

NTSC VECTORSCOPE

NEW



- **PUSH-BUTTON OPERATING CONVENIENCE**
- **AMPLITUDE CALIBRATED DISPLAYS**
- **CHROMINANCE PHASE AND AMPLITUDE, LUMINANCE AMPLITUDE, DIFFERENTIAL PHASE AND DIFFERENTIAL GAIN MEASUREMENTS**
- **LUMINANCE CHANNEL PERMITS R, G, B AND Y PRESENTATIONS**
- **ALL SILICON SOLID-STATE, COOL, QUIET OPERATION**

The Tektronix Type 520 NTSC Vectorscope is designed to measure luminance, hue and saturation of the NTSC composite color television signal. Self-canceling pushbutton switches permit rapid selection of displays for quick analysis of television signal characteristics, and to check Vectorscope calibration. All solid-state circuitry provides low power consumption and cool, quiet operation.

Dual inputs provide time-shared displays for comparison of input-output signal phase and gain distortion. A chrominance channel is provided which demodulates the chrominance signal to obtain color information from the composite video signal for use in VECTOR, LINE SWEEP, R, G, B, I, Q, Differential Gain (dA) and Differential Phase (dφ) displays. A luminance channel separates and displays the luminance (Y) component of the composite color signal. The Y component is combined with the output of the chrominance demodulators for R, G and B displays at a line rate.

A digital line selector permits the display of a single line Vertical Interval Test Signal from a selected line of either field 1 or field 2.

VECTOR PRESENTATION

The vector presentation graphically displays the relative phase and amplitude of the chrominance signal on polar coordinates. To identify these coordinates the graticule (See Fig 1) has points which correspond to the proper phase and amplitude of the primary and complementary colors: R (Red), B (Blue), G (Green); Cy (Cyan), Y_L (Yellow) and M_G (Magenta).

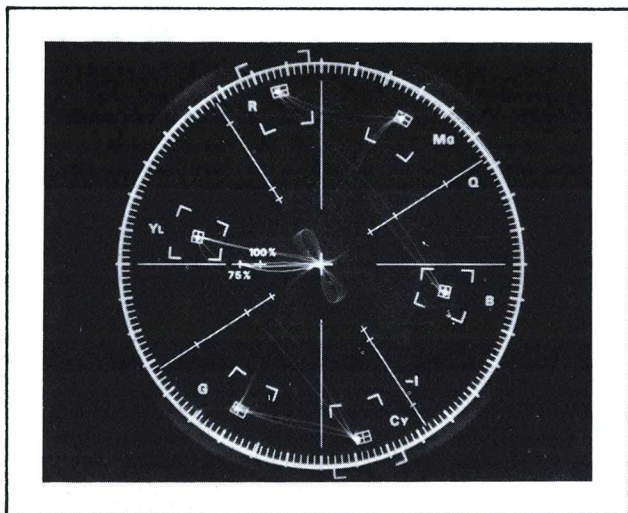


Fig. 1—Vector presentation of NTSC color bar signal.

Any errors in the color encoding, video tape recording or transmission processes which change these phase and/or amplitude relationships cause color errors in the television receiver picture. The polar coordinate type of display such as that obtained on the Type 520 CRT has proved to be the best method for portraying these errors.

The polar display permits measurement of hue in terms of relative phase of the chrominance signal with respect to the color burst. Saturation is expressed in terms of the displacement from center (radial length) toward the color point which corresponds to 75% (or 100%) saturation of the particular color being measured.

The outer boxes around the color points correspond to phase and amplitude error limits per FCC requirements ($\pm 10^\circ$, $\pm 20\%$). The inner boxes indicate $\pm 2.5^\circ$ and 2.5 IRE units and correspond to phase and amplitude error limits per EIA specification RS-189, amended for 7.5% setup.

An internally generated test circle matched with the vector graticule verifies quadrature accuracy, horizontal to vertical gain balance and gain calibration for chrominance signal amplitude measurements. Two methods of measuring phase-shift are provided. Large phase-shifts can be accurately read from the parallax-free vector graticule. A precision calibrated phase shifter with a range of 30° , spread over 30 inches of dial length, is provided for measuring small phase-shifts.

LINEAR-SWEEP PRESENTATION

The linear time base operates at the line rate. Color signals are demodulated along any desired axis, I, Q, R-Y, B-Y, etc. and displayed at the line rate on a linear time base.

