HORITA TSG-51

NTSC Test Signal Generator

USER MANUAL

For Models TSG-51, RM-50/TSG-51, SR-50/TSG-51

Doc. 073162
Rev. B

HORITA®

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1 GENERAL

The TSG-51 provides an economical means of obtaining high quality composite video test and alignment signals and patterns. The TSG-51 generates twenty four computer calculated and digitally synthesized test signals, including black burst, SMPTE color bars, frequency sweep, NTC-7 composite and others.

The TSG-51 also provides a 1KHz/400hZ audio tone output, composite sync, and a color Field-1 reference pulse, plus other optional user selectable signals.

The wide range of signals available from the TSG-51 allows it to be used in a variety of applications to perform checks, measurements, tests, adjustments, and alignments of composite video equipment and distribution paths. These include measuring gain, equalization and luminance-chrominance delays, checking video monitor convergence, gray scale tracking, hue, saturation, purity, adjusting composite video transmitter power and response, etc.

When used with a video distribution amplifier, the TSG-51 can serve as an excellent "house sync" generator in a video editing or production system to synchronize operation of various video switchers, special effects generators, VCRs/VTRs, cameras, monitors, video edit controllers, video titlers, time-base correctors and frame stores, SMPTE time code, and other types of professional video equipment.

An added feature of the TSG-51 is an internal 30/60 second timer which switches the video output to black and the audio output to silence after the preset time has elapsed.

And, because it can operate from batteries, the TSG-51 can also be used in portable situations in the field.

2 FEATURES

* Generates 24 composite video test signals and patterns consisting of:

  Black burst signal at 7.5-IRE and 0-IRE
  Full Field and SMPTE split-field color bars
  White, Red, Green, and Blue flat fields
  Multiburst and 0.5 to 5MHz frequency sweep (with markers) signals
  NTC-7 Composite and Combination signals
  FCC Composite signal
  5-Step and 10-Step modulated and un-modulated staircase signal
  Modulated and un-modulated ramp signal
  Pulse-and-Bar with Window signal
  Safe Area pattern
  17H x 14V Crosshatch pattern with center/safe markers
  Monitor and Transmitter test matrix signals

* Front panel rotary switch and toggle switch for quick selection of video test signals.
* Generates 0dB 1KHz audio tone or optional user selectable 400Hz tone.
* Generates -4 Volt composite sync and 15Hz color reference frame timing pulse or optional user selectable 59.94 field rate square wave signal.
* Video signals generated by the TSG-51 are in accordance with the industry standard EIA RS-170A video timing specification.
* Fully RS-170A SC/H phased and always correct. Never needs adjustment.
* Full-field color bars conform to EIA RS-189A specifications for video levels and colors.
* SMPTE color bars conform to SMPTE specification EG-1-1990.
* A unique feature of the TSG-51 is the automatic timer. The timer switches the TSG-51 from the selected pattern to black-burst after a delay of 30 or 60 seconds following activation of the front panel timer switch. This feature is especially convenient for "pre-striping" a video tape with SMPTE time code and with a video leader consisting of color

bars followed by black for the remainder of the tape.

* Operates from a small AC power adapter, which is included, or can be operated from 9-to-14 volts DC battery power for use in the field.
* Available: Desktop (TSG-51), Rackmount (RM-50/TSG-51), or Shortrack (SR-50/TSG-51).

3 CONNECTING

3.1 Connecting Power

Included with your TSG-51 is an AC power adapter that provides a 9 volt, 500 milliamperes DC output. This adapter is equipped with a miniature phone plug with the "+" (positive) voltage output connected to the front tip of the plug.

Insert the power plug into the TSG-51 "+9V POWER" connector and plug the adapter into 110-120 volt, 60-Hz AC power.

WARNING

ELECTRICALLY OPERATED PRODUCT

As with all electrical products, precautions should be observed during handling and use to prevent electrical shock.

NOTE

Make sure the plug is inserted all the way into the power connector or else damage to the power adapter may result. The TSG-51 has internal protection circuitry to prevent it from being damaged should the wrong polarity of power be applied. However, do not use an adapter of more than 9 volts at 500 milliamperes or damage to the TSG-51 may result.

3.2 Operating From Battery Power

You can operate your TSG-51 from battery power in order to use it in the field as a portable color bar, video test signal, or sync generator.

The TSG-51 can be operated from 9-to-14 volts DC, obtained either from a conventional 12 volt video camera battery, or from the HORITA BP-50 12 volt battery pack. The BP-50 consists of eight rechargeable AA sized batteries, battery holder, power cable, heavy duty cloth case with nylon strap, and convenient wall-type overnight re-charger with LED.

3.3 Connecting The Output Signals

NOTE

As with other video equipment, the TSG-51 VIDEO OUT and SYNC OUT signals need to be terminated by a single 75-Ohm termination in order to provide proper levels to your system.

3.4 Video Out

Color bars and black-burst are examples of common composite video signals. Composite video is a combination of several signals made into one. It contains the picture's black and white information, called luminance, color information, called chrominance, and timing information, called horizontal and vertical sync and blanking. It is nominally a 1 Volt peak-to-peak signal.

Connect the TSG-51 VIDEO OUT signal to your video equipment as determined by the requirements of your system. In general, the VIDEO OUT signal is for equipment with composite video inputs, usually labeled "VIDEO IN", REF VID", "GENLOCK", etc.

3.5 Sync Out

Composite sync is -4 Volt pulse signal made by combining horizontal and vertical sync into one signal. It does not provide luminance, chrominance, or blanking information.

The TSG-51 SYNC OUT signal is for composite sync inputs, usually labeled "EXTERNAL SYNC IN", "EXT SYNC", etc.

3.6 Ref. Frame Out

The Reference Frame output signal is a positive pulse that occurs once every four fields. It is timed to start at the beginning of Field-1 of the standard RS-170A four field sequence and can be used to trigger test equipment.

3.7 Audio Out

The 1KHZ single ended audio tone output level is 0dB, (approximately 776mV RMS or 2.19 volts peak-to-peak), and is for equipment audio inputs usually labeled "LINE IN", "AUDIO IN", "AUDIO LINE IN". etc.

3.8 Connecting to Multiple Video Equipment

The are two methods of connecting the TSG-51 to multiple video inputs: by using "loop-through" or "T" connectors, or by using a video distribution amplifier .

3.9 Using a Video Distribution Amplifier

To use the TSG-51 with a video distribution amplifier (DA or VDA) connect the desired TSG-51 output to the input of the DA and terminate it. Use a video DA for the TSG-51 VIDEO OUT signal and a pulse DA for the SYNC OUT signal. Connect the outputs from the DA to each of the components of your video system as required, making sure each DA output is terminated only once.

3.10 Using Loop-Through or "T" Connectors

The single video (or sync) output of the TSG-51 can operate two or more video units without the need of a distribution amplifier if the equipment can be connected to present only one 75-Ohm terminating load to the TSG-51 output.

