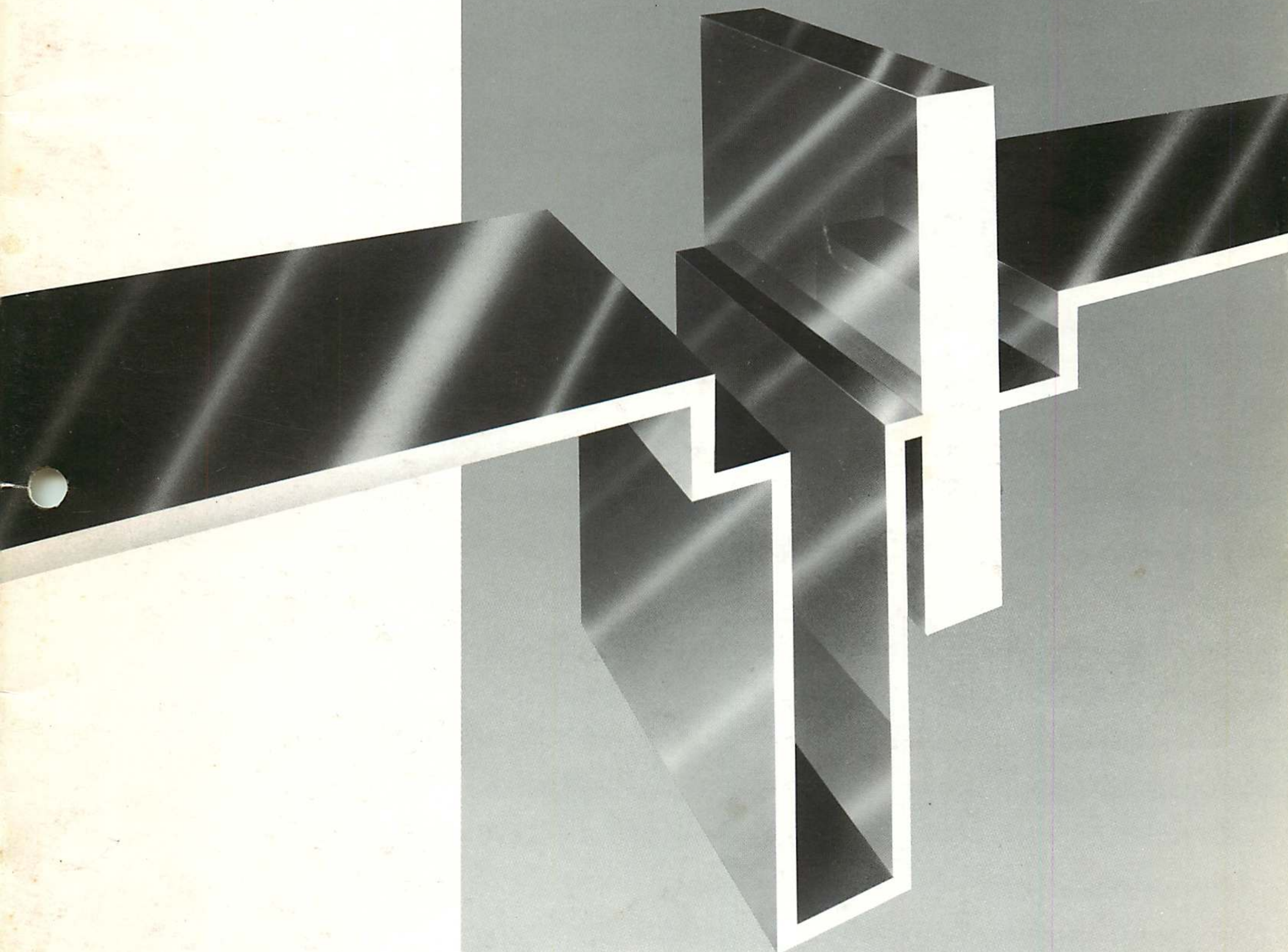
Professional Video Tutorial



Grass Valley Group®

PROFESSIONAL VIDEO TUTORIAL

Produced and Published by
The Grass Valley Group, Inc.

Editors:
David Colborn
Les Brown
Rory Boyce
Grover Cleveland
Eddy Jenkins
Ken James
Bruce Rayner
Chuck Petch

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PREFACE

The SCB-100/200N is a multi-purpose, compact, and high value product that will be purchased by a wide variety of users. We have prepared this tutorial as a companion to the sync generator instruction manual with those people in mind who have little or no background in video technology.

The tutorial shows several system designs for using the SCB-100/200N. In explaining how to use the SCB-100/200N's special features, the tutorial covers typical adjustments on a picture monitor and through the video path. Terms are defined as they are introduced, and again, alphabetically, in a glossary at the back.

If you are an experienced video user, you may want to pass your copy of this tutorial on to a newcomer in the field.

CONTENTS

Color Bars: A standard reference picture containing bands of color with fixed amplitudes and saturations, together with white and black references.

THE SCB FAMILY

The prefix "SCB" represents two of the three major functions of the product family. These are Synchronization and **Color Bar** Generation, without which a television facility is severely handicapped. The third function, not in the acronym, but very much in the products, is Audio Tone. Monaural in SCB-100N; Stereo in SCB-200N.

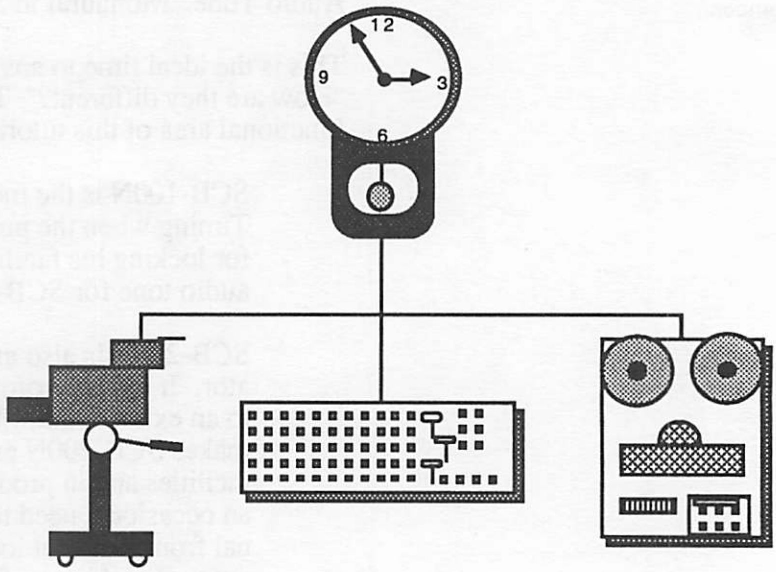
This is the ideal time to answer the questions "Why two models?" and "How are they different?" The detailed explanations appear in each functional area of this tutorial. But by way of basic definition:

> SCB-100N is the most cost-effective solution to Master Timing when the purchaser can foresee NO requirement for locking his facility to an external reference. Also, audio tone for SCB-100N is always monaural.
>
> SCB-200N is also an economical Master Timing Generator. It differs from SCB-100N in that it may be locked to an external color black or video reference. This makes SCB-200N especially useful in teleconferencing facilities and in production facilities when there may be an occasional need to lock facility timing to a video signal from a distant location...or to a piece of rental equipment. In addition, SCB-200N provides stereo audio tone with left-channel identification to make system check-out simple and accurate.

WHY YOU NEED A SYNC GENERATOR

Sync Pulse: Timing pulses added to a video signal to keep the entire video scanning process synchronized in time.

A **sync pulse** generator (SPG), usually known as a 'sync generator,' is like a master clock for your facility. To operate in unison, virtually all the video devices in your studio depend on the sync pulse generator.



There are two types of sync generators in use. The unit that provides sync pulses for the entire studio is referred to as a "reference synchronizing generator". This kind is also known as "master" sync generator. Other synchronizing generators are designed to lock to signals from a reference generator and may be termed "locking masters," "slave synchronizing generators," "source synchronizing generators," or "source timing modules."

Synchronization is necessary any time more than one source (camera, VTR, etc.) is being used. If the sources are not "in sync," the viewer will see rolling, **tearing**, or incorrect colors in the picture whenever a transition (**mix**) is made between sources.

Tearing: A lateral displacement of the video lines due to equipment being "out of sync." Visually, it appears as though parts of the images have been torn away.

Mix (dissolve, crossfade): A transition between two video signals in which one signal is faded down as the other is faded up.

THE USES OF COLOR BARS

Color Bars: A standard reference picture containing bands of color with fixed amplitudes and saturations, together with white and black references.

SMPTE: Society of Motion Picture and Television Engineers (which sets standards).

Color bars are used as a reference to adjust video monitors, set video levels throughout the system, and serve as a quality control device when placed at the beginning of videotapes.

Your SCB-100N/200N provides a stable, convenient, and accurate source of **SMPTE** (U.S. standard) color bars, completely independent of other system equipment such as cameras.

Video Monitor Adjustment

Color bars from the SCB-100N/200N can be useful in adjusting your monitors. See page 25 for information on how this is done.

Level Setting in Video Signal Path

Video Gain: The difference between black and white levels in the video signal. The video gain control affects contrast.

Setup: The specified base of the active picture signal which is at reference black level. Called "setup" because it is placed 7.5 IRE units above blanking (zero IRE). Setup is related to the brightness of the video image. The black level of the picture - related to brightness.

