520A NTSC VECTORSCOPE

Please Check for CHANGE INFORMATION at the Rear of This Manual

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Tektronix
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USER INFORMATION

The Tektronix 520A NTSC Vectorscope is designed to measure luminance, hue and saturation of the NTSC[1] color television signal. Solid-state circuitry is used to reduce power consumption and heat dissipation. With less heat generated, no fan is required and quieter operation is achieved. The 520A is intended for continuous monitoring of the signal. Self-cancelling pushbutton switches permit rapid selection of television signal characteristics, and checking of vectorscope calibration.

The 520A decodes color signals to recover chrominance and luminance information. Luminance signal can be viewed in the Y mode or reapplied to the demodulated chrominance signal to view R, G, B, I, or Q. One line of sweep, differential gain and differential phase can be displayed by push-button selection.

[1] **National Television System Committee**

Vector display is a polar plot, where the length of the vectors is a function of the peak-to-peak amplitude of the chrominance signal. Angular displacement is relative to the phase of the reference vector, referred to as burst.

The 520A is equipped with two signal inputs that can be operated independently or time shared. The chrominance and luminance gain accuracy of each channel can be checked using the internal test signal.

A digital line selector is used to select a single line of Vertical Interval Test Signal (VITS), from line 15 to line 21 of either field. In addition, one line can be selected for presentation on both fields, for Vertical Interval Reference (VIR) signal display.

CHARACTERISTICS

Electrical specifications for this instrument are valid over the specified environmental limits, found at the end of this characteristics section. Calibration within an ambient temperature range of +20°C to +30°C is required. A 20 minute warmup period is required for stated accuracies.

TABLE 1-1

Color Processing

Characteristic	Performance Requirement
CHROMINANCE	
Subcarrier Frequency (F_{sc})	3.579545 MHz.
F_{sc} Bandwidth	F_{sc} +500 kHz ±100 kHz to F_{sc} −500 kHz ±100 kHz.
Vector Phase Accuracy	1° or less error, marker to graticule.
Incremental Accuracy	0.5° error or less in any 10° graticule segment.
Quadrature Phase Adjustment Range	+2° to −2°.
Test Circle Amplitude	0.707 V ±1%.
Color Decoding Accuracy R, G, or B	±3% of color component amplitude.
I Axis	57° ±2° from burst.
Q Axis	147° ±2° from burst.
Differential Gain[2] Deflection Factor	5% deflects trace 25 IRE units (5% or 0.5 inches) ±5%. VITEAC, modulated staircase signal (chrominance +3 dB, −6 dB of 143 mV).
Accuracy (50% APL)	±1% last 90% of trace.
Dynamic Gain (10% to 90% APL)	±1% last 90% of trace.
Differential Phase[3] Resolution	0.1° deflects trace at least 1 IRE unit (0.1 inch). VITEAC, modulated staircase signal (chrominance +3 dB, −6 dB of 143 mV).

[2] **The change in gain of the color subcarrier as the luminance level is varied.**

[3] **The change in phase of the color subcarrier as the luminance level is varied.**

TABLE 1-1 (cont)

Characteristic	Performance Requirement
Differential Phase Burst Phase Reference (50% APL)	0.3° of differential phase last 80% of trace.
Dynamic Phase (10% to 90% APL)	0.3° of differential phase last 80% of trace.
External Phase Reference (50% APL)	0.15° of differential phase last 90% of trace.
Dynamic Phase (10% to 90% APL)	0.15° of differential phase last 90% of trace.
Calibrated Phase Range	+15° to −15°.
Accuracy	10% or less 2° increment. (Total incremental error ±0.5° between +14° and −14°.
Phase Reference Burst Subcarrier Regeneration Phase Error	1° with input burst frequency of 3.579545 MHz ±10 Hz.
Phase Error With Temperature	1° per 10°C, maximum of 5° over ambient operating range.
Phase Error With Input Signal Variation	1° for signal variation of ±3 dB from 1 V composite video. 3° for variation of burst/sync ratio of −6 dB to +10 dB.
Phase Error Due To Breezeway Stability	0.2° for burst timing errors, including burst width variance (8-11 cycles) and breezeway variance (±280 ns).
Phase Error Due To Noise	1° with rms white noise at −24 dB (0 dB = 700 mV rms).
External 3.579545 MHz cw Input Range	1.5 V to 2.5 V.
LUMINANCE	
Luminance Bandwidth	700 kHz to 1.1 MHz.
Luminance Gain	140 IRE units/volt, ±1%, in 75% Cal.
Luminance Gain Range	0.7:1 to 1.4:1 (+3 dB to −3 dB).

