1741C
Analog Dual-Standard Waveform Monitor Specifications and Performance Verification

Technical Reference

077-0152-00

Tektronix

1741C
Analog Dual-Standard Waveform Monitor Specifications and Performance Verification

Technical Reference

This document applies to firmware version 1.0.X.

Warning

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

www.tektronix.com

077-0152-00

Tektronix

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For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit www.tektronix.com to find contacts in your area.

Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

THIS WARRANTY IS GIVEN BY TEKTRONIX WITH RESPECT TO THE PRODUCT IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED. TEKTRONIX AND ITS VENDORS DISCLAIM ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. TEKTRONIX' RESPONSIBILITY TO REPAIR OR REPLACE DEFECTIVE PRODUCTS IS THE SOLE AND EXCLUSIVE REMEDY PROVIDED TO THE CUSTOMER FOR BREACH OF THIS WARRANTY. TEKTRONIX AND ITS VENDORS WILL NOT BE LIABLE FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IRRESPECTIVE OF WHETHER TEKTRONIX OR THE VENDOR HAS ADVANCE NOTICE OF THE POSSIBILITY OF SUCH DAMAGES.

[W2 – 15AUG04]

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power Disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect that there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Wear Eye Protection. Wear eye protection if exposure to high-intensity rays or laser radiation exists.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in this Manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbol(s) may appear on the product:

Preface

This reference document provides technical information about using the 1741C Analog Dual-Standard waveform monitors.

Related User Documents

The following related user documents are available:

- *1741C Analog Dual-Standard Waveform Monitors User Manual*. This document contains the detailed operating information for the instrument. (Tektronix part numbers: English, 077-0150-XX; Simplified Chinese, 077-0151-XX).
- *1741C Analog Dual-Standard Waveform Monitors Service Manual* (Tektronix part number 077-0155-XX). This document provides servicing information for the waveform monitor and is intended for qualified service personnel only.
- *1741C Analog Dual-Standard Waveform Monitors Declassification and Security Instructions* (Tektronix part number 077-0153-XX).
- *1741C Analog Dual-Standard Waveform Monitors Release Notes* (Tektronix part number 071-2585-XX). This document describes any known problems or behaviors that you might encounter while using the waveform monitor.

Specifications

The following tables list the specifications for the Tektronix 1741C Waveform Monitors. Items listed in the Performance Requirement column are generally quantitative and can be tested by the *Performance Verification* procedure in Section 2 of this manual. Items listed in the Reference Information column are useful operating parameters that have typical values; information in this column is not guaranteed.

The specifications listed in the Electrical Specifications portion of these tables apply over an ambient temperature range of +0 °C to +40 °C. The rated accuracies are valid when the instrument is calibrated in an ambient temperature range of +20 °C to +30 °C.

Compliance information is located in the 1741C Analog Dual-Standard Waveform Monitor User Manual.

Electrical Specifications

Table 1: Composite analog input waveform vertical characteristics

Characteristic		Performance requirement	Reference information
Vertical Measurement Accuracy			Measured using cursors or graticules
	1X	± 1%	Typically ±1% at all fixed gain settings
	5X	± 1%	Typically ±1% at all fixed gain settings
Gain			X1, X2, X5, and X10
Variable Gain Range, Nominal			0.25X to 2X Total Range with fixed and variable is 0.25 to 20x
Frequency Response		50 kHz to 5.75 MHz, ± 1%	
Delay Variation over Frequency		± 10 ns to 5.75 MHz	Typically ± 2.5 ns
Transient Response on Sine Squared 2T4 Pulse		Pulse to bar ratio 0.99:1 to 1.01:1	
	Preshoot		≤ 1%
	Overshoot		≤ 1%
	Ringing		≤ 1%
Field Rate Tilt		< 0.5%	With DC Restore Fast or Off
Line Rate Tilt		< 0.5%	With DC Restore Fast or Off
Off Screen Recovery			≤ 0.5% variation in baseline of a 10T (12.5T NTSC) Chroma modulated pulse when positioned anywhere on screen. Signal must meet specification for Video Maximum Operating Amplitude. Any gain setting.
SNR			60 dB_{RMS} minimum, relative to 700 mv for PAL or 714 mv for NTSC.