Chroma Gain: The voltage levels of the colors - how intense the colors are.

Phase: The "hue" or "tint" of the colors.

Use color bars from the SCB-100N/200N to test the output levels of your switcher, videotape recorder, and other devices (**video gain**, **setup**, **chroma gain**, and **phase**). This process is explained beginning on page 18.

Color Bars Placed on Videotape Leaders for Quality Control

Videotape Leaders: A section at the beginning of each videotape devoted to test signals and program information. This part of the tape is used to set up the videotape recorder and associated equipment, and is not normally seen by the audience.

Place color bars on your **videotape leaders** to ensure that future video presentations have the correct levels. If your tapes will be taken somewhere to be edited or duplicated, they will need to include color bars.

THE USES OF AUDIO TONE

An audio tone is placed on master tape leaders (along with color bars) in order to set proper audio levels during editing and playback. The audio tone is also used to set the levels of various other devices, such as mixers and audio recorders. Use of the audio tone is explained on page 27.

DESIGNING YOUR SYSTEM

Color Black: A video signal that contains horizontal, vertical, and color synchronizing information. Color black produces a black screen when viewed on a video monitor.

Time Base Corrector (TBC): A device that compensates for the timing variations in a videotape recorder's playback signal. This variation is caused by "wow and flutter" in the mechanical transport of the videotape recorder. The TBC allows for several adjustments that will be discussed later.

BASIC SYSTEMS

Figure 1 below shows a simple editing system using your SCB-100N/200N, VTRs, and a switcher. This system shows separate sync, blanking (BLKG), and subcarrier (SC) pulses as reference inputs to the switcher. (Many switchers however, including GVG's Model 100, may be equipped with options which allow them to use a single **color black** reference from the SCB-100N/200N, rather than three individual signals.) Since VTRs produce some jitter (instability) at their outputs, it is necessary to include internal or external **time base correctors (TBCs)** to eliminate the jitter.

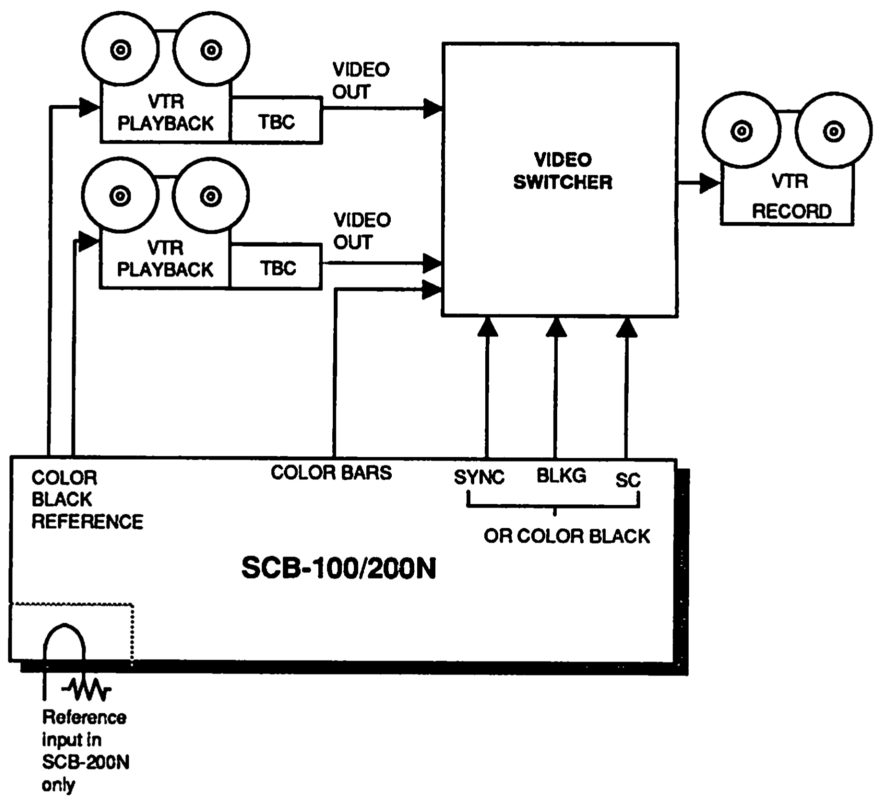


Figure 1. Using The SCB-100N/200N In A Basic Editing System

Source Device: Equipment which produces video signals, such as cameras, tape recorders, or character generators.

Source Timing Module: A specialized synchronizing generator module that is used to time a specific piece of source equipment. It is kept in time by the encoded subcarrier from the reference sync generator. *Note: other types of source synchronizing generators, such as the GVG 9505A, can use either the encoded subcarrier or color black as a reference signal.*

Encoded Subcarrier: A reference system created by Grass Valley Group to provide exact color timing information. It is used like color black to lock devices to a reference, but it provides superior stability and a simpler, less expensive, "genlock" process (see glossary for definition of Genlock). Genlocking to color black is not as reliable as locking to an encoded subcarrier reference and sometimes will result in a picture jump at edit points. The Encoded Subcarrier system virtually eliminates that possibility.

The system in Figure 2 includes a **source device** (perhaps a special VTR) that requires separate pulses (sync, blanking, and subcarrier) and/or does not have its own internal timing adjustments. The separate pulses are supplied by a **source timing module**, a GVG STM-85N, which provides timing adjustments for the source. The only signal the source timing module requires is **encoded subcarrier** from the SCB-100N/200N.

It would be technically correct to use an SCB-200N in a way similar to the STM-85N shown in Figure 2. In such a case the locking signal to the SCB-200N would be color black rather than encoded subcarrier. this would be a logical use if the master sync generator (perhaps in service, for some time, or of another manufacture) were not equipped with an encoded subcarrier output.

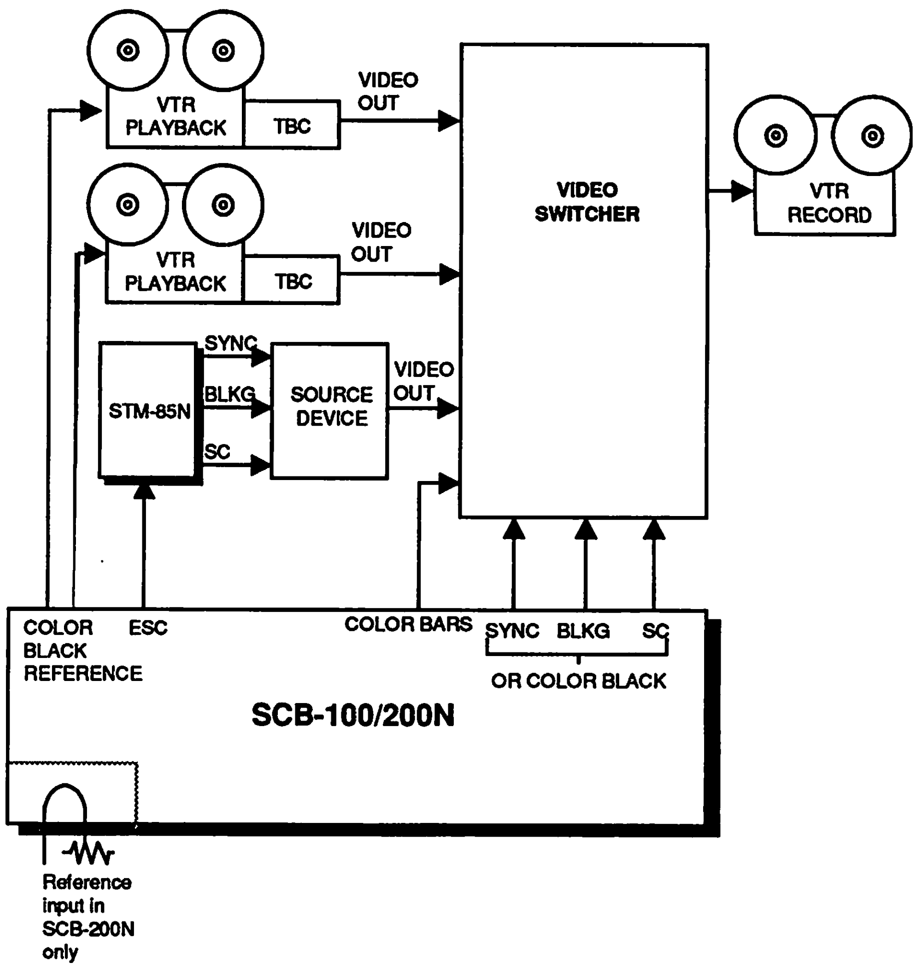


Figure 2. Using the SCB-100N/200N in a Basic System with One Source Device that Requires Separate Pulses and/or Timing Adjustment.

MORE COMPLEX SYSTEMS

The following pages illustrate several more detailed and sophisticated approaches to designing your system using your new sync pulse generator: using delay distribution amplifiers (delay DAs), source timing modules (STMs), or equipment that locks to color black and can be adjusted internally.

Establishing and maintaining precise timing involves a multitude of variables. Often other pieces of equipment in addition to your sync pulse generator are required to keep the source inputs to your switcher in synchronization. The selection and timing of this additional equipment requires an understanding of system timing.

It is important to understand that a properly timed studio does not just happen when you connect equipment as it comes out of the box. A properly timed studio must be designed.