Some video equipment has an internal termination which can be connected or disconnected by way of a switch, usually labeled "TERM ON/OFF", "75-OHM/HI-Z", or equivalent. This is the most versatile. Other video equipment may have no terminator and needs to be externally terminated. This is the next most versatile. The least versatile is equipment having internal termination that is always connected and cannot be disconnected. This is the most common.

If your video equipment has two BNC video connectors for video "loop-through", connect the TSG-51 video output to one of the connectors and switch the terminator off. Next, route the video signal from the looping BNC connector to the input of the next piece of equipment. Repeat this process until all video equipment is connected. Then, on the last unit in line, switch the termination on.

For equipment that does not have looping connectors, use "T" connectors at the input of each piece of video equipment to provide the necessary video in/out connections.

When you have a single piece of equipment with a terminator that cannot be switched off, use it as the last piece of equipment in the line, if possible. If you have multiple pieces of video equipment with terminators that cannot be switched off, you must use a distribution amplifier.

If none of your equipment has terminators, install a 75-Ohm BNC type external terminator at the loop-through output (or T connector) of the last piece of equipment.

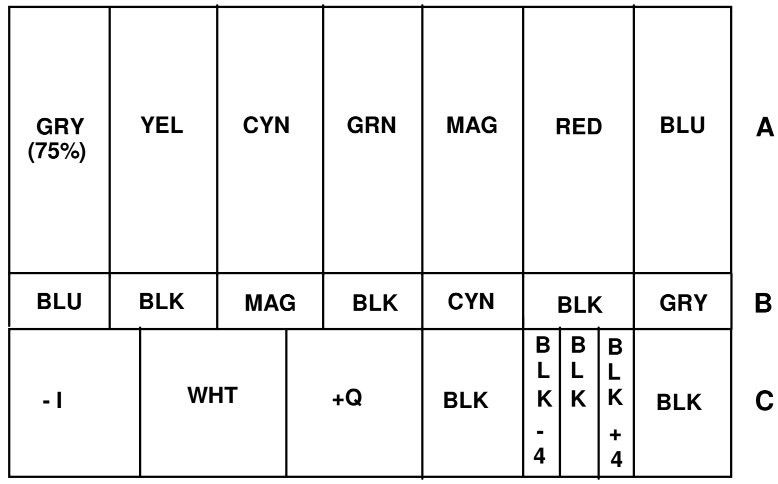
4 OPERATING

To operate the TSG-51 simply connect the desired output signals, apply power and set the POWER switch to ON. A red LED above the power switch (or on the front panel of Rackmount or Shortrack models) lights when the TSG-51 is powered up.

4.1 Selecting the Pattern

The 12 position PATTERN switch, in combination with the 2-position toggle switch, allows selection of the desired signal or patterns for output on the VIDEO OUT BNC connector. The toggle switch operates to select either the white or yellow named signals on the rotary switch. The composite SYNC OUT signal is continuously output regardless of which video pattern is selected.

Although it is not possible to go into detail on all of the patterns provided by the TSG-51, the color bar signals are described in more detail because of their wide general use.



A. Full Field Color Bars on top half of SMPTE Bars
B. Chroma Set Pattern (Reverse Blue)
C. Black Set Pattern (IYQB)

Figure 4-1, SMPTE Color Bars

4.2 Full-Field Color Bars

Full-field color bars consist of a full-field of the color bar portion (top half) of the standard split-field EIA RS-189A color bar pattern, as shown in "A" of Figure-1.

4.3 SMPTE Color Bars

SMPTE color bars consist of the standard split field EIA RS-189A color bar pattern with the addition of special chroma set (Reverse Blue) and black set (IYQB) patterns as shown in Figure-1.

4.4 Monitor Adjustment Using SMPTE Color Bars

The chroma set color bar pattern is used to adjust monitor hue and intensity and the black set pattern is used to adjust brightness and contrast, as described in the following paragraphs.

4.5 Color Hue and Intensity Adjustment

To adjust color hue (phase) and intensity (gain) using SMPTE color bars requires a video monitor that permits the monitor's red and green to be switched off in order to display four blue bars on the top half of the bar display.

1. Switch off the monitor's red and green so only blue bars are displayed and adjust the monitor's color intensity control to match the intensities of the outer blue bars with the chroma set bars just below them.
2. Adjust the monitor chroma hue control to match the intensities of the inner blue bars with the chroma set bars just below.

4.6 Brightness and Contrast Adjustment

To correctly set monitor brightness and contrast, adjust the controls so that the whiter-than-black bar (BLK +4) is visible but the blacker-than-black bar (BLK -4) is not.

4.7 Operating the 30/60 Second Timer

The thirty or sixty second timer is started whenever the TSG-51 TIMER switch is set to 30-SEC or 60-SEC respectively. The timer causes the VIDEO OUT signal to change from the selected pattern to black after the indicated time has elapsed. The pattern is again selected whenever the TIMER switch is set to the center OFF position.

It should be noted that the change from the selected pattern to black (or black to the selected pattern) takes place during the vertical interval for no disturbance to the video signal.

4.8 Using the Timer to Stripe Tapes With Color Bars, Black, & Time-Code

The TSG-51 timer allows you to conveniently pre-stripe video tapes with SMPTE timecode and a video leader consisting of color bars followed by black for the remainder of the tape.

For example, to use the TSG-51 with a HORITA TRG-50 SMPTE time code generator, connect them as shown in Figure-2. Power up the TSG-51 and select the desired color bar pattern.

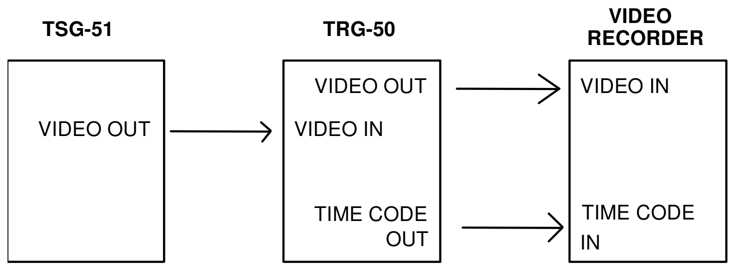


Figure 4-2, Pre-Striping Tapes

To use the 30/60/90/120 second automatic back-time feature of the TRG-50, power it up while holding the RDR/GEN/SET switch in the SET position. When the window display shows one minute (00:01:00:00), release the RDR/GEN/SET switch to the GEN position and the TRG-50 will immediately back-time the generators start time to "23:59:00:00".

When ready to start the recording, place the video recorder into record mode, set the TSG-51 TIMER to 30-SEC, then momentarily switch the RDR/GEN/SET switch to GEN and release, starting the TRG-50 time code generator. Adjust time code recording levels as necessary.

After thirty seconds the video will change from color bars to black, then after another thirty seconds the time code will roll through 00:00:00:00 time. 00:00:00:00 time is generally the "IN time" of the first edit on the tape if it is later used as an edit master.

4.9 Option Jumpers and Selecting Options

Refer to the paragraphs titled "Accessing Adjustments" to gain access to the option jumpers for your particular TSG-51 model.

