grass valley

# SCB-200

## SYNC COLOR BAR GENERATOR

Instruction Manual

TP703400
AUGUST 1989

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A THOMSON BRAND

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## Grass Valley Web Site

The www.thomsongrassvalley.com web site offers the following:

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## WARNING

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules and Class B of VDE 0871 rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user, at his/her expense, will be required to take whatever means necessary to correct the interference.

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# GENERAL INFORMATION

## INTRODUCTION

The SCB-200N NTSC Sync / Color Bar Generator is a fully SC/H-phased, genlocking sync pulse generator, SMPTE color bar generator, and audio stereo tone generator housed in a compact single rack unit frame. The system provides highly stable, reliable, precisely SC/H-phased outputs with low time-base error.

Outputs include: composite sync (one), composite blanking (one), V1 color frame ID pulse (one), color black (four), SMPTE color bars (two), subcarrier (one), the GVG developed ENCODED SUBCARRIER (one), and a balanced stereo audio 1KHz tone (one). In addition, color black setup can be enabled or disabled, and one color black output can be configured for super black output (a level less than blanking) .

## MOUNTING FRAME

The SCB-200N utilizes a compact one rack-unit frame. It is a closed (non-modular) system. All circuitry for SCB-200N operation, as well as the system's power supply, is located on a non-removable printed circuit board housed within the one rack–unit frame. Access to the printed circuit board is gained by removing the cover to the frame and should only be attempted by qualified service personnel who have read and understand the Maintenance Section of this manual.

## SPECIFICATIONS

### Genlock Input

| | |
|---|---|
| Input Type | Composite Video |
| Input Level | 1V p-p video with 40 IRE of sync and burst, ±6dB |
| Return Loss | >40dB to 5MHz |
| Common Mode Voltage | ±12V maximum |

### Subcarrier Oscillator

| | |
|---|---|
| Freerun Frequency | 3.579545MHz |
| Stability vs Temperature | < ±1.4 PPM (±5Hz) |

| | |
|---|---|
| Stability vs Time | < 1 PPM per year |
| Stability vs Line Voltage | < 0.1 Hz per 10% line variation |
| Adjustment Range | > ± 5 PPM |
| Trim Life | > 10 years |

**Performance**

| | |
|---|---|
| Input Common Mode Rejection | >40dB at 60Hz |
| Sync Time Base Error | < 2 nS |
| Subcarrier Jitter | < 0.25 degrees of 3.579545 MHz |
| SC/H Phase Stability | < 5 degrees of 3.579545 MHz |
| H and V Lock Time | < 2 fields |
| Burst and Subcarrier Stability Relative to the Input Over Temp | <3 degrees any setting |

**Controls and Indicators** (Front Panel)

| | |
|---|---|
| Genlock ON/OFF | Switches from VCXO (ON) to TCXO (OFF) |
| GENLOCK PHASE ADJUST | SC/H phase is maintained at the output regardless of the input SC/H phase. To accomplish this, horizontal phase is automatically adjusted. |
| Total Range | 35µS advance to 27µS delay |
| Coarse H Phase | 15 steps in 4.47µS increments |
| Medium H Phase | 16 steps in 279nS increments |
| Fine H Phase | 16 steps in 17nS increments |
| Vernier H Phase | ±10nS continuous adjustment |
| Sync Locked LED | Genlock mode, verifies that the internal horizontal oscillator is locked to sync |
| SC Locked LED | Genlock mode, verifies that the internal subcarrier oscillator is locked to burst |

| | |
|---|---|
| Power ON indicator | Verifies AC power is being supplied to frame |
| Audio Level (rear panel) | –4dB to +8dB continuous adjustment |

**Controls and Indicators** (Internal)

| | |
|---|---|
| Horizontal Blanking | |
| ON | 11.0µS (normal, factory setting) |
| OFF | 10.75µS (narrow) |
| SMPTE Color Bars | Fixed at 10.75µS |
| Vertical Phase | 2H advance to 1H delay |
| Vertical Blanking (factory set to 21 lines) | 16.5 to 24 lines in one-half line increments |
| Color Black Set Up | ON/OFF |
| Super Black | ON/OFF |
| Audio Left Channel ID | ON/OFF |

**Pulse Outputs**

| | |
|---|---|
| Type and Quantity composite blanking (1) composite sync (1) | V1 color frame (1) |
| Risetime | 140nS, ±20nS |
| Amplitude | 4V negative going ± 5% |
| DC | 0V, ± 200mV |
| Overshoot, Ringing and Tilt | < 2% |
| Output Return Loss | > 34 dB to 3.58MHz |
| Output to Output Isolation | > 40 dB to 3.58MHz |
| Spurious Signals | < ± 10mV, 20MHz low pass |

### Color Black Outputs

| | |
|---|---|
| Quantity | 4 (one is jumper selectable as super black) |
| Sync Amplitude | 286mV, ± 5% |
| Burst Amplitude | 286mV, ± 5% |
| Burst Offset | Adjustable to 0V ±5mV |
| Set Up Amplitude (Set Up ON) | 54mV, ± 10% |
| Super Black level (output 4) | Adjustable to -100mV relative to blanking |
| Blanking Level | 0V, ± 50mV |
| Residual Subcarrier | < 7mV |
| Output Return Loss | > 34 dB to 5MHz |
| Output Isolation | > 40 dB to 5MHz |
| Spurious Signals | > 43 dB down, 20MHz low pass |

### Subcarrier Output

| | |
|---|---|
| Quantity | 1 |
| Amplitude | 2V, ± 5% |
| Output Return Loss | > 34 dB to 5MHz |
| Output Isolation | > 40 dB to 5MHz |
| Spurious Signals | > 43 dB down, 20MHz low pass |

### Encoded Subcarrier Output

| | |
|---|---|
| Quantity | 1 |
| Amplitude | 1V, ±10% |
| Output Return Loss | > 30 dB at 3.58MHz |
| Spurious Signals | > 40 dB down, 20MHz low pass |