If you are not knowledgeable in the area of timing and would like more information on the subject in order to install your system, we recommend that you request a copy of Grass Valley Group's NTSC Studio Timing. This is a tutorial on system timing and the design of videotape editing systems using delay and synchronizing generators. Basic video principles are explained and terms defined. You should refer mainly to pages 1 through 15. Ask your sales representative for a complimentary copy.

Additional Help. Grass Valley Group's Customer Service personnel are always ready to assist you with studio timing problems. If you wish to confirm a design concept or request a solution, don't hesitate to call us. The number is (916) 478-3000 – ask for MPD Customer Service.

Character Generator: A device that allows you to generate text for insertion into a picture.

Distribution Amplifier (DA): A device used to multiply (fan out) a video signal. May also include delay and/or cable equalization capabilities.

Subcarrier (SC): A continuous sine wave of extreme frequency accuracy used by source equipment to encode the color information into the video signal. The subcarrier has a frequency of 3.579545 MHz and is often referred to simply as "3.58"

System Design Using Delay

Figure 3 shows a system that will use cumulative delay to achieve system timing. In this system we have a camera, a **character generator**, and two video cassette recorders (VCRs). Color black comes from the reference synchronizing generator. The VCRs have time base correctors on their outputs that lock to the color black reference. These time base correctors provide ample timing adjustment and stability for the VCRs (see definition of time base corrector on page 3).

This approach to system design is usually the least expensive but has the serious drawback that new source equipment may be difficult to integrate in the future and might require major system design changes.

The purpose of the delays is to ensure that all the signals arrive at the switcher inputs in precise time with each other. But there is an additional problem in this system –

> The switcher contains an internal color black and color background generator, and these must also be in time with the input signals. This can be brought about by delaying the sync and blanking pulses to the switcher with pulse delay **distribution amplifiers**. (Since the switcher in the example has an internal adjustment for the color phase of its background generator, the **subcarrier** signal can be connected directly to the switcher.)

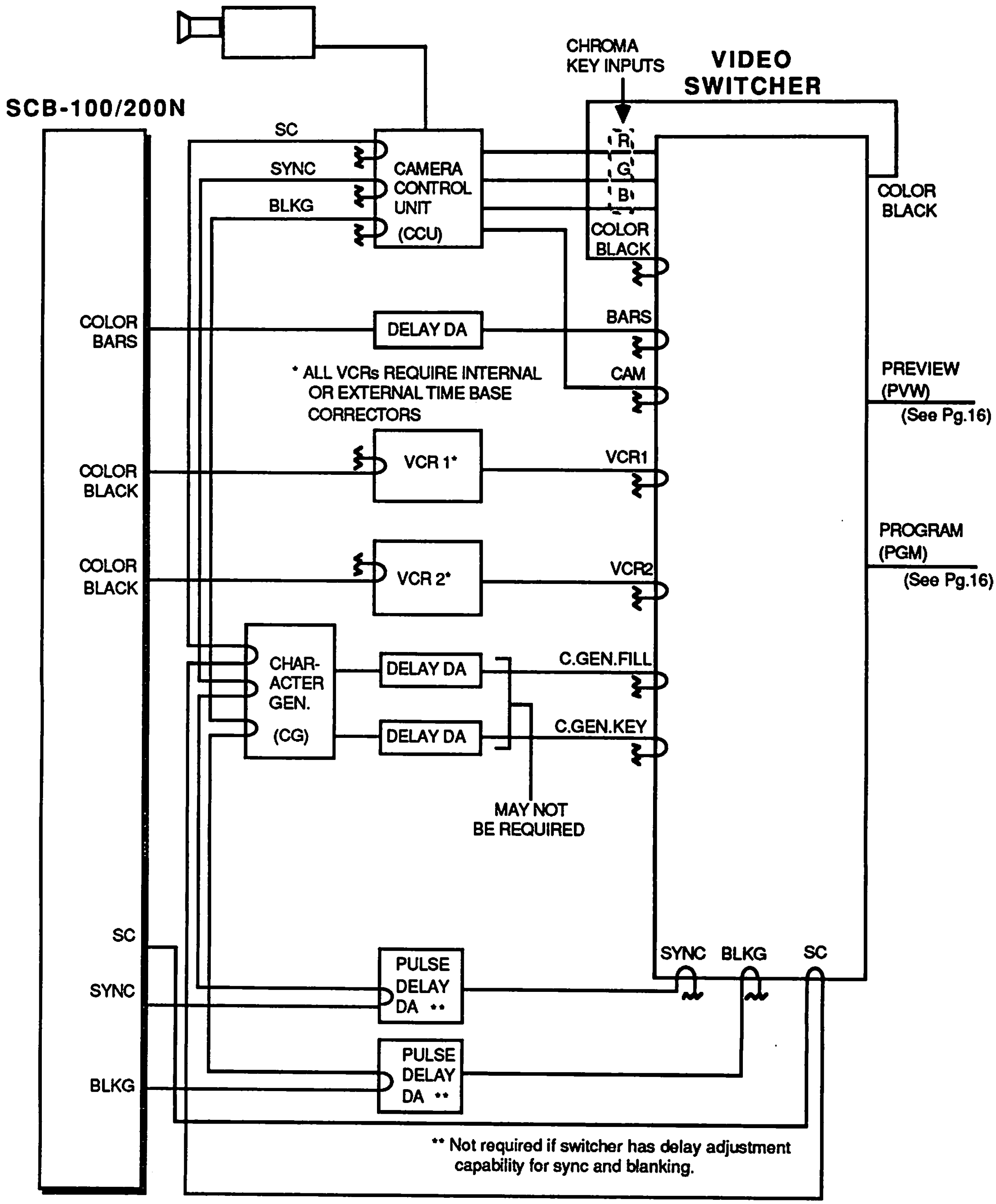


Figure 3. System Design Using Delay DAs.

System Design Using Retiming Equipment

Most of the difficulties encountered in system design can be avoided with a reference/source sync generator system. Grass Valley Group answers this need with the combination of the SCB-100N, SCB-200N and STM-85N (Source Timing Module). Use of these elements provides maximum flexibility and the best timing stability.

The advantages of using the SCB-200N or STM-85N for retiming purposes are:

1) Independent timing of each source is available.

2) Far less cabling is needed, since DAs are not required for separate pulse outputs. A single encoded subcarrier signal is sent to STM-85N's...or Color Black to SCB-200N's. The source timing devices (STM's or SCB-200N's) are located at the sources themselves, keeping connecting cables very short.

3) Devices timed by STM-85N's or SCB-200N's continue to function in the event of reference SPG failure. Use of these devices rather than conventional source SPGs also reduces system costs.

Figure 4 shows a system that uses source timing modules and an SCB-200N locked to your master sync pulse generator to provide synchronized timing to your switcher. As you can see, there are no DAs used. The rest of the equipment remains the same as the system introduced in Figure 3. As in the previous system, the VCRs use time base correctors to maintain stability on playback.

The Following Definitions Are Of Words Used In Figure 4

Key: A signal that can electronically "cut a hole" in the video picture to allow for insertion of other elements such as text or a smaller video picture (smaller video pictures are often keyed into the larger picture during news programs).

Fill: The video information that fills the "hole" cut in the video picture by the key signal.

