by soft clipper)
-0.1 to -0.26 V black	-0.17 V (24 IRE) (with soft white clipper at 0.7V)
VARiable EQualizer-approx. 0 to 500' of 8281 cable (with appropriate equalizer)	Zero

Step 2. Connect a remote control panel and repeat the above checks in the REMOTE control mode.

Step 3. Connect the "Fade to Black" panel.

Step 4. Actuate the lever. The video signal should smoothly fade toblack. The LED should light near the beginning of travel. The relay on the Output Module should actuate near the end of travel.

Step 5. Return to LOCAL control.

Frequency Response

Step 1. Apply a swept frequency to the processor with sync.

If it is not possible to apply a swept frequency to the processor with sync, disable the feedback clamp on the Input Module by connecting TP4 to TP5. Place S2 on the Output Module to CLAMP DISABLE position.

Step 2. Adjust CHROMA GAIN, C7, and R16 on the Input Module, for optimum frequency response. It must be ± 0.2 dB to 6 MHz and 0 to -1 dB at 8 MHz. The response should continue to fall as frequency is increased to 100 MHz.

Step 3. Remove jumper on Input Module, and on Output Module place switch S2 to NORM position.

Differential Gain and Phase

Step 1. Set the processor to the DIRECT mode.

Step 2. Remove the Input and the Sync Generator Modules. Adjust R264 on the Output Module for 0 volts output.

Step 3. Measure the voltage across C65 on the Output Module. If necessary, adjust R259 on the Output Module for 100 mV.

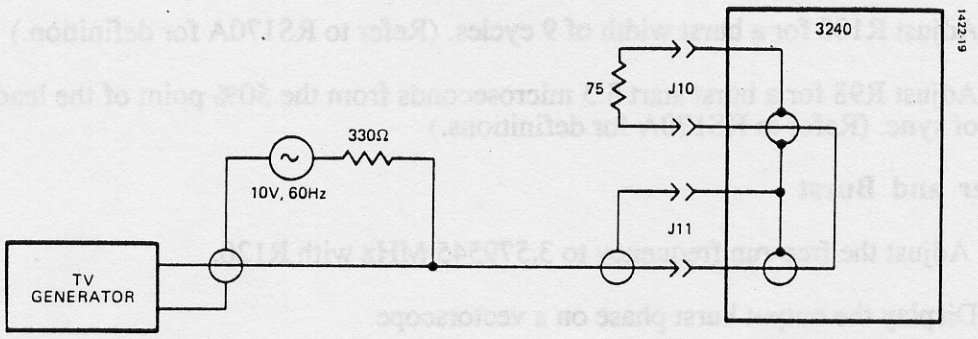


Figure 5-1. Differential Mode Hum Test Setup

Pulse Timing and Rise Times

NOTE

Be sure your horizontal sweep is calibrated.

Step 1. Observe the sync jitter by triggering the scope with the input signal source. It must be less than 10 ns.

Step 2. Observe the sync rise time on the leading edge. Trigger the scope on the output signal. The rise time should be 140 ns ± 10 ns.

Step 3. Observe the burst envelope rise time. It should be 300 ns ± 50 ns.

Step 4. Observe the setup rise time by removing the Input Module. It should be 140 ns ± 20 ns.

Step 5. Observe the blanking rise time by one of the following methods:

a. Use a signal generator with a white picture having very narrow blanking.

b. Change input video to color black. Force the processor to white except for blanking by connecting a 1.1K ohm resistor between TP5 and -10 V test point on Output Module. Allow the 3240 to chop blanking into the white picture.

Observed blanking rise time should be 140 ns ± 20 ns.

Step 6. Adjust the front porch blanking (using the same test method as Step 5) to 1.5 microseconds from the 50% point of the leading edge of sync to the +4 IRE (29 mV) point of the picture. Adjust R91 on the Sync Generator Module for leading edge blanking.

Step 7. Adjust the back porch blanking using R93 in a similar manner as for Step 6. Set to 9.4 microseconds from the 50% point of the leading edge of sync to the +4 IRE (29 mV) point of the picture.

Step 8. Adjust R100 for a burst width of 9 cycles. (Refer to RS170A for definition.)

Step 9. Adjust R98 for a burst start 5.3 microseconds from the 50% point of the leading edge of sync. (Refer to RS170A for definitions.)

Subcarrier and Burst

Step 1. Adjust the free-run frequency to 3.579545 MHz with R120.

Step 2. Display the output burst phase on a vectorscope.

Step 3. Center the BURST PHASE control.

Step 4. Adjust C40 on the Output Module to 0 degrees burst phase relative to that of DIRECT mode.

Step 5. Adjust the BURST LEVEL control to 0.286 volt p-p (40 IRE).

Step 6. Check the subcarrier output level at J40 R94. It should be 2 volts p-p (terminated) ± 10%.

SC/H Phasing

Step 1. Remove the processor input signal. Display the color black signal from the processor output on a scope.

Step 2. Connect the subcarrier to the other input of a scope through a variable delay.

Step 3. Adjust the subcarrier phase and amplitude to be exactly the same (or opposite) as burst.

