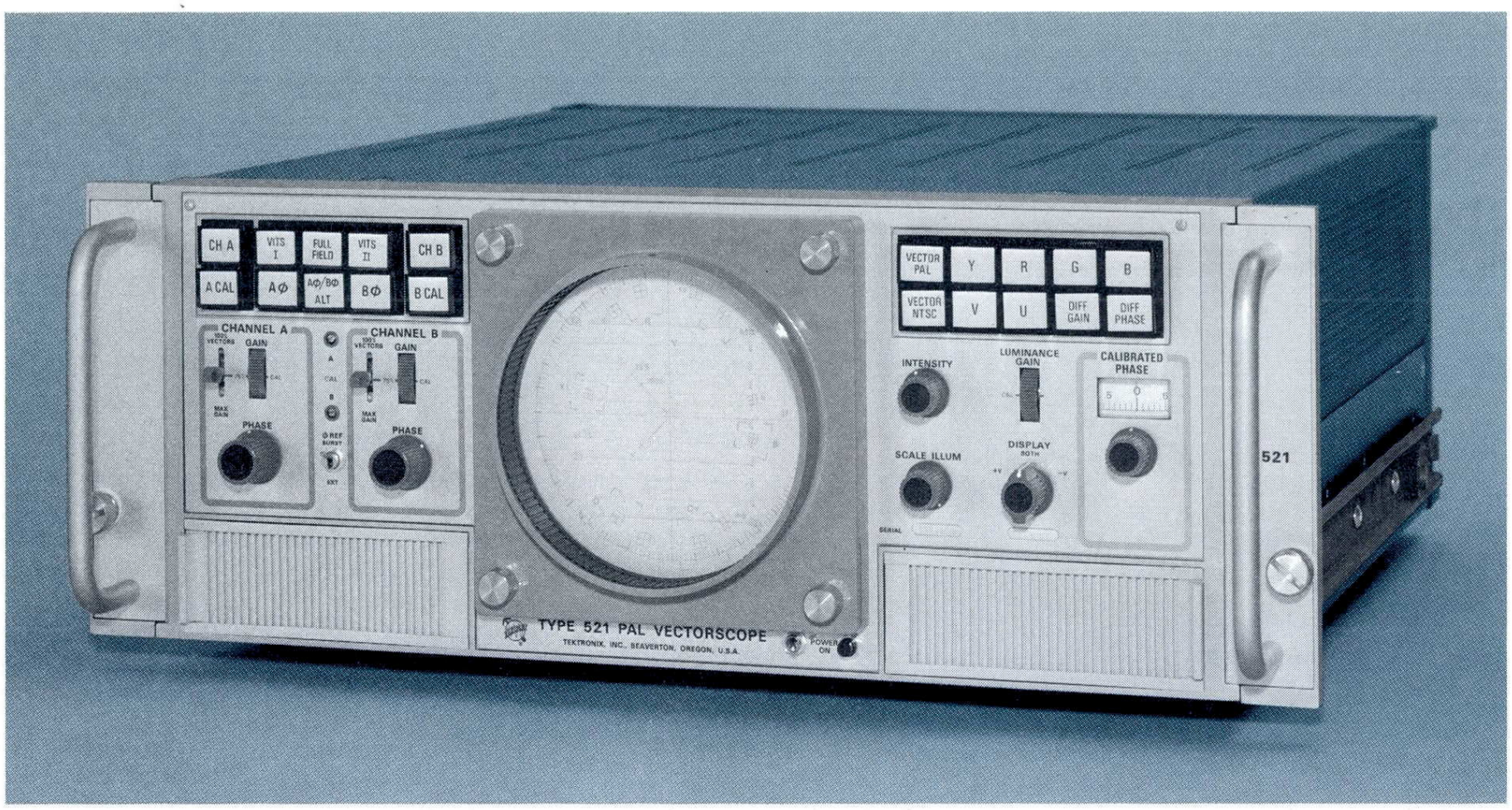
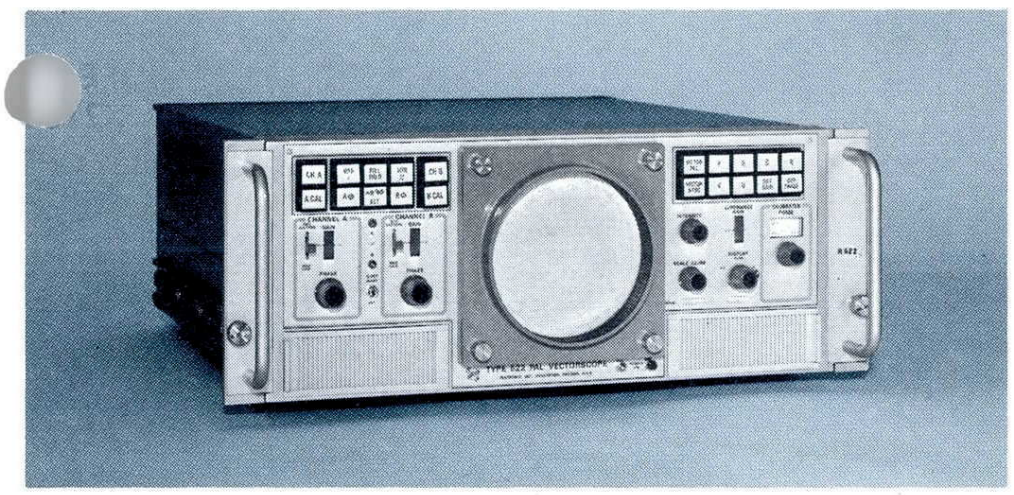
NEW

