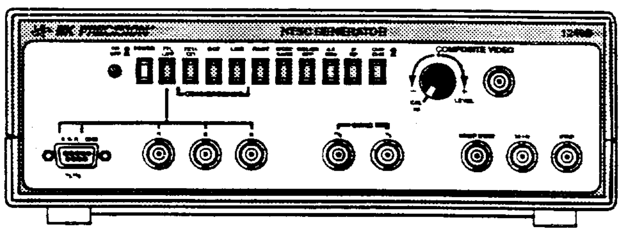
INSTRUCTION MANUAL

B+K PRECISION®

MODEL 1249B



NTSC GENERATOR

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B+K PRECISION®

TEST INSTRUMENT SAFETY

WARNING

Normal use of this instrument exposes you to a certain amount of danger from electrical shock because it is often used to test equipment that contains high voltage. An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 volts dc or ac rms should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages are even more dangerous. Your normal work habits should include all accepted practices that will prevent contact with exposed high voltage, and that will steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. Connect the NTSC Generator's ac power cord only to a 3-wire outlet to assure that the instrument's chassis and ground leads of probes or test cables are at earth ground.
2. Don't expose high voltage needlessly to the equipment under test. Remove housings and covers only when necessary. Turn off equipment while making test connections in or near high-voltage circuits. Discharge high-voltage capacitors after removing power.
3. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
4. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment; make certain such surfaces are not damp or wet.
5. Use the time-proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
6. When testing video equipment that includes a picture tube or CRT, remember that the high voltage power supply and CRT anode operate at very high voltage, often 20,000 volts or more. Carefully void these areas when the equipment is operating. It is also typical for these circuits to retain a high voltage charge long after the equipment is turned off. Before attempting any servicing with the power removed, discharge high voltage points. Also avoid bumping the CRT with a sharp edge. Because of the high vacuum, a nicked CRT may "implode" and cause flying glass fragments.

(continued on inside rear cover)

Instruction Manual
for
Model 1249B

NTSC GENERATOR

BK PRECISION®

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INTRODUCTION

The **B+K PRECISION** Model 1249B NTSC Generator is a versatile, low cost, precision television/video signal generator. It generates a variety of test signals and patterns for comprehensive testing, servicing, and adjustment of video and television equipment. Its applications include television receivers, video tape recorders, closed circuit television systems and components, and master antenna systems and components, as well as most standard computer and video monitors.

The instrument can generate many different patterns, each of which is available as a composite video signal or a modulated rf output on channel 3, channel 4, or the standard television i-f frequency of 45.75 MHz. This provides the proper signal for injection at any point in the equipment.

The video patterns include standard NTSC color bars with standard 75% white or with 100% white, staircase, black raster, and an assortment of convergence patterns. An engineer or technician with a good knowledge of video circuits can use the variety of patterns to analyze and isolate almost any video problem.

The NTSC Color Bars signal generated by the instrument is the same type of color bar signal that is used by the television networks, allowing it to be used to set-up and adjustment TV sets and other equipment for the best performance. This is not possible with lower cost gated rainbow color generators, which produce a signal unlike that used during normal operation.

Separate RGB and sync outputs are available for use with most computer and video monitors using standard 525 line, 15.750 kHz scan. The inputs to these RGB monitors are separate digital signals for red, green, and blue, and separate digital composite sync or separate digital vertical and horizontal sync. The signal level at the RGB outputs is switch selectable between TTL and low (0.8 V). The D-type subminiature connector is directly comparable with IBM Model 5153 PC monitors (TTL signal level should be selected for use with the IBM PC monitor).

Other features include a crystal generated 30 Hz TTL output and a switchable 4.5 MHz sound sub-carrier modulated with a 1 kHz audio tone. The 30 Hz signal is useful for isolating servo problems in video cassette recorders.

The switch selectable 4.5 MHz sound sub-carrier is modulated by a 1 kHz tone and is used to check the sound circuits and audio/video isolation.

FEATURES

NTSC COLOR BARS

Generates standard NTSC color bars pattern (eight bars of standard EIA colors) at NTSC prescribed luminance and chrominance levels and phase.

SELECTABLE COLOR

Color can be switched on or off.

CONVERGENCE PATTERNS

Dots, crosshatch, center dot, and center cross patterns for static and dynamic convergence.

BLACK RASTER

Provides sync and reference black for a clear blemish-free raster.

CRYSTAL OSCILLATORS

IF, CH 3, CH 4, 30 Hz, and sync generation are crystal-controlled for frequency accuracy and stability.

COMPOSITE VIDEO OUTPUT

Composite video output with variable 0 to ± 1 V p-p amplitude into standard 75 Ω impedance. Calibrated 1 V p-p with negative sync.

RF OUTPUT

Standard 75 Ω output modulated by composite video at 10 mV rms on channel 3, channel 4, or 45.75 MHz i-f.

SYNC PULSE OUTPUTS

All outputs can be used simultaneously for maximum flexibility. Permits more complementary testing or multiple independent usage of instrument.

RGB OUTPUTS

Digital red, green and blue (RGB) signals for computer and video monitors with standard 525 line, 15.750 kHz scan. D-Type subminiature connector provides red, green, blue, horizontal sync, and vertical sync signals and is IBM Model 5153 PC monitor compatible. Output level is switch selectable between TTL and LOW (0.8 V ±0.2 V).

30 Hz OUTPUT

30 Hz TTL output is useful for video recorder applications.

4.5 MHz SOUND SUB-CARRIER

4.5 MHz subcarrier modulated with 1 kHz audio tone can be switched on to check sound and verify picture and sound isolation.

SPECIFICATIONS

PATTERNS

NTSC Color Bars:

White (75% or 100%, switch selectable), yellow, cyan, green, magenta, red, blue, black (7.5% set-up). Chroma is switch selectable; COLOR OFF obtains stair case from color bars (stair case white level is switch selectable at 75% or 100%). Interlaced scan.

Chroma Accuracy:

±5° and ±5 IEEE units.

Raster:

Black.

Convergence:

Center dot, 7x11 dots, center cross, 7x11 crosshatch. Selectable interlaced or progressive scan.

RF OUTPUT

Channels:

CH3, CH4, IF.

Frequency:

61.25, 67.25, 45.75 MHz ±0.008 MHz.

Level:

10 mV rms minimum into 75 ohms.

Impedance:

75 ohms.

Stability:

50 ppm.

VIDEO OUTPUT

Polarity:

Negative and positive sync available.

Amplitude:

Variable 0 to ±1 V p-p into 75 ohms. Calibrated 1 V p-p available with negative sync.

Impedance:

75 ohms.

RGB OUTPUTS

BNC and D-Type Sub-Miniature Connectors.

Patterns:

Convergence and color bars.

Levels:

TTL level and low level, (0.8 ±0.2 V), switch selectable.

Impedance:

75 ohms.

SOUND SUBCARRIER

4.5 MHz ±0.2% modulated by approximately 1 kHz audio tone, switch selectable.

SYNC OUTPUTS

Composite:

NTSC-M TTL level; negative polarity sync; interlaced scan for NTSC color bars, selectable interlaced or progressive scan for convergence patterns.

Horizontal:

TTL level (positive polarity sync).

Vertical:

TTL level (positive polarity sync).

Impedance:

75 ohms.

30 Hz OUTPUT

Level:

TTL level square wave.

Impedance:

75 ohms.

COLOR SUBCARRIER

NTSC signal: 3.579545 MHz (±50 Hz) (adaptable to PAL-M).

MISCELLANEOUS

Power Requirements:

105 to 130 VAC, 60 Hz, 8 Watts.

Operating Temperature:

0° to +50°C.

Dimensions (H x W x D):

3-3/8" x 10-3/8" x 11-7/16" (8.6 cm x 26.4 cm x 29.1 cm)

Weight:

2.8 lbs (1.30 kg).

OPTIONAL ACCESSORIES

BNC-to-F Five Foot RG-59/U Cable (part number 539-124-0-000).

BNC-to-BNC Five Foot RG-59/U Cable (part number 539-123-0-000).

Specifications are subject to change without notice.

DEFINITIONS OF TERMS

BARS Pattern. See "NTSC Color Bars".

Back Porch. The portion of a composite video signal between the trailing edge of the horizontal sync pulse and the end of the horizontal blanking pedestal. The color burst occurs during the back porch interval.

Blanking Level. The level of the front and back porches. Zero IEEE units.

Burst. See "Color Burst".

CATV. Cable Television. Also used for Community Antenna Television.

CCTV. Closed-circuit television.

Chroma or Chrominance. The color information contained in a video signal, consisting of hue (phase angle) and saturation (amplitude) of the color subcarrier.

Chroma Amplitude. Amplitude of 3.58 MHz color subcarrier. Represents saturation.

Chroma Phase Angle. Phase angle of 3.58 MHz color subcarrier. Represents hue.

Color Bars. See "NTSC Color Bars".

Color Burst. A few (8 to 10) cycles of 3.58 MHz color subcarrier which occur during the back porch interval. Color burst amplitude is 40 IEEE units and phase is 180°. The color oscillator of a color television receiver is phase locked to the color burst.

Color Subcarrier. The 3.58 MHz signal which carries color information. This signal is superimposed on the luminance level. Amplitude of the color subcarrier represents saturation and phase angle represents hue.

Composite Video Signal. The entire video signal consisting of blanking pulses, sync pulses, color burst, and chrominance and luminance information.

Duty Cycle. Percentage of cycle during which pulse is working. A square wave has a 50% duty cycle. Horizontal sync pulses have about 8% duty cycle—about 5 µs pulse width at 63.5 µs pulse repetition period.

EIA. Electronic Industries Association.

Equalizing Pulse. A portion of the vertical blanking interval which is made up of blanking level and six pulses (8% duty cycle at -40 IEEE units) at one-half the width of horizontal sync pulses and at twice the repetition rate. One equalizing pulse occurs immediately before, and another immediately after, the vertical sync pulse.

