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INSTRUCTION MANUAL

B&K PRECISION

Model 1249B

NTSC GENERATOR

TEST INSTRUMENT SAFETY

WARNING

Normal use of test equipment exposes you to a certain amount of danger from electrical shock because testing must sometimes be performed where exposed voltage is present. 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 pose an even greater threat because such voltage can more easily produce a lethal current. Your normal work habits should include all accepted practices to prevent contact with exposed high voltage, and to 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 or probes ore 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 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; and 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 pints. 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)

TABLE OF CONTENTS

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 d, or the standard television i-f frequency of 45.75MHz. This provides the proper signal for injection at any point in the equipment.

The video patterns include standard NTSC color bats 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. 15.750KHz 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 (0.8V). 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 30Hz TTL output and a switchable 4.5MHz sound sub-carver modulated with a 1 kHz audio tone. The 30Hz signal is useful for isolating servo problems in video cassette recorders.

The switch selectable 4.5MHz sound sub-carrier is modulated by a 1KHz 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. 30Hz. and sync generation are crystal-controlled for frequency accuracy and stability.

COMPOSITE VIDEO OUTPUT

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

RF OUTPUT

Standard 75Ω output modulated by composite video at 10mV rms on channel 3, channel 4, or 45.75MHz 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, 15.750KHz scan. D-Type sub-miniature 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±0.2V).

30Hz OUTPUT

30Hz TTL output is useful for video recorder applications.

4.5MHz SOUND SUB-CARRIER

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

SPECIFICATIONS

PATTERNS

NTSC Color Bars:

White (75% or I00%. 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 EEE units.

Raster:

Black.

Convergence:

Center dot, 7 x 11 dots, center cross,7 x 11 crosshatch. Selectable interlaced or progressive scan.

RF OUTPUT

Channels:

CH3, CH4, IF.

Frequency:

61.25, 67.25, 45.75MHz ±0.008MHz.

Level:

10mV rms minimum into 75 ohms.

Impedance:

75 ohms.

Stability:

50 ppm.

VIDEO OUTPUT

Polarity:

Negative and positive sync available.

Amplitude:

Variable 0 to ±1V p-p into 75 ohms. Calibrated 1V 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±0.2V), switch selectable.

Impedance:

75 ohms.

SPECIFICATIONS (CONT.)

SOUND SUBCARRIER

4.5MHz ±0.2% modulated by approximately 1KHz 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: 3.579545MHz (±50Hz) (adaptable to PAL-M).

MISCELLANEOUS

Power Requirements:

105 to 130VAC, 60Hz. 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).

NOTE: Specifications and information are subject to change without notice. Please visit www.bkprecision.com for the most current product information.

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 subcamer.

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

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

Color Bars. See "NTSC Color Bars".

Color Burst. A few (8 to 10) cycles of 3.58MHz 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 3.58MHz signal which carves 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 5µs pulse width at 63.5µs 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.

DEFINITIONS OF TERMS (CONT.)

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 4.2MHz.

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.

IFFE. 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 or 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 vanes 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 [FEE 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 line to achieve interlaced scan).

THE NTSC COLOR VIDEO SIGNAL

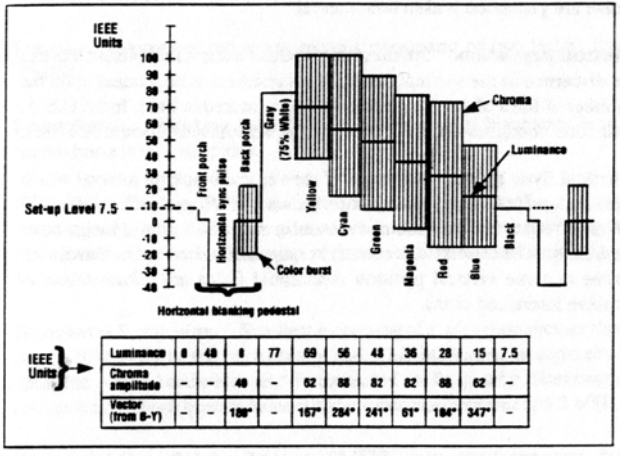

Fig. 1. Composite of Video Signal; One Horizontal Line of NTSC Color Bars Signal

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 15.734.26Hz and a vertical scan frequency of 59.94Hz. A 3.579545MHz 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 horizontal sync pulse is followed by a 4.79 microsecond back porch at the blanking level. When a color signal is being generated, 8 to 10 cycles of 3.579545MHz 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 60Hz rate (59.94Hz 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 30Hz 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 fast 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 100%