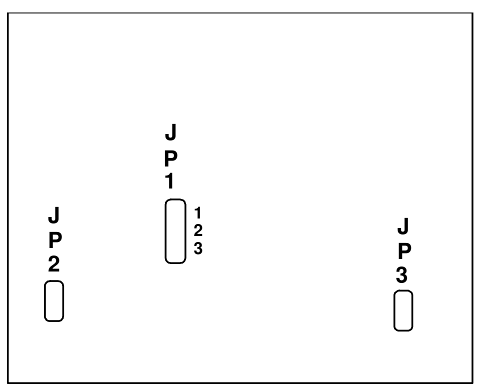


Figure 4-3, Option Jumper Locations

4.10 Selecting 400Hz Audio Tone

The TSG-51 audio tone frequency can be changed from 1Khz to 400Hz or 400 Hz to 1Khz by way of jumpers installed on the main circuit board. This jumper information is also screened on the circuit board.

NOTE:

After changing frequencies, it is recommended that the audio tone amplitude be checked as described in the "Performance Checks and Calibration" section of this manual.

1. Gain access to the TSG-51 option jumpers.
2. Referring to Figure-3, remove the shorting jumpers from across the two pins on both JP2 and JP3. Replace the jumpers such that they are on only one of the pins, and are not shorting the pins together. This provides storage for the jumpers.
3. The audio tone will now be at 400 Hz. To change back to 1Khz, connect the jumpers so that they again short the two pins together on JP2 and JP3.

4.11 Selecting 59.94Hz Output

The "REF FRAME OUT" signal can be changed to a field rate square wave signal by changing jumper positions on the main circuit board.

1. Gain access to the TSG-51 option jumpers.

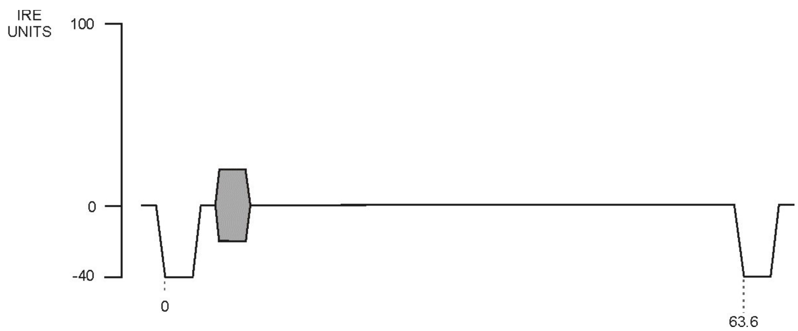
2. Referring to Figure-3, remove the shorting jumper from across pins 1 and 2 of JP1 and connect to pins 2 and 3.

3. The REF FRAME OUT signal will now be a 59.94 Hz field rate square wave signal. If the REF FRAME OUT signal is desired, connect the shorting jumper across pins 1 and 2 of JP1.

5 Test Pattern Specifications and Uses

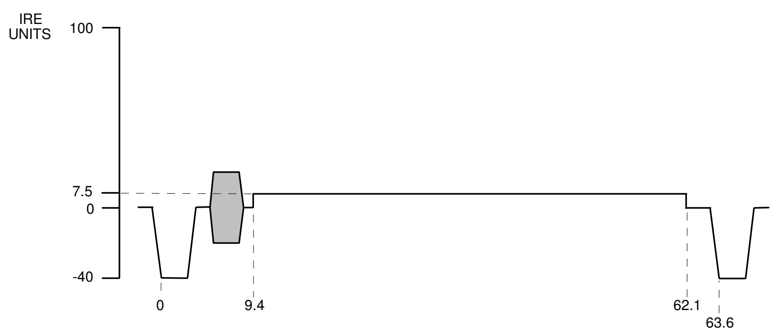
5.1 0 BLACK, 7.5 BLACK

Black Burst, also referred to as Blackburst, Color Black or Crystal Black, is used for synchronizing video equipment, pre-striping (blacking) tapes, and performing noise measurements. 0 Black has a 0 IRE setup (black) level, 7.5 Black, the standard in the USA, has a 7.5 IRE setup level.



Setup Level: 0 IRE
P-P Amplitude: 60 IRE (428.57mV)

Figure 5-1, Black Burst, 0 IRE

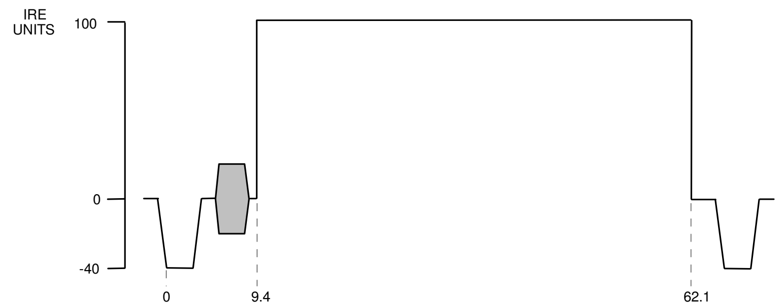


Setup Level: 0 IRE
P-P Amplitude: 60 IRE (428.57mV)

Figure 5-2, Black Burst, 7.5 IRE

5.2 WHITE

100 IRE White Field. The 100 IRE white field has uses for monitor purity checking and white balance adjustment and tracking, gain checks of video distribution paths, and transmitter power measurements.



P-P Amplitude: 140 IRE (1 Volt)

Figure 5-3, 100 IRE White Field

5.3 FULL

Full Field EIA RS-189A Color Bars. Color bars are used for general amplitude and timing measurements. They are the most widely available signal used in all aspects of system setup and testing. EIA color bars are also used in the top half of the SMPTE Color Bars signal/pattern.

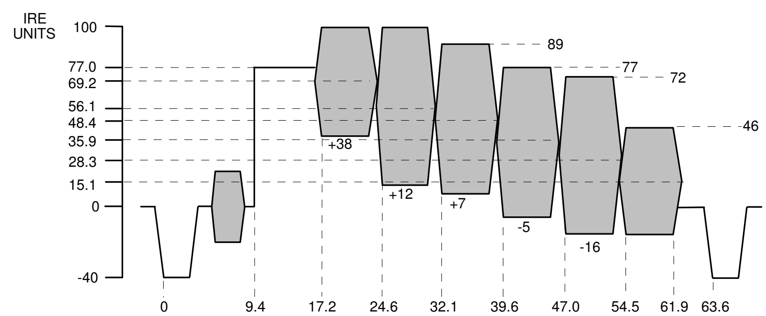


Figure 5-4, Full Field Color Bars, SMPTE Bars Top Portion

5.4 SMPTE

SMPTE EG-1-1990 Color Bars. SMPTE bars are a "split field" color bar signal/pattern with the top portion the same as EIA color bars. The lower portion chrominance and luminance bars add patterns for visually setting brightness, contrast, hue, and saturation levels on color monitors.