## SMPTE Color Bars

| | |
|---|---|
| Quantity | 2 |
| Amplitude | 1Vp-p |
| Blanking Level | 0.0V, ±50mV |
| Luminance Amplitude Error | < ±0.5 IRE units |
| Luminance Rise Time | 140nS, ± 20nS |
| Chrominance Amplitude Error | < 2% |
| Chrominance Rise Time | 420nS, ±50nS |
| Chrominance Phase Error | < 2 degrees |
| Residual Subcarrier | < 7mV |
| Overshoot and Ringing | < 1% |
| Luminance/Chrominance Delay | < 20nS |
| Output Return Loss | > 34 dB to 5MHz |
| Output Isolation | > 40 dB to 5MHz |
| Spurious Signals | > 40 dB down, 6Mhz low pass |

## Stereo Audio Tone

| | |
|---|---|
| Quantity and Type | 2 Channels (1 left - 1 right), Balanced |
| Impedance | < 50 Ohms |
| Frequency | 1000Hz, ± 10% locked to vertical |
| Amplitude | adjustable between -4dBm and +8dBm |
| Channel ID (ON/OFF select) | Left channel amplitude increase of 4±1dB for 33mS every 500mS |
| Amplitude Stability Over Temp | <1dB change |

### Mechanical/Power/Environmental

| | |
|---|---|
| Frame | One rack–unit: 1.75"H / 19"W / 11"D |
| Input Voltage | 105 to 135V (115V setting)<br>210 to 270V (230V setting) |
| Power Consumption | < 20 Watts |
| Temperature Range | For specifications listed, 0 to 50°C |
| Relative Humidity | Up to 95%, non–condensing |

## REPAIR AND RETURN INSTRUCTIONS

Your Grass Valley Group equipment was designed to be very reliable. If repairs are needed, instructions for returning the equipment are provided below. (For detailed information on troubleshooting, repair, and replacement parts, refer to the maintenance section of this manual.)

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 the Modular Products Service Center at (916) 478-3000. The service representative will give you directions for returning the equipment. Ask for a return authorization number (RA #) 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 related charges are paid by the customer except when GVG returns equipment after warranty-covered repairs are made.

# INSTALLATION

## INTRODUCTION

Before installing this equipment, check the shipping box for power cord and other hardware, and examine the unit for damage. Any damage should be promptly reported to the carrier.

## RACK MOUNTING

NOTE

It may be necessary to make internal adjustments before installing the equipment in the rack. Refer to the Operation Section for information on how the unit is configured for shipment and how to reconfigure for your application.

The SCB-200N NTSC Sync / Color Bar Generator system is housed in a one rack-unit tray. The tray installs in a standard 19-inch (48.26 cm) equipment rack. A vertical space of 1.75" / 4.45 cm with a depth of 11 inches (approx. 26.00 cm) is required for installation. Use of the rear support hardware, as well as installing the system where it can be kept cool, is recommended.

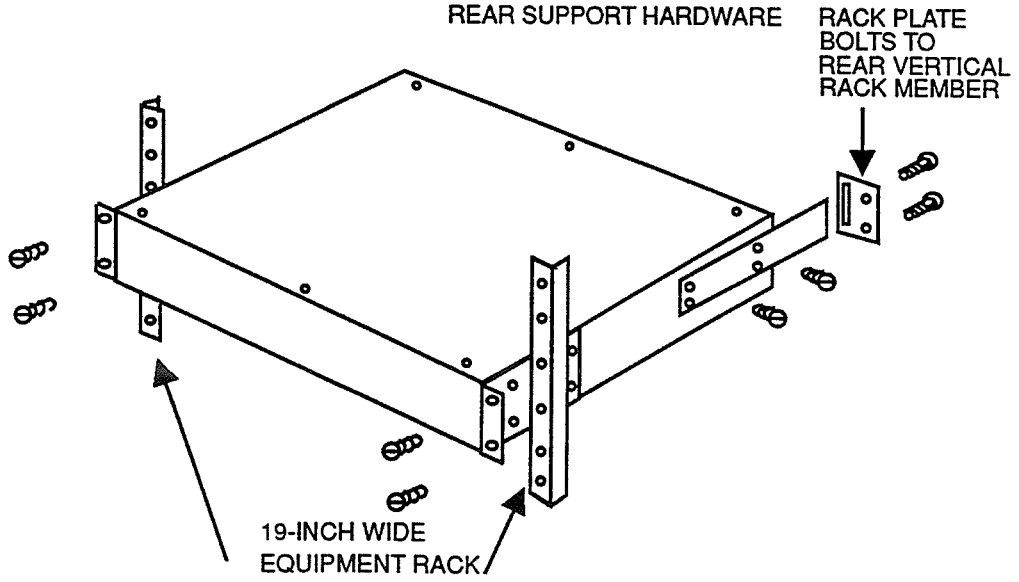


Figure 2-1. Rack Mounting for the SCB-200N

## CABLE CONNECTIONS

Output signal routing is through the rear panel video and audio connectors (see Figure 2-2). All output video signals are of 75Ω source impedance and therefore require a 75Ω termination at their final destination point. The LEFT and RIGHT AUDIO TONE outputs are designed to drive either an unterminated or a 600Ω terminated line.

**CAUTION**

Grounding either the + or - Audio Tone Outputs may result in equipment damage. Do not ground either the + or - Audio Tone Outputs.

NOTE

If fanout of the SCB-200N Encoded Subcarrier source locking signal is required, do not use subcarrier distribution amplifiers. Standard video distribution amplifiers should be used instead.

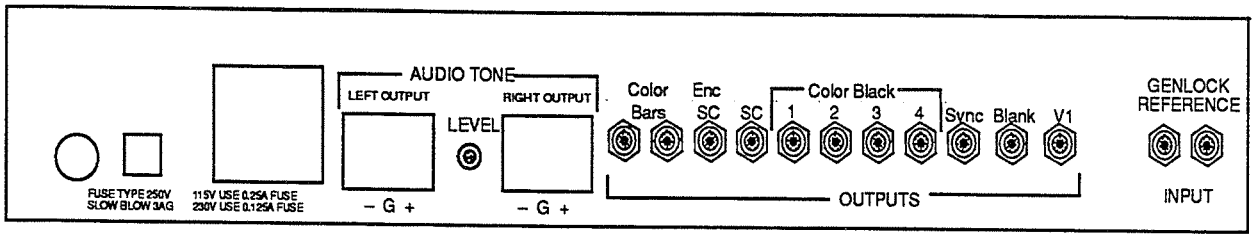


Figure 2-2. SCB-200N Cable Connections

## LINE VOLTAGE SELECTION

Follow the steps in Figure 2-3 when changing or selecting a line voltage.

