

## 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**  
**Vertical Deflection System**

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Frequency Response 1 V Full Scale or in X5 Gain FLAT	50 kHz to 6 MHz within 2% of response at 50 kHz.  6 MHz to 8 MHz, within 5% 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
IRE (1740)	Response per IEEE Std 205. Response at 15 kHz does not vary between FLAT and IRE by more than 1%.		13
LUM (1741 and 1742)	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	Lower -3 dB point at 2.83 MHz $\pm$ 0.15 MHz. (3.68 MHz $\pm$ 0.15 MHz.)  Upper -3 dB point at 4.33 MHz $\pm$ 0.15 MHz. (5.18 MHz $\pm$ 0.15 MHz.)  Response at 3.58 (4.43) MHz does not vary between FLAT and CHROMA by more than 1%.  Attenuation at 7.2 MHz (8.9 MHz) greater than 25 dB.		14
Transient Response 1 V Full Scale or X5 Gain FLAT (using 2T Pulse and 2T Bar) Preshoot	1% or less.	Specifications apply for full screen height video input signal, with variable GAIN control in its detent position, inputs ac or dc coupled.	12

Table 1-1  
Vertical Deflection System (cont.)

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
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 $\mu$ s Bar	1% or less.		12
Overscan	Less than 2% variation in base- line of 100 IRE (700 mV) 12.5T (20T) modulated pulse as it is po- sitioned over the middle 80% of the screen, with the inputs ac coupled.	Variable GAIN control in detent. X5 selected.	12
Differential Gain	Displayed differential gain is 1% or less with 10% to 90% APL changes	Chroma filter must be selected. Baseline at 50 IRE and dis- played subcarrier 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.	FLAT response selected.	7
X5 Gain	140 IRE (1.0 V) within 3% with 0.2 V input.		7
Variable Gain Range 1 V Full Scale	Input signals between 0.7 V and 0.2 V can be adjusted to 140 IRE (1.0 V) display.		7
X5 Gain	Input signals between 0.14 V and 0.70 V can be adjusted to a 140 IRE (1.0 V) display.		7
Maximum Absolute Input Level	$\pm 2$ V (dc + peak ac).		NC
DC Input Impedance (Unterminated)	Greater than 15 k $\Omega$ .	Displays in excess of 200 IRE (1.428 V) may cause frequency response aberrations.	22
Return Loss (75 $\Omega$ ) 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 $\Omega$ . Input in use or not in use, instrument power on or off, all deflection factor settings.	22

Table 1-1  
Vertical Deflection System (cont.)

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Crosstalk Between Channels		Greater than 70 dB of isolation between channels. Measured at $F_{SC}$ between Channel A, Channel B, and EXT REF.	
Loop-Thru Isolation		Greater than 80 dB of isolation between channels. Measured at $F_{SC}$ between Channel A, Channel B, and EXT REF.	
VIDEO OUTPUT Frequency Response	50 kHz to 6 MHz, within 3% of response at 50 kHz.	Terminated in 75 $\Omega$ .	11
Differential Gain (50% APL)	Within 1% with a 140 IRE (1.0 V) display.		19
Differential Phase (50% APL)	Within 1° with a 140 IRE (1.0 V) display.		19
Dc Level on Output	0.5 V or less into 75 $\Omega$ load.	Input ac or dc coupled with no input signal applied	9
Output Impedance (Nominal)		75 $\Omega$ .	
Return Loss (75 $\Omega$ )	At least 30 dB, 50 kHz to 6 MHz.	With instrument turned on.	22
Input to VIDEO OUTPUT Gain Ratio	1:1 $\pm$ 5% at 15 kHz.	VIDEO OUTPUT not affected by front-panel controls other than INPUT selector setting.	9

Table 1-2  
DC Restoration

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
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	20% or less.	Attenuation of 60 Hz on Input Signal.	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 (7.14 mV) or less.	Input ac or dc coupled.	10
Blanking Level Shift Due to Presence or Absence of Burst	1 IRE (7.14 mV) or less shift from no color burst to presence of color burst.	Input ac or dc coupled.	10

Table 1-3  
Calibration

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Calibrator Signal Frequency	100 kHz, $\pm 100$ Hz. Synchronizes in 2H and 1H sweep.	Crystal controlled. Timing accuracy is 10 $\mu$ s. $\pm 0.01$ $\mu$ s. Can be used as 10 $\mu$ s timing calibrator in magnified 2H sweeps.	8
Amplitude	140 IRE (1 V) display to within 0.5%.		8
Position		Calibrator signal overlaps crt center point when a clamped 1 V video signal is properly positioned.	