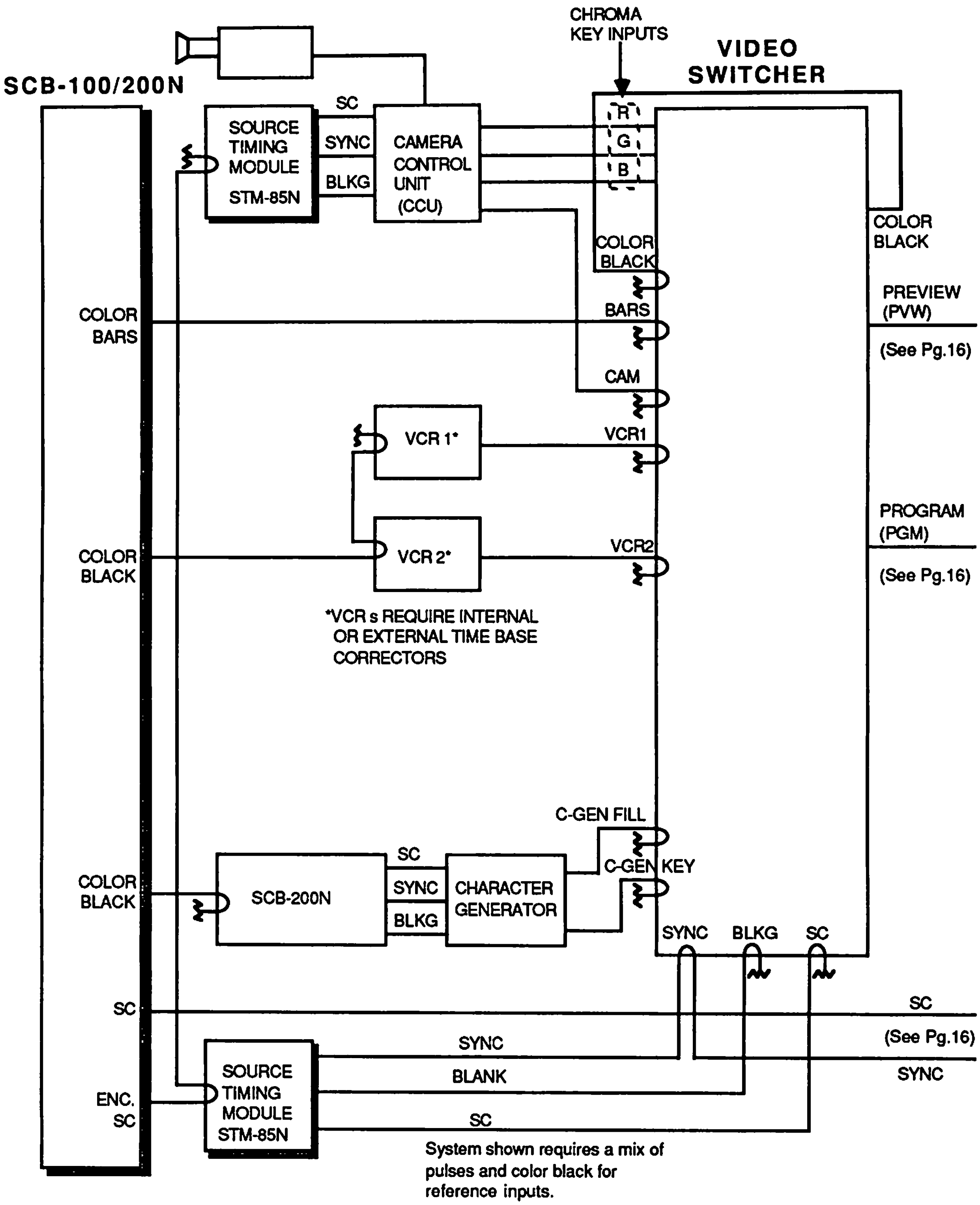


Figure 4. System Design Using Source Timing Modules.

System Design Using Equipment With Internal Timing Adjustments And Color Black As Reference.

Figure 5 shows a video system in which all the source equipment uses color black as a reference and in which each piece of source equipment has an internal timing adjustment. This is a simple configuration but the individual pieces of equipment are more complex and often more costly.

SC/H Phasing: The phase or time relationship of the subcarrier to (the leading edge of) horizontal sync. The definition of horizontal sync and more about SC/H phase is found in the GVG booklet NTSC Timing.

Notice that the switcher is receiving both color bars as an input signal and color black as a reference signal. Since both of these signals are coming from the SCB-100N/200N, we know that they are in time with each other. System timing is achieved by adjusting each of the system components to be in time with the color bar and color black inputs from the SCB-100N/200N at the input to the switcher. As with the previous systems, each piece of source equipment should be **SC/H phased** (timed) according to the instructions in the GVG booklet NTSC Timing.

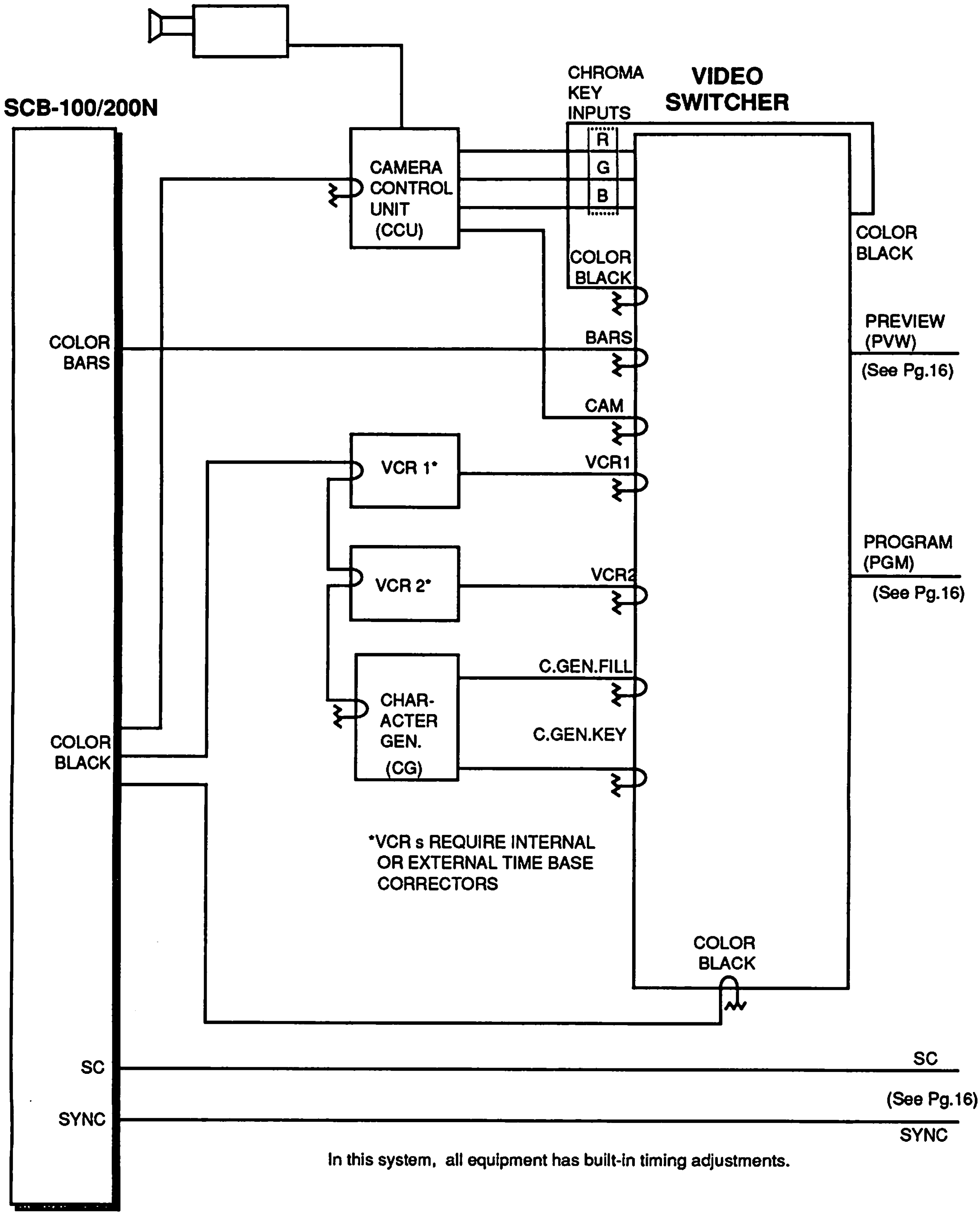


Figure 5. System Using Color Black Reference

SYSTEM DESIGN FOR OUTSIDE SIGNALS

Figure 6 demonstrates an economical solution to the problem posed by the arrival of outside signals over which you have no control, but with which you must work in real time.

In this instance a signal from a distant teleconference site is integrated into the local system. Not only is the local system **gen-locked** to the **distant source**, the SCB-200N Locking Master Synchronizing Generator is simply adjusted to bring the studio equipment into time with the incoming signal. With this setup, it is possible to use the distant signal just as though it originated right in your own equipment area.

Our example shows the distant signal arriving via satellite (upper left of Figure 6). It may optionally be passed through a GVG Model 7510 Video Processing Amplifier for enhanced stability. The signal is then **looped through** the locking input of the SCB-200N and continues on to the video switcher. The **retiming** controls of the SCB-200N are then adjusted to bring the local facility in time with the distant source. How to use those controls is discussed later in this tutorial. You may wish to further explore system timing in the GVG publication NTSC Studio Timing.

Gen-Lock: A technique which permits referencing the local master synchronizing generator to outside equipment

Distant Source: An outside video source over which you have no direct timing control.

Loop-thru: A video signal enters a piece of equipment, is sampled, then returned to the outside world for further use. Loop-thru circuitry requires careful design to prevent signal degradation.

Retiming: Adjustment of a local synchronizing generator which has been locked to a distant source. This permits the local facility to use the distant source in real-time production through a video switcher.