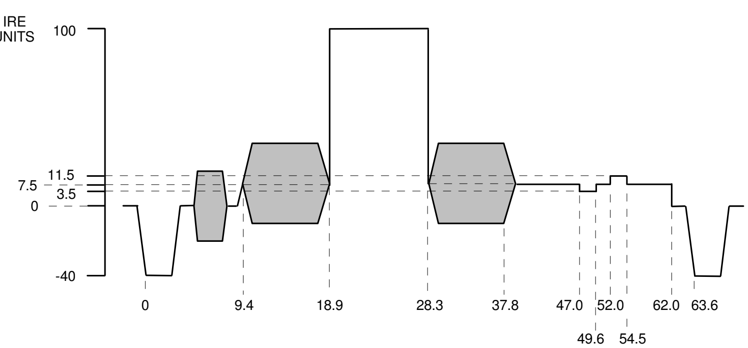


Figure 5-5, SMPTE Color Bars, Lower Portion IYQB

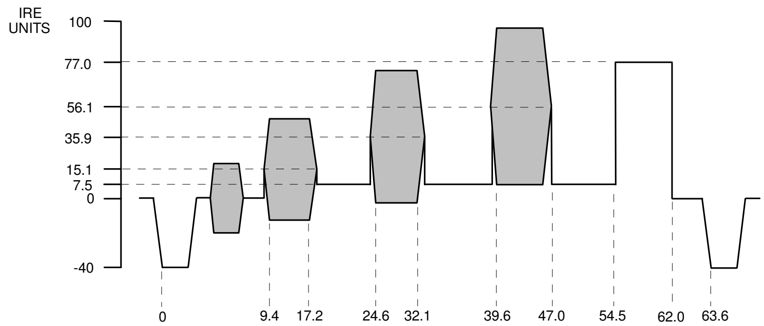
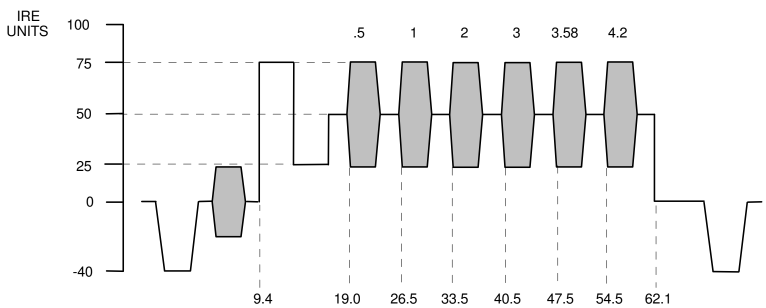


Figure 5-6, SMPTE Color Bars, Lower Portion Reverse Blue

5.5 MULTI

Multi Burst of Frequencies. Multiburst contains packets of six different frequencies for checking basic luminance and chrominance frequency response of various equipment and distribution paths, as well as checking video monitor horizontal resolution.

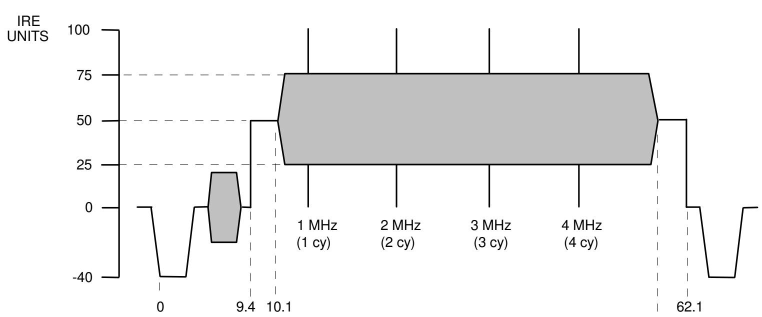


Reference Amplitude: 100 IRE ±1 IRE
Burst Frequencies: 0.5, 1, 2, 3, 3.58, and 4.2 MHz
Packet Amplitudes: 50 IRE (25-75 IRE)
Packet Matching Error: <2% (1 IRE)
Packet Rise time: 0.5 MHz 140 nS, all others 400 nS.

Figure 5-7, Multiburst

5.6 SWEEP

Frequency Sweep. Frequency Sweep is a continuous sweep of frequencies within the video baseband range and provides for detailed frequency response testing of luminance and chrominance distribution paths as well as checking video monitor horizontal resolution. This signal also contains four embedded markers for identification of four specific frequencies within the continuous sweep.

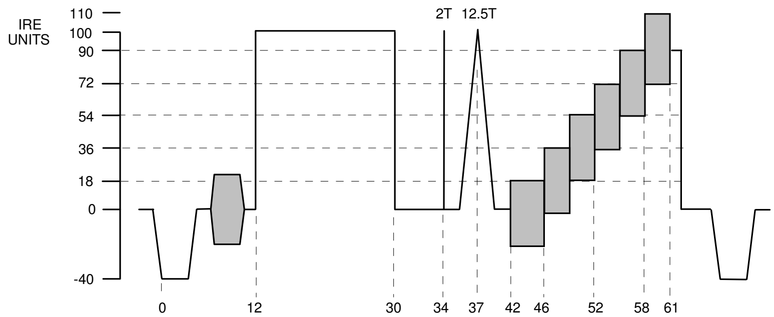


Sweep Range: 0.5 to 5 MHz
Sweep Amplitude: 50 IRE (25-75 IRE)
Sweep Amplitude Error: <2% (1 IRE)
Markers: Cycle count markers at 1, 2, 3, and 4 MHz points
Marker Amplitude: 100 IRE

Figure 5-8, Frequency Sweep

5.7 NTC7 CP

NTC-7 Composite. This signal contains various signal elements for performing amplitude, phase, chrominance-luminance delay, and some distortion measurements of studio and video distribution paths. The rise time of some components is to fast for transmitter testing

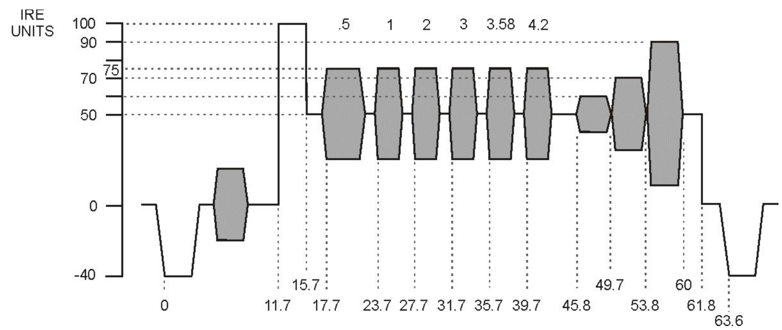


White Bar Amplitude: 100 IRE
2T Pulse HAD: 250 nS ±25nS
2T Pulse Ringing: <2% peak
Chrominance Phase: -180° (same as burst)
12-1/2 T Pulse Phase: 60°

Figure 5-9, NTC-7 Composite

5.8 NTC7 CBN

NTC-7 Combination. This signal contains multiburst and a modulated pedestal for frequency response and distortion tests of video distribution and transmission paths.