DUAL DISPLAY

In dual-channel operation, successive samples of channels A and B are displayed on a time-shared basis. The switching rate is locked to horizontal sync and switching transients are blanked. Input-output signals from video equipment can be conveniently compared on channel A and B for phase and/or amplitude distortion. The subcarrier processing channel contains two uncalibrated 0° to 360° phase-shifters and one 30° CALIBRATED PHASE shifter. While viewing channel A or B, either of the uncalibrated phase-shifters, $A\phi$ or $B\phi$, can be switched into the subcarrier processing channel. $A\phi$ and $B\phi$ will lock to channel A and B respectively, when A and B channel are time-shared, permitting independent phase control of channel A and B displays. Phase shifts caused by unequal signal paths are easily cancelled, leaving only phase and amplitude distortion caused by equipment deficiencies. Video cable lengths can be accurately matched for time delay at color subcarrier frequency to less than 0.5° phase difference. Accurate amplitude measurements of chrominance and luminance are provided from the CRT. An internal 1-V luminance amplitude calibration test signal is provided to check the gain accuracy of channel A and B amplifiers and the luminance channel.

DIFFERENTIAL GAIN AND DIFFERENTIAL PHASE MEASUREMENTS

The two main chrominance-signal distortions are differential gain and differential phase. Both can be measured on the

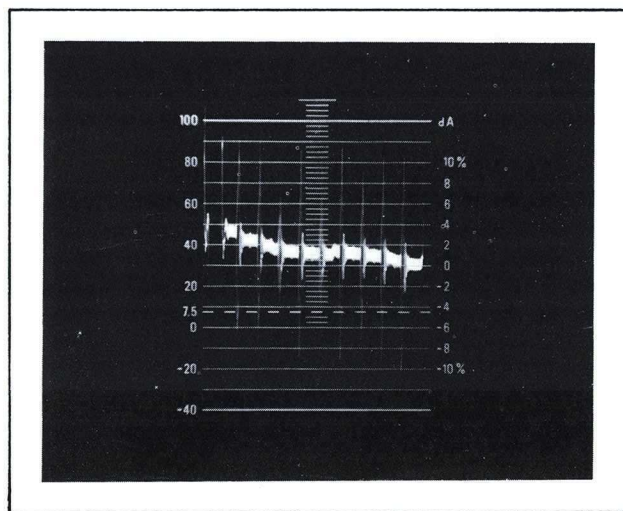


Fig. 2—Differential Gain presentation using a modulated stair-step signal. The right side of the graticule is marked in % of gain distortion. From white to black luminance levels the indicated gain distortion is 3%.

Type 520 Vectorscope. Differential gain (Fig 2) is a change in color subcarrier amplitude as a function of luminance. In the reproduced color picture, the saturation will be distorted in the areas between the light and dark portions of the scene. The IRE graticule major divisions represent % of voltage gain or loss when making a differential gain measurement. The 520 permits differential gain measurements with accuracy to better than 1%.

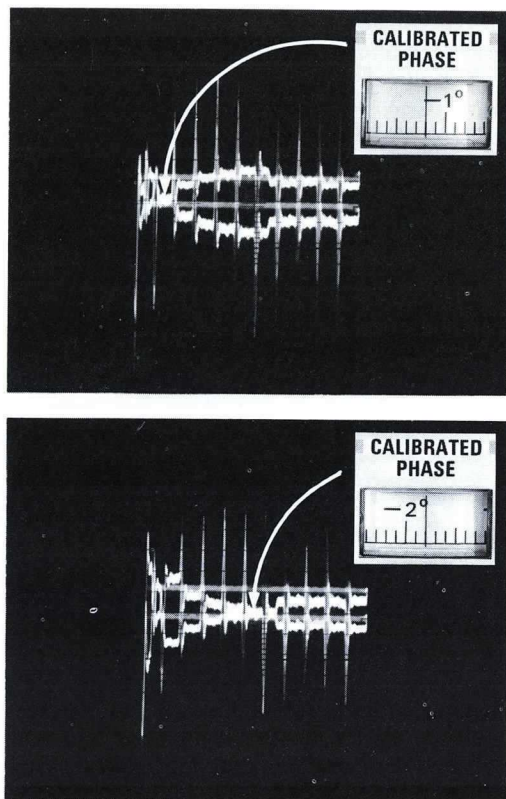
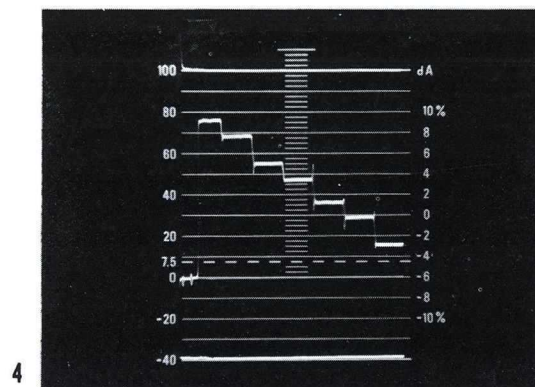


Fig. 3—Differential Phase presentation using a modulated stair-step signal. A trace overlay technique provides excellent resolution for measuring small phase changes. From reference point in top photo (1st step of stairstep signal overlayed) to point of measure in second photo (5th step overlayed) represents 1.4° differential phase distortion.