521/522 PAL Vectorscope R521/R522





- ***PUSH-BUTTON OPERATING CONVENIENCE***
- ***AMPLITUDE CALIBRATED DISPLAYS***
- ***LUMINANCE AMPLITUDE, CHROMINANCE PHASE AND AMPLITUDE, DIFFERENTIAL PHASE AND DIFFERENTIAL GAIN MEASUREMENTS***
- ***THE LUMINANCE CHANNEL AND THE LINE-RATE TIME BASE PERMIT DECODED R, G, B and Y DISPLAYS***
- ***ALL SILICON SOLID-STATE, COOL, QUIET OPERATION***

The Tektronix Types 521 and 522 PAL Vectorscopes are designed to measure luminance amplitude, and chrominance phase and amplitude of the PAL composite color television signal. Both units are identical in concept and operation. The Type 521 PAL Vectorscope is designed for 625 line 50 field PAL Color TV signals utilizing a color subcarrier frequency of 4.43361875 MHz and is calibrated to observe video signals with 0 set-up level. The Type 522 PAL Vectorscope* is designed for 525 line 60 field PAL Color TV signals utilizing a color subcarrier frequency of 3.575611 MHz and is calibrated to observe video signals with 50-mV set-up level. Self-canceling push-button 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 are provided permitting 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 PAL, VECTOR NTSC, R, G, B, U, V, Differential Gain and Differential Phase 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 Insertion Test Signal from a selected line of either field 1 or field 2.

*The Type 522 PAL Vectorscope is for use with the PAL system currently used in Brazil only.

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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, complementary and conjugate chrominance vectors: Red (R) (r), Green (G) (g), Blue (B) (b), Cyan (Cy) (cy), Magenta (Mg) (mg) and Yellow (Yl) (yl).