Field. One-half a television picture. One complete vertical scan of the picture, containing 262.5 lines. Two fields make up a complete television picture (frame). The lines of Field 1 are vertically interlaced with Field 2 for 525 lines of resolution.

Frame. A complete television picture, consisting of two fields. See "Field".

Front Porch. Blanking level pulse at end of line of horizontal scan, before horizontal sync pulse.

Horizontal Blanking Pedestal. That portion of each line of composite video signal which blanks the picture while the CRT retrace returns to the left side of the screen. Consists of front porch, horizontal sync pulse, and back porch.

Horizontal Resolution. Smallest increment of a television picture that can be discerned in the horizontal plane. This increment is dependent upon the video bandwidth and is measured in frequency. Horizontal resolution of a high quality monochrome television receiver is 4.2 MHz.

Horizontal Sync Pulse. Pulse at -40 IEEE units which synchronizes horizontal scan rate of television receiver to composite video signal. Starts each line at same horizontal position.

Hue. Distinction between colors. Red, blue, green, yellow, etc. are hues. White, black, and grey are not considered hues.

IEEE. Institute of Electrical and Electronic Engineers.

IEEE Unit. A standard 1-volt peak-to-peak composite video signal is divided into 140 equal units, scaled from -40 to +100, which are then called IEEE units. Luminance and chrominance amplitude are measured in IEEE units. Sync pulses extend from 0 to -40 units. Blanking level is 0. Picture information spans the +7.5 set-up level (black) to +100 (100% white) levels. Chroma amplitude is the peak-to-peak amplitude of the color subcarrier, which rides on the luminance level.

Interlace. Vertical offset between Field 1 and Field 2 that causes lines of Field 1 to fall between the lines of Field 2. Also see "Field".

Luminance. The amount of light intensity perceived by the eye as brightness. Luminance information is represented by the amplitude of the composite video signal.

MATV. Master antenna television.

Monochrome. Black and white television signal. Contains sync and luminance but no color burst or chroma.

NTSC. National Television Systems Committee. Established the color television standards now in use in the U.S.A. and many other nations of the world.

NTSC Color Bars. A pattern generated by the NTSC Generator, consisting of eight equal width color bars. Colors are white (75%), black (7.5% set-up level), 75% saturated pure colors red, green, and blue, and 75% saturated hues of yellow, cyan, and magenta (mixtures of two colors in 1:1 ratio without third color).

Resolution. See "Horizontal Resolution" and "Vertical Resolution".

Saturation. Vividness of color. Degree to which a color is not diluted by white light. Highly saturated color is very vivid. The same hue becomes a pastel shade when diluted by white light. Saturation is represented by chroma amplitude and is measured in IEEE units. The number of IEEE units for fully saturated color varies from hue to hue.

Set-up. The separation between blanking and black reference levels. This instrument uses the NTSC standard set-up level of 7.5 units.

Staircase. A pattern generated by the NTSC Generator, consisting of equal width luminance steps decreasing in amplitude. The staircase pattern is useful for checking linearity of luminance.

Subcarrier. See "Color Subcarrier".

VCR. Video cassette recorder.

VTR. Video tape recorder. In this manual, the term "VTR" includes reel-to-reel and cassette type.

Vertical Blanking Interval. That portion at the beginning of each field of composite video signal which blanks the picture while the CRT retrace returns to the top of the screen. The equalizing pulses and vertical sync pulse are generated within this interval.

Vertical Resolution. Smallest increment of a television picture that can be discerned in the vertical plane. This increment is dependent upon the number of lines of scan per frame, and is measured in lines. In the U.S.A. and other countries using NTSC systems, vertical resolution is 525 lines.

Vertical Sync Pulse. A portion of the vertical blanking interval which is made up of blanking level and six pulses (92% duty cycle at -40 IEEE units) at twice the horizontal sync pulse repetition rate. Synchronizes vertical scan of television receiver to composite video signal. Starts each frame at same vertical position (sequential fields are offset ½ line to achieve interlaced scan).

Resolution. See "Horizontal Resolution" and "Vertical Resolution".

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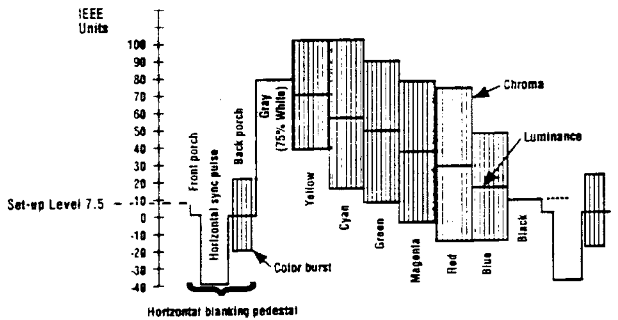


IEEE Units

Luminance	0	40	0	77	69	56	48	36	28	15	7.5
Chroma amplitude	-	-	40	-	62	88	82	82	88	62	-
Vector (from B-Y)	-	-	180°	-	167°	284°	241°	61°	104°	347°	-

Fig. 1. Composite Video Signal; One Horizontal Line of NTSC Color Bars Signal.

HISTORY

In 1953, the NTSC (National Television Systems Committee) established the color television standards now in use by the television broadcast industry in the United States and many other countries. It was, of course, compatible with the monochrome (black and white) system that previously existed. The makeup of a composite video signal is dictated by NTSC specifications. These specifications include a 525-line interlaced scan, operating at a horizontal scan frequency of 15,734.26 Hz and a vertical scan frequency of 59.94 Hz. A 3.579545 MHz subcarrier contains the color information. The phase angle of the subcarrier represents the hue; the amplitude of the subcarrier represents saturation.

HORIZONTAL SYNC

(Refer to Fig. 1)

The "beginning" of a line horizontal scan occurs at the leading edge of the horizontal blanking pedestal. In a television receiver, the horizontal blanking pedestal starts as the electron beam of the CRT reaches the extreme right-hand edge of the screen (plus a little overscan in most cases). The horizontal blanking pedestal prevents illumination of the screen during retrace, that is, until the electron beam deflection circuits are reset to the left edge of the screen and ready to start another line of video display. The entire horizontal blanking pedestal is at the blanking level or the sync pulse level. In a television receiver, the blanking and sync pulse levels are the "blacker than black" levels that assure no illumination during retrace.

The horizontal blanking pedestal consists of three discrete parts: the front porch, the horizontal sync pulse, and the back porch. The front porch is a 1.40 microsecond period at second horizontal sync pulse at the -40 IEEE units level. An explanation of IEEE units follows in the "Amplitude" paragraph. When the horizontal sync pulse is detected in a television receiver, it initiates flyback, which ends the horizontal scan and rapidly resets the horizontal deflection circuit for the next line of horizontal scan. The horizntal sync pulse is followed by a 4.79 micro-second back porch at the blanking level. When a color signal is being generated, 8 to 10 cycles of 3.579545 MHz color burst occur during the back porch. The color burst signal is at a specific reference phase. In a color television receiver, the color oscillator is phase locked to the color burst reference phase before starting each horizontal line of video display. When a monochrome signal is being generated, there is no color burst during the back porch.

VERTICAL SYNC

(Refer to Fig. 2)

A complete video image as seen on a TV screen is called a frame. A frame consists of two interlaced vertical fields of 262.5 lines each. The image is scanned twice at a 60 Hz rate (59.94 Hz to be more precise), and the lines of Field 2 are offset to fall between the lines of Field 1 (interlaced) to create a frame of 525 lines at a 30 Hz repetition rate.

At the beginning of each vertical field, a period equal to several horizontal lines is used for the vertical blanking interval. In a television receiver, the vertical blanking interval prevents illumination of the CRT during the vertical retrace. The vertical sync pulse, which is within the vertical blanking interval, initiates reset of the vertical deflection circuit so the electron beam will return to the top of the screen before video scan resumes. The vertical blanking interval begins with the first equalizing pulse, which consists of six pulses one half the width of horizontal sync pulses, but at twice the repetition rate. The equalizing pulse has an 8% duty cycle. The vertical sync pulse occurs immediately after the first equalizing pulse. The vertical sync pulse is an inverted equalizing pulse at 92% duty cycle. The wide portion of the pulse is at the -40 IEEE units level and the narrow portion of the pulse at the blanking level. A second equalizing pulse at 8% duty cycle occurs after the vertical sync pulse, which is then followed by 13 lines of blanking level (no video) and horizontal sync pulses to assure adequate vertical retrace time before resuming video scan. The color burst signal is present after the second equalizing pulse.

Note that in Field 1, line 522 includes a full line of video, while in Field 2 line 260 contains only a half line of video. This timing relationship produces the interlace of Fields 1 and 2. The NTSC color bars pattern generated by this instrument is interlaced per NTSC standards.