Table 2: Composite analog inputs A, B, C, and D physical layer

Characteristic	Performance requirement	Reference information
Formats Supported		NTSC, NTSC no setup, and PAL systems, I, B, D, G, H. Complies with SMPTE 170M & ITU-R BT.471 Manual or auto detect of input standard
Internal Reference		Proper horizontal and vertical synchronization with a composite signal of appropriate line and field rate In multi-input display sync to the first active input signal in the sequence A, B, C, D
Input Dynamic Range, Typical		± 6 dB range relative to 1 V composite video
Video Maximum Operating Amplitude with Clamp Off (DC Coupled), Typical		–1.8 V to +2.2 V (all inputs) DC +peak AC
Maximum Absolute Video Input Voltage		–6.0 V to +6.0 V (DC + peak AC)
Input Type		Passive loop-through 75 Ω compensated
DC Input Impedance		20 kΩ
Return Loss	≥ 40 dB to 6 MHz with power on	Typically > 46 dB to 6 MHz, > 40 dB to 10 MHz (power on). Typically 35 dB with power off for standard amplitude video
Video Input Crosstalk Between Channels, Typical		≥ 60 dB to 6 MHz
Loop through Isolation, Typical		≥ 70 dB to 6 MHz
DC Offset with Restore Off, Typical		≤ 20 mV Measured in full screen mode at X5 Gain. Spec is set to accommodate moving a calibrated composite option card between mainframe slots or to a different instrument.
DC Restore Modes		Fast, Slow, and Off modes. Back Porch clamp. Slow has a typical bandwidth of 10 Hz Fast has a typical bandwidth of 500 Hz
DC Restore Offset Error, Typical		≤ 2 mV Registration between back porch and 0 V graticule
DC Offset Between Inputs With Restore Off		≤ 7 mV
DC Restore 50 Hz and 60 Hz Attenuation		
Fast Mode	> 95% attenuation	
Slow Mode	< 10% attenuation, < 10% peaking	
Blanking Shift with 10% to 90% APL Change, Typical		≤ 1 IRE (7 mV PAL)

Table 2: Composite analog inputs A, B, C, and D physical layer (cont.)

Characteristic	Performance requirement	Reference information
Blanking Shift with Presence and Absence of Burst, Typical		≤ 1 IRE (7 mV PAL), Typically 0 mV
Lock Range		± 50 ppm fixed frequency error, remains locked Vector typically remains locked to ± 80 ppm. Waveform display typically remains locked to ± 200 ppm
Lock in Presence of Hum, Typical		700 mV_{p-p}, on full amplitude 100% color bar signal, remains locked
Lock in Presence of White Noise, Typical		Signal/Noise ratio of 32 dB, 5 MHz bandwidth on black burst, remains locked
Color Framing		Correct color framing detected for signals having < 45 SCH phase error with burst present

Table 3: Waveform sweep (horizontal) deflection

Characteristic		Performance requirement	Reference information
Sweep	Accuracy	± 0.5%, all rates	Fully digital system
	Linearity	0.2% of time displayed on screen	Fully digital system
Timing Cursor Delta Readout Accuracy, Typical			± 0.5% of sweep time displayed on screen
Rates			1, 2, 3, or 4 line, or field depending on mode
Line Select			In 2-line sweep, the selected line is the first displayed line.

Table 4: Waveform mode filter characteristics

Characteristic	Performance requirement	Reference information
Luma Filter Gain	1 ± 0.1% relative to flat gain at 50 kHz	
Luma Filter Frequency Response	≤ 3 dB attenuation at 800 kHz > 32 dB attenuation at F_{SC}	
Chroma Filter Gain	1 ± 1.0% at Fsc, relative to flat gain	
Chroma Filter Response	3 dB bandwidth 1 MHz ± 0.2 MHz F_{SC} is automatically selected based on input standard, implemented digitally, centered on F_{SC}	
Chroma Filter Attenuation at 2x F_{SC}	≥ 25 dB Implemented digitally. Typically 2Fsc attenuation is 28 dB for NTSC, 53 dB for PAL	