Table 1-4  
Horizontal Deflection System

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Sweep	Sweep will occur in all Horizontal mode settings with or without synchronization.		4
1FLD Sweep Repetition Rate	Equal to field rate of applied video or external sync.		4
2FLD Sweep Repetition Rate	Equal to frame rate of applied video or external sync.		4
1FLD and 2FLD Sweep Magnification		Approximately X20. EIA (CCIR) vertical blanking interval must be 8 to 10 divisions in width.	
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.		4
2H Sweep Repetition Rate	Equal to half line rate of applied video or external sync.		4
Sweep Length		2H and 2FLD sweep length is nominally 12.5 divisions.	4
Timing Accuracy 1 $\mu$ 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
0.5 $\mu$ s/div.	To within 3%.		5
Linearity 1 $\mu$ s/div. & 0.5 $\mu$ s/div.	Within 2%.		5
2H MAG Registration	Some portion of vertical blanking interval is visible when unmagnified 2H sweep is centered.		4
HORIZONTAL Position	Any portion of a synchronized video sweep can be positioned on screen in all sweep modes.		4

Table 1-5  
Synchronization

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Input Requirements Internal Reference	Composite video or black burst with sync amplitudes 40 IRE (300 mV PAL/PAL-M) $\pm 6$ dB.		3
EXTERNAL REFERENCE Waveform Mode	Sync amplitude between 143 mV and 4 V will synchronize sweeps.		3
Vector Mode	Composite video or black burst with sync and burst amplitudes 40 IRE (300 mV PAL/PAL-M) $\pm 6$ dB.		17
EXTREF Input Dc Input Impedance (Unterminated)	Greater than 15 k $\Omega$ .		
Return Loss (75 $\Omega$ )	At least 40 dB from 50 kHz to 6 MHz.	Loop-through terminated in 75 $\Omega$ , instrument power on or off.	22
Absolute Maximum Input Voltage		$\pm 12$ V (dc plus peak ac).	
Maximum Operating Input Voltage		Peak ac + dc should be within +8.0 V and -5.6 V for proper operation.	

Table 1-6  
RGB/YRGB Mode

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
RGB/YRGB	Will display either a 3- or 4-step RGB/YRGB display.	Waveform Mode must be selected. Internal jumper is used to change from 3-step to 4-step capability. Factory set to 3-step.	6
Staircase Amplitude RGB or YRGB	A 10 V input will result in a horizontal display of 9 divisions $\pm 1.4$ major divisions.		6
Maximum Operating Staircase Signal Voltage	12 V p-p ac component. Signal voltage not to exceed $\pm 12$ V dc 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. See Table 3-2.	
Magnifier		Functions in normal manner during 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 1-7  
Vector Mode

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Nominal Subcarrier Frequency ( $F_{SC}$ ) NTSC (1740)  PAL (1741)  PAL-M (1742)		3.579545 MHz.  4.43361875 MHz.  3.57561149 MHz.	
Chrominance Bandwidth Upper -3 dB Point Lower -3 dB Point	$F_{SC} + 500$ kHz, $\pm 100$ kHz. $F_{SC} - 500$ kHz, $\pm 100$ kHz.		15
+ V/PAL (1741 and 1742)		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.	
Vector Phase Accuracy	Within 1.25°.	Measured with Color Bar signal.	16
Vector Gain Accuracy		Typically within 1.25 IRE (2.5%).	
Quadrature Phasing	Within 0.5°.		NC
Subcarrier Regenerator  Pull-in Range 1740 1741/1742	Within 50 Hz of $F_{SC}$ . Within 10 Hz of $F_{SC}$ .	Subcarrier Regenerator free-runs in absence of appropriate signal. Reference can be burst of either displayed signal or external reference signal.  The 1741 and 1742 are tested to 10 Hz, but will typically lock to within 50 Hz.	17
Pull-In Time		Within 1 second, with subcarrier frequency within 50 Hz (10 Hz for 1741/1742) of $F_{SC}$ .	17
Phase Shift with Subcarrier Frequency Change 1740  1741/1742	Within 0.5° from $F_{SC}$ to ( $F_{SC} + 50$ Hz), or $F_{SC}$ to ( $F_{SC} - 50$ Hz).  Within 0.5° from $F_{SC}$ to ( $F_{SC} + 10$ Hz), or $F_{SC}$ to ( $F_{SC} - 10$ Hz).		17
Phase Shift with Burst Amplitude Change	Within 2° from nominal burst amplitude to $\pm 6$ dB.	Internal or External burst reference.	17
Phase Shift with Input Channel Change	Within 0.5°.	EXT REF selected.	18