AMPLITUDE

(Refer to Fig. 1)

A standard NTSC composite video signal is 1 volt peak-to-peak, from the tip of a sync pulse to 100% white. This 1 volt peak-to-peak signal is divided into 140 equal parts called IEEE units. The zero reference level for this signal is the blanking level. The tips of the sync pulses are at -40 units, and a sync pulse is approximately 0.3 volt peak-to-peak. The portion of the signal that contains video information is raised to a set-up level of +7.5 units above the blanking level. A monochrome video signal at +7.5 units is at the black threshold. At +100 units the signal represents

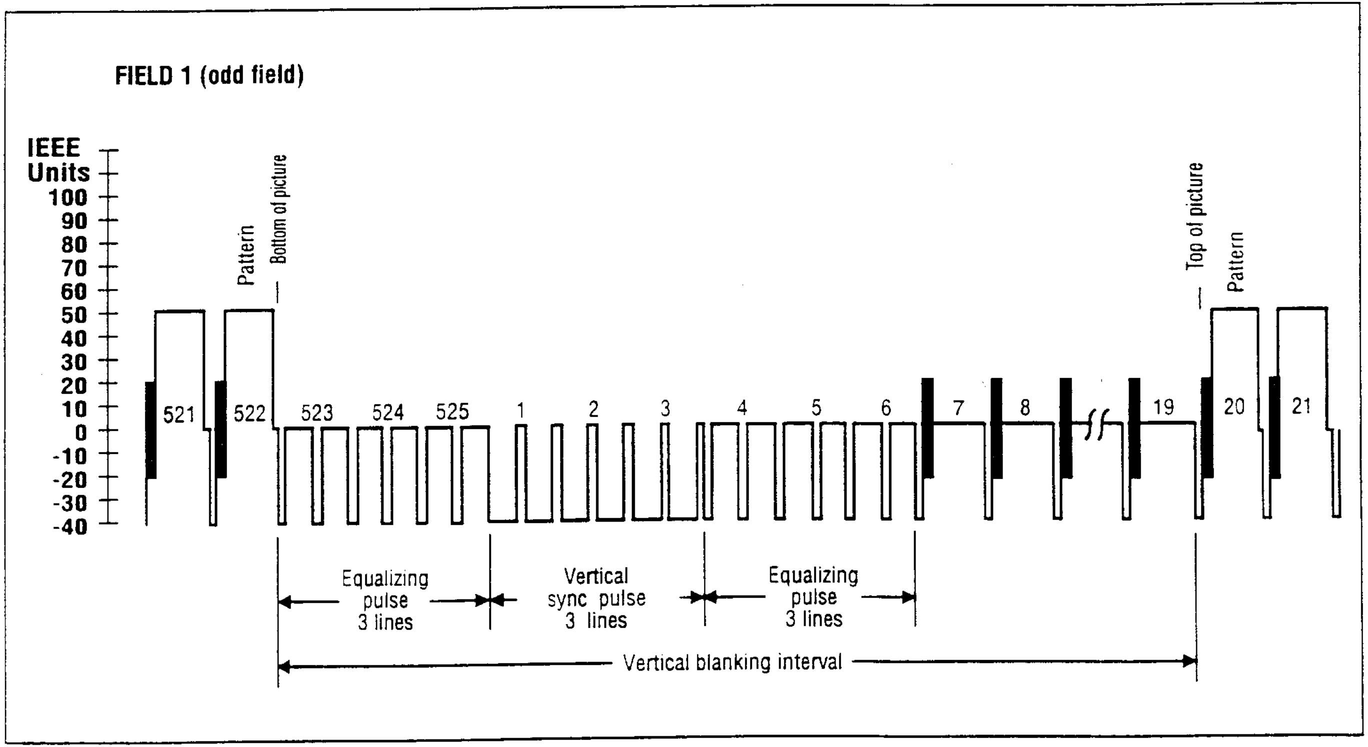


Fig. 2A. Composite Video Signal Showing Vertical Blanking Interval (Field 1).

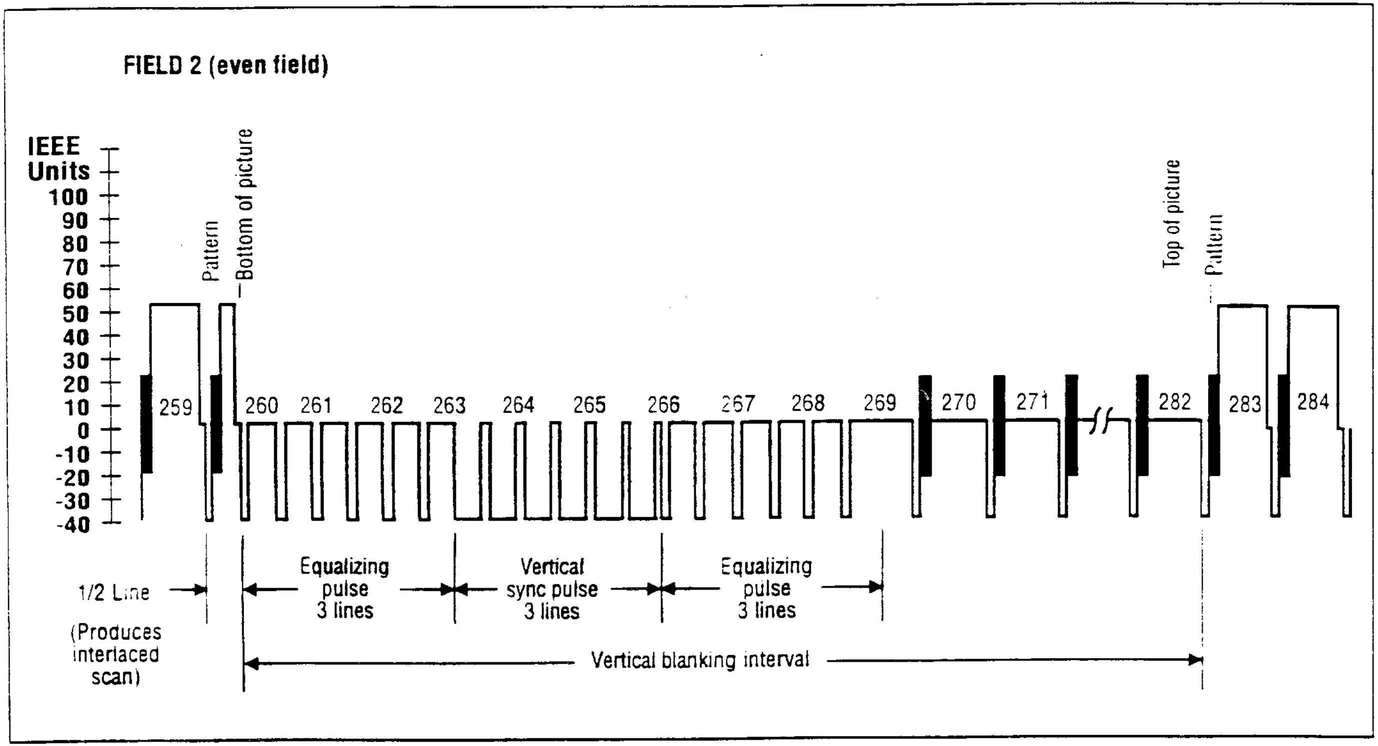


Fig. 2B. Composite Video Signal Showing Vertical Blanking Interval (Field 2).

100% white. Levels between +7.5 and +100 units produce various shadings of grey. Even when a composite video signal is not at the 1 volt peak-to-peak level, the ratio between the sync pulse and video must be maintained, 0.3 of total for sync pulse and 0.7 of total for 100% white.

There is also a specific relationship between the amplitude of the composite video signal and the percentage of modulation of an rf carrier. A television signal uses negative modulation, wherein the sync pulses (-40 units) produce the maximum peak-to-peak amplitude of the modulation envelope (100% modulation) and white video (+100 units) produces the minimum amplitude of the modulation envelope (12-1/2% modulation). This is very advantageous, because the weakest signal condition, where noise interference can most easily cause snow, is also the white portion of the video. There is adequate amplitude guard band so that peak white of +100 units does not reduce the modulation envelope to zero.

COLOR

(Refer to Fig. 3)

The color information is a composite video signal consists of three elements: luminance, hue, and saturation.

Luminance, or brightness perceived by the eye, is represented by the amplitude of the video signal. The luminance component of a color signal is also used in monochrome receivers, which is converted to a shade of grey. Yellow is a bright color and has a high level of luminance (is nearer to white), while blue is a dark color and has a low level of luminance (is nearer to black).

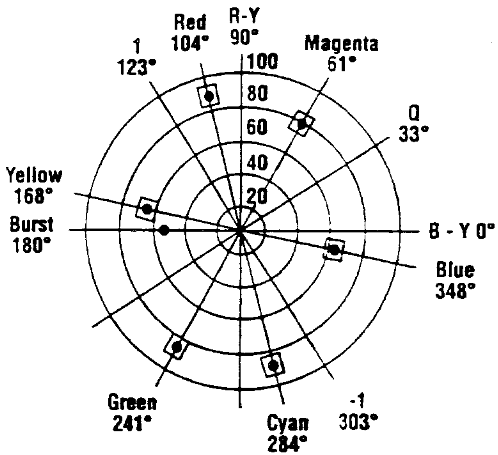
Hue is the element that distinguishes between colors, red, blue, green, etc. White, black and grey are not hues. The phase angle of the 3.58 MHz color subcarrier determines the hue. The three primary video colors of red, blue, and green can be combined in such a manner to create any hue. A phase shift of 360° will produce every hue in the rainbow by changing the combination of red, blue, and green.

Saturation is the vividness of a hue, which is determined by the amount the color is diluted by white light. Saturation is often expressed in percent; 100% saturation is a hue with no white dilution, which will produce a very vivid shade. Low saturation percentages are highly diluted by white light and produce light pastel shades of the same hue. Saturation information is contained in the amplitude of the 3.58 MHz color subcarrier. Because the response of the human eye is not constant from hue to hue, the amplitude required for 100% saturation is not the same for all colors.

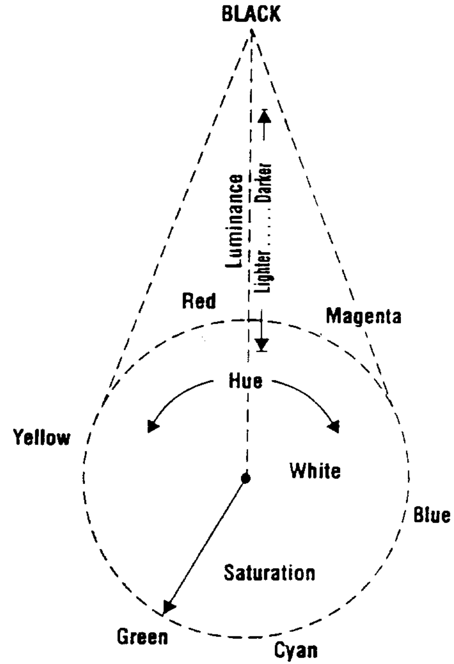
The combination of hue and saturation is known as chroma, or chrominance. This information is normally represented by a vector diagram. Saturation is indicated by the length of the vector and hue is indicated by the phase angle of the vector. The entire color signal representation is three dimensional, consisting of the vector diagram for chrominance and a perpendicular plane to represent the amplitude of luminance.