Table 5: Composite vector mode

Characteristic	Performance requirement	Reference information
Displayed Vector Gain Accuracy	± 2.5% PAL, ±1.25IRE NTSC, 75% Bars Graticule	Color Bar test signal will land within 50% of the distance between the center and edges of the small target boxes. Small boxes are ± 5% PAL, ±2.5IRE NTSC (75% bars graticule). Typical gain accuracy is ± 1%. Gain is tied to the Displayed Vertical Measurement Accuracy. Chrominance demodulation and filtering implemented digitally.
Displayed Vector Phase Accuracy	± 1.25 degrees	Color Bar test signal will land within 50% of the distance between the center and edges of the small target boxes. Small boxes are ±2.5 degrees. Color Bar black/white display dot aligned with center dot target. Any Residual Subcarrier will displace this alignment and affect this specification. Chrominance demodulation and filtering implemented digitally.
Display to Graticule Registration	Centered in target, +0.5 box diameter With the color bar black/white display dot centered in target. Boxes are 2% targets	
Vector Display		U /B-Y is displayed on horizontal axis and V /R-Y is displayed on vertical axis.
Bandwidth, Typical		Fsc ± 360 kHz
Displayed Differential Phase	± 1 degree	
Displayed Differential Gain, Typical	± 1%	
Center Dot Reference		Video is gated off to locate the Center Dot, showing a “true” zero subcarrier reference. This is for showing residual subcarrier.
Quadrature Phasing	± 0.1°	Implemented digitally.
Horizontal to Vertical Bandwidth Matching	< 0.5° at 500 kHz and 2 MHz	

Table 6: Timing display

Characteristic	Performance requirement	Reference information
Input Timing Relative to External Reference		Display of Vertical and Horizontal timing offset graphically and numerically. One clock cycle resolution. Patented proprietary display. Display Timing difference between input and Ref at rear panel or relative to an offset saved by the user.

Table 6: Timing display (cont.)

Characteristic	Performance requirement	Reference information
Timing Display Zero Definition		For vertical timing, conforms to SMPTE 168-2002. For horizontal timing, zero delay analog signals have coincident syncs. Timing zero is equivalent to nominal zero delay on TG700. Also agrees with signal that shows minimal shift on the waveform display when going from internal to external. Vertical timing, according to SMPTE 168, specifies that the lines with the start of the broad pulses are aligned.
Operation with input and reference being different formats		In cases where there are multiple ways to interpret the phase relationship, multiple indicators of the phase will be shown. The numeric display will follow the smallest phase offset.

Table 7: Picture mode

Characteristic	Performance requirement	Reference information
Format (XGA)		Allows viewing picture in all formats. Full screen picture occupies the central portion of the XGA raster area. For tile mode, the image is downsampled to fit the 512 x 350 size. Frames are repeated as needed to achieve XGA frame rate; similar to 3:2 pulldown on some frame rates.
Pix Border On/Off		Allows user to mask or show the inactive portions of the raster such as sync. When the border is on, the image is scaled to correct the aspect ratio.
Synchronization		Picture mode always uses internal timing; it is not affected by external sync.
Aspect Ratio		Allows choice of 16:9 or 4:3.

Table 8: Picture monitor outputs (VGA Pix Mon)

Characteristic	Performance requirement	Reference information
Signal Format VGA DSUB Outputs		HD-15 socket connector, standard RGBHV pin-out. Composite signal is output on the "G" channel of the connector: signal (+) is pin 2, signal return is pin 7. Terminate signal in 75 ohms. May use conventional VGA to BNC cable; output signal will be on the "green" BNC. Remaining connections (R, B, H, V) carry no signal.
DAC Resolution		10 bit
Impedance		75 Ω unbalanced
Return Loss on BNCs, Typical		>20 db, 300 kHz to 6 MHz, measured at HD-15 connector. Return loss is affected by the VGA to BNC adapter cable. Use a high quality 75 Ω cable for best performance.
Composite Amplitude, Typical		1V ± 5% peak-to-peak when selected input is driven with a 1V peak-to-peak signal.
Composite mode SNR,Typical		60 dB RMS to 700 mV with 6 MHz BW.

Table 9: LCD display

Characteristic		Performance requirement	Reference information
Display Area	Horizontal		13 cm
	Vertical		10 cm
Resolution			1024 (H) x 768 (V) pixels
Color Palette			6 bits per component. LSB is dithered to improve picture
Pixel Defects		≤ 6 bad pixels	

Table 10: External XGA output (EXT DISPLAY)

Characteristic	Performance requirement	Reference information
Content		Identical to front-panel LCD display
Output Levels		0.7 V or 1 V for RGB signals, selectable. Fixed 5 V for H and V sync signals
Resolution		1024 (H) x 768 (V) pixels

Table 10: External XGA output (EXT DISPLAY) (cont.)