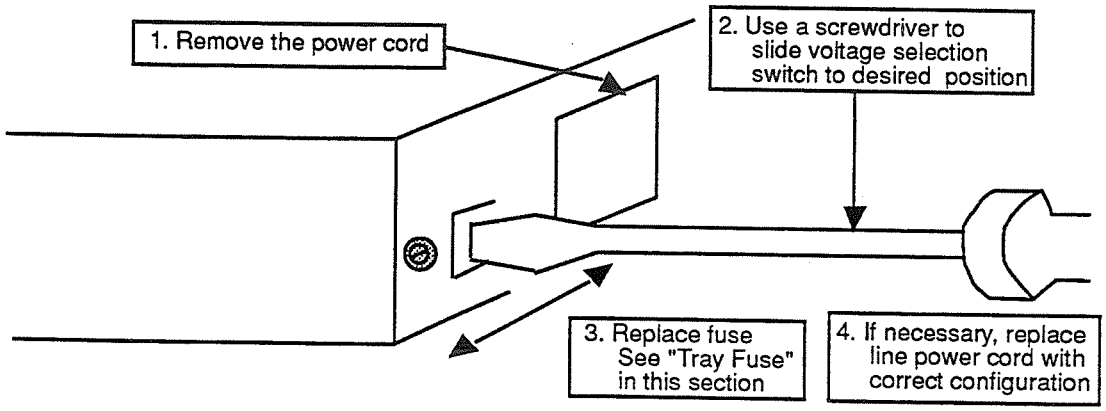


Figure 2-3. Line Voltage Selection Procedure

## TRAY FUSE

To check or replace the fuse, insert a slotted screwdriver in the fuse slot on the rear of the tray and twist counter-clockwise. Refer to Figure 2-4 below.

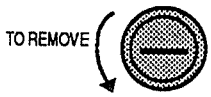


Figure 2-4. Tray Fuse

## INITIAL INSTALLATION TEST

The following instructions will ensure that the SCB-200N is operating properly.

1. Verify proper selection of the frame's input line voltage.
2. Plug the AC power cord into the receptacle on the rear of the frame and connect to the appropriate AC power line. Verify that the system power supply LED is lighted.
3. Connect a reference video signal to the GENLOCK input.
4. Verify the presence of the correct video signals at the output.
5. Set the GENLOCK switch to the ON position, and verify that the SYNC LOCKED and SC LOCKED LEDs are on.
6. Adjust the COARSE, MEDIUM, FINE, and VERNIER controls, and verify that the phase of the output signals move relative to the input.
5. Monitor the AUDIO TONE output, and verify that the signals are present. Adjust for the required level in your facility.

This concludes the initial installation test.

# OPERATION

## INTRODUCTION

In addition to the front and rear panel controls, a number of internal controls may require adjustment in order to configure the SCB-200N for specific applications. Other internal controls are factory set, and they should only be adjusted by a qualified service person. Adjustment of these controls is described in the Maintenance Section of this manual.

## FRONT PANEL CONTROLS (Figure 3-1)

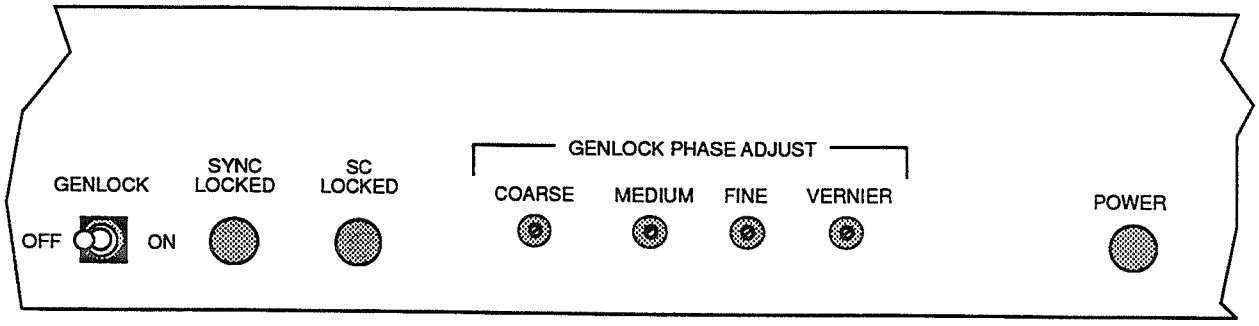


Figure 3-1. SCB-200N Front Panel

The GENLOCK ON/OFF switch determines whether the SCB-200N is locked to the incoming video (ON) or is freerunning (OFF).

The SYNC LOCKED LED indicates that the SCB-200N horizontal oscillator is locked to the sync on the genlock reference input video signal.

The SC LOCKED LED indicates that the internal oscillator is locked to the burst on the genlock reference input video signal.

Use the GENLOCK PHASE ADJUST controls to adjust the relative position of the output signals with reference to the genlock input signal. These controls only operate when there is an input signal present and GENLOCK is ON. The controls shift the output phase as follows:

| Control | No. of Steps | Phase Shift/Step |
|---|---|---|
| Coarse | 15 | 4.7µS |
| Medium | 16 | 279nS |
| Fine | 16 | 17nS |
| Vernier | Continuous | 20nS |

## REAR PANEL CONTROL

The AUDIO LEVEL control (Figure 3-2) sets the output level of both the left and right outputs over a range of -4 to +8dBm.