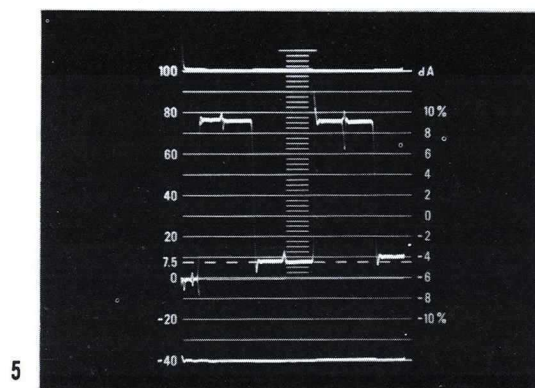
Differential phase (Fig 3) is a phase modulation of the chrominance signal by the luminance signal. In the reproduced color picture, the hue will vary with scene brightness. Differential gain and differential phase may occur separately or together. The causes of these distortions are amplitude non-linearity and time delay that are not independent of the signal level. Differential phase is read from the precision calibrated phase shift control. Dial resolution is excellent with 1° phase shift represented by approximately 1 inch of dial movement. The vertical deflection of the display is greatly magnified and inverted on alternate lines allowing the use of a trace overlay technique and the slide-back method for measuring small phase changes. The CALIBRATED PHASE control provides direct readout of differential phase. Using the standard linearity test signal, differential phase of 0.2° can be measured.

RED (R), GREEN (G), BLUE (B) AND LUMINANCE (Y) OBSERVATIONS

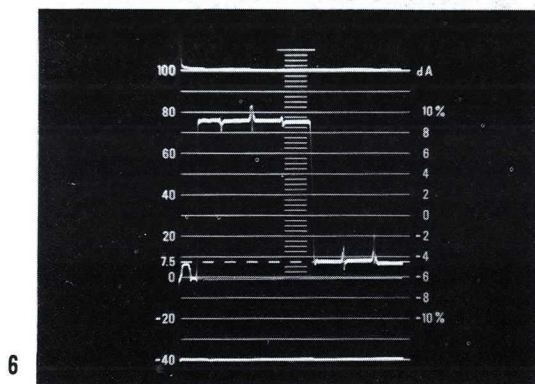
The Type 520 provides a luminance channel which permits the separation and display of the luminance (Y) component from the composite color signal (Fig 4). The Y component can also be combined with the output of the chrominance demodulators for R, G and B displays at a line rate (Figs 5, 6, 7). Amplitude measurements of color signal components can be made with an accuracy of 3%.



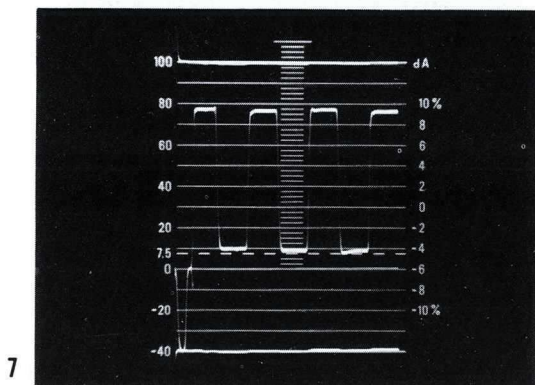
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Line sweep presentations of the luminance (Fig. 4), Red (Fig. 5), Green (Fig. 6), and Blue (Fig. 7), components of the NTSC color bar signal.

TYPE **520** **R520**

VERTICAL INTERFIELD TEST SIGNAL OBSERVATION

Vertical Interval Test Signals from preselected lines of either field 1 or field 2 can be displayed on the Type 520 Vectorscope.

Binary counters operate in conjunction with the field selector to select lines in either field that may carry suitable test signals. These circuits enable the Vectorscope to be used for measuring differential gain and differential phase from test signals transmitted in the vertical blanking interval of color broadcasts.

Normally, lines 18 and 19 in either field 1 or field 2 are selected by means of the VITS 18 and VITS 19 pushbuttons in conjunction with the FIELD switch. Internal quick-disconnect jumper wires permit selecting any lint from 7 through 21 of either field. Intensity and focus are automatically adjusted for optimum viewing of VITS.

GRATICULE

Two separate graticules provide references for vector and line sweep displays. The parallax-free vector graticule, or the IRE graticule, is automatically selected and edge-lighted concurrent with operating mode selection.