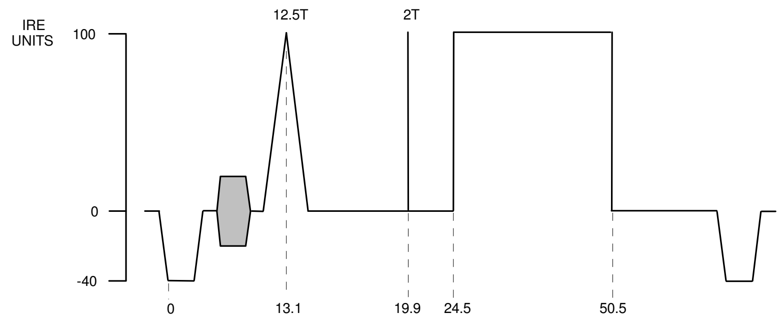


White Bar Amplitude: 100 IRE
Chrominance Phase: -180° (same as burst)

Figure 5-10, NTC7 Combination

5.9 PUL/BR

Pulse and Bar with Window. This signal is used for amplitude, timing, and distortion measurements. Modulated pulse portion tests chrominance-to-luminance gain and delay. Window portion tests monitor DC restoration and scan distortion.

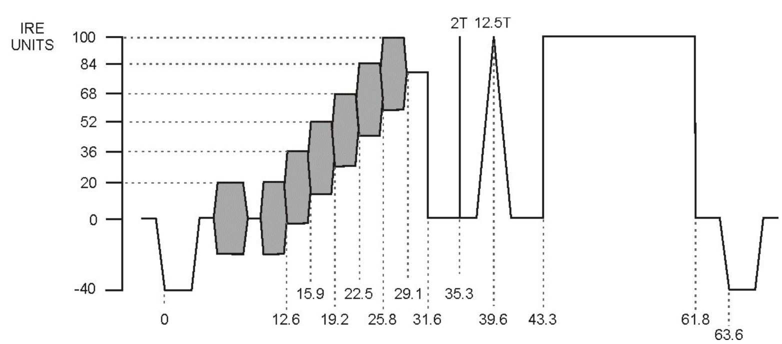


2T Pulse HAD: 250 ±25nS	2T Pulse Ringing: <2% peak
12-1/2 T Pulse Phase: 60°.	White Bar Amplitude: 100 IRE
Window Timing: Lines 72 to 202	Field Tilt: <.5%, Line Tilt: <.5%

Figure 5-11, Pulse and Bar with Window

5.10 FCC CP

FCC Composite. NTC-7 Composite. This signal has the same uses as the NTC-7 Composite signal for performing amplitude, phase, chrominance-luminance delay, and some distortion measurements, but has slower rise times suitable for transmitter testing.

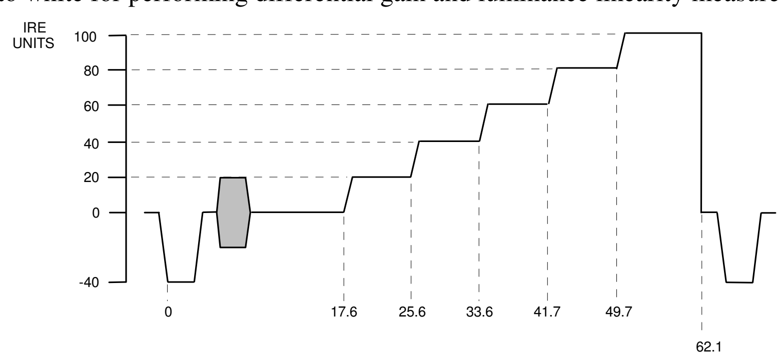


White Bar Amplitude: 100 IRE
12-1/2 T Pulse Phase: 60°
Chrominance Phase: -180° (same as burst)

Figure 5-12, FCC Composite

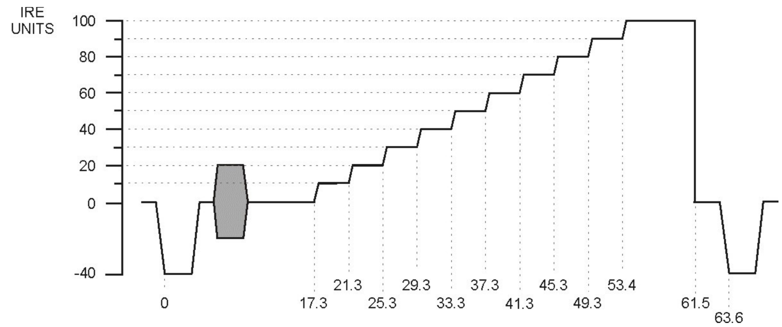
5.11 5-STEP, 10-STEP

5-Step and 10-Step Luminance Gray Scale. These signals are an un-modulated (no chrominance) luminance staircase of 5 or 10 steps from black to white for performing differential gain and luminance linearity measurements.



Maximum Amplitude: 100 IRE
Step Amplitude: 20 IRE Step
Step Matching Error: <1% (Linearity Error)

Figure 5-13, 5-Step Luminance Staircase

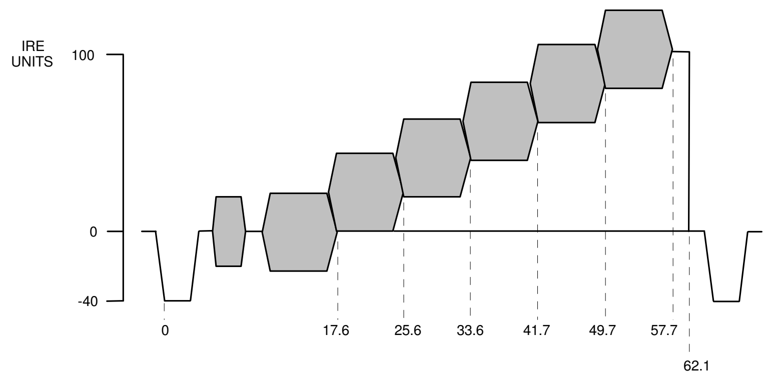


Maximum Amplitude: 100 IRE
Step Amplitude: 10 IRE Step
Step Matching Error: <1% (Linearity Error)

Figure 5-14, 10-Step Luminance Staircase

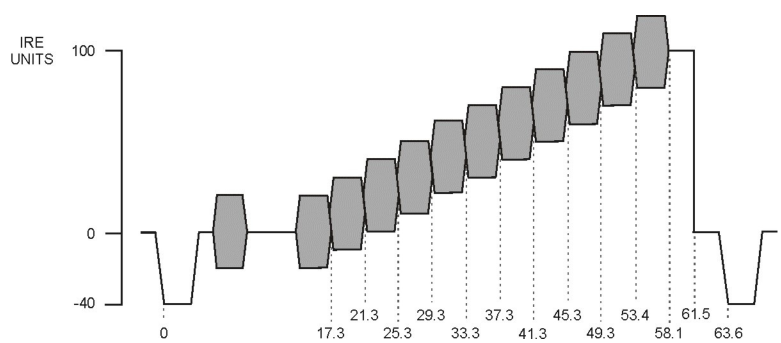
5.12 MOD-5, MOD-10

5-Step and 10-Step Staircase with Chroma Modulation. These signals have the same luminance uses as the 5-STEP and 10-STEP, but the chroma modulation allows measurement of differential gain and phase.



