

SPECIFICATION

The Performance Requirements listed in the Electrical Characteristics apply over an ambient temperature range of 0°C to +50°C. The rated accuracies are valid when the instrument is calibrated at an ambient temperature range of +20°C to +30°C, after a warm-up time of 20 minutes.

Test equipment used to verify Performance Requirements must be calibrated and working within the limits specified in the Recommended Equipment List located in Checks and Adjustments, Section 5.

Table 1-1
ELECTRICAL CHARACTERISTICS

Vertical Deflection System - Waveform Mode

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Frequency Response 1 V Full Scale or in X5 Gain FLAT	50 kHz to 6 MHz within 2% of response at 50 kHz.	Specifications apply for full screen height video input signal, with variable GAIN control in its detent position, inputs ac or dc coupled.	11
	6 MHz to 8 MHz, within +2%, -5% of response at 50 kHz.		
IRE (1750)	Response per IEEE Std 205 (Fig. 1-1). Response at 15 kHz does not vary between FLAT and IRE by more than 1%.		13 7
LUM (1751)	Less than 3 dB attenuation at 1 MHz and greater than 40 dB attenuation at 4.43 MHz. Response at 15 kHz does not vary between FLAT and LUM by more than 1%.		13 7
CHROMA (1751 values in brackets)	Lower -3 dB point at 2.88 MHz \pm 0.1 MHz. (3.73 MHz \pm 0.1 MHz.)		14
	Upper -3 dB point at 4.28 MHz \pm 0.1 MHz. (5.13 MHz \pm 0.1 MHz.)		14
	Response at 3.58 (4.43) MHz does not vary between FLAT and CHROMA by more than 1%.		14
	Attenuation at 7.2 MHz (8.9 MHz) greater than 25 dB.		14

Table 1-1 (cont)

Vertical Deflection System - Waveform Mode (cont)

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Transient Response 1 V Full Scale or in X5 Gain FLAT (using 2T pulse and 2T bar)		Specifications apply for full screen height video input signal, with variable GAIN control in its detent position.	
Preshoot	1% or less.		
Pulse-to-Bar Ratio	0.99:1 to 1.01:1.		12
Overshoot	2% or less.		12
Ringing	2% or less.		12
Tilt Field Rate Square Wave or Vertical Window	1% or less.		12
25 μ s Bar	1% or less.		12
Overscan	Less than 2% variation in baseline of 100 IRE (700 mV) 12.5T (20T) modulated pulse as it is positioned over the middle 80% of the screen, with the inputs ac coupled.	Variable GAIN control in detent. X5 GAIN selected.	12
Differential Gain	1% or less with 10% and 90% APL changes.	Chroma filter must be selected. Baseline at 50 IRE and displayed sub-carrier adjusted to 100 IRE with X5 and VAR gain.	19
Deflection Factor 1 V Full Scale	140 IRE (1.0 V) within 1% with 1 V input.	With FLAT response selected.	7
With X5 Gain	140 IRE (1.0 V) within 3% with 0.2 V input.		
Variable Gain Range 1 V Full Scale	Input signals between 0.7 V and 2 V can be adjusted to 140 IRE (1.0 V) display.		7
With X5 Gain	Input signals between 0.7 V and 2 V can be adjusted to a 140 IRE (1.0 V) display.		7
Maximum Absolute Input Level	± 2 Vdc + peak ac.	Displays in excess of 200 IRE (1.428 V) may cause frequency response aberrations.	
DC Input Impedance (Unterminated)	Greater than 15 Ω .		22

Table 1-1 (cont)

Vertical Deflection System - Waveform Mode (cont)