Z AXIS INPUT

The Z-AXIS INPUT connector accepts external trace-brightening pulses for intensifying a portion of the display during the time of interest. A 1-V negative-going pulse is required.

VIDEO INPUTS

Dual input connectors (Fig 8) for each channel permit 75-Ω loop through operation with a bridging resistance greater than 15 kΩ and a bridging capacitance less than 9 pF.

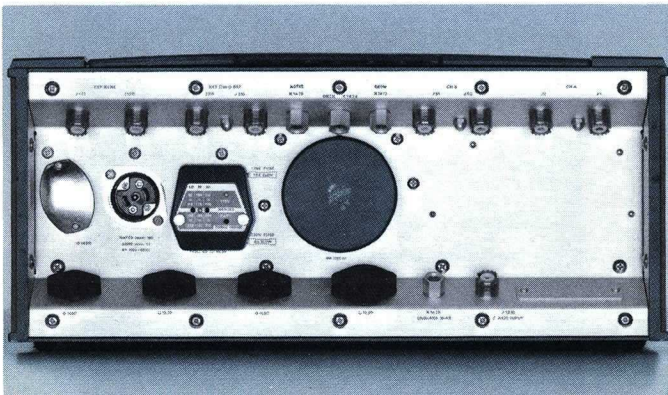


Fig. 8—Rear view of R520 Vectorscope. The mounting angle of the coax connectors permit connecting cables to leave the instrument without protruding excessively and with a minimum of clearance space required.

POWER REQUIREMENTS

90 to 136 VAC or 180 to 272 VAC, 47 to 63 Hz, 95 watts maximum at 115 V and 60 Hz. Rear panel selector provides rapid accommodation for six line-voltage ranges.

ENVIRONMENTAL CAPABILITIES

Ruggedly designed to withstand temperature and altitude variations, vibration, shock, and transportation. Listed instrument characteristics are valid over a temperature range of 0° C to +50° C ambient.

MECHANICAL CHARACTERISTICS

The Type 520 Vectorscope is available in two mechanical configurations. A cabinet model (Type 520) (Fig 9) and a rackmount model (Type R520). Both instruments are electrically identical. The R520 mounts in a 19-inch rack and is provided with slide-out chassis tracks for convenient access to internal components.

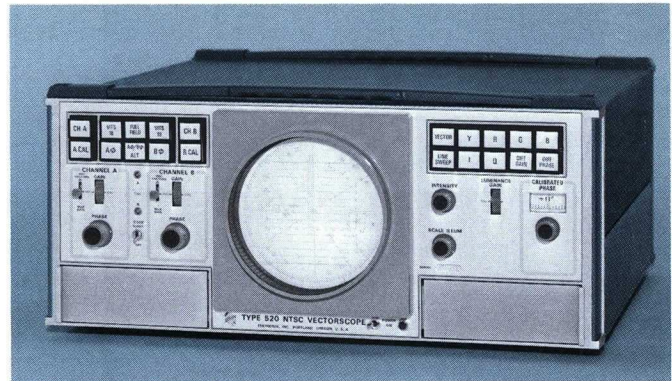


Fig. 9—Cabinet model.

DIMENSIONS AND WEIGHTS

| | | | |
|--------------------------|------------|-----------------------------------|----------|
| TYPE 520 | Height | 7 in | 17.8 cm |
| | Width | 16 ⁷ / ₈ in | 42.8 cm |
| | Depth | 20 in | 50.8 cm |
| | Net Weight | 33 lb | 15 kg |
| TYPE R520 | Height | 7 in | 17.8 cm |
| | Width | 19 ¹ / ₈ in | 48.6 cm |
| | Depth | 20 in | 50.8 cm |
| | Net Weight | 33 lb | 15 kg |
| Domestic shipping weight | | ≈61 lb | ≈27.7 kg |
| Export-packed weight | | ≈82 lb | ≈37.3 kg |

INCLUDED STANDARD ACCESSORIES

TYPE 520: Smoke-gray filter, installed (378-0581-00); camera gasket and mounting screws (016-0114-00); power cord (161-0036-00); 3 to 2-wire adapter (103-0013-00); 2 instruction manuals (070-0639-00).

TYPE R520. Same as Type 520 but includes rackmounting hardware.

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|----------------------------------|--------|
| TYPE 520 NTSC VECTORSCOPE | \$1850 |
| TYPE R520 NTSC VECTORSCOPE | \$1850 |

OPTIONAL ACCESSORIES

C-27 TRACE RECORDING CAMERA

f/1.9, 1:0.5 lens; Polaroid Land* Pack-Film back.

Order C-27-549

Type 520 to C-27 Camera Adapter, order 016-0225-00 .. \$ 15

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U.S. Sales Prices FOB Beaverton, Oregon