Characteristic	Performance requirement	Reference information
Color Palette		6 bits per component
Connector Pin Assignments		Pin 1: R Pin 2: G Pin 3: B Pin 4: NC Pin 5: GND Pin 6: GND Pin 7: GND Pin 8: GND Pin 9: NC Pin 10: NC Pin 11: NC Pin 12: NC Pin 13: HSync Pin 14: VSync Pin 15: NC

Table 11: LTC time code input / ground closures

Characteristic	Performance requirement	Reference information
LTC Input Connector		Balanced, unterminated via rear-panel GC remote connector. (See Table 16.)
LTC Input Impedance		Greater than 10 kΩ.
LTC Signal Characteristics		Longitudinal Time Code per IEC Publication 461.
LTC Signal Amplitude Range, Typical		0.2 V_{p-p} to 5.0 V_{p-p}, balanced differential or single-ended.

Table 11: LTC time code input / ground closures (cont.)

Characteristic	Performance requirement	Reference information
Ground Closure Input Signaling (Preset Selection)		TTL thresholds, 5 V maximum input, –0.5 V minimum input. Pull low to assert Has internal 10 kΩ pull-up to 5 V on each input. Direct or encoded inputs must be asserted and stable for at least 150 ms to be recognized reliably. Inputs that are stable for 75 ms or less will never be recognized. Inputs are sampled every 16.6 ms. Five consecutive samples must all have the same code for the code to be accepted. It is possible to pulse the codes synchronously with the sampling process and trick the system. Users are encouraged to work within the intent of the specification to insure reliable operation.
Ground Closure Output Characteristics		One open collector output Pulled up by 10 kΩ resistor in series with a diode to + 5 V. Pull down current is limited by 10 Ω resistor. Maximum current allowed is 100 mA.

Table 12: VITC decoding

Characteristic	Performance requirement	Reference information
Sources		Composite Input A, B, C, or D

Table 13: External reference

Characteristic	Performance requirement	Reference information
Input Type		Passive loop-through, 75 Ω compensated.
Operational		Locks to 625 and 525 line interlace Composite sync Analog signals. Reference must have a frame rate compatible with the selected input. WFM, VECTOR, and LINE SEL modes derive timing from the selected sync reference. Picture mode does not use the timing from the external reference.
Analog Sync Format	625i/50 PAL and 525i/59.94 NTSC composite sync signals. Proper operation only when the display and reference signals have the same line and field rates.	

Table 13: External reference (cont.)

Characteristic	Performance requirement	Reference information
Input Signal Level, Typical		–6 dB to +6 dB variation of nominal synchronization signal Nominal sync pulse amplitudes are: 300 mV PAL, 286 mV NTSC.
Low Frequency Input Impedance		20 kΩ
Absolute Maximum Input Voltage, Typical		± 5 V DC plus peak AC
Return Loss, Typical		> 40 dB to 6 MHz > 35 dB to 30 MHz
Hum Tolerance, Typical		Operates with 500 mV_{p-p} at 50 or 60 Hz added hum
Signal/Noise Tolerance, Typical		Operates to –25 dB added noise

Table 14: Ethernet

Characteristic	Performance requirement	Reference information
IP Address Mode		Supports manual and DHCP.
SNMP		For instrument control and feedback of status. Complies with SNMP version 2c.
Connector Type		RJ-45 LAN connector supporting 10/100 Base-T.

Table 15: USB

Characteristic	Performance requirement	Reference information
Type		Host
Speed		Complies with USB 1.1 and USB 2.0 full speed specification. Full speed operation in accordance with USB 2.0 spec is 12 Mb/s.

Table 16: Remote port

Characteristic	Performance requirement	Reference information
Alarm Output Type		Open collector. Has weak pull-up with a diode to + 5 V

Table 16: Remote port (cont.)