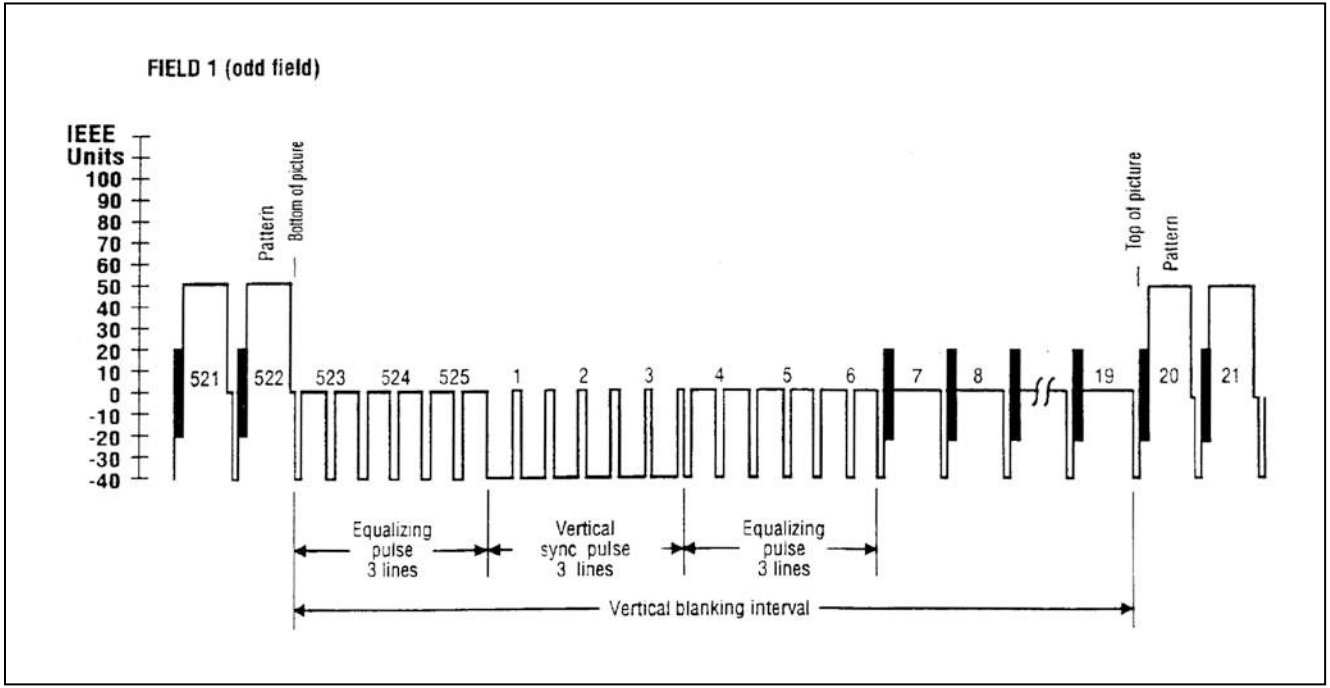

Fig. 2A. Compo site Video Signal Showing Vertical Blanking Interval (Field 1).