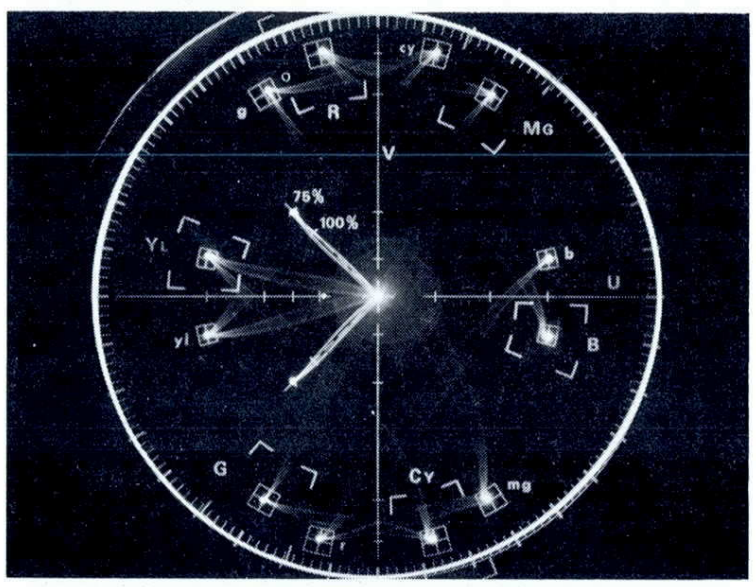


Fig 1A—Vector PAL presentation of PAL color bar signal.

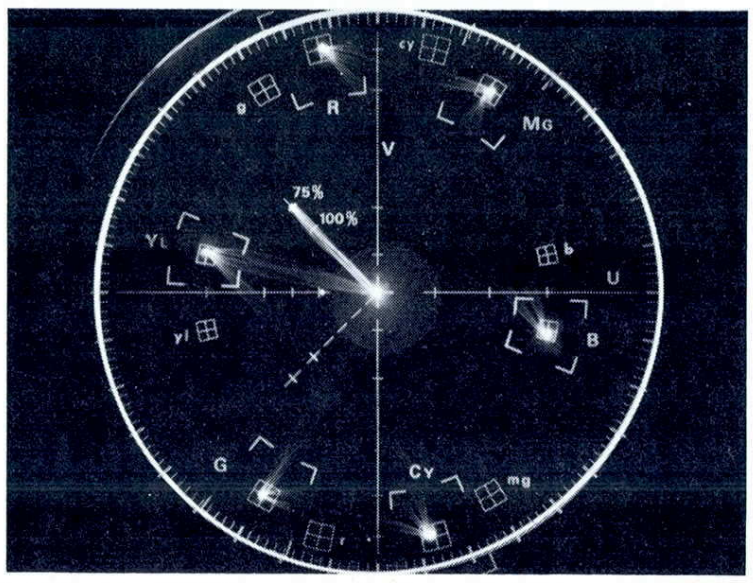


Fig 1B—Vector NTSC presentation of PAL color bar signal.

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 a vectorscope 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 (±10°, ±20%). The inner boxes indicate ±3° phase angle and ±5% amplitude.

(+V), (+V and −V) and (−V) vector displays are provided, permitting observation of the 135° and 235° burst-related color information, individually or combined.

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, U, V, 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, Aϕ or Bϕ, can be switched into the subcarrier processing channel. Aϕ or Bϕ 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 Types 521 and 522 PAL Vectorscopes. 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 luminance graticule major divisions represent % of voltage gain or loss when making a differential gain measurement. The 521 and 522 PAL Vectorscopes permit differential gain measurements with accuracy to better than 1%.