Characteristic	Performance requirement	Reference information			
Connector Pin Assignments		*Pin*	*Signal*	*Direction*	
		1	GND	Out	
		2	Time Code Positive (LTC input)	In	
		3	Time Code Negative (LTC input)	In	
		4	GND	Out	
		5	Ground Closure Output	Out	
		6	Preset Recall A1	In	
		7	Preset Recall A2	In	
		8	Preset Recall A3	In	
		9	Preset Recall A4	In	
		Hex	*Binary Pins 9,8,7,6*	*Direct mode selection*	*Encoded Mode selection*
		F	1111	none	none
		E	1110	Preset 1	Input D
		D	1101	Preset 2	Input C
		C	1100		Input B
		B	1011	Preset 3	Input A
		A	1010		
		9	1001		
		8	1000		Preset 8
		7	0111	Preset 4	Preset 7
		6	0110		Preset 6
		5	0101		Preset 5
		4	0100		Preset 4
		3	0011		Preset 3
		2	0010		Preset 2
		1	0001		Preset 1
		0	0000		

Table 17: Power source

Characteristic	Performance requirement	Reference information
Electrical Rating	100 - 240 VAC ±10%, 50/60 Hz 115 watts max.	
Supply Connection		Detachable cord set
Power Consumption, Typical		50 to 110 VA at 110 or 240 VAC
Surge, Typical		7.5 Amps at 90 V 10 amps at 240 V
Fuse Rating		T3.5, 250 V Not operator replaceable. Refer servicing to qualified service personnel.

Table 18: Miscellaneous

Characteristic	Performance requirement	Reference information
Real-time Clock Battery Life		>10 year

Physical Specifications

Table 19: Physical characteristics

Characteristic		Standard
Dimensions	Height	5 1/4 inches (133.4 millimeters)
	Width	8 1/2 inches (215.9 millimeters)
	Depth	18 1/8 inches (460.4 millimeters)
Weight	Net	12 pounds (5.5 kilograms)
	Shipping	20 pounds (9.1 kilograms), approximate

Table 20: Environmental performance

Category		Standards or description
Temperature	Operating	0 °C to +40 °C
	Non Operating	–20 °C to +60 °C
Humidity	Operating	20% to 80% relative humidity (% RH) at up to +40 °C, non-condensing
	Non Operating	5% to 90% RH (relative humidity) at up to +60 °C, non-condensing
Altitude	Operating	Up to 9,842 feet (3,000 meters)
	Non Operating	Up to 40,000 feet (12,192 meters)

Table 20: Environmental performance (cont.)

Category	Standards or description
Cooling	Variable Fan. Forced air circulation with no air filter.
Required Clearances	Do not block the bezel or rear panel vent holes, or more than half the vent holes on the sides

Alarms

The following tables list the alarms that may be set for the waveform monitors.

Table 21: Common alarms

Alarm	Description
HW Fault	Indicates a system fault occurred. May require service
Reference Missing	Indicates that no signal is detected on the Ref input when REF EXT is selected
Ref Lock	Indicates unable to lock to the Ref input signal when REF EXT is selected
Ref Fmt Mismatch	Indicates that the signal format detected on Ref input differs from the configured External Ref format
Video Fmt Change	Indicates that a change occurred in the format of the selected video input signal
Video Fmt Mismatch	Indicates that the signal format detected on the selected video input differs from the configured Input Format.
Vid/Ref Mismatch	Indicates that the Ref signal format is not compatible with the Input signal format.
Line Length Error	Indicates that the length of a video line differs from that expected for the detected video format
Field Length Error	Indicates that the length of a video field differs from that expected for the detected video format
Timecode Vitc Missing	Indicates that a break or discontinuity in the VITC has occurred
Timecode Vitc Invalid	Indicates that the VITC was lost for one frame but has reappeared
Timecode Ltc Missing	Indicates that a break or discontinuity in the LTC has occurred
Timecode Ltc Invalid	Indicates that the LTC was lost for one frame but has reappeared

Table 22: Composite specific alarms

Alarm	Description
Cmpst Input Missing	Indicates that no signal is detected on the selected composite video input
Cmpst Lock	Indicates unable to lock to the selected composite video input

Performance Verification

This section contains a collection of manual procedures for verifying that the monitors perform as warranted.

This chapter is divided into two sections: *Incoming Inspection Procedures* and *Performance Verification Procedures*. The test procedures in this chapter provide an extensive confirmation of performance and functionality.

NOTE. *Before performing any of the procedures and tests in this manual, the waveform monitor must have been operating for a warm-up period of at least 20 minutes and must be operating within the specified operating temperature range. (See Table 20 on page 12.)*

Test Records

Use the following tables to record the measured performance or Pass/Fail status for each step of the specified test procedure. In cases where a measurement is made in different units than specified in the manual, the actual measured values that correspond to the specification limits are shown in parentheses.