Luminance amplitude and linearity error same as 5-Step
Chrominance Amplitude: 40 IRE
Chrominance Phase: -180° (same as burst)
Diff Gain Error: 1.5% maximum
Diff Phase Error: 1.5° maximum

Figure 5-15, 5-Step Modulated Staircase



Luminance amplitude and linearity error same as 10-Step
Chrominance Amplitude: 40 IRE
Chrominance Phase: -180° (same as burst)
Diff Gain Error: 1.5% maximum
Diff Phase Error: 1.5° maximum

Figure 5-16, 10-Step Modulated Staircase

5.13 RAMP LUMA, RAMP MOD

Modulated and Un-modulated Ramps. These signals have the same uses as the un-modulated and modulated stair step signals, but provide a finer visualization and resolution of differential gain and phase measurements.

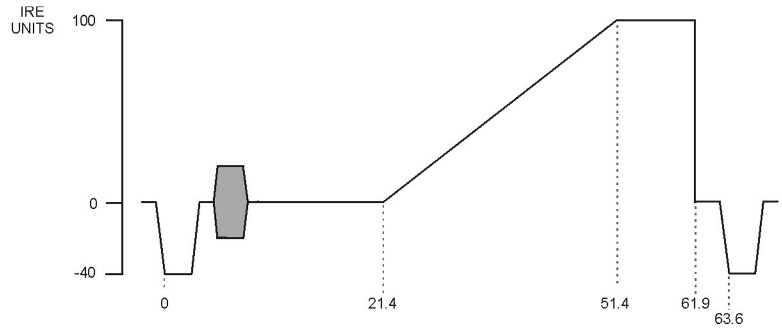
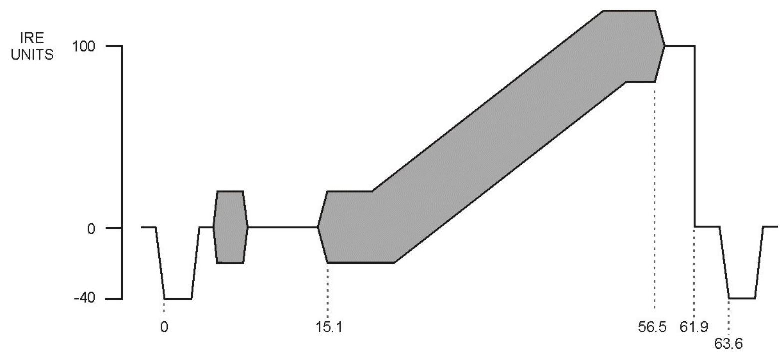


Figure 5-17, Luminance Ramp

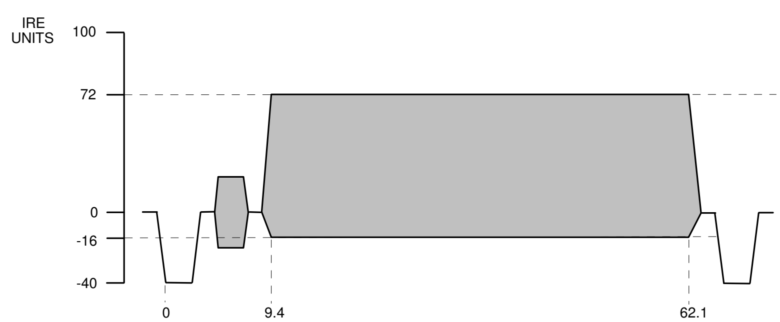


Chrominance Phase: -180° (same as burst)

Figure 5-18, Modulated Ramp

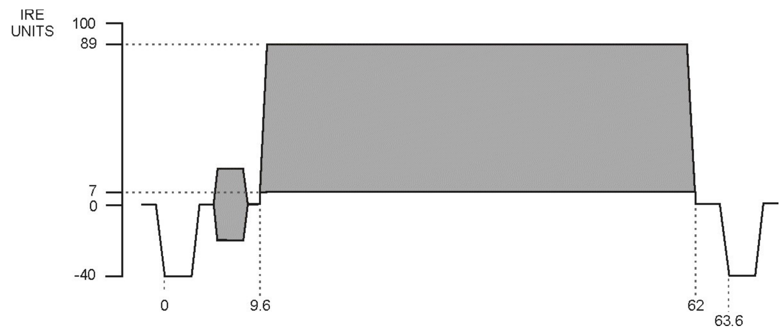
5.14 RED, GREEN, BLUE

Red, Green, and Blue Fields. These primary color fields are generally used for performing monitor purity checks and adjustments.



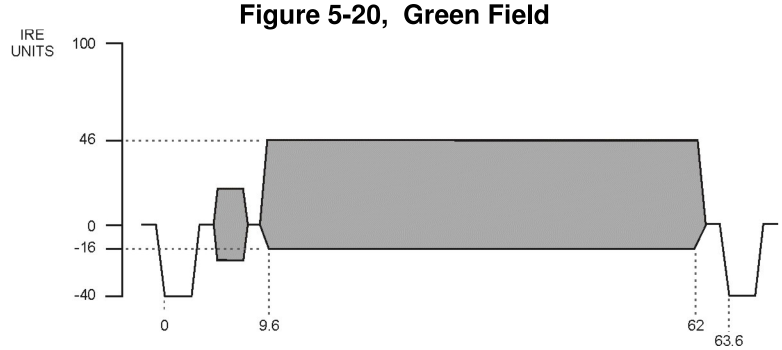
Luminance Amplitude:	28 IRE
Chrominance Amplitude:	88 IRE
Chrominance Phase:	104°

Figure 5-19, Red Field



Luminance Amplitude: 48 IRE
Chrominance Amplitude: 82 IRE
Chrominance Phase: 241º

Figure 5-20, Green Field



Luminance Amplitude: 15 IRE
Chrominance Amplitude: 62 IRE
Chrominance Phase: 347º

Figure 5-21, Blue Field

5.15 CONVG

Convergence Crosshatch. This horizontal and vertical crosshatch pattern is used for checking and performing video monitor static and dynamic convergence adjustments. Dark markers at 90% point of the scanned image define SMPTE RP 27.3 "safe action" area. this pattern also has a center dot and center H and V lines.

Amplitude: 77 IRE
Pattern: 13 horizontal (with equivalent 14H spacing) and 17 vertical lines per field
Pulse HAD: 225 nS ±25 nS

5.16 SAFE

Sate Action and Safe Title Reticule.
Amplitude: 77 IRE
Pattern: Safe Title/Action markers at 80%/90% of scanned image
Pulse HAD: 225 nS ±25 nS

5.17 MON MTRX

Monitor Matrix. The monitor matrix is a combination of monitor test and adjustment patterns for observing overall monitor performance.