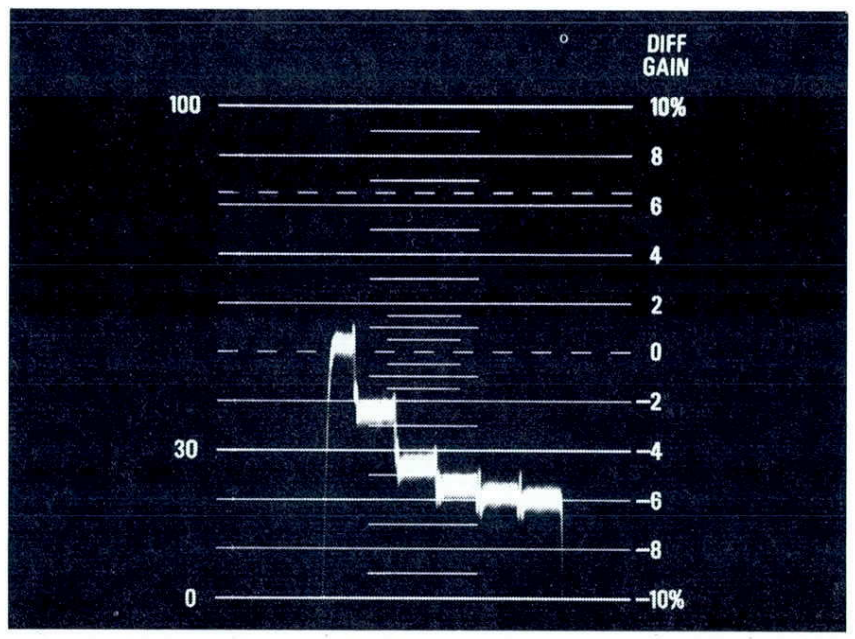
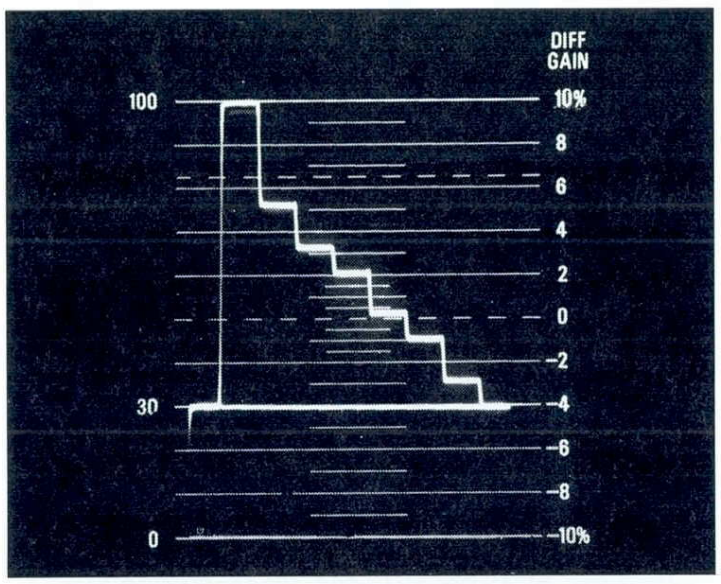


Fig 2—Type 521 PAL and Type 141A system being used to measure differential gain of a typical cascade of video amplifiers. Indicated differential gain is 6½%.



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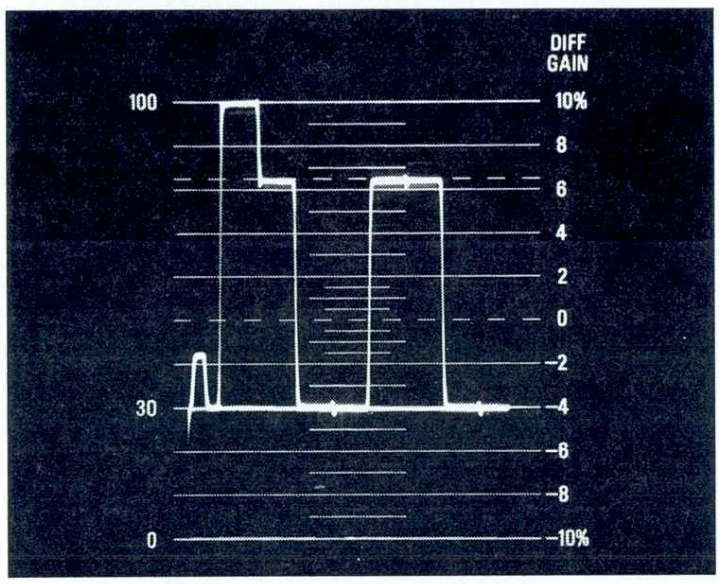