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Return Loss (75 Ω) Video Inputs (CH-A, CH-B)	At least 40 dB from 50 kHz to 6 MHz.	A and B channels, loop-through terminated in 75 Ω . Input in use or not in use, instrument power on or off, all deflection factor settings.	22
Crosstalk between Channels		Greater than 70 dB isolation between channels. Measured at Fsc between CH-A, CH-B, and EXT REF.	
Loop Through Isolation		Greater than 80 dB isolation between channels. Measured at Fsc between CH-A, CH-B, and EXT REF.	
PIX MON OUT Frequency Response	50 kHz to 6 MHz, within 3% of response at 50 kHz.	Terminated in 75 Ω .	
Differential Gain (50% APL)	Within 1% with a 140 IRE (1.0 V) unit display.		
Differential Phase (50% APL)	Within 1° with a 140 IRE (1.0 V) unit display.		
Dc Level on Output	0.5 V or less into 75 Ω load.	Input ac or dc coupled with no input signal applied.	9
Output Impedance (Nominal)		75 Ω	
Return Loss (75 Ω)	At least 30 dB, 50 kHz to 6 MHz.	With instrument turned on.	22
Input to PIX MON OUT Gain Ratio	1:1 \pm 5% at 15 kHz.	PIX MON OUT not affected by front-panel controls other than the INPUT and LINE SELECTOR settings.	9

Table 1-1 (cont)

DC Restoration

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
DC Restorer Clamp Time		Back Porch or Sync Tip. Selectable with an internal jumper. Factory set to Back Porch.	
Low-Frequency Response at 60 Hz Attenuation of 60 Hz on Input Signal	20% or less.		10
Blanking Level Shift with 10% to 90% APL Change	APL changes from 50% to either 10% or 90% will cause blanking level shift of 1 IRE unit (7 mV) or less.	Input ac or dc coupled.	10
Blanking Level Shift Due to Presence or Absence of Burst	1 IRE unit (7 mV) or less shift from no color burst to presence of color burst.		10

Calibrator

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Calibrator Signal Frequency	100 kHz, ± 0.1 kHz. Synchronizes in 2H and 1H sweep.	Crystal controlled. Timing accuracy is 10 μ s, ± 10 ns. Can be used as 10 μ s timing calibrator in magnified 2H SWEEP.	8
Amplitude	1 V, $\pm 0.5\%$		8
Position		Top of calibrator waveform must be between 80 IRE (0.86 V) and 120 IRE (1.14 V) on graticule when Back Porch of video signal is positioned to 0 IRE (0.300 V) line, with back porch DC RESTORER on. Calibrator signal shall overlap the crt center point when clamped 1 V video signal is properly positioned.	

Table 1-1 (cont)

Horizontal Deflection System

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Sweep	Sweep will occur in all Horizontal mode settings with or without synchronization.		4
1FLD Sweep Repetition Rate Even or Odd	Equal to frame rate of applied video or external sync.	Displays one field.	4
Both	Equal to field rate of applied video or external sync.	Displays one field.	4
2FLD Sweep Repetition Rate Even or Odd	Equal to frame rate of applied video or external sync.	Displays two fields. (one frame)	4
Both	Equal to field rate of applied video or external sync.	Displays one field.	4
1FLD MAG and 2FLD MAG Sweep Magnification		Approximately X20	
2FLD MAG Registration	Some portion of vertical blanking interval is visible when unmagnified 2FLD sweep is centered.		4
1H Sweep Repetition Rate	Equal to line rate of applied video or external sync.	Displays one field.	4
2H Sweep Repetition Rate	Equal to half line-rate of applied video or external sync.	Displays two lines.	4
Sweep Length		2H and 2FLD sweep length is nominally 12.5 divisions.	4
Timing Accuracy 1 μ S/div.	To within 2%	All timing and linearity specifications exclude the first and last major divisions of the unmagnified display. Timing can be adjusted $\pm 5\%$ with front-panel SWEEP CAL.	5
0.2 μ S/div	To within 2%		5
Linearity 1 μ S/div and 0.2 μ S/div	Within 2%		5
2H MAG Registration	Some portion of the horizontal blanking interval is visible when unmagnified 2H is centered.		4
HORIZONTAL Position	Any portion of a synchronized video sweep can be positioned to any point on the screen in all sweep modes.		4