Test Record — Functional Tests

Table 23: 1741C analog waveform monitor functional test record

Instrument Serial Number:	Certificate Number:		
Temperature:	RH %:		
Date of Calibration:	Technician:		
Functional Test (Incoming Inspection)	**Incoming**	**Outgoing**	**Comments**
Basic Turn On and Self Test			
Front Panel LEDs			
POST			
Front Panel Test			
LCD Pixel and Defects			
LCD Color Palette and Advanced Diagnostics Test			
LCD Color Palette Test			
Advanced Diagnostics			
Fan Test			
External Reference			
NTSC Lock			
Ref Missing			
Composite Input (Option CPS)			
CMPST A, WFM with NTSC			
CMPST A, Vector with NTSC			
CMPST A, Picture with NTSC			
CMPST B, WFM with NTSC			
CMPST B, Vector with NTSC			
CMPST B, Picture with NTSC			
CMPST C, WFM with NTSC			
CMPST C, Vector with NTSC			
CMPST C, Picture with NTSC			
CMPST D, WFM with NTSC			
CMPST D, Vector with NTSC			
CMPST D, Picture with NTSC			

Table 23: 1741C analog waveform monitor functional test record (cont.)

Functional Test (Incoming Inspection)	Incoming	Outgoing	Comments
LTC Waveform and Decode			
LTC Waveform			
LTC Decode			
Ground Closure Remote			
Remote Input - Activate Preset			
Remote Output - Ground Closure			
Ethernet Functionality			

Test Record — General Tests

These tests apply to all 1741C model instruments.

Table 24: 1741C analog waveform monitor video performance test record

Instrument Serial Number:		Certificate Number:		
Temperature:		RH %:		
Date of Calibration:		Technician:		
Performance Test	**Minimum**	**Incoming**	**Outgoing**	**Maximum**
External Reference Return Loss				
To 6 MHz	–40 dB			
To 30 MHz	–29 dB			
External Reference Formats supported: Bi-Level	Pass			
External Reference Lock Range	–50 ppm			50 ppm
External Reference Lock in Presence of Hum: Bi-Level	Pass			
LTC Decoding Functionality	Pass			
Analog Pixmon Gain and Offset				
Clock Amplitude	Pass			
Clock Frequency	Pass			
Composite Analog Frequency Response	99% (7 mV)			99% (7 mV)
Composite Analog Delay Variation Over Frequency (Group Delay)	-10 ns (–7.1 mV)			+10 ns (7.1 mV)
Composite Analog Pulse to Bar Ratio	99% (–7 mV)			101% (7 mV)
Composite Analog Field Rate Tilt	–0.5% (-3.5 mV)			+0.5% (+3.5 mV)
Composite Analog Line Rate Tilt	-0.5% (–3.5 mV)			+0.5% (+3.5 mV)

Table 25: 1741C waveform monitor video performance test record

Instrument Serial Number:		Certificate Number:		
Temperature:		RH %:		
Date of Calibration:		Technician:		
Performance Test	**Minimum**	**Incoming**	**Outgoing**	**Maximum**
Composite Analog Input Return Loss, A, B, C, and D Inputs				
Input A	–40 dB			
Input B	–40 dB			
Input C	–40 dB			
Input D	–40 dB			

Table 25: 1741C waveform monitor video performance test record (cont.)

Performance Test	Minimum	Incoming	Outgoing	Maximum
Composite Analog Input DC Offset with Restore Off	–10 mV			10 mV
Composite Analog Input Clamp Off Check	Pass/Fail			
Composite Analog Input DC Restore Hum Attenuation				
DC Restore Off	Pass			
Fast Mode	(0 mV)			5% (35 mV)
Slow Mode	90% (643 mV)			110% (785 mV)
Composite Analog Vertical Measurement Accuracy	707.71 mV			722.01 mV
External Reference Lock Range	–50 ppm			50 ppm
VITC Decoding Functionality	Pass			

Video and General Performance Verification Procedures

This performance verification includes procedures that verify standard and option-equipped instruments.