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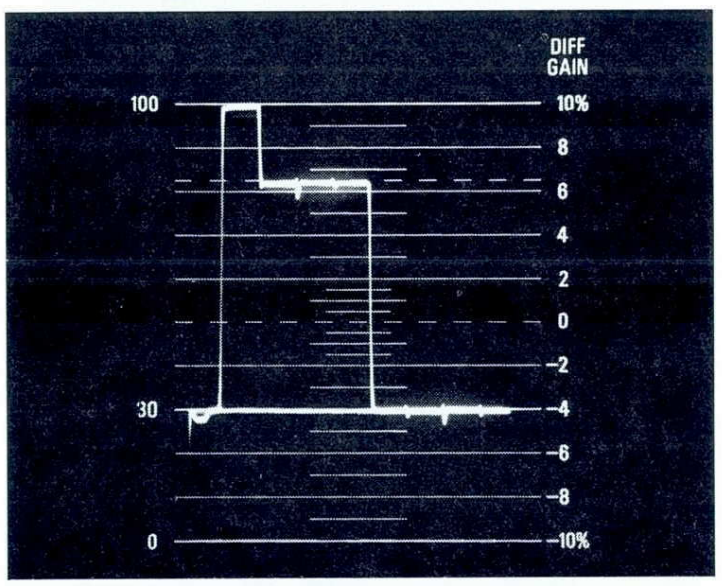

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Line sweep presentations of Luminance (signal sequence; white, yellow, cyan, green, magenta, red, blue, and black, fig 3), decoded Red (fig 4), decoded Green (fig 5), and decoded Blue (fig 6), components of the PAL color bar signal. Photos were taken using a Type 141A PAL Television Test Signal Generator, a Type 521 PAL Vectorscope, and a C-27-549 Camera.

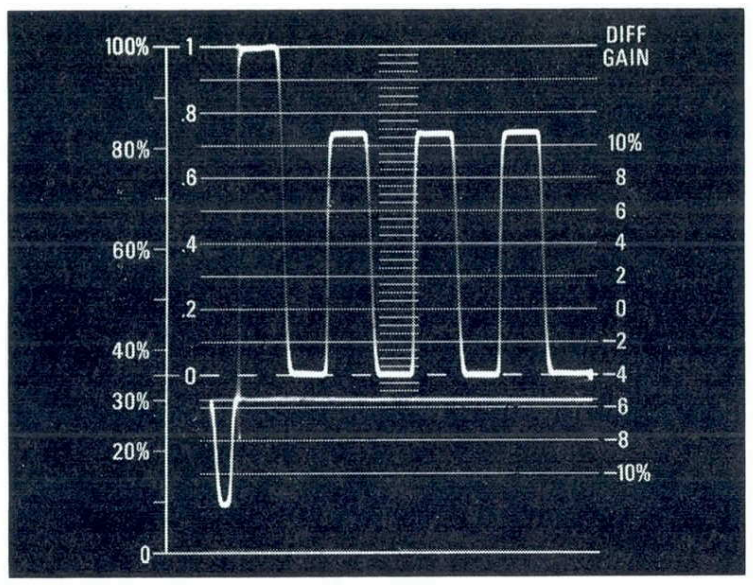

Fig 7—Line-sweep presentation of decoded Blue component of PAL color-bar signal.

Note difference between Type 521 and Type 522 graticules, the Type 522 graticule is designed for 50 mV set-up.