Matrix sequence: Convergence
Multiburst
5-Step
NTC-7
Convergence
SMPTE bars
Convergence

5.18 XMT MTRX

Transmitter Matrix.. The transmitter matrix is a combination of signals for transmitter test and adjustment and for observing overall transmitter operation. Each signal has a vertical duration of 40 lines.

Matrix sequence:	NTC7 Composite 100% White Field 10-Step Modulated 0 IRE Black FCC Composite Black Sync (0 IRE, No Burst)

Figure 5-22 Transmitter Matrix Black Sync, 0 IRE, No Burst

5.19 General Specifications and Timing

Signal Characteristic	Performance Specification	Measurement Information
Luminance Amplitude Accuracy	±1% of 100 IRE	
Chrominance Luminance Gain	±2% of 100 IRE	Multiburst White Flag-to-3.58 Packet P-P Amplitude
Chrominance Luminance Delay	≤15nS 10nS Typical	Measured Using NTC - 7 Signal
Blanking Level	0 VDC +10mV -300mV	Varies with Average Picture Level (APL)
Luminance Rise Time	250nS ±25nS	Except Where Specified Otherwise
Chrominance Rise Time	400nS ±40nS	Except Where Specified Otherwise
Burst Amplitude	40 IRE (285.7mV) ±2%	
Burst Rise Time	400nS ±40nS	
Sync Amplitude	40 IRE (285.7mV) ±1% of 100 IRE	
Sync Rise Time	140nS ±20nS	

Line Timing	See Figures	5-1 to 5-22
Front Porch Duration	1.5uS ±100nS	
Line Blanking Interval	10.9uS ±200nS	Measured at 20 IRE Point of Active Video
Breezeway Duration	600nS ±100nS	
Line Sync Duration	4.7uS ±100nS	Measured at 50% Amplitude Point
Vertical Serration Duration	4.7uS ±100nS	Measured at 50% Amplitude Point
Equalizing Pulse Duration	2.3uS ±100nS	Measured at 50% Amplitude Point
Burst		
Delay From Sync	5.308uS ±35nS	19 Cycles of Subcarrier
Burst Duration	2.51uS ±100nS	9 Cycles of Subcarrier
Output Impedance	75 Ohms	
Return Loss	$\geq$ 36 dB to 4.2 MHz	
Signal-to-Noise Ratio	$\geq$ 60 dB	Black RMS Noise to peak white
Subcarrier Stability	3.579545 MHz ±100 Hz (5-35°)	

6 MAINTENANCE

6.1 Cleaning

1. Do not attempt to disassemble your TSG-51 to clean it.

2. Clean your TSG-51 using only a damp cloth.

3. **NEVER** use water or solvents such as alcohol, window cleaner, etc., to clean your TSG-51.

6.2 Service and Troubleshooting

If you suspect your TSG-51 is not operating properly, check the following:

1. Check all coaxial cables for opens or shorts.

2. If using an AC power adapter different from the one supplied with the TSG-51, make sure it supplies the TSG-51 with at least 9 volts (maximum of 14 volts) when the TSG-51 is switched on.

You may return your TSG-51 to HORITA for service. Please contact HORITA first, either by phone or mail, before returning your unit.

6.3 Performance Checks and Calibration Procedures

Various video, audio, and frequency adjustments are provided in the TSG-51 which do not normally require service. The TSG-51 should be powered up for 1/2 hour before any adjustments are performed.

The test equipment you use to evaluate the performance of and calibrate the TSG-51 also has its own set of specifications. Sometimes the tolerance in these specifications may exceed the specifications for the TSG-51. This should be taken into account when checking TSG-51 characteristics such as transient and frequency response, differential phase and gain, etc.

Before adjusting the TSG-51, make sure your test equipment has been recently calibrated. The TSG-51 is calibrated at the factory using common test equipment such as television waveform monitors and vectorscopes. Specified performance of the TSG-51 should be measurable and verifiable using this same type of equipment, and taking into account its tolerance specifications as well. For example, the TSG-51 line tilt specification of ±1 IRE is what you should be able to measure on your own equipment.

6.4 Required Test Equipment

LEADER 5870 (or equivalent) Combination NTSC Waveform Monitor/Vectorscope with SCH monitor

Digital Voltmeter, 3 or 4 digit

6 ft. length of high quality RG-59 coaxial cable

75 Ohm, .1% precision BNC termination

6.5 Performance Checks

Performance checks of the TSG-51 are made using the waveform monitor (WFM). Many of the checks are simply to be performed as described in the waveform monitor/vectorscope manual(s) and those particular checks are referred to in this manual as required.

6.6 Setup

1. Connect the TSG-51 Video Out to the input of the 5870 WFM. Make sure the video signal is terminated at the back of the 5870 with the precision 75 Ohm terminator.

2. Select the TSG-51 SMPTE color bar pattern output and observe the bars with the WFM. ***NOTE:*** Set the WFM "DC Restore" function to "ON".

6.7 Checks

1. Luminance Amplitude

a. Set the WFM to display 2H lines.

CHECK- Refer to the WFM procedure and verify that the video signal amplitude is 100 IRE ±1 IRE (1%) (714.3mV ±7.14mV) as measured from blanking level to the 100 IRE peak white level.

2. 5-Step Staircase Linearity

a. Set the TSG-51 pattern to 5-STEP, set the WFM vertical magnification to X5 and horizontal to display 1H line.

CHECK- use the WFM vertical and horizontal position controls to move each individual step to the center of the gratical and verify that each is 100 IRE ±1 IRE (1%).

3. Line Tilt

a. Measuring line tilt requires that the TSG-51 100 IRE white field option be selected.

b. Set the WFM for a normal display of 1H or 2H lines.

CHECK- that the active line portion measures 100 IRE ±1 IRE (1%). Disregard the area immediately around the transitions.

4. Field Tilt

Measure the same as line tilt except set the WFM to display 2 fields.

CHECK- Field tilt measures < ± 1 IRE.

5. Chrominance-Luminance Delay
a. Select the NTC-7 signal from the TSG-51.

b. Set the WFM to display 1H line, H magnification to .2 uS.

c. Adjust H and V positioning to display the bottom of the 12.5T modulated pulse along the 100 IRE line, or a line that has divisions of 2 IRE.

CHECK- that the sine wave-like envelope at the base of the 12.5T pulse appears flat and varies no more than 1.5 IRE (10.7mV), equivalent to 15nS.

6. Ringing
a. Select the NTC-7 signal from the TSG-51

b. Set the WFM to display 1H line, H magnification to .2uS.

c. Adjust the H and V positioning to display the bottom of the 2T pulse along the 100 IRE line or a line that has divisions of 2 IRE.

CHECK- for a maximum of 2 IRE (14.28mV) of ringing following the 2T pulse

7. Chrominance-to-Luminance Gain
a. Select the Multiburst signal from the TSG-51.

b. Set the WFM for a normal display of 1H line.

CHECK- that the white and black flags and the 3.58 MHz burst packet both have equal amplitudes within ±2 IRE (2%).