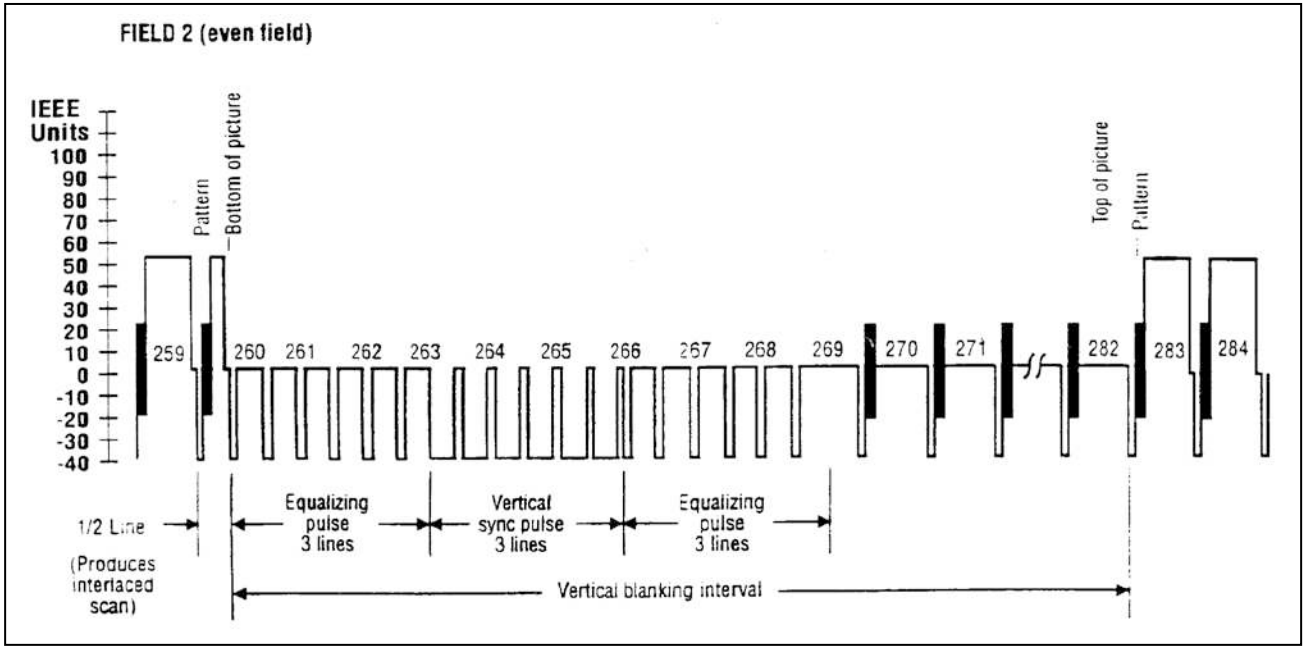

Fig. 2B. Composite Video Signal Showing Vertical Blanking Interval (Field 2)

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 3.58MHz 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 3.58MHz 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 amplitude