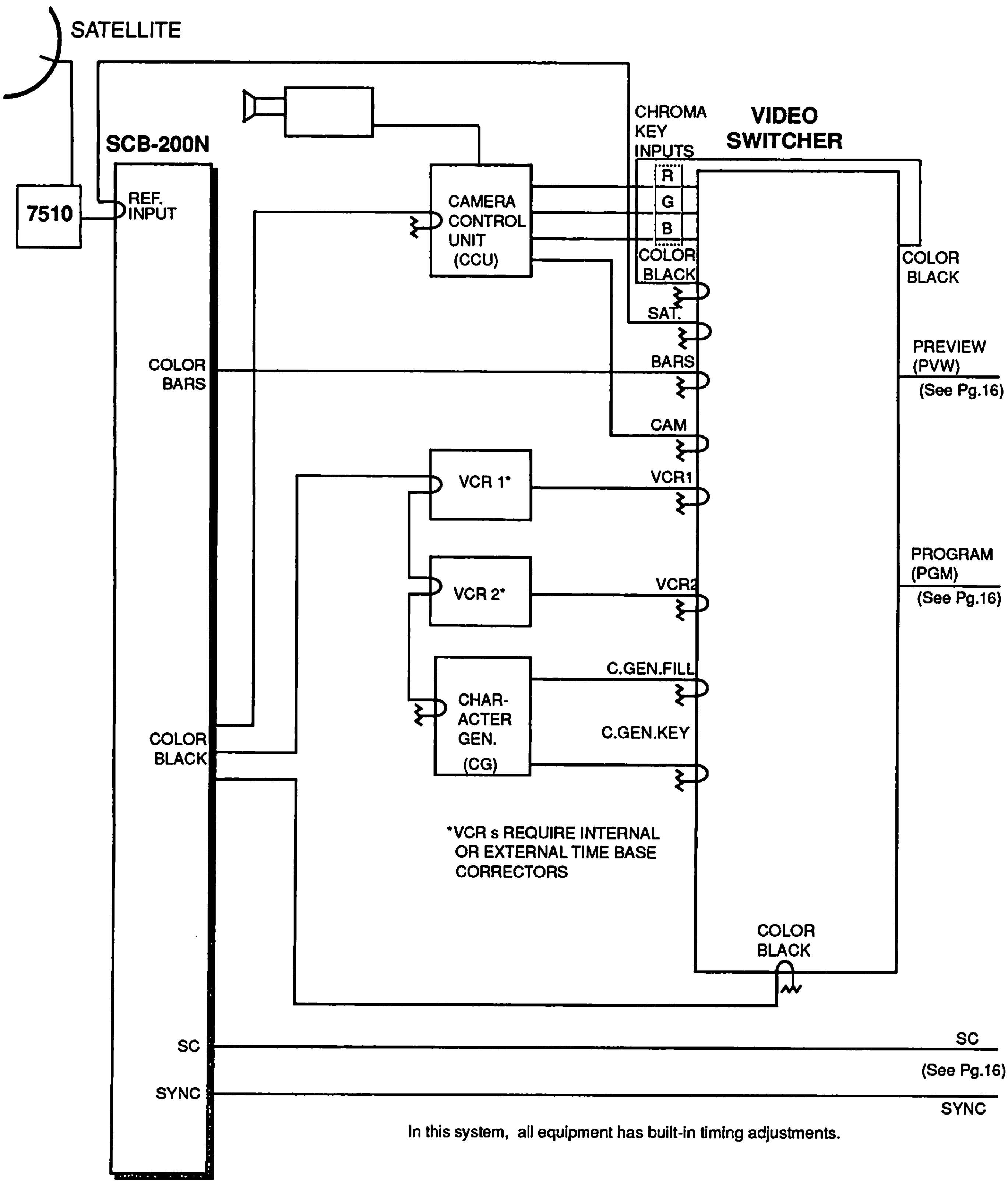


Figure 6. System Locking To A Distant Signal

PROGRAM/PREVIEW OUTPUT CONFIGURATION

In the system below, the monitors are locked to a separate sync pulse from the SCB-100N/200N sync generator. This is useful in the event that there is sync instability in the video coming from the switcher. The instability will show up as jitter on the monitors. Without the separate sync lock to the sync generator, jitter would not be visible.

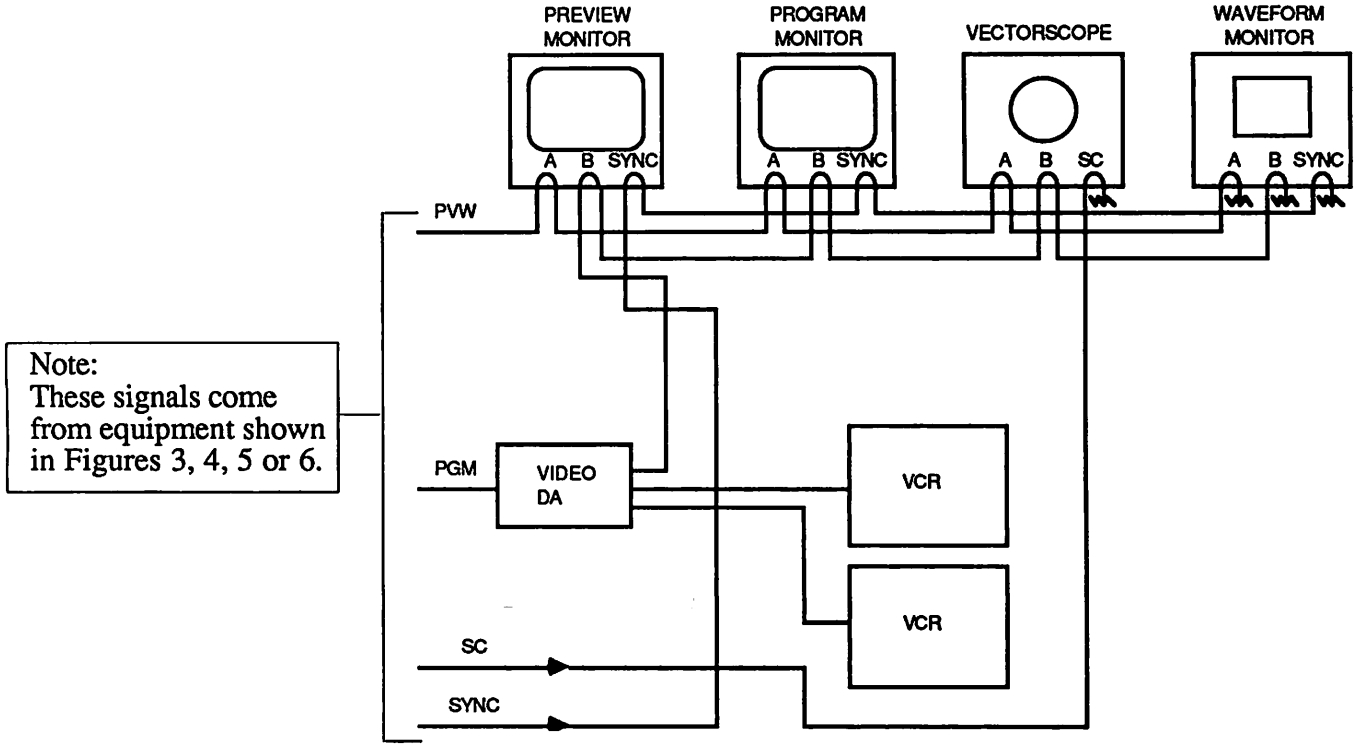


Figure 7. Use of a Sync Reference for Monitors

A Note About Monitors, Waveform Monitors, and Vectorscopes:

In most studios the configuration above is standard. The Program monitor is used for observing the output of the switcher's program line. The Preview monitor is used to view the next effect or transition before it is put "on air."

The Waveform monitor gives a visual indication of the levels of the video signal while the Vectorscope is concerned only with the relationship and amplitude of the color information in the signal. The waveform monitor and the vectorscope in Figure 6 can be switched to observe either the program or the preview signal.

USING COLOR BARS

INTRODUCTION

The color bars signal is the most widely used test signal in television studio operations. By feeding the reference color bars signal from a SCB-100N/200N to a piece of studio equipment and examining the output of that piece of equipment with a waveform monitor and a vectorscope, the equipment can be tested and properly adjusted.

Upstream-Downstream. It is important to understand that any piece of "upstream" equipment that can be adjusted will have an effect on pieces of "downstream" equipment that follow it. For example, a switcher takes signals in and passes the signals on to videotape recorders. The recorders pass their signals on to monitors. It would be a mistake to begin adjustment at the monitors in this case. The testing and adjustment should begin at the equipment that is the furthest "upstream" in the system; then systematically continue through the system to the end.

Required Test Equipment. A waveform monitor and a vectorscope are very necessary pieces of studio equipment. While some video level adjustments using color bars on a picture monitor are possible (setup, video gain, phase), the results will vary from operator to operator. Color bars are an accurate reference for setting video levels only when a waveform monitor and vectorscope are used.

Where to Look. The waveform monitor and vectorscope should be capable of "looking" at the signals going into and coming out of each piece of equipment that is to be adjusted. In many studios, this means that they will be physically moved around from place to place. In some studios, patching or switching systems are installed so that the waveform monitor and vectorscope can be electrically switched to the test points as needed.

LEVEL SETTING WITH COLOR BARS

It is impossible to cover all possible studio configurations in this tutorial. As we approach a basic system we will assume the following:

A simple system consisting of an SCB-100N or SCB-200N, one VTR with time-base corrector, and a video switcher with internal timing adjustment. We will give brief consideration to the use of a "distant" signal in an SCB-200N based system.

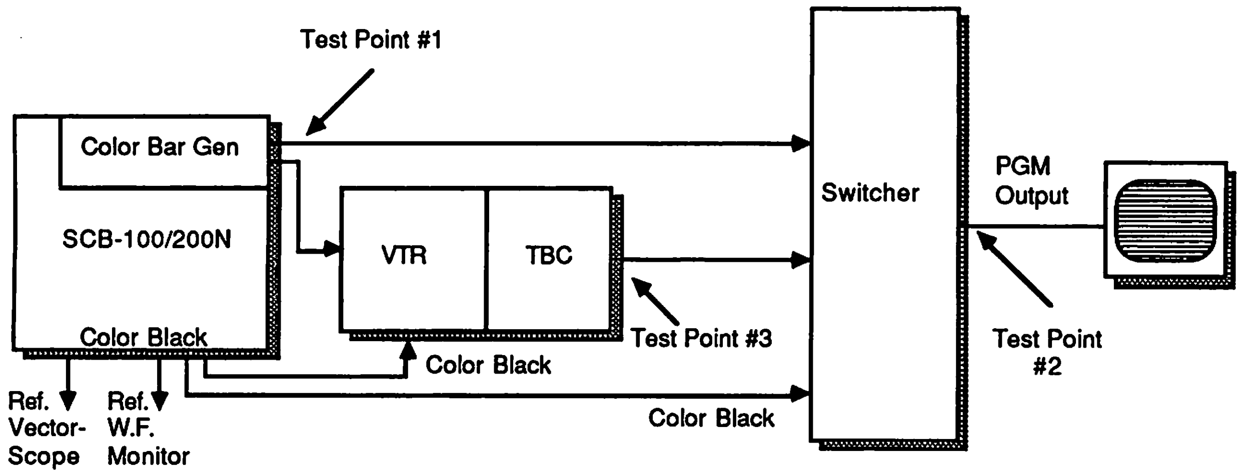


Figure 8. Timing Test Points in the Basic Studio

Initial Setup

First, remove the cable which normally connects color bars to your switcher. We'll call this Test Point #1 (Figure 8). Connect a new cable from Test Point #1 to your waveform monitor and vectorscope. During initial setup, the scopes must NOT have EXTERNAL REFERENCE selected on their front panel switches. Ensure that each is set to its calibrated position. You may have to move the Horizontal Position knob on your waveform monitor and the phase knob on your vectorscope to observe displays which match those in figures 9 and 10. Familiarize yourself with those displays.