NTSC COLOR BARS SIGNAL

Refer again to Fig. 1. As mentioned previously, the chroma amplitude required for 100% saturation of some hues is considerably greater than for other hues. Also, the luminance level for each color differs. The NTSC color bars signal generates standard EIA colors at the prescribed luminance level (brightness), chroma phase angle (hue), and chroma ampli-



Standard color-phase vector diagram



3-Dimensional concept of color

Fig. 3. Elements of Color Television Signal.

tude (saturation) set forth by the NTSC. This is the test signal used in broadcasting studios and transmitting equipment. This makes the NTSC Generator a superior instrument for servicing and adjusting color television receivers and all types of other video equipment. An NTSC color bars pattern is specified or recommended for most tests and adjustments in video cassette recorders.

The precision of the NTSC color bars signal is beyond comparison with that of a low cost color bar generator. A color bar generator usually produces all hues at the same luminance level (or with no luminance component) and same chroma amplitude, which of course is not equivalent to the color signals being transmitted by broadcast stations. Many hues are oversaturated. Also, the chroma phase angle is normally produced by using a carrier that is offset enough from 3.58 MHz so that 360° phase shift occurs during each horizontal line. This produces a gated rainbow pattern rather than specific, phase controlled colors.

1. **Power Indicator**. Lights when power is on.
2. **POWER Switch**. Turns power on and off.
3. **RGB TTL/LOW Switch** Selects TTL or low RGB output level. When this switch is released (**LOW** position), a positive logic state at the RGB output jacks (**R, G,** and **B** BNC jacks and the **RGB** 9-pin D-type connector) is at 0.8 V ±0.2 V level. When this switch is engaged (TTL position), the pulses are at a TTL level. This switch also selects interlaced or progressive scan for convergence patterns: when the switch is released the convergence patterns use interlaced scan, and then the switch is engaged, the convergence patterns use progressive scan.

NOTE

The **DOT, LINE, RAST,** and **NTSC BARS** switches are mechanically interlocked; i.e., selection of a new pattern automatically releases the previous selection. Releasing all four switches by partially pressing any one of them will provide a color bars or staircase pattern with 100% white level. The five selectable patterns are available at the **COMPOSITE VIDEO, IF/RF,** or **RGB** output jacks.

4. **CONVERGENCE Switches.** Select one of four available convergence patterns as follows:

   Only **LINE** switch engaged:

   A single vertical and horizontal line intersecting at the center of the screen.

   LINE and **7 X 11** switches engaged:

   7 horizontal lines and 11 vertical lines.

   Only **DOT** switch engaged:

   A single dot at the center of the screen.

   DOT and **7 X 11** switches engaged:

   7 horizontal rows by 11 vertical columns of dots.

5. **RAST Switch.** Selects a black or blank raster pattern. Sync and reference black are provided for a blemish free raster.
6. **NTSC BARS Switch**. Selects NTSC Color Bar pattern.
7. **COLOR OFF Switch.** Works in conjunction with **NTSC BARS** switch and selects color or monochrome (black and white) output. When this switch is engaged, the color subcarrier is switched off and the **NTSC BARS** pattern will be displayed as shades of grey. When this switch is disengaged, the color subcarrier is switched on and the **NTSC BARS** pattern will be displayed in color.
8. **4.5 MHz Switch.** Turns 4.5 MHz subcarrier (sound) on and off. When this switch is engaged, a 4.5 MHz sound carrier (modulated by approximately 1 kHz) is included in the signal at the **IF/RF** output

jack. When this switch is disengaged, no sound carrier is included in the signal.

9. **IF/RF Switch.** Sets modulated output signal (at the **IF/RF** output jack) to rf or i-f frequency. When this switch is engaged, the signal at the **IF/RF** jack is at i-f signal frequency (45.75 MHz) and the **CH 4/CH 3** switch has no effect. When disengaged, the signal at the **IF/RF** jack is at rf signal frequency (61.25 MHz for CH 3 or 67.25 MHz for CH 4).

10. **CH 4/CH 3 Switch**. Works in conjunction with rf position of **IF/RF** switch. Sets rf output carrier frequency to correspond to CH 4 or CH 3. When the **IF/RF** switch is in the rf position (disengaged) and this switch is disengaged (in the **CH 3** position), the output signal at the **IF/RF** jack corresponds to TV channel 3 (61.25 MHz). When the **IF/RF** switch is in the **RF** position (disengaged) and this switch is engaged (in the **CH 4** position), the output signal at the **IF/RF** jack corresponds to TV channel 4 (67.25 MHz). When the **IF/RF** switch is in the **IF** position (engaged), this switch has no effect on the output.

11. **COMPOSITE VIDEO LEVEL Control.** Adjusts level and polarity of composite video signal at **COMPOSITE VIDEO** output jack. Counterclockwise rotation produces a composite video signal with negative going sync pulses (standard signal). Full counterclockwise rotation of this control provides maximum output signal with a calibrated level of 1 V p-p into 75 Ω. Amplitude reduces to minimum at mid-point. Further clockwise rotation reverses polarity (positive going sync) and progressively increases amplitude. Full clockwise rotation of this control provides an output signal with a level of approximately 1 V p-p into 75 Ω.

12. **COMPOSITE VIDEO Jack.** Provides a video output for signal substitution directly into the video circuits of a television receiver and for testing video recorders.

13. **IF/RF Jack.** Provides approximately 10 mV rms (into 75 Ω) rf envelope modulated by composite video. Output carrier frequency can be set to 45.75 MHz (**IF**), 61.25 MHz (**CH 3**), or 67.25 MHz (**CH 4**) by the **CH 4/CH 3** and **IF/RF** switches.

14. **30 Hz Jack.** Provides a 30 Hz square wave TTL level output useful for troubleshooting video recorders.

15. **COMPosite SYNC Jack.** Provides both horizontal and vertical sync pulses for external use such as monitors requiring separate composite sync or sync trigger for an oscilloscope. Sync pulse is negative polarity. Output impedance is 75 Ω, level is TTL compatible.

16. **SYNC V_S Jack.** Provides vertical sync pulses for external use such as vertical sync for RGB monitors or sync trigger for an oscilloscope. Sync is positive polarity. Output impedance is 75 Ω, level is TTL compatible.

17. **SYNC H_S Jack.** Provides horizontal sync pulses for external use such as horizontal sync for RGB monitors or sync trigger for an oscilloscope. Sync pulse is positive polarity. Output impedance is 75 Ω, level is TTL compatible.

18. **B Jack**. Provides blue output signal for use with RGB monitors. Output impedance is 75Ω and output level is switch selectable (using the **RGB TTL/LOW** switch).

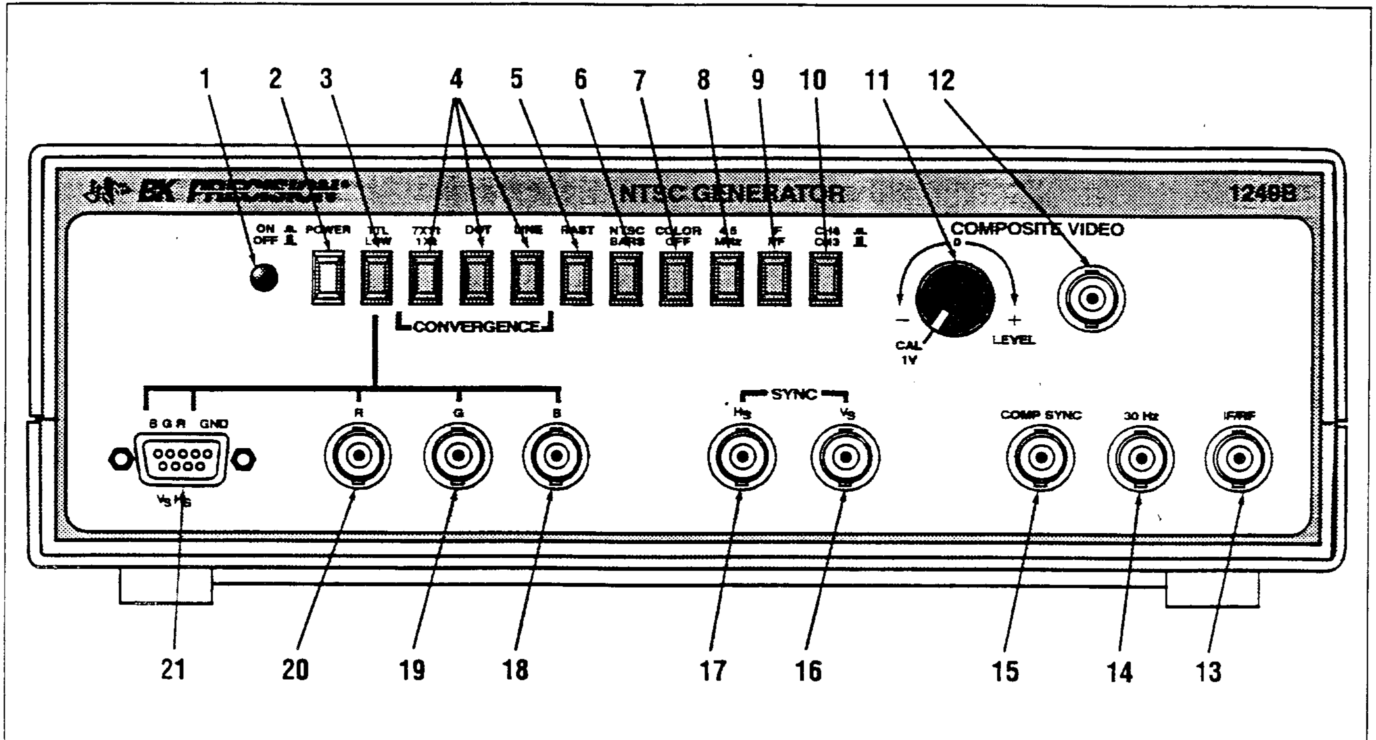


Fig. 4. Controls and Indicators.