Table 1-1 (cont)

Synchronization

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Input Requirements SCH Modes	Composite video or black burst, 286 mV (NTSC) 300 mV (PAL) sync and burst, ± 3 dB.		3
Other Modes	Stable display with Composite video, black burst, or composite sync with 286 mV (NTSC) or 300 mV (PAL), ± 6 dB.		3
EXT REF (Waveform Mode)	Sync amplitude between 143 mV and 4 V.		3
EXT REF Input Dc Input Impedance (Unterminated)	Greater than 15 k Ω .		
Return Loss (75 Ω)	At least 40 dB from 50 kHz to 6 MHz.		22
Absolute Maximum Input Voltage		± 12 Vdc plus peak ac.	
Maximum Operating Input Voltage		Peak ac + dc should be within +8.0 V and -5.6 V for proper operation.	

RGB/YRGB Mode

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
RGB/YRGB	Will display either a 3 or 4 step RGB/YRGB display.	The Waveform Mode must be selected.	6
Staircase Amplitude RGB or YRGB	A 10 V input will result in a horizontal display of 9 divisions ± 1.4 major divisions.		6
Maximum Operating Staircase Signal Voltage	12 V p-p ac component. Signal voltage not to exceed ± 12 Vdc plus peak ac.		
Sweep Repetition Rate	Field or line rate of displayed video or external sync signal as selected by front-panel HORIZONTAL controls.	2H and 2FLD SWEEP rates overridden in the RGB/YRGB mode.	6
Control		RGB/YRGB mode selected by applying ground (TTL low) at the appropriate pin on the rear-panel REMOTE connector.	
MAGnifier		Functions in normal manner for RGB/YRGB.	6
Sweep Length	3 step: 3.4 - 4.1 divs. 4 step: 2.5 - 3.1 divs.	Field or line rate sweeps.	6

Table 1-1 (cont)

Vector Mode

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Chrominance Processing Characteristics			
Nominal Subcarrier Frequency			
NTSC (1750)		3.579545 MHz.	
PAL (1751)		4.43361875 MHz.	
Chrominance Bandwidth			
Upper -3 dB Point	Fsc + 500 kHz, ± 100 kHz.		15
Lower -3 dB Point	Fsc - 500 kHz, ± 100 kHz.		15
+V/PAL (1751)		PAL or +V-type display as selected by front-panel button. When pushed, V axis is inverted at a 1/2 line rate to produce a single vector display.	
Display			
Vector Phase Accuracy	$\pm 1.25^\circ$.	Measured with Color Bar signal.	16
Vector Gain Accuracy		$\pm 2.5\%$ (typical)	16
Quadrature Phasing	Within 0.5° .		
Subcarrier Regenerator		Subcarrier Regenerator free runs in absence of appropriate signal.	
Pull-In Range			
1750	± 50 Hz of Fsc.		17
1751	± 10 Hz		
Pull-In Time		Within 1 second, with subcarrier frequency within 50 Hz (10 Hz for 1751) of Fsc.	17
Phase Shift with Subcarrier FREQUENCY CHANGE			
1750	$\pm 0.5^\circ$ from Fsc to (Fsc + 50 Hz), or Fsc to (Fsc - 50 Hz).		17
1751	$\pm 0.5^\circ$ from Fsc to (Fsc + 10 Hz), or Fsc to (Fsc - 10 Hz).		17

Table 1-1 (cont)

Vector Mode (cont)