Now remove your 'scope cable from Test Point #1 and reconnect the cable that normally connects color bars to your video switcher.

Connect your 'scope cable to Test Point #2 and select the color bar input on the program row of your production switcher. If your switcher has an internal blanking processor, turn it off now. The images on your scopes should be the same as observed at Test Point #1. If they are not, consult the technical manual for your switcher.

Remove the 'scope cable from Test Point #2 and relocate it to Test Point #3.

E-E Mode: The mode obtained when the VTR is set to record but the tape is not running. This stands for "electronics to electronics" and means that the VTR is processing all of the signals that it would normally use during recording and playback, but without actually recording onto the tape.

Luminance: The brightness component of the video picture information which includes setup but does not include color information. (The video picture information contains two components: luminance [brightness and contrast] and chrominance [hue and saturation]).

Chrominance: The color components of a video signal, which include hue and saturation, but do not include brightness.

IRE: Units of measurement dividing the area between the bottom of sync and white level into 140 equal units. 140 IRE equals 1 Volt peak to peak. IRE stands for Institute of Radio Engineers.

Next, place the VTR in "**E-E Mode**". This is normally done by pressing only the RECORD button on the VTR so that the tape does not move. (Refer to your VTR Operator's Manual for specific information.)

With color bars as the source, adjust the input level of your VTR for 100% as shown on the VTR's video level meter. Observe the output of your timebase corrector with the waveform monitor and vectorscope (Test Point #3). Make the following adjustments on your time base corrector or video processing amplifier.

Luminance/Chrominance Adjustment

1. Adjust the setup control (also called black reference, black level – related to monitor brightness) to 7.5 **IRE** on the waveform monitor's scale. See Figure 9. Note that by adjusting setup you will affect the apparent brightness of the image on your monitors.

2. Adjust the video gain control (also called white level - 100 IRE, white bar, reference white – related to monitor contrast) to 100 IRE. See Figure 9. Note that by adjusting video gain you will affect the apparent contrast of the image on your monitors.

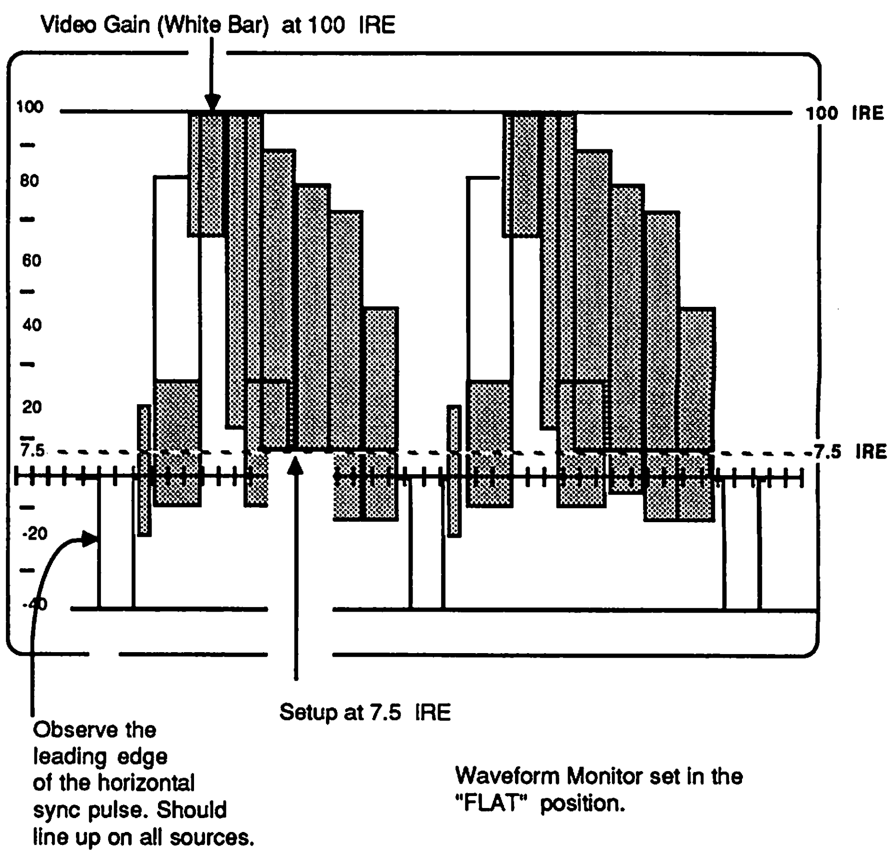


Figure 9. Adjustment of Setup and Video Gain On Waveform Monitor.

Note: the horizontal time relationship shown in Figure 9 is not intended to be an accurate representation.

3. Adjust phase (also called hue, burst phase, chroma phase, tint) so that the burst vector dot is aligned with the 75%/100% line on the vectorscope. The other vector dots which represent the various colors (YL=yellow, R=red, MG=magenta, B=blue, CY=cyan, G=green) should line up in relation to, though possibly not within, their respective boxes. See Figure 10.

4. Adjust chroma gain (also called chroma, color, saturation) so that the vector dots are centered in their six boxes. See Figure 10. If some vector dots will center in their boxes but others will not, compromise the settings.

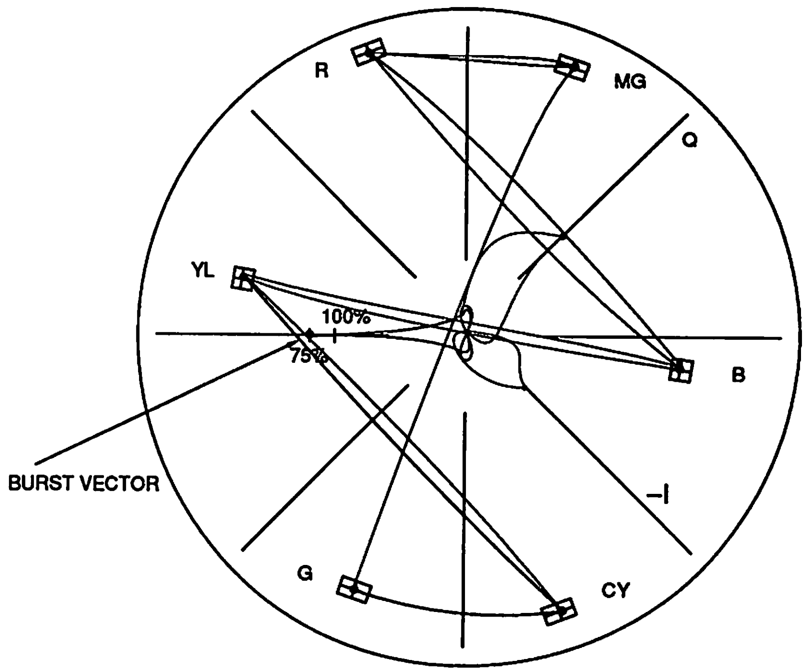


Figure 10. Adjustment of Burst Phase and Chroma Gain Using a Vectorscope

5. Now record about two minutes of bars onto a videotape. Play the tape back on the VTR being aligned and observe the waveform monitor and vectorscope. The images may be slightly less sharp, but should not differ greatly from those seen while in the "E-E" mode.

6. Repeat steps 3-5 above for each VTR in the system.

7. Repeat steps 3-4 above for other equipment in the system.

TIMING WITH COLOR BARS

The information which follows is not a complete explanation of timing but rather a brief summary intended to get you started. For detailed timing information consult the free GVG publication NTSC Studio Timing, available from your distributor.

Note

This section assumes that your video switcher is equipped for internal pulse regeneration. This may be a standard feature or an option. If your switcher is not so equipped, consider obtaining the option (if available) or using a GVG STM-85N or other source synchronizing generator in conjunction with your switcher. In this application, switcher "black" and "background" adjustments noted below would be performed on the source timing generator, not on the switcher. You may wish to consult your GVG representative or distributor for assistance before proceeding.

Free-Run Adjustments

1. Ensure that "blanking insertion" (if present in your video switcher) is turned OFF.

2. Connect your waveform monitor/vectorscope cable to Test Point #2 (Figure 8) and be sure that any video cables which might have been disconnected earlier have been properly re-connected to your video switcher.