19. **G Jack.** Provides green output signal for use with RGB monitors. Output impedance is 75 Ω and output level is switch selectable (using the **RGB TTL/LOW** switch).

20. **R Jack.** Provides red output signal for use with RGB monitors. Output impedance is 75 Ω and output level is switch selectable (using the **RGB TTL/LOW** switch).

21. **RGB 9-Pin D-Type Sub-Miniature connector.** Provides red, green, blue, vertical sync (**V_S**), and horizontal sync (**H_S**) signals. Pin layout and level (**TTL**) are IBM Model 5153 PC monitor compatible. Low level is also available by engaging the RGB TTL/LOW switch.

19. **G Jack.** Provides green output signal for use with RGB monitors. Output impedance is 75 Ω and output level is switch selectable (using the **RGB TTL/LOW** switch).

20. **R Jack.** Provides red output signal for use with RGB monitors. Output impedance is 75 Ω and output level is switch selectable (using the **RGB TTL/LOW** switch).

21. **RGB 9-Pin D-Type Sub-Miniature connector.** Provides red, green, blue, vertical sync (**V_S**), and horizontal sync (**H_S**) signals. Pin layout and level (**TTL**) are IBM Model 5153 PC monitor compatible. Low level is also available by engaging the RGB TTL/LOW switch.

4. **RF Output**

The rf output of the NTSC Generator may be applied to a television receiver, video tape recorder or other video equipment tunable to channel 3 or 4. Use the following procedure:

a. Connect a coaxial cable from the **IF/RF** output jack of the NTSC Generator to the antenna terminals. The 75 Ω input point is desired, or use 75 Ω to 300 Ω coupler.

b. Set the **RF/IF** switch on the Generator to the **RF** position (disengaged).

c. Set the channel selector of the equipment under test to channel 3 or channel 4, whichever is not used for broadcasting in your area.

d. Set the **CH 4/CH 3** switch on the NTSC Generator to the same channel that was selected on the equipment under test.

e. Patterns may now be selected.

5. **I-F Output**

The i-f output of the NTSC Generator may be injected into the i-f section of television receivers, video tape recorders, or any other video product using the standard 45.75 MHz i-f frequency. Use the following procedure:

a. Connect a probe to the **IF/RF** output jack of the NTSC Generator.

b. Set the **RF/IF** switch on the Generator to the **IF** position (engaged).

c. The probe may be used to inject the 45.75 MHz i-f signal at the desired point.

d. Patterns may now be selected.

6. **Composite Video Output**

A composite video signal may be applied to the input or injected at subsequent test points of non-rf equipment such as video monitors, video distribution amplifiers, signal processing equipment, etc. A composite video signal may also be injected into circuit points after the video detector in television receivers, video tape recorders, or other rf equipment. The **IF/RF** and **COMPOSITE VIDEO** output jacks may be used simultaneously if desired. Use the following procedure:

a. Connect a coaxial cable or probe from the **COMPOSITE VIDEO** jack of the Generator to the desired point in the equipment under test.

b. Adjust the **COMPOSITE VIDEO LEVEL** control to obtain the desired signal level and sync polarity at the output jack. Fully counterclockwise rotation gives maximum amplitude with negative polarity sync. Clockwise rotation reduces level and the center of rotation is minimum level. Rotation past the center reverses the polarity of the signal to positive sync and further clockwise rotation increases signal level. Maximum clockwise rotation is approximately 1 V p-p level, although it is uncalibrated.

c. A calibrated 1 V p-p signal level with negative sync polarity is available when the **COMPOSITE VIDEO LEVEL** control is fully counterclockwise to the **CAL** position.

d. Patterns may now be selected.

NTSC STANDARD COLOR BAR PATTERN

1. Perform the "INITIAL SET-UP" procedure.
2. Press the **NTSC BARS** switch. Be sure that the **COLOR OFF** and **4.5 MHz** switches are released.
3. The NTSC Color Bar pattern should now be displayed on the screen.

STAIRCASE PATTERN

1. Perform the "INITIAL SET-UP" procedure.
2. Press the **NTSC BARS** switch and the **COLOR OFF** switches.
3. A monochrome bars (staircase) display with progressively darker shades of grey should now be displayed (with the lightest bar on the left side of the screen and the darkest on the right side of screen) on the screen.

COLOR BARS WITH 100% WHITE

1. Perform the "INITIAL SET-UP" procedure.
2. Release all of the pattern selection switches (the four black pushbuttons) by slightly depressing one of them. Make sure that the **COLOR OFF** switch is disengaged.
3. A color bars pattern with 100% white color bar on the left side of the screen should now be displayed.

STAIRCASE WITH 100% WHITE

1. Perform the "INITIAL SET-UP" procedure.
2. Release all of the pattern selection switches (the four black pushbuttons) by slightly depressing one of them. Make sure that the **COLOR OFF** switch is engaged.
3. A monochrome bars display with progressively darker shades of grey (left to right) should now be displayed on the screen. The left most bar will be 100% white.

CONVERGENCE PATTERNS

1. Perform the "INITIAL SET-UP" procedure.
2. Any of the four convergence patterns may be selected by pressing the appropriate switch(es) as follows:

Only **LINE** switch engaged:

A single vertical and horizontal line intersecting at the center of the screen.

LINE and **7 X 11** switches engaged:

7 horizontal lines and 11 vertical lines.

Only **DOT** switch engaged:

A single dot at the center of the screen.

DOT and **7 X 11** switches engaged:

7 horizontal rows by 11 vertical columns of dots.

3. Convergence patterns use interlaced scan when the **RGB TTL/LOW** switch is released. This causes a slight jitter effect in the appearance of the pattern. Progressive scan may be selected by engaging the **RGB TTL/LOW** switch for a jitter-free pattern. Most people prefer to use progressive scan for convergence patterns, but some newer TV sets will not accept the signal unless interlaced scan is used.

All convergence patterns are monochrome. On most sets the entire **7 X 11** pattern (when **7 X 11** switch is engaged) will not be visible due to overscan; it is desirable to display a pattern of at least 7 horizontal and 10 vertical lines or dots.

BLACK RASTER PATTERN

1. Perform the "INITIAL SET-UP" procedure.
2. Press the **RAST** switch. The **COLOR OFF** switch should have no effect on the display regardless of whether it is engaged or disengaged.
3. The screen should not be completely black (black raster or black-burst).

4.5 MHz SUBCARRIER USE

To check for audio isolation, the **4.5 MHz** can be switched on when the NTSC color bars pattern is selected. In a well designed properly adjusted receiver, the sound trap should prevent the 4.5 MHz subcarrier from affecting the picture quality. In receivers where the audio is not completely removed from the video component of the signal, a "herring bone" pattern will appear on the screen.

To check the audio circuitry, the **4.5 MHz** switch should be engaged when any pattern is selected. The 4.5 MHz subcarrier is modulated by an audio tone (approximately 1 kHz) that can be used to troubleshoot the audio circuitry in video equipment.

RGB OUTPUT

Independent red, green, and blue (RGB) outputs are available for testing and adjusting color monitors that use separate red, green, and blue inputs rather than a composite video input. Such color monitors are often used with computers having color graphic display capability, etc.

The Model 1249B will provide compatible test signals for most RGB monitors using standard 525 line, 15.750 kHz horizontal scan. It is not compatible with high resolution graphics monitors which use special high frequency scan rates.

Some color monitors accept either composite video signals or RGB signals. Often, positive polarity vertical and horizontal sync is required in RGB monitors. Some RGB monitors use low level RGB signals and vary color saturation in response to analog changes of the signal level. Others use higher TTL level excitation and display only fully saturated colors. The Model 1249B NTSC Generator provides signals for most versions.

Separate **R, G,** and **B** outputs with selectable **TTL** or **LOW** level are available at BNC connectors on the front panel. In addition, positive polarity $\mathbf{V_S}$ (vertical sync) and $\mathbf{H_S}$ (horizontal sync) are available at additional BNC connectors, also on the front panel. To simplify connections, a 9-pin connector (sub-miniature D-type) is provided which mates with the 9-pin connector used on the most common RGB monitor configuration (the connector is IBM PC compatible). This duplicates the functions of the **R, G, B** $\mathbf{V_S}$, and $\mathbf{H_S}$ jacks in one connector so that all connections are made simultaneously with a single cable.

The procedure for using the RGB outputs is as follows:

1. Connect the RGB outputs of the NTSC Generator to the inputs of the color monitor.
   a. Connect the **R, G,** and **B** outputs of the Generator to the corresponding red, green, and blue inputs of the color monitor.
   b. If composite sync is required, connect the **COMPOSITE SYNC** output of the Generator to the sync input of the monitor.
   c. If separate vertical and horizontal positive polarity sync is required, connect the $\mathbf{V_S}$ and $\mathbf{H_S}$ outputs of the generator to the corresponding vertical and horizontal sync inputs of the monitor.
   d. If the color monitor is equipped with a 9-pin connector that mates with the RGB receptacle on the Generator, connect it. All necessary connections are made simultaneously.
2. Select **TTL** or **LOW** level as appropriate for the monitor being tested.
3. Select the desired pattern.

WAVEFORM MONITORING

It is often desirable to examine the waveform on an oscilloscope or waveform monitor. For example, in troubleshooting a television receiver, the **COMPOSITE VIDEO** output may be applied to an oscilloscope or waveform monitor and the waveform used for reference. Meanwhile, the rf or i-f output which is modulated with the same waveform may be applied at various points in the equipment under test. The waveform measured at the video detector of the unit under test may be compared to the reference waveform generated by the NTSC Generator. Degradation of the waveform indicates poor circuit performance or misadjustment. A dual trace oscilloscope is very handy for such waveform comparison.