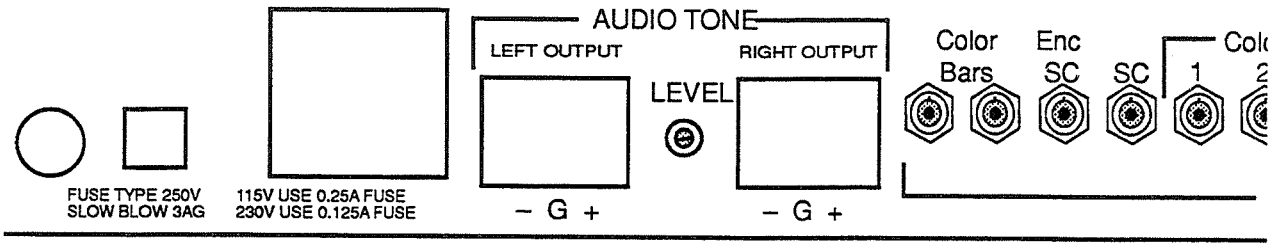


Figure 3-2. SCB-200N Audio Tone Level Control

## INTERNAL CONTROLS

**WARNING**

The cover to the SCB-200N frame must be removed to gain access to all internal controls and adjustments. With the cover removed, the power supply input circuitry (120VAC) is exposed and a possible shock hazard exists. Because of this, only an experienced and qualified service person should attempt any internal adjustments.

Internal controls may be accessed by removing the top cover the SCB-200N. Remove the cover as shown in Figure 3-3.

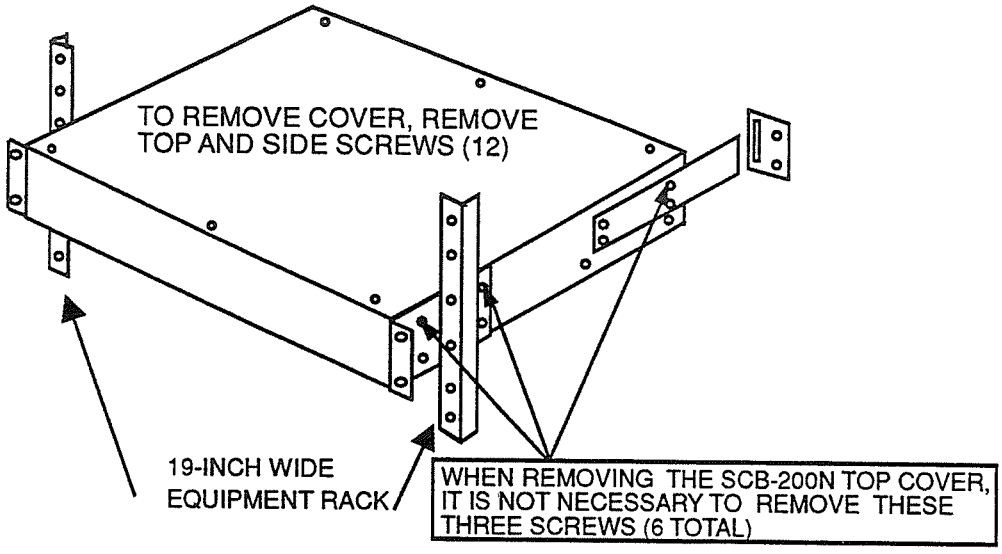


Figure 3-3. Removing the Top Cover

Internal controls that may require adjustment to configure the SCB-200N for specific applications are as follows:

**Vertical Blanking Width** (S631, switch position 1, 2, 3, and 4)

| Switch Positions | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | Lines Blanked | |
| ON | ON | ON | ON | 16.5 | |
| ON | ON | ON | OFF | 17.0 | |
| ON | ON | OFF | ON | 17.5 | |
| ON | ON | OFF | OFF | 18.0 | |
| ON | OFF | ON | ON | 18.5 | |
| ON | OFF | ON | OFF | 19.0 | |
| ON | OFF | OFF | ON | 19.5 | (Factory settings) |
| ON | OFF | OFF | OFF | 20.0 | |
| OFF | ON | ON | ON | 20.5 | |
| OFF | ON | ON | OFF | 21.0 | |
| OFF | ON | OFF | ON | 21.5 | |
| OFF | ON | OFF | OFF | 22.0 | |
| OFF | OFF | ON | ON | 22.5 | |
| OFF | OFF | ON | OFF | 23.0 | |
| OFF | OFF | OFF | ON | 23.5 | |
| OFF | OFF | OFF | OFF | 24.0 | |

**Horizontal Blanking Width** (S631 Switch Position 6)

| | |
|---|---|
| ON | 11.0µS (normal) |
| OFF | 10.75µS (narrow, factory setting) |

**Line Advance/Delay** (S631 Switch Positions 7, 8)

| 7 | 8 | Delay/Advance |
|---|---|---|
| ON | ON | 1 line delay |
| OFF | ON | nominal (same as reference, factory setting) |
| ON | OFF | 1 line advance |
| OFF | OFF | 2 line advance |

**Setup**

Jumper JP122 Position

| | |
|---|---|
| ON | 7.5 IRE of set up for all COLOR BLACK outputs (factory setting) |
| OFF | No set up |

**Super Black**

Jumper JP121 Position

| | |
|---|---|
| ON | Super black on COLOR BLACK output 4 (J022). R128 adjusts output level |
| OFF | No super black output (factory setting) |

**Audio Left Channel ID**

Jumper JP171 Position

| | |
|---|---|
| ON | Tone burst increases left channel amplitude for 33µS every 500mS (factory setting) |
| OFF | No tone burst |

# FUNCTIONAL DESCRIPTION

## INTRODUCTION

The following descriptions are to the block level. Refer to schematic diagram B10-066749-00 and Block Diagram B00-066749-00 while reading this description.

The SCB-200N is a complete Reference Sync Pulse Generator that provides all the reference and calibration signals required for a studio system. It operates either as a master sync generator or it can be genlocked to a reference video signal. When operating in the genlocked mode, the generator's output timing can be adjusted relative to the input over a range of 35µS advance to 27µS delay horizontally and a range of 2 lines advance to 1 line delay vertically. Color black and color bars output remain SC/H remains phased regardless of the SC/H phase relationship of the input. The following is a list of the output signals:

| SIGNAL | NUMBER OF OUTPUTS |
|---|---|
| V1 | 1 |
| Blanking | 1 |
| Sync | 1 |
| Color Black | 4 (one is selectable as super black) |
| Subcarrier | 1 |
| Encoded Subcarrier | 1 |
| SMPTE Color Bars | 2 |
| 1000Hz Stereo Audio Tone | Left and right channel balanced |

## FUNCTION BLOCKS

**Encoded Subcarrier** (refer to Figure 4-1)

Encoded Subcarrier is a source locking signal developed by the Grass Valley Group to eliminate jitter, instability, incorrect SC/H phase, and group delay caused problems inherent in a color black system. The encoding provides a 180 degree phase inversion of two cycles of subcarrier at the beginning of line eleven of color field one. The ENCODED SUBCARRIER reference locking signal is available from Model SCB-200N Sync / Color Bar Generator. For additional information on this signal and studio timing, refer to the NTSC Studio Timing: Principles and Applications booklet (available from your GVG sales representative).