3. Sequentially select each VTR, camera, etc. on the program bank of your video switcher, and observe the waveform monitor/vectorscope displays. If the images differ from those observed earlier at Test Point #3, consult the Problems and Solutions Table on Page 24. Horizontal shift of waveform display and rotation of the vector display are normal at this stage.

4. Select External Reference (EXT) as the locking source on your waveform monitor and vectorscope. Re-check to be certain that Color Black from your SCB-100N/SCB-200N is connected to the External Reference Input of each. (Some vectorscopes may require subcarrier instead of color black.)

5. Select color bars (from your SCB-100N/SCB-200N) on the program row of your video switcher. Using the H-Position knob on your waveform monitor, adjust the leading edge of Horizontal Sync (Figure 9) to a convenient reference point. Using the Phase knob on your vectorscope, adjust the display so that the burst vector is properly placed (Figure 10). You may wish to increase the gain of the vectorscope display so that the burst vector dot is close to the outer rim of the display. This will make later equipment adjustments simpler.

Note

From this point forward, do not adjust the H-position knob of the waveform monitor or the phase knob of the vectorscope unless directed to do so.

6. Now adust switcher Black and Background timing. Select Black or Background on the program bank of your video switcher. Using the switcher retiming controls (see switcher technical manual), adjust the leading edge of Horizontal sync and the burst vector dot to match the reference positions you established with Color Bars in step 5 above.

7. Select, in sequence, each additional local source (VTRs, Cameras, etc.) and adjust their timing controls to achieve Horizontal and burst vector matches as in Step 6 above. Do not attempt to adjust for any "distant" source at this time.

8. Return your vectorscope gain control to the calibrated position and, on the program bank of your video switcher, step through the sources you have timed to be certain none have been accidentally mis-adjusted.

9. *Omit this step if you are using an SCB-200N and plan to time for an outside source.* When satisfied with your results, turn blanking insertion back ON in your video switcher (if it is so equipped).

Gen-Lock Adjustment (SCB-200N Only)

Gen-Lock: A technique which permits referencing the local master synchronizing generator to outside equipment

1. Connect video from the distant source (satellite feed, network, etc.) to the **gen-lock** input of your SCB-200N and, using the loop-through connector, continue it on to your video switcher (Figure 6).

2. Remove the Color Black feed from the reference inputs of your waveform monitor and vectorscopes. Using a convenient length cable, connect distant source video from the loop-through input of the video production switcher to bring distant source video to the reference inputs of your waveform monitor and vectorscope (presumes a Tektronix 1740, 1750, or similar). If using a 7510 processing amplifier, you may wish to use one of its remaining three outputs instead of looping.

Note

Be sure that External Reference is selected as the locking source on both your waveform monitor and vectorscope.

3. Place the SCB-200N gen-lock switch in the ON position. Observe that both SCB-200N gen-lock indicators are illuminated. If they are not, observe the condition of the locking signal (video from the distant source) at the input of the SCB-200N. It is possible that the signal may temporarily not be present; it may be monochrome at the time of observation or may be in sufficiently poor condition as to require processing before it can be used. The GVG Model 7510 Video Processing Amplifier is recommended in this latter case.

4. With your waveform monitor and vectorscope still connected to Test Point #2, select the distant source on the program bank of your video switcher, and observe the images on both 'scopes. It is highly unlikely that you'll be fortunate enough to find color bars present when you want them. Therefore you'll need to rely upon the leading edge of H-sync and the burst vector dot on whatever video is currently present.

5. Adjust the H-position control of your waveform monitor to move the leading edge of horizontal sync to the reference position noted in earlier timing operations. Adjust the phase control of your vectorscope to rotate the burst vector dot to the reference position. THESE CONTROLS SHOULD NOT BE ADJUSTED AGAIN UNTIL TIMING IS COMPLETE.

6. Select local color bars on your video switcher. Note that the position of the display on both 'scopes has shifted. Since you have no control over the distant source, you must now adjust your system to match the new reference obtained in step 5 above. To do this, simply adjust the retiming controls (coarse, medium, fine, and vernier) on the front panel of your SCB-200N.

A. Observing the leading edge of Horizontal sync on your waveform monitor, begin adjusting the SCB-200N controls noted in step 6 above. Stop when you have brought the leading edge of H-sync to the reference position.

B. Observing the vectorscope display, use the SCB-200N vernier and fine retiming controls to bring the burst vector dot of the local color bars to the reference position.

Note

You may find it impossible to have both the burst vector dot and the leading edge of horizontal sync in precisely the right positions at the same time. In this case, get the burst vector dot right and ignore the horizontal sync position. The condition is the result of improper subcarrier to horizontal phasing at the distant source. You can't fix it from here and it will have negligible effect on your system, except in the most demanding edit situations – and not even then, if your video switcher is equipped for blanking insertion.

7. As a final check, quickly sequence through all your sources. You'll see that your entire system is in time. Now you may remove your waveform monitor and vectorscope from their test usage and return them to normal duty. You'll also wish at this time to turn blanking insertion back on in your switcher (if it is so equipped) and turn gen-lock off on your SCB-200N.

Remember that you'll have to turn gen-lock back on any time you wish to integrate a distant source into real time production – and it may be necessary to repeat the gen-lock adjustment steps above to accommodate changes occurring at the distant source.

PROBLEMS AND SOLUTIONS

The main principle to be kept in mind is that *different systems require different solutions*. Your studio will be much more complex than the one presented above. Here are some common problems that occur in timing studios.

Problem: Chroma level (chroma gain) is low but video level (video gain) is all right.
Analysis: Video cables >50 ft. may reduce the amount of chroma without reducing the level of video.
Solution: Either increase the chroma gain or use an equalizing distribution amplifier.

Problem: Chroma Phase is not correct.
Analysis: Long runs of video cable will change the phase of the chroma. Fifty feet of cable will bring about a 100° shift in phase.
Solution: Adjust the source timing to compensate.

Problem: Gain of both video and chroma is very high - about two-thirds of normal.
Analysis: The signal is "unterminated" or the gain of one of the preceding stages is set incorrectly. All video signal cables should be "terminated" by a resistive load of 75 ohms. This is accomplished internally in some equipment, or externally by use of 75 ohm terminating resistors that attach to the BNC connectors on your equipment.
Solution: Check the cable run carefully to ensure that there is one terminating resistor in place where the cable run ends. If the terminations are correct, check the gain of the equipment ahead of the trouble point.

Problem: Gain of both video and chroma is very low - perhaps one half of normal.
Analysis: The signal is "double-terminated" or the gain of one of the preceding stages is set incorrectly. All video signal cables should be "terminated" by only one resistive load of 75 ohms. This is accomplished internally in some equipment, or by use of 75 ohm terminating resistors that attach to the BNC connectors on your equipment.
Solution: Check the cable run carefully to ensure that there is one terminating resistor in place where the cable run ends. Be certain that the equipment at the end of the cable doesn't already contain a termination (check your operator's manual). If the terminations are correct, check the gain of the equipment ahead of the trouble point.

Problem: Lock indicators on SCB-200N won't light.
Solutions: 1. Is Gen-Lock switch ON? If not, turn it on.
2. Is a locking signal present?
3. What is condition of locking signal? A monochrome signal will light only the sync indicator. A low-level or badly distorted signal may make locking impossible. Consider use of a GVG 7510 Video Processing Amplifier to improve the signal.

ADJUSTING A MONITOR USING COLOR BARS

Brightness and Contrast Adjustments

Step 1. **Adjust Brightness** (a function of setup, black level, black reference) First preset the contrast control to mid-range.

Standard method: adjust brightness while watching the black set (PLUGE) so that the whiter-than-black bar is just visible and both the black and blacker-than-black bars are no longer visible.

Alternate method: adjust brightness until the black bar above black set in Figure 11 is completely black. Turn brightness level up until black bar is reasonably grey and then turn it back down again just to the point at which the black bar ceases to get any darker.

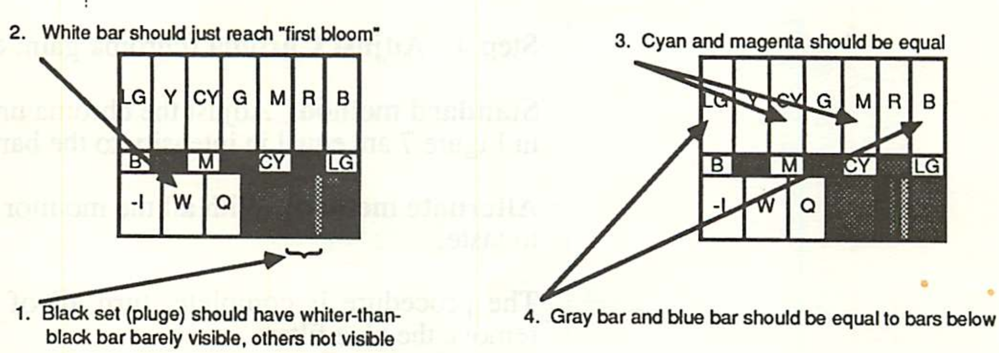


Figure 11. Adjusting A Color Monitor Using SMPTE Color Bars

Step 2. **Adjust Contrast** (an adjustment of video gain, white level, white bar, white reference)

Standard method: adjust the contrast until the white bar in Figure 11 is quite gray and then turn it up just to the point at which it just appears to change from gray to white. This is called "blooming of the whites" and it is important that contrast not be turned up past the "first blooming" so as to avoid distortion.