Required Equipment

Table 26: Required test equipment (video and general performance)

Test Equipment	Requirements	Example
XGA Monitor	Computer monitor capable of 1024 x 768 x 60 Hz scan rate	
Test generator	NTSC Black	Tektronix TG2000 with BG1 and additional modules indicated below:
	Composite signals required for Option CPS: ■ NTSC 0% flat field ■ NTSC 100% color bars	AVG1 module for TG2000 AWVG1 module for TG2000
	Precision calibration signals [1]	Tektronix part number 067-0465-00 (AVC1) module for TG2000 [2]
75 Ω coaxial cables (3 required)	General purpose digital video Male-to-male BNC connectors 1 or 2 meters long	Belden 8281 Tektronix part numbers 012-0159-00 or 012-0159-01
75 Ω Terminator for Analog Video	Male connector, precision	Tektronix part number 011-0102-03
75 Ω Network Analyzer or Spectrum Analyzer with Tracking Generator and Return Loss Bridge	Measure return loss. 60 dB range to 10 MHz, 40 dB range to 300 MHz. 75 Ω test port; 50 Ω input and output test ports	Agilent 8712 75 Ω Tektronix 2712 Wide Band Engineering A57TUC with male 75 Ω BNC test port
Sync pickoff adapter		Tektronix part number 012-1680-00
Test oscilloscope	>2 GHz bandwidth with 75 Ω input	Tektronix TDS7404B with TCA75 adapter
75 Ω calibration kit		Maury 8580A 75 Ω BNC
VITC Generator		Horita VG-50 or Adrienne AEC-Box-28
LTC Generator		Horita TG-50 or Adrienne AEC-Box-28
RCA to 9 pin header custom cable	9-pin male Dsub connector, Tektronix part number 131-1007-00, RCA plug Allied 932-1098, and wire. (See Figure 1.)	

Table 26: Required test equipment (video and general performance) (cont.)

Test Equipment	Requirements	Example
VGA to 5x BNC adapter cable	15 pin VGA connector input, 5 BNC connector outputs	Tektronix part number 174-5126-00
1 to 2 VDC voltage source	1.5 V battery or power supply	
BNC to retractable hook tip		Tektronix part number 013-0076-01
BNC barrel connector		

1 The required custom signals are provided on the User Documents CD. These signals are also provided for an AVG1 module, if an 067-0465-00 (AVC1) is not available. Download the PVCustomSignals.zip file, unzip it, and install the signals on your TG2000.

2 Note that the 067-0465-00 (AVC1) is not available outside of Tektronix. Other equipment can be substituted but it might not have sufficient accuracy to guarantee the specifications. For hum insertion, a general-purpose sine wave generator can be used to terminate and drive back into the video signal through appropriate impedance matching.

Basic Setup

Use the following setup for all tests unless otherwise specified.

1. Connect the power cord to the rear of the waveform monitor.
2. Connect an XGA monitor to rear of instrument.
3. Connect the power cord to the AC mains and allow at least 20 minutes for the waveform monitor to warm up before beginning any procedures.

Instrument Tests

The following procedures apply to all base instruments except where labeled for specific models. Do all tests except those that exclude your model.

External Reference Return Loss

This test uses a network analyzer to check the reflections from the input. You can also use the spectrum analyzer, tracking generator, and return loss bridge to make this measurement.

1. Turn on the network analyzer and set it for return loss, the S11 measurement.
2. Set the frequency range for approximately 300 kHz to 35 MHz.
3. Use the calibration kit and calibrate the network analyzer with one of the BNC cables attached.
4. Connect the calibrated end of the cable to one of the Reference inputs on the waveform monitor.
5. Terminate the other Reference connector with the precision termination.
6. Measure the return loss from 300 kHz to 6 MHz. Record the lowest return loss value (the biggest reflection) over the frequency range in the test record.
7. Replace the precision termination with the wideband termination.
8. Measure the return loss from 300 kHz to 30 MHz. Record the lowest return loss value (the biggest reflection) over the frequency range in the test record.

External Reference Formats Supported: Bi-Level

Check that the unit under test can reference to NTSC and PAL while viewing signals.

1. Set the waveform monitor to the factory presets.
2. Press the **EXT REF** button to select the external reference mode.
3. Connect a 525 color bars signal from a AWVG1 module to the CMPST A input of the instrument under test and terminate the loopthrough with a 75 Ω terminator.
4. Apply an NTSC 0% Flat Field signal from the AVG1 output to the Reference input of the waveform monitor. Terminate the other Reference input with a precision termination.
5. Check that the lower-left corner of the waveform monitor display shows the proper standard for the reference.
6. Check that the Waveform and Vector displays are locked.
7. Log either Pass or Fail in the test record.
8. Leave test setup as is for the next test.