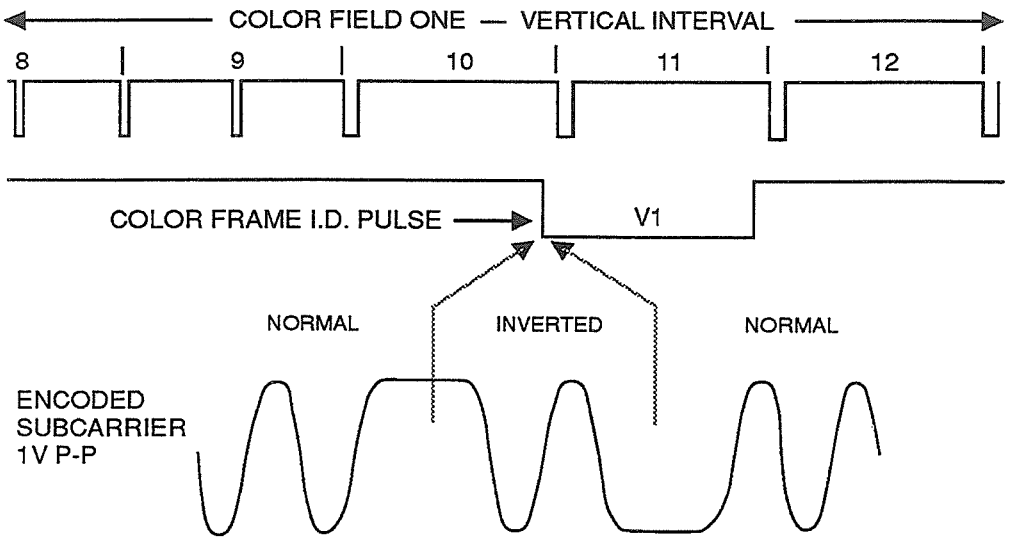


Figure 4-1. Encoded Subcarrier Timing Signal

**Power Supply and Voltage Regulators** (Sheet 5)

AC power enters the SCB-200N through line filter J081, fuse F191, voltage selector S091, and transformer T281. Secondary voltage is rectified and filtered before being applied to +10V regulator U791, -10V regulator U781, and +5V regulator U671. U472 regulates the voltage at the input to U671 at a fixed +10V.

**Input Amplifier** (Sheet 1)

The reference input is applied via loop-through connectors to input amplifier U001. The input signal is coupled differentially to cancel common mode hum. U201 integrates the sampled back porch level and feeds it back to the input to maintain the back porch at 0V.

**Fine and Vernier Phase** (Sheet 1)

Output of U001 is applied to a lumped-constant delay line. The line provides four taps, spaced at approximately 22° (17nS). The signal is selected by analog multiplexer U301, buffered, then split into a delayed and an undelayed path to drive vernier delay circuit U401. Control of the multiplexer is from the two LSBs of S962. The vernier phase control, R971, determines the amount of the delayed and undelayed signals that are mixed together to give a continuous adjustment over the 22nS range.

**Sync Separator** (Sheet 1)

The signal from the Vernier Phase control is applied via a low pass filter to sync tip DC restorer, U411A. The restorer sets the sync tip level at the input to comparators U411B and U511B to -200mV. The comparators pick off the sync tip level at at ground. The outputs are positive and negative going sync pulses which are differentiated and applied via transistor drivers to the sample FETs. The sync and back porch levels are stored in sample capacitors and buffered by U512A and U512B. The voltage is split and applied with the filtered input signal to comparator U511A. U511A picks off the sync at the 50% point, resulting in a very accurate and stable sync signal, to be applied to the Sync Generator circuitry.

**Horizontal Phase Lock** (Sheet 1)

Separated sync is applied as an input signal to the horizontal phase-locked loop. Sync is compared to a regenerated H reference pulse at U701B and U811B. An error voltage from U911B is applied to the 4MHz oscillator to pull it back into lock with the average position of sync. U721 divides down the clock to provide a window signal around the incoming sync. A horizontal reference pulse from U721B is output to the SC/H phase tracker.

**Color Lock** (Sheet 2)

Color lock ASIC U841 detects presence of burst, generates sample pulses, compares phase of burst with regenerated 3.58MHz, monitors the error voltage, and provides drive for a loop speed switch. Inputs to U841 are band-pass-filtered delayed video and separated sync. U841 output drives the loop filter to provide an error signal for the 14.3MHz oscillator. In the event that burst is not present, the signal from the SC/H error detector is switched to the loop filter, forcing the oscillator to lock to the incoming sync.

The SC LOCKED LED is driven from the color-lock-loop speed switch. Drive to the LED is only enabled when the Sync Pulse Generator detects that vertical sync is present.

**TCXO/VCXO and Four Phase Divider** (Sheet 2)

Output of TCXO Y621, the high-stability temperature-compensated oscillator is only applied to the Four-Phase Divider circuit when GENLOCK has been turned off or when no vertical sync is present. When GENLOCK is turned on, the output of VCXO Y431 provides reference clock. Control of the VCXO is provided by the Color Lock circuit.

U442 and U341A form a Four Phase Divider whose output is at 3.58MHz. Multiplexer U541 is controlled by the two MSBs of fine phase control S962 to provide 90° phase steps.

**SC/H Phase Tracker** (Sheet 4)

The SC/H Phase Tracker compares the incoming horizontal reference pulses to the regenerated 7.16MHz clock and adjusts the position of the horizontal load pulse to maintain a fixed SC/H phase relationship. U852 provides phase comparison, U771B is the loop filter, and U851 controls fine adjustment of the horizontal position. U862 discharges the loop filter capacitor whenever the SC/H error is too large, whenever the fine phase is changed, or whenever the presence of a vertical signal is detected. Load pulses are applied to the Sync Pulse Generator ASIC U641.