Color Adjustments

The standard method is to turn off the red and green guns on your monitor. Since monitors vary, this may be accomplished by a single switch for "blue", or you might need to individually turn off the red and green guns by means of switches. If there is no way to turn off the red and green guns, a blue filter can be placed over the monitor instead. If neither of these options is available to you, follow the Alternate Methods shown below.

Step 3. **Adjust Hue** (phase, chroma phase, tint)

Standard method: Adjust the hue until Figure 7's cyan and magenta bars are equal in intensity to the bars just below them.

Alternate method: with all the monitor colors on, adjust hue until the yellow bar (Y) is a lemon yellow, making sure that the magenta bar (M) is not red or purple.

Step 4. **Adjust Chroma** (chroma gain, color, saturation).

Standard method: Adjust the chroma until the grey bar and blue bar in Figure 7 are equal in intensity to the bars below.

Alternate method: With all the monitor colors on, adjust flesh tones to taste.

The procedure is complete: turn all of the color guns back on or remove the blue filter.

HOW TO USE THE AUDIO TONE

An audio tone is typically placed on tape leaders along with color bars in order to allow for setting of proper audio levels for editing and playback. The information below relates to monaural tone provided by the SCB-100N. Stereo tone is provided by SCB-200N; its use is very much like that of monaural tone except that it is fed to left and right channels, effectively doubling the number of audio paths in use. The tone provided by SCB-200N includes an audible identifier in the left channel to make it simple to check system phasing. When your system installation is complete, you may wish to turn off the left-channel identifier. This is accomplished by changing a jumper position inside the SCB-200N. Consult your technical manual if you wish to do this.

BASIC USE OF AUDIO TONE

Figure 12 illustrates a basic method of using the SCB-100N audio tone with your equipment. Simply connect the audio tone output to the audio input on your recording VCR. When color bars are being placed on your tape leaders, include an audio tone at the same time. Be certain to adjust the audio input level control on your VTR to indicate 100% on the audio meter.

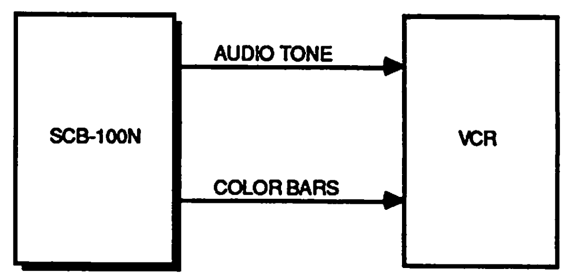


Figure 12. Basic Use Of Audio Tone

USE OF AUDIO TONE WITH AN AUDIO MIXER

A more sophisticated audio system might use the audio tone generator as an input to an audio mixer as shown in Figure 13. Levels into and out of the mixer could then be calibrated.

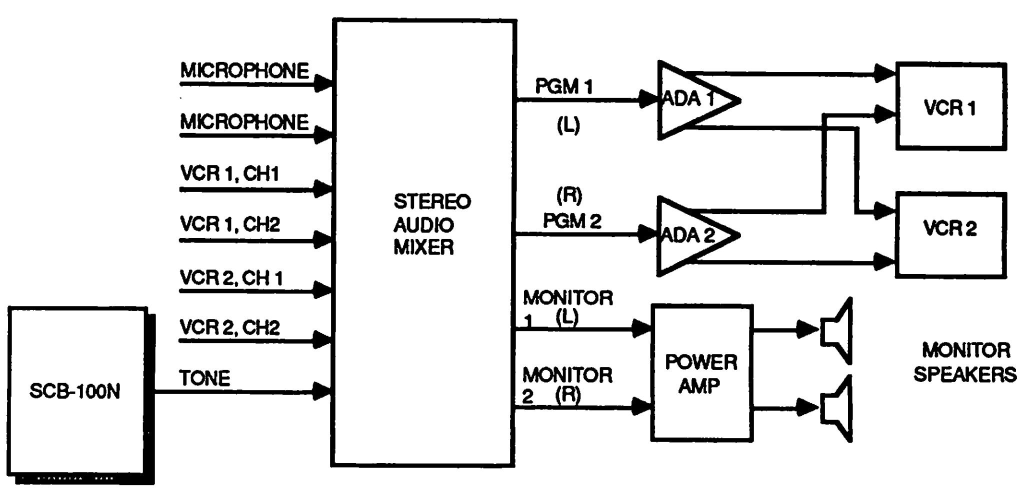


Figure 13. Use Of Audio Tone With Mixer

Glossary of Terms

Brightness: Overall DC (direct current) voltage level of the video signal. Brightness control is an adjustment of setup (black level, black reference).

Camera Control Unit (CCU): Remote control device for video camera usually placed in the editing suite. Controls usually include video levels, color balancing, and iris control.

Character Generator (CG): Device that allows you to generate text for use in video productions.

Chroma Gain (chroma, color, saturation): The voltage levels of the colors. How intense the colors of the active picture are.

Chrominance: The chrominance component of the video picture information which includes burst phase (hue) and chroma gain (saturation). The video picture information contains two components: luminance (brightness and contrast) and chrominance (hue and saturation)

Color Bars: A picture containing bands of color with fixed amplitudes and saturations, together with white and black references.

Color Black: A video signal that contains horizontal, vertical, and color synchronizing information. Known as composite video, color black produces a black screen when viewed on a video monitor.

Contrast: The range of light-to-dark values of the image which are proportional to the voltage difference between the black and white voltage levels of the the video signal. The contrast control is an adjustment of **video gain** (white bar, white reference).

Distribution Amplifier (DA): Device used to multiply (fan out) a video signal. May also include delay and/or cable equalization capabilities.

E-E Mode: The mode obtained when the VTR is set to record but the tape is not running. This stands for "electronics to electronics" and means that the VTR is processing all of the signals that it would normally use during recording and playback, but without actually recording onto the tape.

Encoded Subcarrier: A reference system created by Grass Valley Group to provide exact color timing information.

Fill: The video information that fills the "hole" cut in the video picture by the key signal.

Gen-lock: A technique which permits referencing the local master synchronizing generator to outside equipment.

Hue (tint, phase, chroma phase): The "tint" of the colors themselves.

IRE: Units of measurement dividing the area between the bottom of sync and white level into 140 equal units. 140 IRE equals 1 Volt peak-to-peak. IRE stands for Institute of Radio Engineers.

Key: A signal that can electronically "cut a hole" in the video picture to allow for insertion of other elements such as text or a smaller video picture (smaller video pictures are keyed into the larger picture a great deal on the news).

Loop-through: A video signal entering a piece of equipment is returned to the outside world for further use. Loop-through circuitry requires careful design to prevent signal degradation.

Luminance: The luminance component of the video picture information which includes setup but does not include color information. The video picture information contains two components: luminance (brightness and contrast) and chrominance (hue and saturation).

Mix: (dissolve, crossfade) A transition between two video signals in which one signal is faded down as the other is faded up.

Phase (chroma phase, hue, tint): The phase of the colors can be adjusted and this changes the "hue" or "tint" of the colors themselves.

Retiming: Adjustment of a local synchronizing generator which has been locked to a distant source. This permits the local facility to use the distant source in real-time production through a video switcher.

Saturation (chroma, chroma gain, color): The voltage levels of the colors. How intense the colors of the active picture are.

SC/H Phased or Timed: The phase or time relationship of the subcarrier to (the leading edge of) horizontal sync. The definition of horizontal sync and more about SC/H phase is found in the booklet NTSC Studio Timing.

Setup: The specified base of the active picture signal which is at reference black level. Called "setup" because it is placed 7.5 IRE units above blanking (zero IRE). Setup is related to the **brightness** of the video image.

SMPTE: Society of Motion Picture and Television Engineers (which set standards).

Source: Video producing equipment such as cameras, tape recorders, graphics or character generators.

Source Timing Modules: A synchronizing generator on a module that is used to adjust the timing of a specific piece of source equipment. It is kept in time by a reference sync pulse generator.

Subcarrier (SC): A continuous sine wave, of extremely accurate frequency, used by source equipment to encode the color information into the video signal. The subcarrier has a frequency of 3.579545 MHz, and is often referred to simply as "3.58." (A sample of this subcarrier is included during horizontal blanking and is called color burst.)

Sync Generator (sync pulse generator, SPG): Device that generates synchronizing pulses needed by source equipment.

Sync Pulse: Sync pulses are simply timing pulses added to a video signal to keep the entire video process synchronized in time.

Tearing: a lateral dispacement of the video lines due to sync instability. Visually it appears as though parts of the images have been torn away.

Time Base Corrector: Device used to stabilize the timing of a tape machine so it will match other sources.

Video Switcher (switcher, production switcher, video mixer): Device that allows transitions between different video pictures. May also contain special effects generators; these manipulated the video picture into interesting patterns and shapes.

Video Gain: Expressed on the waveform monitor by the voltage level of the whitest whites in the active picture signal. Defined as the range of light-to-dark values of the image which are proportional to the voltage difference between the black and white voltage levels of the the video signal. Video gain is related to the **contrast** of the video image.

Wipe: A transition between two video signals that occurs in the shape of a selected pattern.

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Grass Valley Group®

A TEKTRONIX COMPANY

THE GRASS VALLEY GROUP INC.

P.O. Box 1114, Grass Valley, CA 95945 USA
Telephone (916) 478-3000
TRT: 160432