1. Connect a coaxial cable from the **COMPOSITE VIDEO** output jack to the vertical input of the oscilloscope. Terminate into 75Ω.

2. Connect another cable from the **COMP SYNC** output jack to the external trigger input of the oscilloscope.
3. Select the external triggering mode on the oscilloscope.
4. A sweep rate of about 10 µs/div is appropriate for viewing horizontal lines of composite video, 2 ms/div for viewing vertical fields, and 5 ms/div for viewing vertical frames. The sweep vernier may be used for fine adjustment of the waveform display.

SIMULTANEOUS OUTPUTS

For maximum flexibility, all output jacks may be used simultaneously if desired. This can be a valuable aid in many applications. These outputs are summarized as follows:

The **COMPOSITE VIDEO** output is continuously available when the instrument is operating. The video component of the signal is dependent upon the selected pattern.

The **IF/RF** output is continuously available when the instrument is operating. It may be set to operate on channel 3, channel 4, or i-f frequencies. It is modulated by the same signal that appears at the **COMPOSITE VIDEO** output jack (however, level is fixed and sync pulse is negative going), although the modulated 4.5 MHz subcarrier can be added.

The **COMP SYNC**, $\mathbf{V_S}$, $\mathbf{H_S}$, and **30 Hz** are also continuously available. The **COMP SYNC** output supplies negative polarity sync, and the $\mathbf{V_S}$ and $\mathbf{H_S}$ sync outputs supply positive polarity signals. The **30 Hz** signals is a TTL level square wave useful for video recorder troubleshooting.

NTSC COLOR BARS

Versatility

The NTSC color bars pattern is the basic pattern used for most testing, troubleshooting, and adjustments in video equipment. It is one of the most valuable and versatile color patterns ever devised. The NTSC color bars pattern is very effective for adjusting any type of consumer or industrial color video equipment for maximum performance. For troubleshooting and servicing, analysis of the NTSC color bars pattern or its waveform usually localize a color related problem to a specific few circuits.

Color Television Receivers

The NTSC color bars pattern provides a standard reference for color adjustments and troubleshooting in television receivers. The pattern contains bars of the three primary colors: red, blue, and green. These are good reference for checking 3.58 MHz phase problems. The grey, yellow, cyan, and magenta help define problems wherein the mix of colors is not in the correct proportions. The **COLOR OFF** switch removes the chroma component entirely and is very helpful in defining problems as either chroma or luminance related.

Video Recorders

The NTSC color bars pattern is virtually a necessity for video recorder servicing. This includes video cassette recorders and video disc players. Most manufacturers specify an NTSC color bar input signal in their literature. Adjustment procedures are usually based upon an NTSC color bar input, and the waveforms shown at various points on the schematic diagram are those obtained with an NTSC color bar input. Some manufactuers provide "field" and "factory" procedures in their literature. However, the "field" procedures merely eliminate all adjustments that require an NTSC color bars pattern, which severly restricts the amount of servicing that can be performed. With an NTSC generator, you can perform the "factory" procedures. The NTSC color bars pattern is essential for chroma and luminance alignment and is also preferred for general troubleshooting.

Overall VCR Performance

An overall performance test of a VCR may be conducted by recording the NTSC color bars pattern, then playing it back on a video monitor. There should be no noticeable difference between the video played back from the VCR and an NTSC color bars pattern applied directly to the monitor.

Luminance and Chroma Balance

In a VCR, the luminance and chroma signals are separated during the recording process, and recombined during the playback process. If luminance and chroma signals are not maintained at the proper proportions when separated, color distortion will probably occur, particularly in the vividness of colors or color saturation. Waveforms may be examined throughout the VCR for proper luminance to chroma proportions. Another problem that may be encountered is a difference in delay between the luminance signal and the chroma signal. This will cause fuzziness along the edges of the color bars.

STAIRCASE

The staircase pattern (**NTSC BARS** and **COLOR OFF** switches engaged) is recommended for frequency equalization adjustment in the recorder amplifier circuit of VCR's. The FM signal which carries luminance information in a VCR is shifted to a different frequency with each step of the staircase signal. However, record current should remain constant across the FM frequency band. Frequency equalization should be adjusted so that record current is equal for all steps of the staircase input signal.

CONVERGENCE

Center Cross Pattern

The center cross pattern (**LINE** switch engaged, **7 X 11** switch disengaged) should intersect at the center of the screen and there should be no tilt of the horizontal line. Improper centering indicates the need for centering adjustment or a deflection circuit fault. Tilt may require repositioning of the deflection yoke for correction. This pattern also provides a good general check of vertical and horizontal sync.

Center Dot Pattern

Some technicians and engineers prefer to use a center dot for centering adjustment.

Dots Pattern

The dots pattern (**DOT** and **7 X 11** switches both engaged) is used for static convergence, usually by converging the center dot of the pattern. A 7 x 11 dot pattern is generated. Most sets have some overscan so that all dots are not visible, except possible under low voltage conditions. Some sets have a tendency toward more overscan than others. It is desirable to display at least a 7 x 9 dot pattern.

Crosshatch Pattern

The crosshatch pattern (**LINE** and **7 X 11** switches both engaged) is normally preferred for dynamic convergence, although some technicians prefer the dots pattern for both static and dynamic convergence. The crosshatch pattern checks vertical and horizontal linearity. Each square should be the same size, which is a convenient reference for making linearity adjustments. The crosshatch pattern is also used to check pincushion distortion, which often appears at the outside edges of large screen TV sets as bends in the lines.

RF and I-F

The tuners and i-f sections of VCR's and color television receivers are essentially the same. Servicing of these sections can be aided by the rf and i-f outputs of the NTSC Generator. Performance of the VCR or TV set should be nearly as good when using the rf signal on channel 3 or 4 as when applying composite video directly into the video section. If not, there is a problem in the tuner or i-f section, which can be isolated by injecting rf or i-f signals at various points and identifying the point at which normal operation is lost.

SYNC

The NTSC color bars and staircase pattern include NTSC sync pulses, the same type as those produced by a broadcast station. The sync amplitude of 40 IEEE units is often the reference against which the remainder of the luminance signal is compared. Circuits can be checked for sync clipping by observing the staircase pattern on an oscilloscope and checking whether the sync pulse amplitude remains at 0.53 compared to the 75% white step (grey) which is a reference of 1.0. AGC circuits, which respond to sync pulse amplitude, can be checked by using the **COMPOSITE VIDEO** output and varying the level. The overall amplitude of the video can be varied, but the sync pulse amplitude is a constant percentage of the total video amplitude.

The precise timing of the sync pulses allows proper adjustment of servo circuits which control tape speed in VCR's, and switching circuits which should switch between video heads to allow a continuous transition from field to field.

30 Hz OUTPUT

Due to their electro-mechanical nature, servos are a common problem with VCR's. Using standard troubleshooting techniques and tools, isolating a servo problem can be very difficult, if not impossible. Using the 30 Hz output of the NTSC Generator however, should allow relatively simple isolation of the trouble spot.

VCR's utilize closed loop feedback circuits to control the heads. By injecting the 30 Hz signal at different points in the closed loop, the faulty circuit should be relatively easy to isolate. For example, if you were to inject the 30 Hz signal from the Generator into the feedback path and no change in servo operation was noted, the problem would be with the circuit that receives the feedback signal. Conversely, if you noticed a change in the servo operation, the problem would be in the circuit that sends the feedback signal.

CCTV APPLICATIONS

Closed circuit television systems do not usually include a built-in NTSC color reference signal. The NTSC Generator can be used to supply such a reference. All equipment in the system can then be adjusted to the same reference while connected into or removed from the system.

Virtually all equipment used in CCTV systems is designed around certain standard signal conditions at the input and output terminals. This allows equipment to the compatible, without modification, when interconnected as a system. Among the standard signal conditions are positive polarity video signal (negative sync pulses), 1 volt peak-to-peak signal amplitude, 75 Ω impedance, and unbalanced line (one side grounded). The NTSC Generator has these characteristics, which simplifies set-up for testing, troubleshooting, and adjustment.

CATV APPLICATIONS

Cable television systems also use the standard signal conditions specified in the "CCTV Applications" paragraph at input and output terminals. The channel 3 or 4 rf output of the unit can be used throughout a CATV network to test, adjust, or troubleshoot amplifiers, cables, and any other equipment.

MATV APPLICATIONS

Master antenna systems for hotels, motels, apartment buildings, etc. can be checked by applying the channel 3 or 4 rf output of the Generator to the input of the network (or a branch of the network) and examining the pattern obtained on channel 3 or 4 direcctly from the screen of each TV set. To isolate problems in the distribution network from problems in an individual TV set, apply the channel 3 or 4 rf output of the NTSC Generator directly to the antenna terminals of the TV set. A proper display on the screen indicates that there is a problem in the distribution network.

VECTORSCOPE MEASUREMENTS

A vectorscope measurement is usally more helpful for trouble analysis than observing the pattern displayed on the picture tube. If an NTSC Vectorscope is available, it is recommended. The display on an NTSC Vectorscope with the NTSC color bars pattern applied should be six dots located within the six small boxes of the Vectorscope as shown in Fig. 3. The displayed vector pattern may be extracted from anywhere in the composite video or 3.58 MHz color circuits. Amplitude must be initially adjusted so the color burst aligns with the 75% mark on the vectorscope graticule.

If an NTSC vectorscope is not available, the demodulated color signals from the red and blue guns can be used as the X and Y inputs to a good laboratory oscilloscope (such as the **B+K Precision** Model 2120). The resulting display is a vectorscope pattern as shown in Fig. 7. The oscilloscope should be set up for vectorscope operation as follows:

1. Select the **NTSC BARS** pattern and apply to the TV set under test.

2. Set up to the oscilloscope for X-Y operation. Adjust the position controls to center the dot on the screen with no signal input to the oscilloscope.

3. Connect the X and Y inputs of the oscilloscope to the red gun as shown in Fig. 5.

4. Adjust the vertical and horizontal oscilloscope gain to equal amounts. This will cause the spot to become a 45° line as shown in Fig. 5.