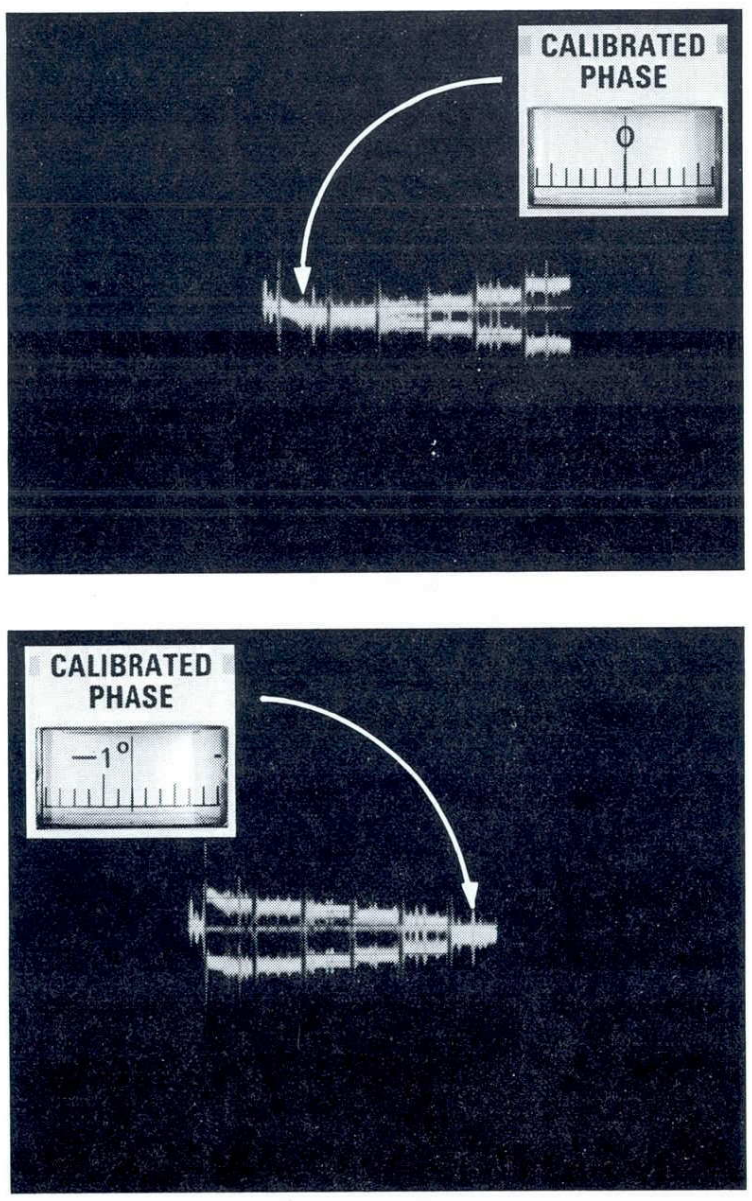

Fig 8—Differential Phase presentation using a modulated staircase signal. A trace overlay technique provides excellent resolution for measuring small phase changes. From reference point in top photo (1st step of staircase signal overlayed) to point of measure in bottom photo (6th step overlayed) represents 1.2° differential phase distortion.

Differential phase (fig 8) is a phase modulation of the chrominance signal by the luminance signal. Differential phase may result in picture impairment.

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521/522 PAL Vectorscope R521/R522

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. Reference burst is selectable, internal or external.

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

The Types 521 and 522 PAL Vectorscopes provide a luminance channel which permits the separation and display of the luminance (Y) component from the composite color signal (fig 3). The Y component can also be combined with the output of the chrominance demodulators for R, G and B displays at a line rate (fig 4, 5, 6). Amplitude measurements of color signal components can be made with an accuracy of 3%.

VERTICAL INSERTION TEST SIGNAL OBSERVATION

Vertical Insertion Test Signal from preselected lines of either field 1 and 3 or field 2 and 4 can be displayed on the Types 521 and 522 PAL Vectorscopes.

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.

Specific lines are selected by means of the VITS I and VITS II push buttons. Vectorscopes normally are shipped from the factory with the following lines selected by these switches:

	(VITS I) FIELDS 1 and 3	(VITS II) FIELDS 2 and 4
Type 521/R521	lines 17 and 18	lines 330 and 331
Type 522/R522	lines 15 and 16	lines 278 and 279

Internal quick-disconnect jumper wires permit selecting any line from 4 through 22 or 316 through 335 with the Type 521, and any line from 12 through 18 or 275 through 281 with the Type 522. 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 PAL vector graticule, or the luminance 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 BNC input connectors (fig 9) for each channel permit 75-Ω loop through operation with a return loss greater than 46 dB* to 5 MHz. Amplitude range is 0.7 V to 1.4 V VIDEO (sync tip to peak white).