Table 1-7  
Vector Mode (cont.)

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Phase Shift with Reference Switched Between Internal and EXT REF	Within 0.5°.		18
Phase Shift with X5 Gain	Within 2°.		18
Phase Shift with VAR GAIN Control	Within 1° 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	Within 1°.	Measured with 140 IRE (1 V) linearity signal (5 step, 10 step, or Ramp) with 40 IRE (300 mV) of subcarrier.	19
Differential Gain	Within 1%.		19
Position Control Range Horizontal	At least 1/4" from center.		20
Vertical	At least 1/4" from center.		
Clamp Stability	1/64" or less.	Center Spot Movement with Rotation of PHASE Control.	20
Variable GAIN Range X1	Input subcarrier signals between 28 IRE (210 mV) and 140 IRE (1.05 V) can be adjusted to normal Burst vector length.		21
X5	Input subcarrier signals between 6 IRE (42 mV) and 28 IRE (210 mV) can be adjusted to normal Burst vector length.		

Table 1-8  
CRT Display

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Crt Viewing Area		80 x 100 mm. Horizontal, 12.5 divisions; Vertical, 170 IRE units (1.19 V).	
Accelerating Potential		Nominally 15 kV.	
Trace Rotation Range	Greater than $\pm 1^\circ$ from horizontal.	Total adjustment range is typically $8^\circ$ .	
Graticule Dual Internal (1740/1741)		Internal Waveform and Vector graticule. Variable scale illumination.	
Waveform (1740/1741 Opt. 05, 1742)		Internal, variable scale illumination.	
Vector (1740/1741 Opt. 05, 1742)		External, variable scale illumination. Illuminated when VECTOR or R-Y (V AXIS) mode is selected.	

Table 1-9  
Power Source

CHARACTERISTIC	PERFORMANCE REQUIREMENTS	SUPPLEMENTAL INFORMATION	CHECK STEP
Mains Voltage Ranges 100 V 120 V 220 V 240 V	90 - 110 V. 108 - 132 V. 200 - 242 V. 218 - 250 V.		2
Mains Frequency Range	48 Hz to 66 Hz.		
Power Consumption		50 Watts maximum in ac. 30 Watts nominal in dc.	
Optional Battery Operation Battery Voltage Input Range	11 V to 16 V.		2
Overvoltage Protection Polarity Reverse		Will blow DC FUSE (battery fuse) if greater than 20 V is applied to the DC INPUT or polarity reversed.	
Undervoltage Protection	Instrument will be shut down when battery voltage (under load) is below 9 V.		
Battery Current	Less than or equal to 3.5 A at 12 V.		

**Table 1-10**  
**Environmental Characteristics**

CHARACTERISTIC	SUPPLEMENTAL INFORMATION
Temperature Non Operating Operating	- 55° C to +75° C. 0° C to +50° C.
Altitude Non-Operating Operating	To 50,000 feet. To 15,000 feet.

**Table 1-11**  
**Physical Characteristics**

CHARACTERISTIC	INFORMATION
Dimensions Height Width Length Weight	5 1/4 inches (133.4 mm). 8 1/2 inches (215.9 mm). 18 1/8 inches (460.4 mm). Approximately 18 lbs (approximately 8 kg).

**Table 1-12**  
**Safety**

CHARACTERISTIC	INFORMATION
Safety/EMI	Designed to meet or exceed: UL - 1244 Factory Mutual - 3820 CSA Bulletin 556B IEC 348 FCC EMI Compatibility (FCC Rules Part 15 Subpart J, Class A) VDE 0871.5 (Class B)