5. Leave the vertical (Y) input connected to the red gun but move the horizontal input to the blue gun as shown in Fig. 6.

6. A display similar to that shown in Fig. 7 should be obtained. However, several factors may affect the display as follows:

   a. The HUE control of the TV under test will rotate the display. The HUE control may be adjusted to obtain the display nearest to that shown in Fig. 7. Starting from a centered position, the HUE control can typically rotate the display ±30°.

   b. The COLOR control of the TV under test (chroma amplitude) adjusts the amplitude of the display. This control should typically be adjusted for the highest amplitude obtainable without distortion (just below the point where further rotation of the control does not increase amplitude of display).

c. The display shape depends upon the chroma bandpass, demodulator alignment, and design of the TV chassis. The better the alignment and bandwidth, the closer the vector waveform will be to the ideal waveform.

d. Display shape will vary depending upon whether TV chassis uses 90° or 105° angle of demodulation.

7. The vectorscope pattern can be a valuable tool for troubleshooting color problems, including improper alignment and adjustment, if the normal vectorscope pattern is known. However, since normal patterns vary considerably from one TV to another, a library of normal dislays measured from various popular TV chassis in good working condition is desirable for reference.

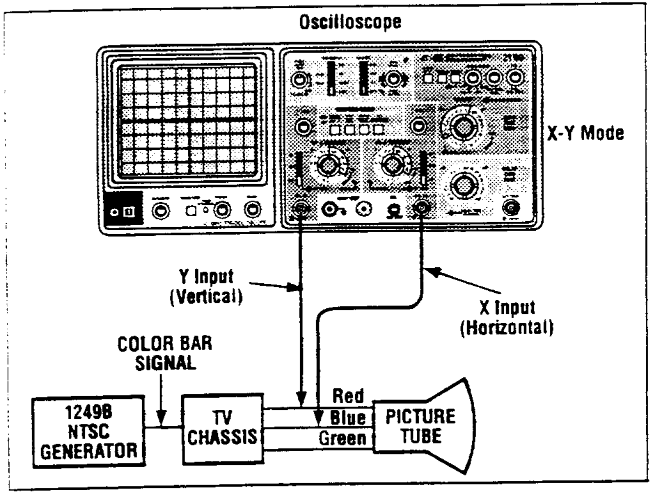


Fig. 5. Using a Conventional Oscilloscope as a Vectorscope, step 1 (set-up).

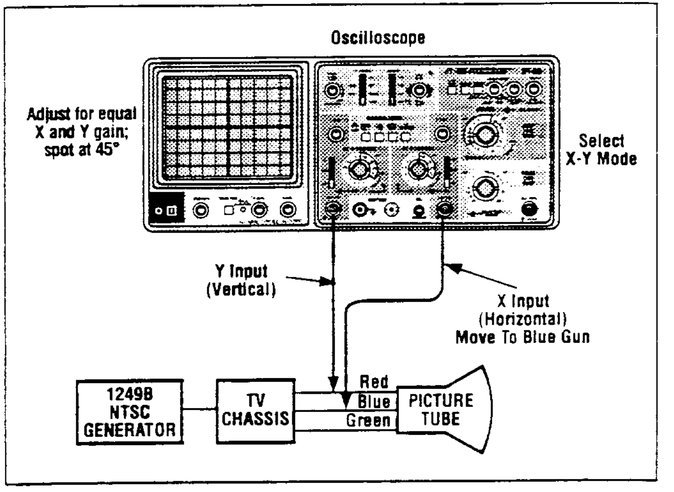


Fig. 6. Using a Conventional Oscilloscope as a Vectorscope, step 2 (set-up).

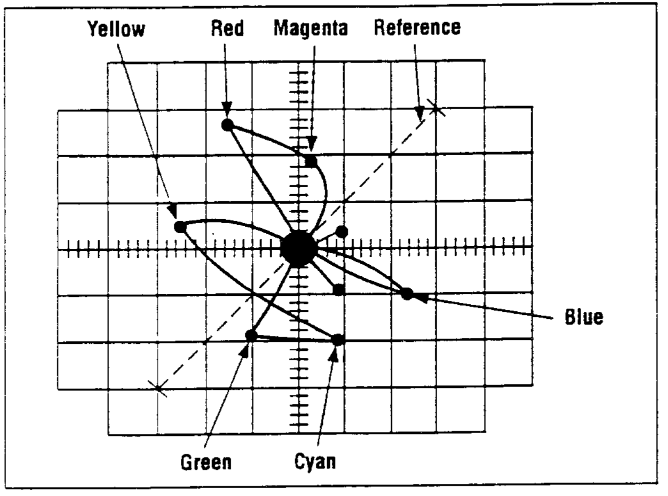


Fig. 7. Typical Vectorscope Display of Demodulated Color Bars Pattern Viewed on Conventional Oscilloscope.

WARNING

The following instructions are for use by qualified service personnel only. To avoid electrical shock, do not perform servicing unless you are qualified to do so.

A shock hazard is present when the top cover is removed if the power cord is plugged into an ac outlet. AC line voltage may be present on the fuse holder, line cord receptacle, **POWER** *switch, and power transformer even when the* **POWER** *switch is off.*

CASE REMOVAL

In order to replace the fuse or calibrate the NTSC Generator the case must be removed. To remove the case perform the following steps:

1. Turn the Generator upside down and remove the four screws.
2. Lift the bottom half of the case straight up.

FUSE REPLACEMENT

If the fuse blows the pilot light will go out and the Generator will not operate. The fuse should not open unless a problem has developed in the unit. Determine and correct the cause of the blown fuse, then replace only with a 1/16 A, 250 V slow blow fuse (**B+K Precision** Part No. 190-002-9-001). The fuse is only accessible by removing the case. For fuse location refer to Fig. 8.

CALIBRATION

This unit was carefully checked and calibrated at the factory prior to shipment. Readjustment is recommended only if repairs have been made in a circuit affecting calibration. The location of the calibration adjustments is shown in Fig. 8. Keep in mind that some calibration procedures require high precision test instruments. Those adjustments should be attempted only if the proper test equipment is available and you are experienced in its use. The following test equipment is required for complete calibration:

NTSC Vectorscope.
Waveform Monitor.
Frequency Counter with 1 ppm time base accuracy. **B+K Precision** Model 1856A or equivalent.

1. Before beginning calibration, turn on the NTSC Generator and allow 15 minutes of warm-up time.
2. Engage **COLOR OFF** and **RAST** switches. All other switches (except **POWER**) should be disengaged.

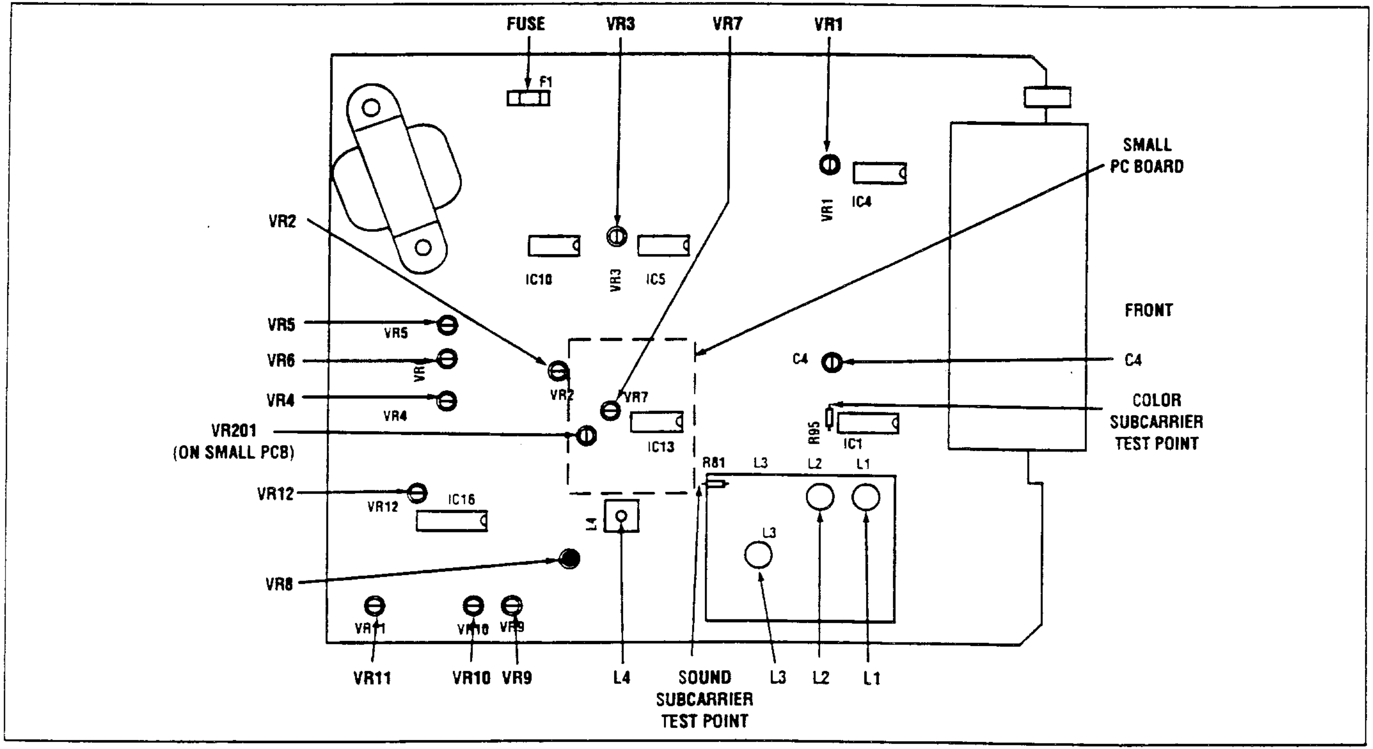


Fig. 8. Adjustment and Test Point Locations.