*Exceeds CCIR recommendation 451-2, paragraph 3.1 and 3.2

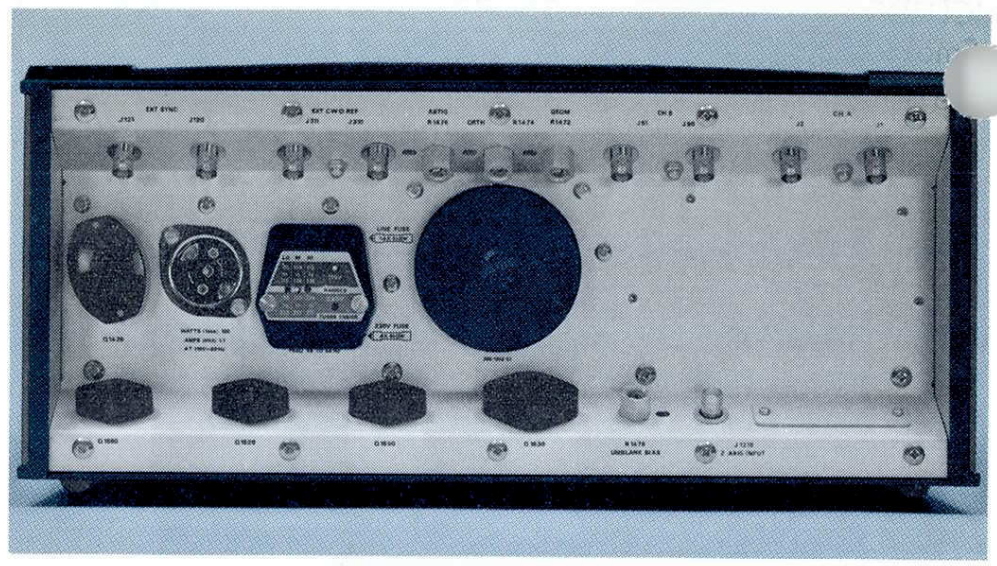

Fig 9—Rear view of Type 521 PAL Vectorscope (Type 522 is identical). The mounting angle of the coax connectors permits connecting cables to leave the instrument without protruding excessively and with a minimum of clearance space required.

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

Listed instrument characteristics are valid over a temperature range of 0°C to +50°C ambient.

MECHANICAL CHARACTERISTICS

The Types 521 and 522 PAL Vectorscopes are available in two mechanical configurations, a cabinet model (fig 10) and a rackmount model. Both instruments are electrically identical. The Types R521 and R522 mount in a 19-inch rack and are provided with slide-out chassis tracks for convenient access to internal components.