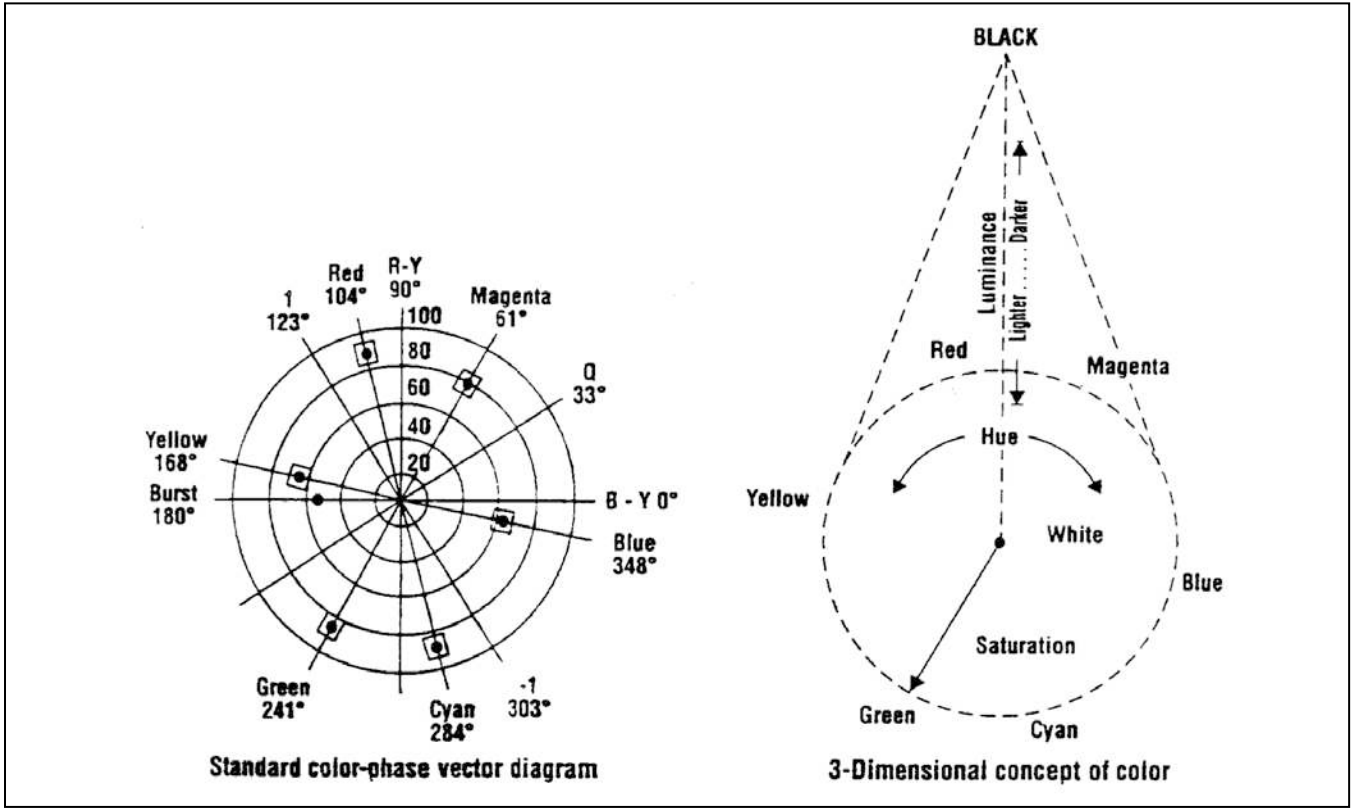

Fig. 3. Elements of Color Television Signal

(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 3.58MHz so that 360° phase shift occurs during each horizontal line. This produces a gated rainbow pattern rather than specific, phase controlled colors.

CONTROLS AND INDICATORS

1. **POWER Switch**. Turns power on and off.

2. **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 0.8V ±0.2V 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 bats or staircase pattern with 100% white level. The five selectable patterns are available at the **COMPOSITE VIDEO, IR/RF**, or **RGB output** jacks.

3. **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 4.5MHz subcarrier (sound) on and off. When this switch is engaged, a 4.5MHz sound carrier (modulated by

approximately 1KHz) 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 (45.75MHz) and the **CH 4/CH 3** switch has no effect. When disengaged, the signal at the **IF/RF** jack is at rf signal frequency (61.25MHz for CH 3 or 67.25MHz for CH 4).

10. **CH 4/CH 3 Switch.** Works in conjunction with rf position of **IFIRF** 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 (61.25MHz). 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 (67.25MHz). 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 1Vp-p into 75Ω. 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 1Vp-p into 75Ω.

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

14. **30Hz Jack.** Provides a 30Hz 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 75Ω, level is TTL compatible.

16. **SYNC Vs 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 75Ω. Level is TTL compatible.

17. **SYNC Hs 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 75Ω. 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**).

CONTROLS AND INDICATORS (CONT.)