**Sync Pulse Generator** (Sheet 2)

The Sync Pulse Generator provides the pulses required for generating the output signals, regulates coarse and medium vertical and horizontal phase, produces vertical and horizontal blanking output, and provides the necessary vertical detection circuitry. Inputs are sync, horizontal load, and regenerated 14.3MHz, 7.16MHz, and 3.58 clocks.

**Pulse Output Amplifiers** (Sheet 6)

Pulses from the Sync Pulse Generator are buffered by U321, pass through the 140nS filters, and are then applied to the inverting input of the output amplifiers. Each output amplifier includes its own feedback resistor and 75Ω output resistor.

**Subcarrier and Encoded Subcarrier Output Amplifiers** (Sheet 6)

The 3.58MHz square wave generated at U442 (Sheet 2) is reclocked by U441 (sheet 2), low-pass filtered, then buffered to drive output amplifier U141. The V1 signal from the Sync Pulse Generator (Sheet 2) is used to invert the subcarrier phase via U341C to produce the Encoded Subcarrier. This signal is then reclocked and low-pass filtered before driving the output through Q141.

**Color Black Former and Output Amplifier** (Sheet6)

The Color Black Former U031 gates subcarrier onto a composite sync signal derived from the sync and blanking outputs. U031 also shapes the burst risetime. The output section drives the four color black outputs.

**Super Black Current Summer (Sheet 6)**

Blanking drives current source Q121. The output current is connected through JP121 to COLOR BLACK output 4 (J022) on the rear panel.

**SMPTE Color Bars Generator** (Sheet 3)

Clock and timing signals from U641 are applied to horizontal address generator U652 and vertical address generator U551. Address information is latched in U662 and U651 before being applied to SMPTE Color Bars prom U661. The output of U661 is clocked into latch circuit U561 and then into latch circuit U462 before being applied to (R/2R ladder) RN451. The clock signal to U462 is delayed by the Bars Phase circuit for adjustment of phase relative to color black.

### Color Bars Prom (U661) Address Organization

#### Pattern Selection

Pattern information is controlled by the A12 and A11 address lines. Pattern coding is as follows.

| Pattern | A12 | A11 |
|---|---|---|
| Color Black | 0 | 0 |
| Color Bars | 0 | 1 |
| Black Set (Pluge) | 1 | 0 |
| Blue Bars | 1 | 1 |

#### Phase Information

Since the subcarrier phase changes by 180° from line to line, two lines of data must be stored for each pattern. The line phase is controlled by A10.

| Line Phase | A10 |
|---|---|
| – Phase | 0 |
| + Phase | 1 |

#### Horizontal Data

Horizontal addressing accesses the individual data points across the selected pattern line. The horizontal address lines are A9, A8, .....A0.

### Vertical Address Generator (Refer to Figure 4-2)

Vertical address generator U551, after being reset by the V12 pulse, counts the lines in 2 fields and outputs the appropriate addressing information via V10, V11, and V12. In addition to the address codes, a clock inhibit signal (V12) is sent to the output. This signal stops the clock to the Prom output latch and holds the output data at blanking level during the vertical pulse period of vertical blanking.

### Horizontal Address Generator (Refer to Figure 4-2)

Integrated circuit U652 generates the horizontal address information. Address outputs H9 through H0 are incremented every 70nS by the 14.3MHz clock. The address outputs are reset to zero at the beginning of each line by the horizontal drive pulse.

An additional function of this IC is to generate vertical blanking from the color black and vertical drive pulses. This is used to switch the V10 and V11 outputs to zero during vertical blanking. This ensures that the color bar blanking width tracks the color black vertical blanking.

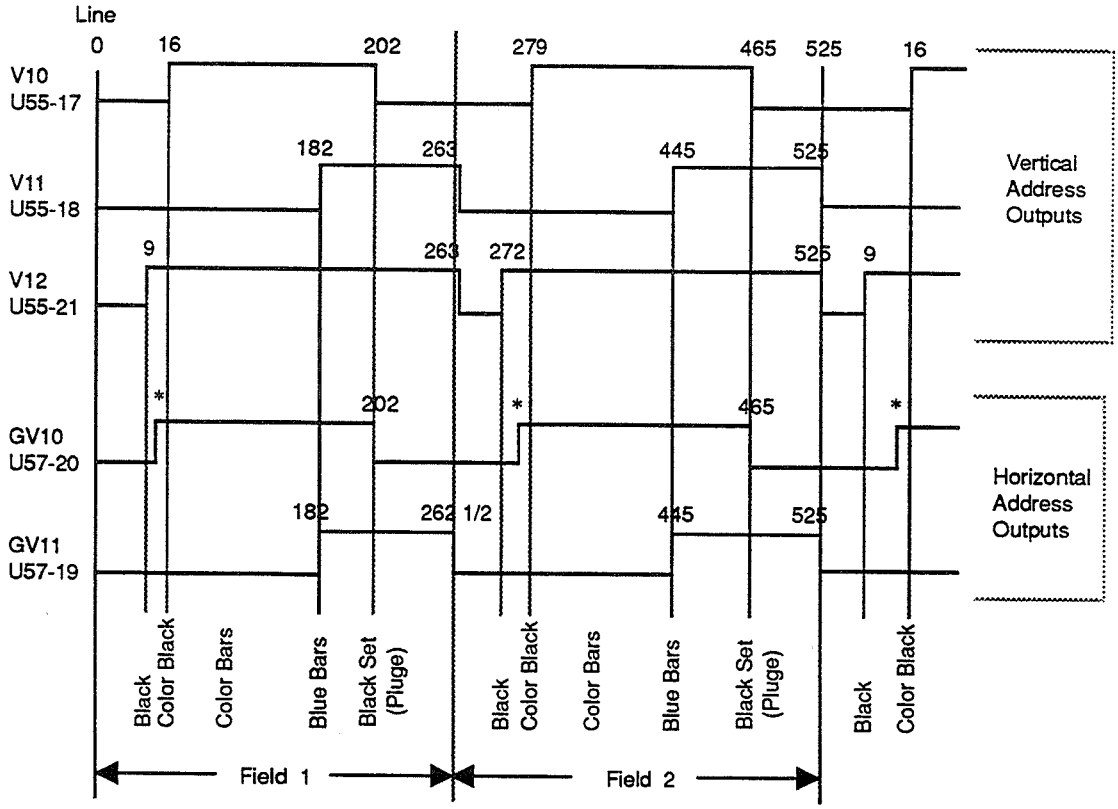


Figure 4-2. Vertical and Horizontal Address Generator Timing Diagram

### Color Bars Output

The output of the R/2R ladder is low pass filtered, then applied to the gain control. Following this control, the signal is applied to Output Amplifier U151. The shaped sync is passed through the SC/H delay stage for adjustment of color bars SC/H phase. The delayed signal is then added to the output signal through the Sync Level control.