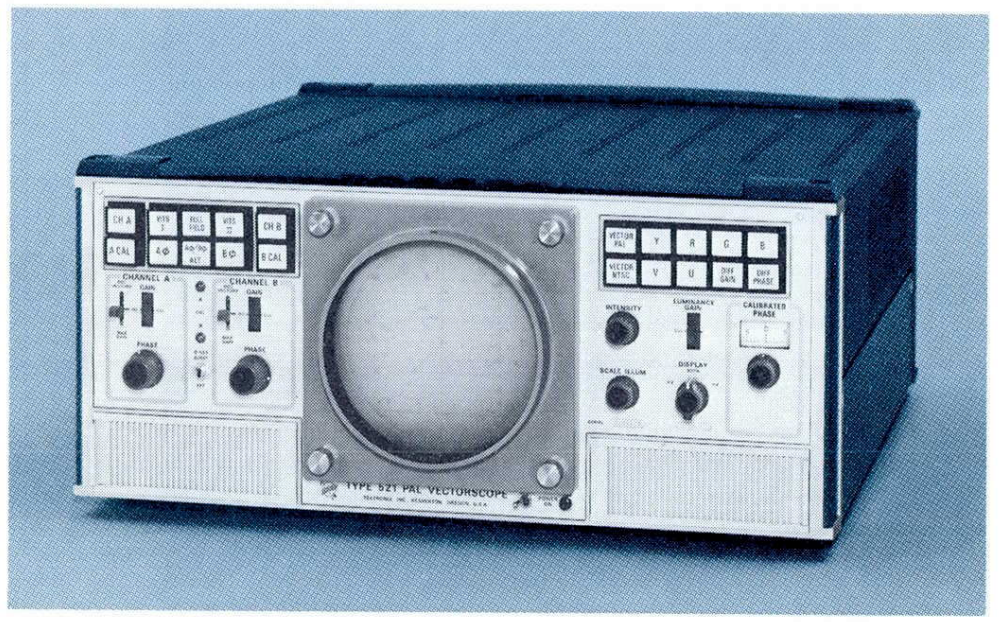

Fig 10—Cabinet model.

DIMENSIONS AND WEIGHTS

Types 521 and 522	Height	7 in	17.8 cm
	Width	16⅞ in	42.9 cm
	Depth	19⅛ in	48.7 cm
	Net weight	33 lb	15 kg
Types R521 and R522	Height	7 in	17.8 cm
	Width	19 in	48.3 cm
	Depth	19¾ in	50.2 cm
	Net weight	33 lb	15 kg

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INCLUDED STANDARD ACCESSORIES

Smoke-gray filter (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 each: 521/R521 070-1027-00, 522/R522 070-1033-00.

TYPES R521 and R522: Same as Types 521 and 522 but include rackmounting hardware, and mounting tracks (351-0101-00).

ORDERING INFORMATION

Cabinet Model PAL Vectorscopes

TYPE 521 ..... **$2150**
TYPE 522 ..... **$2400**

Rackmount Model PAL Vectorscopes

TYPE R521 ..... **$2175**
TYPE R522 ..... **$2425**

UHF connectors are optional and may be specified without additional cost.

OPTIONAL ACCESSORIES

C-27 TRACE RECORDING CAMERA

f/1.9, 1:0.5 lens; Polaroid Land* Pack-Film back.
Order C-27-549 ..... $505
Type 521/522 to C-27 Camera Adapter,
order 016-0225-02 ..... $ 16

*Registered Trademark, Polaroid Corporation

U.S. Sales Prices FOB Beaverton, Oregon

75-Ω VOLTAGE STEP-UP TERMINATION

The 75-Ω Voltage Step-Up Termination provides a ×5 increase in chrominance amplitude and permits Differential Gain and Differential Phase measurements to be made to a higher degree of accuracy when used with a Tektronix Vectorscope. Input impedance to the termination is a constant 75 Ω. Use of the termination requires a source of external sync to the vectorscope.

FOR USE WITH TYPE 521 VECTORSCOPE
BNC connectors, order 011-0109-00 ..... $27.50

FOR USE WITH TYPE 522 VECTORSCOPE
UHF connectors, order 011-0100-00 ..... $27.50
BNC connector, order 011-0100-01 ..... $27.50

SINGLE SIDEBAND CHROMA AMPLITUDE EQUALIZER

The Single Sideband Chroma Amplitude Equalizer is designed for use with a Tektronix Vectorscope in transmitter applications where a vestigial sideband signal is being demodulated with a detecting diode. The corrector provides a ×2 increase in chrominance amplitude and passes luminance components with little or no attenuation. Input impedance is 75 Ω.

FOR USE WITH TYPE 521 VECTORSCOPE
UHF connectors, order 011-0108-00 ..... $27.50
BNC connectors, order 011-0108-01 ..... $27.50

FOR USE WITH TYPE 522 VECTORSCOPE
UHF connectors, order 011-0107-00 ..... $27.50
BNC connectors, order 011-0107-01 ..... $27.50