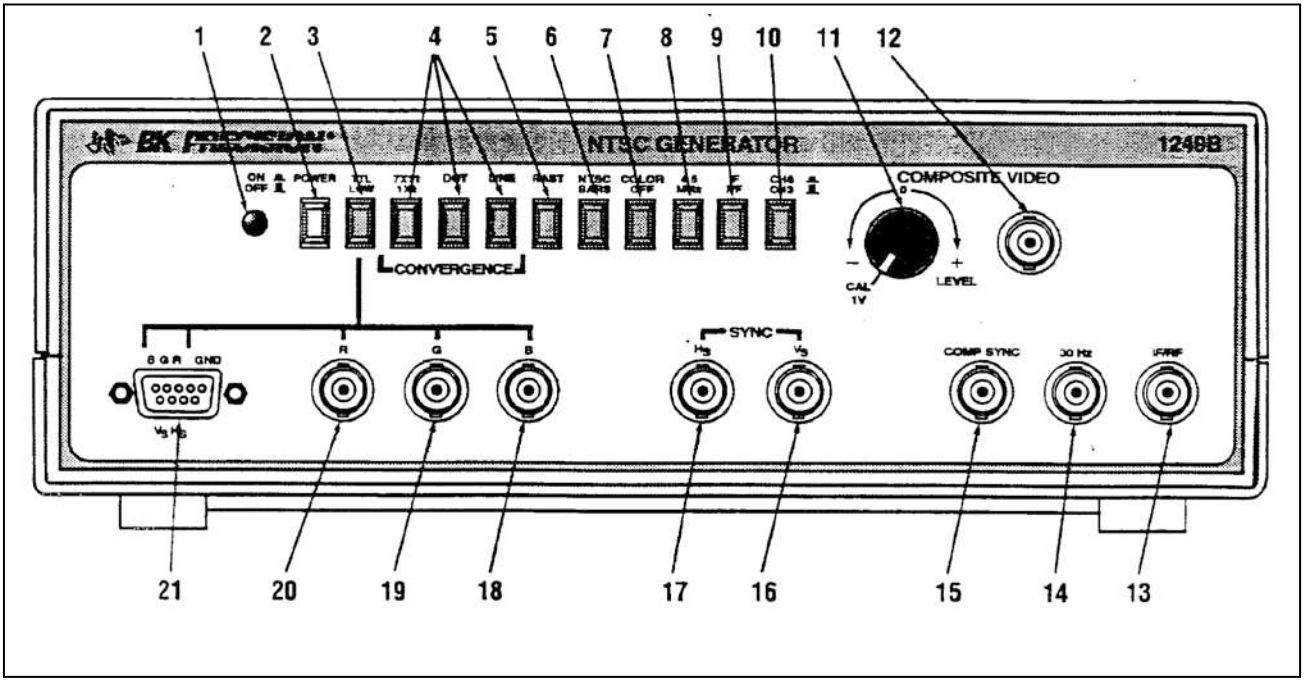

Fig. 4. Controls and Indicators

CONTROLS AND INDICATORS (CONT.)

19. **G Jack**. Provides green output signal for use with RGB monitors. Output impedance is Ω75 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 75Ω 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 (**Vs**), and horizontal sync **(Hs)** 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.

OPERATING INSTRUCTIONS

WARNING

To prevent electrical shock, observe the precautions listed in the TEST INSTRUMENT SAFETY section, located on the inside front cover of this manual.

PRECAUTION AND TIPS

1. The most commonly encountered hazard in the use of this instrument is "hot chassis" equipment. Always connect an isolation transformer (such as the **B & K Precision** Model TR-110 or 1604 Isolation Transformer or Model 1653A or 1655A AC Power Supply) between the wall outlet and any "hot chassis" equipment under test. See the TEST INSTRUMENT SAFETY section, steps 7 and 8 for more information

2. The **RF/IF** and **COMPOSITE VIDEO** outputs of this NTSC Generator are rated to withstand voltages of -35 to +35 volts. All other outputs are rated to withstand -5 to +5 volts. The NTSC Generator must only be connected to circuit points where the dc + ac peak voltage is within the specified limit (±35 volts for the **RF/IF** and **COMPOSITE VIDEO** outputs and ±5 volts for all other outputs). If in doubt, make a voltage measurement first. Also take care to prevent accidental contact with high voltage points.

3. All outputs have a source impedance of 75Ω. Therefore, 75Ω coaxial cable RG-59/U) is recommended for interconnecting cables.

FAMILIARIZATION

To familiarize yourself with the operating controls, capabilities and operating characteristics of the NTSC Generator, we recommend that you connect it to a color television receiver that is in proper operating condition and observe all the patterns. An oscilloscope or waveform monitor may also be used to observe all the waveforms produced.

INITIAL SET-UP

1. Connect the power cord of the NTSC Generator to a 120VAC, 60Hz outlet
2. Turn on the instrument by setting the **POWER** switch to the **ON** position (engaged). The **POWER** indicator will light when the power is on.
3. Apply power to the equipment under test and turn it on. For "hot chassis" equipment, use an isolation transformer.

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 75Ω input point is desired, or use 75Ω to 300Ω 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 45.75MHz 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 45.75MHz 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 1Vp-p level, although it is uncalibrated.

c. A calibrated 1Vp-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 **4.5MHz** 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 **N T S C 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 baron 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 I00% 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 I I 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 I I 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** TTI/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 **4.5MHz** 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 4.5Hz 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 **4.5MHz** switch should be engaged when any pattern is selected. The 4.5MHz subcarrier is modulated by an audio tone (approximately lKHz) 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, 15.750KHz horizontal