**Audio and Output Amplifers** (Sheet 5)

Counter U461A, along with U361A, B, and C is used to divide down 2H clock pulses to produce a 1049Hz square wave. A reset from V/2 via U461, U471B and U362A ensures that the square wave is locked to the vertical rate.

The square wave is filtered by band pass filter U261 and U271. The output drives audio level R061 and is then amplified by U162A. The signal is directly routed via U161A and U161B to the right channel output. The left channel signal is controlled by the 33/500mS pulse generator (U461B, U371A, B, and C, and latch U471A). U162B acts as a comparator to drive FET Q271, allowing the signal to rise in amplitude during a 33mS period in every 500mS.

# MAINTENANCE

**ADJUSTMENTS** (Refer to drawing B07-066749-00 at the back of this manual.)

## Test Equipment Required

The following equipment is required to align the SCB-200N to factory specifications. Other equipment may be substituted but must be of equal or greater performance.

| | |
|---|---|
| Vectorscope/waveform monitor | Tektronix 1750 |
| Oscilloscope | Tektronix 465B |
| Digital Voltmeter (DVM) | Fluke 8000 Series |
| Frequency Counter | HP 5384A with OPTION 004 |
| Source of NTSC color black or composite video signal | |

## Preliminary Instructions

**WARNING**

The cover to the SCB-200N frame must be removed to gain access to all internal controls and adjustments. With the cover removed, the power supply input circuitry (120VAC) is exposed and a possible shock hazard exists. Because of this, only an experienced and qualified service person should attempt any internal adjustments.

Refer to Figure 5-1 to remove the top cover.

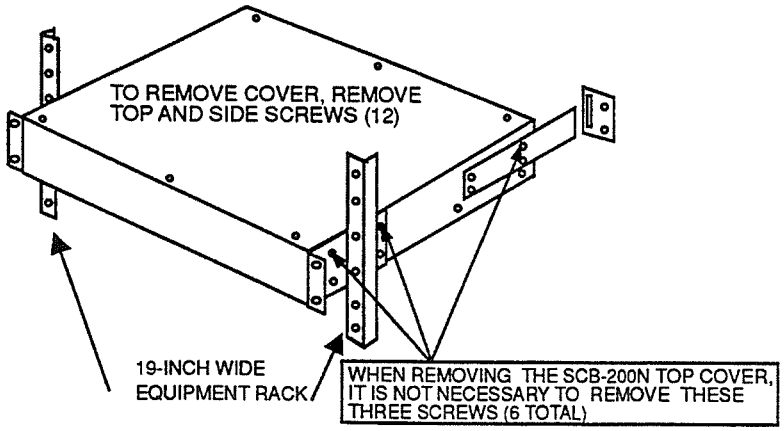


Figure 5-1. Removing the Top Cover

## Adjustment Procedure

1. ENSURE THAT A SAFETY SHIELD IS INSTALLED OVER THE 120VAC POWER SUPPLY INPUT SECTION.

2 Apply power and verify that the power LED is ON.

3. Verify test point voltages are +10V±200mV, -10V±200mV, +5V±200mV.

### Outputs

Verify that signals are present at all outputs, and check that the outputs are the correct type and amplitude (see Specifications in Section 1 of this manual.

### Lock LEDs

Ensure that neither of the Lock LEDs are lit when no video signal is connected to the input, then do the following:

1. Switch GENLOCK ON, then OFF. Verify that both SC LOCKED and SYNC LOCKED LEDs remain off.

2. Connect a 1V p-p video signal to the input. Switch GENLOCK ON, and verify that both LOCK LEDs are on and that the SYNC output is locked to the input. Switch GENLOCK OFF, and verify that both LOCK LEDs extinguish and the the SYNC output freeruns.

3. Apply a mono video signal to the input, and switch GENLOCK ON. Verify that the SC LOCKED LED extinguishes and that the SYNC LOCKED LED is on. Verify that the SYNC output is locked to the input.

### Input Common Mode

Apply a 1V p-p 60Hz common mode signal to the input, and be sure to terminate it. Verify that there is an amplitude of less than 100mV at TP101.

### Internal Signal Verification

Apply a 10V p-p signal to the input, and be sure to terminate it. Check for the following signals:

| | |
|---|---|
| TP101 | Inverted video 1V p-p |
| TP151 | +2.5V±100mV |
| TP261 | 1049Hz Audio tone, 1.4V p-p, locked to Vert. |
| TP301 | Inverted video 1V p-p, back porch of -0.6V |
| TP501 | 2V p-p video, back porch of -0.6V |
| TP661 | +5V±200mV |
| TP741 | Peak chroma >+400mV peak during burst |
| TP731 | Chroma, burst amplitude of 0.5V, DC value -0.7V |
| TP821 | DC 0V±2V |
| TP871 | DC 0V±2V, with a correctly SC/H phased input |
| TP981 | +10V±200mV |
| TP982 | -10V±200mV |
| TP921 | DC 0V±2V |

### Oscillator Freerun Frequency (Minimum warm-up time is 30 Minutes)

1. Connect a video signal to the GENLOCK input, and switch GENLOCK to ON. Verify that the subcarrier output is locked to the input.

2. Adjust R133 (SC AMP) for 2V p-p at the SC output.
3 Switch GENLOCK OFF, and verify that the subcarrier is not locked.

4. Connect a frequency counter to the SC output, and verify that the frequency is 3.579545MHz±1Hz. If not, remove the screw from TCXO Y621, and adjust for the correct frequency.