Step 4. Adjust R70 on the Sync Generator Module for correct SC/H phasing on the leading edge of sync. Correct phasing occurs when the 50% point of the leading edge of sync coincides with a negative-going zero-crossing of subcarrier.

Step 5. Apply a correctly phased SC/H signal to the processor input. This may be checked in a similar manner to steps 1 thru 4. (Refer to the SC/H Phased Source Calibration Procedure at the end of this section.)

Step 6. Set the processor to the DIRECT mode and adjust the leading edge of sync to the middle of the scope.

NOTE

It should coincide with a zero crossing of subcarrier.

Step 7. Set the processor to NORMAL and set S2 (Sync Generator, SC/H clocking) to ON. Adjust H phase to be the same as Step 6.

Step 8. Set S2 (Sync Generator) to OFF. The sync timing should be within 40 ns of the same subcarrier zero crossing.

Step 1. If a cable equalizer is provided:

a. Remove the strap from E-G (Input module).

b. Insert the correct equalizer subassembly.

c. Adjust the equalizer controls and VAR EQ for optimum frequency response using the desired cable.

Step 2. If a console remote control panel 093680-00 is also provided:

a. Strap A-B and C-D (Input module).

b. Set all controls on the remote panel to mid-range.

c. Connect the control panel to the 3240 using the correct cable.

d. Set the processor to REMOTE (controls will operate in parallel).

e. Operate each control on the remote panel, one at a time, and check for proper operation.

f. Return all remote controls to mid-settings.

g. Set the processor to LOCAL control.

SC/H Phased Source Calibration

Use a previously aligned 3240 in the freerun mode.

Step 1. Connect the color black output (J20) to the A input of a scope.

Step 2. Connect the subcarrier output (J40) through an adjustable delay line to the B input of a scope.

Step 3. Display A-B and adjust the subcarrier amplitude for a null at burst. Adjust the delay line for a null at burst.

Step 4. Display A alternate with B. Expand the display such that the leading edge of sync can be seen compared to zero crossings of subcarrier.

Step 5. Adjust R70 of the Sync Generator Module for a positive zero crossing at the 50% point of sync.

REPAIR AND RETURN INSTRUCTIONS

Your Grass Valley Group equipment was designed to be very reliable. In case repairs are needed, however, the following instructions are provided.

If you did not obtain your equipment directly from GVG, please contact the distributor from whom your equipment was purchased (In countries other than the United States, always contact your distributor).

If you obtained your equipment directly from GVG, contact our Service Center at 800-223-4484. The service representative will give you directions for returning the equipment. Ask for a return authorization number (GA #) which will permit the factory to accept your equipment when it arrives.

NOTE

Out-of-warranty repairs cannot begin until a valid purchase order number has been provided

24-hour turnaround time for service can be arranged for an additional charge. It must be requested at the time return instructions are obtained.

Return packaging should be the original shipping carton or another container which will provide adequate protection against shipping damage.

Shipping and related charges are paid by the customer except when GVG returns equipment after warranty-covered repairs are made.

Manufacturers Abbreviation List

APH	Amphenol
BUS	Bussman, Mfg.
CKC	C & K Components
CLA	Clarostat Mfg. Co.
CRM	Corcom, Inc.
FPC	Fiar-Rite Products Corp.
GVG	Grass Valley Group
IEE	Industrial Electronics Engrs.
KIN	Kings Electronics Co, Inc.
MOT	Motorola Semiconductor
SWI	Switchcraft, Inc.
TRW	TRW, Inc.
WIN	Winchester Electronics

INTRODUCTION

System-level drawings for the standard Model 3240 and control panels are listed in Table 7-1. The drawings are listed by group level within the system by number and title. In addition to the drawings listed below, Section 1 contains a simplified system block diagram, and Section 4 contains a detailed system block diagram. Section 8 contains data packages which include drawings for printed circuit modules.

Drawings are arranged in numerical order, but are presented in Table 7-1 according to function.

TABLE 7-1. DRAWINGS

Drawing Level	Number	Title
System Frame	D11-093682	Wiring Diagram, 3240 Frame, 1-RU.
	E11-093683	Wiring Diagram, 3240 Frame, 2-RU.
Control Panels	D11-093695	Wiring Diagram, 3240 Control Panel
	D11-093681	Wiring Diagram, 3240 Delegate Panel
	D11-093680	Wiring Diagram, 3240 Console Panel
	C11-096301	Wiring Diagram, 3240 Fade-to-Black Control Lever
Power Regulation	C10-058030	Schematic Diagram, Power Regulator 3400/3200 Series Modules

INTRODUCTION

This section contains and individual data package for each printed-circuit module. Each data package includes all applicable information such as theory, adjustments, parts lists, drawings, etc. The data packages are arranged as listed in Table 8-1.

TABLE 8-1. DATA PACKAGES

Assembly Number	Title
061057	3200A Power Supply Module
066337	NTSC/PAL-M Input Module
066338	Output Module
066339	NTSC Color Lock Module
066341	NTSC Sync Generator Module
066559	Pulse DA-3 Pulse Distribution Amplifier Module
066560	NTSC Test Signal Generator Submodule
066309	Linearity Corrector Module
066340	Video AGC Module
066344	VIR AGC Module
066342	Relay Bypass Module
066343	External Reference Module