TABLE 1-2

Input Signal Processing

Characteristic	Performance Requirement
Video Input Amplitude Range	0.7 V to 1.4 V (sync tip to peak white).
Maximum DC Level	±20 V.
Gain Stability Time	±1%.
Temperature	±5%.
Line Voltage	±1%.
Time Sharing Switching Rate	1/4 H rate, locked to H sync.
Horizontal Sync Input Range (50% APL)	0.7 V to 1.4 V.
Dynamic (10% to 90% APL)	0.8 V to 1.4 V.
External Horizontal Sync Input Range (50% APL, Composite Video)	0.7 V to 1.4 V.
Dynamic (10% to 90% APL, Composite Video)	0.7 V to 1.4 V.
Composite Sync	3.5 V to 7.5 V.
Gain Range, Variable (Channel A and B)	0.5:1 to 1.4:1 (+3 dB to −6 dB).
Input Attenuator 100% Vectors	0.75 gain ±2% (75% Cal).
75%	140 IRE units/volt ±1%.
Maximum Gain	Internally adjustable to at least 5 times gain (75% Cal).
Return Loss (input in use or not, power on or off). Input A and B	At least 40 dB, dc to 5 MHz.
External Phase Reference	At least 40 dB, at 3.58 MHz.
External Sync[4]	At least 46 dB, dc to 5 MHz (connected for 3.5 to 7.5 V). At least 40 dB, dc to 5 MHz (connected for 0.7 to 1.4 V).

[4]Normally connected for 3.5 V to 7.5 V amplitude at the factory.

TABLE 1-3

Horizontal and Vertical Display

Characteristic	Performance Requirement
Clamp Stability Temperature	±1 minor division.
Line Voltage	±1 minor division.
Vector Stability, With Rotation of A and B Phase Controls	±2 minor divisions X and Y axis (±2 mV of F_{sc} on sync tips).
Luminance, Display Shift	±1 minor division (with dynamic shift of APL from 10% to 90%).
Display Shift Between Line Sweep, I, Q, and Differential Phase.	±3 IRE units.

TABLE 1-4

Power Source

Characteristics	Performance Requirement
Line Voltage Ranges	90-110 Vac 104-126 Vac 112-136 Vac 180-220 Vac 208-252 Vac 224-272 Vac
Maximum Power Consumption (115 Vac at 60 Hz)	100 W.
Maximum Current (115 Vac at 60 Hz)	1.1 A.
Line Frequency	47-63 Hz.

Power Cord Conductor Identification

Conductor	Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Blue	White
Grounding (Earthing)	Green-Yellow	Green-Yellow

CRT

The 520A NTSC Vectorscope uses a T5201 crt having a minimum horizontal resolution of 12 lines/cm, and minimum vertical resolution of 10 lines/cm. Maximum geometry (bowing) error is 0.5 mm; orthogonality variation is 1° or less. The useable scan radius is 5.5 cm. The trace rotation is at least +3° to −3°, and is controlled by the front panel BEAM ROTATION control.

ENVIRONMENTAL CONSIDERATIONS

Storage or transportation (non-operating) temperatures of −40°C to +65°C and altitude variations up to 50,000 feet are acceptable.

Following a 20 minute warmup period, the performance requirements of this instrument are met in a temperature range of 0°C to +50°C at altitudes up to 15,000 feet.

In the original packaging, or when repackaged according to instructions, this instrument is qualified under National Safe Transit Committee procedure 1A, Catagory 1. See repackaging instructions located at the rear of the Disassembly Instructions section of this manual.

PHYSICAL SIZE

The 520A NTSC Vectorscope is normally shipped in a rackmounting configuration. The following dimensions are for the rackmount. Bench mount dimensions can be found in the Mounting Hardware pull-out. Height 7 inches (17.8 cm), width 19 inches (48.3 cm), depth 19.75 inches (50.2 cm).

Net weight is 33 pounds (15 kg); shipping weights are approximately 61 pounds (27.7 kg) domestic and 82 pounds (37.3 kg) export.