### SC/H Phase Centering

1. Connect a video signal with known correct SC/H phase to the input. Turn GENLOCK ON.

2. Set R874 (SC/H TRACKER CENTER) to the center of its range. Measure the voltage at TP871, and adjust R874 for 0V±50mV.

3. Measure the SC/H phase at the COLOR BLACK output, and adjust R421 for SC/H phase coincidence.

4. Toggle the GENLOCK switch OFF, then ON, and verify that the signal comes back to the correct SC/H phase.

5. Switch S962 through each position, and verify that the SC/H phase remains correct.

**Phase Range**

1. Connect a waveform monitor to the output, set the COARSE GENLOCK PHASE ADJUST switch in the up position, and verify that adjusting the MEDIUM switch through all 16 steps adjusts the horizontal phase in 280nS increments.

2. Beginning with the COARSE switch in the down position, verify that the control adjusts phase in 4.47µS steps. Steps 15 and 16 should not change the phase.

3. Use a vectorscope to verify that the FINE switch adjusts phase 22.5±2° for each step.

4. Rotate the VERNIER control from end to end, and verify that its total range is >20°.

**Pulse Outputs** (All with risetime of 140nS, ±20nS)

1. Verify that the V1 pulse is 4V, ±0.1V with a risetime of 140nS±20nS.

2. Verify that the BLANKING pulses are 4V, ±0.1V with a risetime of 140nS±20nS.

3. Verify that the SYNC pulses are 4V, ±0.1V with a risetime of 140nS±20nS.

**Pulse Widths**

Horizontal Blanking Width

| S631Dip Switch Position 6 | |
|---|---|
| ON | 11.00 microseconds (normal) |
| OFF | 10.75 microseconds (narrow) |

Vertical Blanking Width

| S631 Dip Switch Positions | | | | Width |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | In Lines (per RS-170A) |
| ON | ON | ON | ON | 16.5 |
| ON | ON | ON | OFF | 17 |
| ON | ON | OFF | ON | 17.5 |
| ON | ON | OFF | OFF | 18 |
| ON | OFF | ON | ON | 18.5 |
| ON | OFF | ON | OFF | 19 |
| ON | OFF | OFF | ON | 19.5 |
| ON | OFF | OFF | OFF | 20 |
| OFF | ON | ON | ON | 20.5 |
| OFF | ON | ON | OFF | 21 |
| OFF | ON | OFF | ON | 21.5 |
| OFF | ON | OFF | OFF | 22 |
| OFF | OFF | ON | ON | 22.5 |
| OFF | OFF | ON | OFF | 23 |
| OFF | OFF | OFF | ON | 23.5 |
| OFF | OFF | OFF | OFF | 24 |

## Line Advance/Delay

(S631 Switch Positions 7, 8)

| 7 | 8 | Delay/Advance |
|---|---|---|
| ON | ON | 1 line delay |
| ON | OFF | 1 line advance |
| OFF | ON | nominal (same as reference, factory setting) |
| OFF | OFF | 2 line advance |

## Setup

Jumper JP122 Position

| | |
|---|---|
| ON | 7.5 IRE of set up for all COLOR BLACK outputs (factory setting) |
| OFF | No set up |

### Color Black Out

1. Connect a COLOR BLACK output to a waveform monitor
2. Adjust R125, COL BLK SYNC LEVEL, for a sync level of 286mV±7mV.
3. Filter out the chroma and adjust R222, BURST OFFSET, for minimum pedestal during the burst period.
4. Remove the chroma filter. Adjust R234 BURST LEVEL for a burst amplitude of 286mV (± 7mV).
5 Adjust R421, COL BLK SC/H PHASE for 0.0°±1°.
6. Confirm that with JP122, SET UP, in the OFF position, the color black has no set up and the blanking level is 0V±50mV.
7. Move JP122 to the ON position, and verify that the set up level is 54mV±5.4mV.

### Encoded Subcarrier Out

Verify that the amplitude is 1V (±0.1V).

### SMPTE Color Bars Out

1. Adjust R252, COLOR BARS LEVEL for 714mV±2mV between black and white levels.
2. Adjust R148, BARS SYNC LEVEL for a sync level of 286mV±7mV.
3. Adjust R443, BARS PHASE, to align the burst phase with color black burst phase.
4. Adjust R224, BARS SC/H PHASE for 0.0°±1°.
5. View Color Bars on a monitor, and verify that the sequence and positions are correct.
6. View Color Bars on a vectorscope, and verify that the vector dots are in the boxes.

### Audio Out

1. Connect AUDIO TONE RIGHT OUTPUT to an oscilloscope, (+) to channel A and (–) to channel B, and set the scope controls to A minus B. Terminate across the output with 600Ω. Note: DO NOT GROUND the (+) or (–) outputs.

2. Turn R061, AUDIO LEVEL fully counter-clockwise, and verify that the amplitude is < 1.38Vp-p.

3. Turn R061, AUDIO LEVEL fully clockwise, and verify that the amplitude is > 5.5Vp-p, then set it to 3.5V±0.1V.

4. Connect the AUDIO TONE RIGHT OUTPUT to a frequency counter, and verify that the frequency is 1049Hz±1Hz.

5. Connect the AUDIO TONE RIGHT OUTPUT to a distortion analyzer, and verify that the distortion is <1%.

6. Connect the AUDIO TONE LEFT OUTPUT to an oscilloscope, (+) to A channel, (-) to B channel, and set the oscilloscope to A minus B. Terminate across the outputs with 600Ω. Note: DO NOT GROUND the (+) or (-) outputs.

7. Place jumper JP171 in the TONE BURST OFF position, and verify that the output is 3.5V±0.1V.

8. Place jumper JP171 in the ON position, and verify that a 33mS burst of 5.3V±0.5V occurs every 500mS.

This concludes the adjustments for the SCB-200N.

## REPAIR AND RETURN INSTRUCTIONS

Your Grass Valley Group equipment was designed to be very reliable. In case repairs are needed, however, follow the instructions in this section. To return the equipment for repair, do the following:

**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 the Modular Products Service Center at (916) 478-3000. The service representative will give you directions for returning the equipment. Ask for a return authorizations number (GA #) which will permit the factory to accept your equipment when it arrives.

NOTE

If you service equipment that is still under warranty, the warranty may be voided.

Out-of-warranty repairs cannot be made until a valid purchase order number has been provided.

**Service orders** for all Modular Products Division equipment are processed within 24 hours upon receipt of request.

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

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