8. Differential Phase and Gain
Follow the directions in the manual for your WFM.

9. H SYNC Amplitude and Rise Time
Follow the directions in the manual for your WFM.

10. H Blanking
Follow the directions in the manual for your WFM.

11. H and V Sync Timing
Follow the directions in the manual for your WFM.

6.8 Accessing Adjustments

To access TSG-51 adjustments, remove the bottom cover by removing the two screws from the front panel and then sliding the bottom cover out towards the front.

If you have a Rackmount or Shortrack packaged TSG-51, remove the four screws from the top cover and remove the cover.

Adjustments are located on the circuit board as shown in Figure-3.

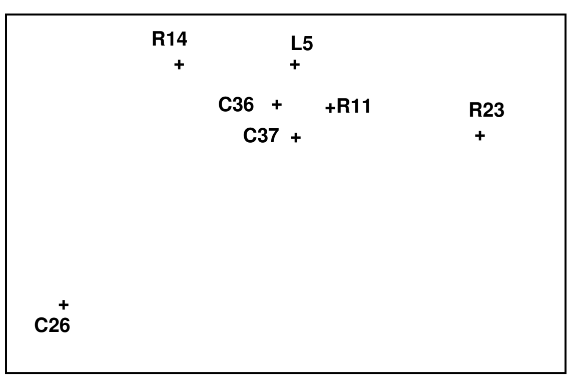


Figure 6-1, Adjustment Locations

6.9 Master Oscillator Frequency Adjustment

The TSG-51 has a crystal controlled master oscillator that operates at a frequency of 14.318180 MHz, which is four times the NTSC subcarrier frequency of 3.579545 MHz. There is a trimmer to adjust this frequency should that be necessary, and adjustment can be by using an "off the air" video signal or a frequency counter.

6.10 Off the Air Method

The frequency of the TSG-51 master oscillator can be set very accurately by using off the air television broadcast signals.

1. Connect the TSG-51 Video Out through a BNC "T" connector to the input of a video monitor.
2. Connect the video output from a TV receiver/monitor or VCR tuner to the other input of the "T" so that the two video signals mix and are simultaneously displayed on the monitor. Alternately a monitor with separate A and B video inputs and a "mix" display mode can be used.
3. Set the TV channel to one of the major networks.

NOTE:

Make sure you are viewing a network originated signal. Do not make this adjustment using a locally originated signal, such as from cable services, colleges, etc.

4. The TV monitor will "lock up" to either the TSG-51 or the off air signal, sometimes switching back and forth between the two. There will be a relatively dark vertical bar going from top to bottom of the screen and it will appear to be stationary or to be moving slightly from left to right or from right to left. The bar will also have a colored stripe in its right half, and the stripe will be continuously changing colors.
5. Carefully adjust C26 for minimum movement of the bar across the screen, and then for the slowest change of the colored stripe. It should be possible to have the stripe go through all its colors only a few times a second or less. Switch TSG-51 power OFF and ON if necessary.

6.11 Frequency Counter Method

1. Connect a frequency counter to monitor the clock signal at U6-8
2. Adjust C26 for a frequency reading of 14.318180Mhz +/-10Hz

6.12 Video Amplitude and Equalization

The video level is set at the factory for an output amplitude of 1 volt. Whenever the video amplitude is adjusted, the video equalization should also be adjusted.

1. Select the SMPTE color bar pattern from the TSG-51
2. Connect the waveform monitor to Video Out and set it to observe 2H lines with the DC restorer set to ON, and the blanking level positioned to 0 IRE.
3. Adjust R11 AMP for a video level of 1 volt p-p (140 IRE), ±1.4 IRE (1%) as measured from the -40 IRE sync tip level to the 100 IRE white level.
4. Switch to the Vectorscope and adjust C37 EQ to place the chroma vectors at the centers of the targets. If only a waveform monitor is available, adjust C37 for the tops of the chroma levels for the first two color bars (yellow and cyan) that are next to the SMPTE 100 IRE white level to also be at 100 IRE.

6.13 Video Filter Adjustment

NOTE:

This is a factory adjustment that should not normally require user service. This adjustment affects transient and frequency response, and luminance and chrominance delay characteristics of the TSG-51. The filter adjustments also interact with the video amplitude and equalization adjustments. There is a compromise between transient response as observed on the 2T pulse, frequency sweep flatness, and luminance/chrominance delay as observed on the 12.5T modulated pulse.

1. Adjust video amplitude and equalization as previously described.
2. Switch the TSG-51 pattern to SWEEP (frequency sweep) and observe the waveform. It should be flat within ±2 IRE

from .5Mhz to 5Mhz.

If the waveform is barrel or bowtie shaped, adjust R14 slightly to flatten it. Re-adjust video amplitude and equalization as necessary.

If the waveform is bent or has a crook in it at the 5Mhz side that cannot be satisfactorily removed using R14 and the amplitude and equalization adjustments, slightly adjust L5 and C36 to flatten the response. Repeat Step-b as necessary until the frequency sweep is within the specified flatness.

3. Select the NTC-7 pattern and check transient response and luminance/chrominance delay. Slightly adjust L5 and C36 as required. Repeat Step-b and Step-c as required.

6.14 Audio Tone Amplitude

The audio tone amplitude should be checked whenever the audio tone is changed between the 1Khz and 400Hz frequencies

1. Connect the voltmeter to the 1KHz 0dB output and set it to measure AC RMS volts.
2. Adjust R23 for a reading of 776mV RMS (2.19V p-p), ±7.8mV (1%).

7 SPECIFICATIONS

Power

Operation	9-to-14V DC, 350 milliamperes
Connector	3.5 MM mini phone jack
AC Adapter	9 volt, 500 milliamperes

Video Output

Standard	RS-170A timing
SCH	0º ± 5º
SMPTE	SMPTE EG-1-1990
Full-Field	EIA RS-189A colors
Amplitude	1 volt peak-to-peak (140 IRE) with 75-Ohm termination

Sync Pulse Output

Standard	RS-170A timing
Type	Composite sync
Amplitude	-4.0 volts with 75-Ohm termination

Audio Tone Output

Type	1 KHz/400 H .05% crystal controlled sine wave	
Amplitude	OdB = 775 mV RMS = OdB/OdBu, adjustable for	OdB = 1.0V RMS = OdBV
Impedance	Less than 20 ohms	

59.94 HZ

5V logic square wave signal.

Ref Frame Output

Type	1H pulse (63.5uS) on line 262 of color field 4
Amplitude	+5 volts, (CMOS)

Connectors

VIDEO OUT	
SYNC OUT	BNC
REF FRAME	
AUDIO TONE	

OUT	RCA
POWER	3.5MM Mini Phone - center pin "+"

Switches And Controls

Power	ON/OFF Switch with red LED
Timer	3 position toggle
Pattern	12 position rotary,.2 position toggle

Environment

Operating	5C to 40C (41F to 104F)
Storage	-10C to 60C (14F to 140F)

Dimensions

1.75"H, 3.5"W, 4.5"D

Weight

Approximately 15 Oz. (shipping weight approximately 29 Oz. including power adapter)

Specifications subject to change without notice