3. Connect the Waveform Monitor and the Vectorscope to the **COMPOSITE VIDEO** jack (terminated into 75 Ω). Set the Waveform Monitor response to FLAT and the sweep to 2H. Set the variable amplitude control on the Waveform Monitor to the CAL position, set the sync to internal, and turn on the DC restorer.

Color Subcarrier Adjustment

1. Connect the frequency counter at the junction of R95 and pin 6 of IC1 (the right hand side of R95) and adjust C4 for a reading of 3.579545 MHz ±3 Hz on the frequency counter.

Sound Subcarrier Adjustment

1. Press the **4.5 MHz** switch on the Generator.
2. Connect the frequency counter at the junction of R81 and pin 13 of IC18 (the back lead of R81) and adjust L4 for a reading of 4.49 MHz ±10 kHz on the frequency counter.
3. Release the **4.5 MHz** switch on the NTSC Generator.

I-F and RF Adjustments

1. Make sure that the **CH 4/CH 3** switch is disengaged (in the **CH 3** position), connect the frequency counter to the **IF/RF** jack, and adjust the core of L2 fully clockwise (to the bottom) or until the frequency counter reads below 61.245 MHz.
2. Now adjust L2 counterclockwise until the frequency counter reads 61.250 MHz ±5 kHz. Turn the core an additional 1/2 turn counterclockwise. The reading on the frequency counter should remain stable.
3. Press the **CH 4/CH 3** switch on the NTSC Generator (so that it is in the **CH 4** position).
4. With the frequency counter still connected to the **IF/RF** jack, adjust the core of L3 fully clockwise (to the bottom) or until the frequency counter reads below 67.245 MHz.
5. Now adjust L3 counterclockwise until the frequency counter reads 67.250 MHz ±5 kHz. Turn the core an additional 1/2 turn counterclockwise. The reading on the frequency counter should remain stable.
6. Press the **IF/RF** switch on the Generator (so that it is in the **IF** position).
7. Adjust the core of L1 fully clockwise (to the bottom) or until the frequency counter reads below 45.745 MHz.
8. Now adjust L1 counterclockwise until the frequency counter reads 45.750 MHz ±5 kHz. Turn the core an additional 1/2 turn counterclockwise. The reading on the frequency counter should remain stable.
9. Release the **IF/RF** switch (return to channel 4 rf operation). The counter should now read 67.250 MHz ±5 kHz. If the reading is unstable, repeat step 5.
10. Release the **CH 4/CH 3** switch. The switch should now be in the **CH 3** position. The frequency counter should now read 61.250 MHz ±5 kHz. If the reading is unstable, repeat step 2.

Sync Pulse Adjustment

1. Set the **COMPOSITE VIDEO LEVEL** control to CAL position and adjust VR8 for sync pulse amplitude of -40 IRE on the Waveform Monitor (baseline on zero line).

2. Press the **NTSC BARS** switch and release the **COLOR OFF** switch. Set the Waveform Monitor for a sweep speed of 1 µs/div.

3. Adjust VR10 and VR11 on the 1249B for minimum ripple on the bottom edge of the sync pulse. Repeat until no further improvement is possible.

Color Adjustments

1. Adjust the vertical and horizontal position controls on the Vectorscope so that the dot is exactly centered on the screen and make sure that the gain control is adjusted for a sync pulse amplitude of –40 IRE.

2. Press the **NTSC BARS** switch and release the **COLOR OFF** switch on the Generator.

3. Adjust VR12 on the NTSC Generator to align the burst vector with the mark on the horizontal axis of the Vectorscope. Readjust the phase control on the Vectorscope. Readjust the phase control on the Vectorscope if necessary.

4. Adjust VR4 and VR9 on the Generator to bring the red vector into the small R box on the Vectorscope display.

5. Adjust VR6 to bring the blue vector into the small B box on the Vectorscope display.

6. Adjust VR5 to bring the green vector into the small G box on the Vectorscope display.

7. If necessary, readjust VR12 to align the burst vector with the proper mark. Also if necessary, readjust VR4, VR5, VR6, and VR9 to bring all six vectors into their proper boxes.

8. Return the Waveform Monitor sweep switch to 2H and adjust VR7 on Generator for grey level of 77 IRE on the Waveform Monitor. Recheck Vectorscope display and readjust vectors if necessary.

9. Release all of the pattern selection switches (the four light colored pushbuttons) by slightly depressing one of them. With the Waveform Monitor sweep switch still set on 2H, adjust VR201 on the Generator for a white level of 100 IRE units on the Waveform Monitor. Engage the **NTSC BARS** switch.

10. Adjust VR2 on the Generator so that the black color bar (the last one) is 2.5 divisions wide on the Waveform Monitor. If waveform jitters, readjust VR2 slightly so that spacing is between 2.5 and 2.0 divisions.

11. Press the **LINE** and **7 X 11** switches on the NTSC Generator. Adjust VR3 so that the top horizontal line of the Waveform Monitor display is at 100 IRE.

12. Adjust VR1 fully counterclockwise. If the tops of the vertical lines on the Waveform Monitor display are not at 100 IRE, adjust VR1 until they are.

INSTRUMENT REPAIR SERVICE

Because of the specialized skills and test equipment required for instrument repair and calibration, many customers prefer to rely upon **B+K Precision** for this service. We maintain a network of **B+K Precision** authorized service agencies for this purpose. To use this service, even if the instrument is no longer under warranty, follow the instructions given in the WARRANTY SERVICE INSTRUCTIONS. There is a nominal charge for instruments out of warranty.

WARRANTY SERVICE INSTRUCTIONS
(For U.S.A. and its Overseas Territories)

1. Refer to the MAINTENANCE section of your **B+K PRECISION** instruction manual for adjustments that may be applicable.
2. If the above-mentioned does not correct the problem you are experiencing with your unit, pack it securely (preferably in the original carton or double-packed).
3. Enclose a letter describing the problem and include your name and address.
4. Enclose proof of purchase date; that is, a dated copy of the sales receipt.
5. Deliver to, or ship PREPAID (UPS preferred in U.S.A.) to the nearest **B+K PRECISION** authorized service agency (see list enclosed with unit).

If your list of authorized **B+K PRECISION** service agencies has been misplaced, contact your distributor for the name of your nearest service agency, or write to:

B & K-Precision
Factory Service Operation
1031 Segovia Circle
Placentia, CA 92870
Tel (714) 237-9220
Fax(714) 237-9214

Also use this address for technical inquiries
and replacement parts orders.

LIMITED ONE-YEAR WARRANTY

B & K Precision warrants to the original purchaser that its product, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of purchase.

B & K Precision will, without charge, repair or replace, at its option, defective product or component parts upon delivery to an authorized **B & K Precision** service contractor or the factory service department, accompanied by proof of the purchase date in the form of a sales receipt.

To obtain warranty coverage in the U.S.A., this product must be registered by completing and mailing the enclosed warranty registration card to **B & K Precision**, 1031 Segovia Circle, Placentia, CA 992870 - 7137 within fifteen (15) days from the date of purchase.

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. It is void if the serial number is altered, defaced or removed.

B & K Precision shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

This warranty gives you specific rights and you may also have other rights which vary from state to state.

Model 1249B **Date Purchased**__________

CUSTOMER SUPPORT
1-800-462-9832

B+K Precision offers courteous, professional technical support before and after the sale of their test instruments. The following services are typical of those available from our toll-free telephone number:

- Technical advice on the use of your instrument.
- Technical advice on special applications of your instrument.
- Technical advice on selecting the best instrument for a given task.
- Information on optional accessories for your instrument.
- Information on instrument repair and recalibration services.
- Replacement parts ordering.
- Information on other **B+K Precision** instruments.
- Requests for a new **B+K Precision** catalog.
- The name of your nearest **B+K Precision** distributor.

Call toll-free 1-800-462-9832
Monday through Friday, 8:00 A.M. to 5:00 P.M.
(Pacific Standard Time)

(continued from inside front cover)

7. Testing "hot chassis" video equipment is especially hazardous unless the proper safety precautions are taken. Most recent television receivers and other equipment with a two-wire ac power cord are the "hot chassis" type; this even includes many with polarized power plugs. A plastic or wooden cabinet usually insulates the chassis to protect the customer, but when the cabinet is removed for servicing there is great danger of serious electrical shock if the chassis is touched. To prevent electrical shock, always connect an isolation transformer between the ac outlet and any hot chassis equipment under test. The **B+K Precision** Model 1604 or TR-110 Isolation Transformer, or Model 1653 or 1655 AC Power Supply is suitable for most applications. To be on the safe side, treat all two-wire ac powered equipment as "hot chassis" unless you are sure it has an isolated chassis or an earth ground chassis. Use of an isolation transformer has no disadvantage, even if it is not required.

8. In addition to the hot chassis shock hazard mentioned in item 7, severe damage to test instruments or the equipment being tested is probable from connecting a cable between the NTSC Generator and any "hot chassis" equipment unless an isolation transformer is used. The antenna terminals of a hot chassis set should already be isolated from the chassis, unless defective, and the isolation transformer may not be required. For connection to any other point, an isolation transformer is needed.

9. Capacitive coupled outputs of the Model 1249B NTSC Generator are rated at ±35 volts (dc + ac peak) maximum; this includes the **IF/RF** and **COMPOSITE VIDEO** jack. All other input and output jacks are direct coupled and are rated at ±5 volts (dc + ac peak) maximum. Make test connections at circuit points which do not exceed this value. If in doubt, first make voltage measurement with voltmeter or oscilloscope. Connection to higher voltage may damage the equipment.

10. When testing any ac powered equipment, remember that ac line voltage is usually present on some power input circuits such as the on-off switch, fuses, power transformer, etc. any time the equipment is connected to an ac outlet, even if the equipment is turned off.

11. Servicing of this unit should be performed only by qualified electronics technicians who are trained to work safely in the presence of high voltage.

12. Never work alone. Someone should be nearby to render aid if necessary. Training in CPR (cardio-pulmonary resuscitation) first aid is highly recommended.