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Phase Shift with Burst Amplitude Change	$\pm 2^\circ$ from nominal burst amplitude to ± 6 dB.	Internal or External burst reference.	17
Phase Shift with Input Channel Change	$\pm 0.5^\circ$.	With EXT REF selected.	18
Phase Shift with Reference Switched Between Internal and EXT REF	$\pm 0.5^\circ$.		18
Phase Shift with X5 Gain	$\pm 2.0^\circ$.		18
Phase Shift with VAR GAIN Control	$\pm 1^\circ$ as gain is varied from 3 dB to -6 dB.		18
PHASE Control Range		360° continuous rotation.	
Burst Jitter	0.5° or less.	With 140 IRE (1 V) composite video input. INT or EXT referenced.	18
Display Characteristics			
Differential Phase	$\pm 1^\circ$.		19
Differential Gain	$\pm 1\%$.		
Position Control Range			
VECTOR HORIZ	At least 6 mm from center.		20
VECTOR VERT	At least 6 mm from center.		
Clamp Stability	0.04 mm (1/64") or less.	Center Spot Movement with Rotation of PHASE Control.	20
Variable GAIN Range	Input subcarrier signals between 210 mV and 1.05 V can be adjusted to normal burst vector length.		
With X5 GAIN Selected	Input subcarrier signals between 43.2 mV and 210 mV can be adjusted to normal burst vector length.		21

Table 1-1 (cont)

SCH Mode

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Accuracy Absolute	$\pm 5^\circ$ phase at 25°C .		23
Relative		$\pm 2^\circ$	
Temperature Coefficient		$\pm 0.1^\circ$ phase/ $^\circ\text{C}$.	
Acquisition Time	Less than or equal to 1 sec.		23
Display Phase Error		$\pm 1.25^\circ$, calibrated for zero display phase error at zero SCH phase.	
Ext Reference to Int Reference Match	$\pm 0.5^\circ$		25
CH A to CH B Match	$\pm 0.5^\circ$		25
Input Timing		Stable display with any time relationship between signals on CH A, CH B, and EXT REF.	
Display Range EXT REF	360° .		
Int. Ref.	$\pm 80^\circ$.		24

Crt Display

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Crt Viewing Area		80 X 100 mm. (Horizontal, 12.5 divisions; Vertical, 170 IRE units (1.19 V).	
Accelerating Potential		15 - 16.25 kV. (17.5 kV max.)	
Trace Rotation Range	Greater than $\pm 1^\circ$ from horizontal.	Total adjustment range is typically 8° .	
Graticule 1750	Internal with variable SCALE illumination.		
1751	Internal with variable SCALE illumination.		

Table 1-1 (cont)

Power Source

Characteristic	Performance Requirements	Supplemental Information	Perf Ck Step No.
Mains Voltage Ranges 115 V 230 V	90-132 V 200-250 V		2
Mains Frequency Range	48 Hz to 66 Hz.		
Power Consumption		48 Watts (163 BTU/hr) maximum.	

Table 1-2
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Supplemental Information
Temperature Non-Operating	-55°C to +75°C.
Operating	0°C to +50°C.
Altitude Non-Operating	To 15,000 meters (50,000 feet).
Operating	To 4,500 meters (15,000 feet).
Vibration Operating	15 minutes each axis at 0.015 inch, frequency varied from 10-55-10 Hz in 1-minute cycles with instrument secured to vibration platform. Ten minutes each axis at any resonant point or at 55 Hz if no resonant point is found.
Shock Non-Operating	30 g's, 1/2 sine, 11 ms duration, 3 shocks per surface (18 total).
Transportation	Qualified under NTSC Test Procedure 1A, Category II (30-inch drop).
Humidity	Will operate at 95% relative humidity for up to five days. Do not operate with visible moisture on circuit boards.

Table 1-3
CERTIFICATION

Characteristics	Information
Safety	Designed to meet or exceed: UL 1244 Factory Mutual 3820 CSA Bulletin 556B IEC 348 (VDE 0871.5 Class B)
Electro-Magnetic Interference	Conforms with FCC EMI Compatibility (FCC Rules Part 15 Subpart J, Class A)