External Reference Lock Range

Vary the time base of the reference to measure lock range.

1. Adjust the AVG1 time base offset to –50 ppm. Verify that the readout in the lower-left corner of the waveform monitor display does not indicate an unlocked signal. It is normal for the system to momentarily lose lock when the time base is changed.

NOTE. *The waveform display will not be stable because the CMPST time base is not in sync with the reference.*

2. Increase the negative time base offset until the waveform monitor cannot sustain lock. Record the maximum offset capability in the test record.
3. Repeat steps 1 and 2, but use positive offsets to test the positive end of the lock range.
4. Reset the AVG1 Module parameters to remove the timebase offset.

External Reference Lock in Presence of Hum, Bi-Level

Apply a 0 dB hum signal to the Reference and verify that the waveform monitor still locks correctly.

1. Set the waveform monitor to the factory presets.
2. Connect the TG2000 black burst signal to the video input of the AVC1. Route the video output of the AVC1 (not the precision video output) to one of the waveform monitor REF inputs. Terminate the other REF input.
3. Connect a composite signal from the TG2000 to the waveform monitor, select the appropriate input to display the signal, and terminate the loopthrough with a 75 Ω terminator.
4. Set the AVC1 for 0 dB of 60 cycle hum.
5. Press the **EXT REF** button to select the external reference mode.
6. Check that the signal is locked and the WFM and VECTOR displays are stable.
7. Record Pass or Fail in the test record.

LTC Decoding Functionality

Apply an LTC signal and verify it is correctly decoded.

An LTC is input through the 9-pin REMOTE connector on the rear panel. To input an LTC signal, you need to construct a cable as shown in the following figure. This cable has seven wires from the Remote connector, with two of them also connected to an RCA connector. Pin 2 of the Remote connector is connected to the center pin of the RCA connector, and pin 3 is connected to the shield of the RCA connector.

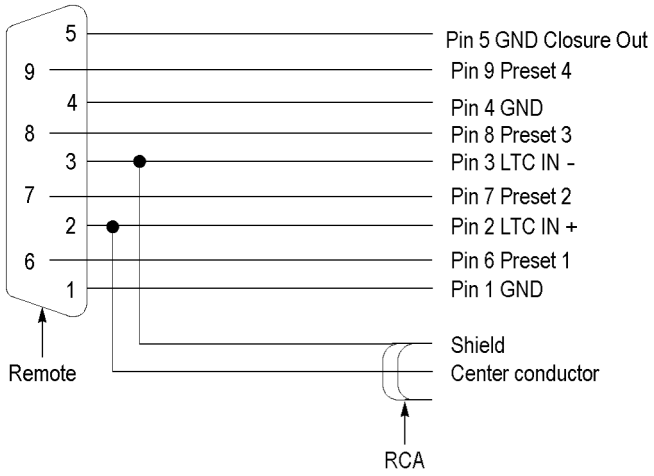

Figure 1: Wiring diagram for LTC input/Ground Closure cable

NOTE. *Apply a signal to only one connector at a time.*

1. Set the waveform monitor to the factory presets.
2. Connect the RCA connector on the custom cable to the output of the Timecode generator. Connect the custom cable 9-pin connector to the REMOTE connector on the waveform monitor rear panel.
3. Set the timecode source to LTC by pressing CONFIG button, select Aux Data Setting > Time code Display if present > LTC.
4. If using a Horita TRG50 LTC generator, set the switches to:

Control or Setting	Value
V-Size	LRG
V-Pos	TOP
Mode	GEN
Data	TC

5. It may be necessary to reset the LTC generator via the mode switch. Momentarily move the Mode switch to SET, and back to GEN.
6. Verify that the Decoded LTC is displayed in the lower right corner of the display.
7. Record Pass or Fail in the test record.

Video Tests

Analog Pixmon Gain and Offset

This test uses an oscilloscope to check the active video gain and black (blanking) levels at the Pixmon output.

1. Set the waveform monitor to the factory presets.
2. Connect a VGA to 5x BNC adapter cable to the waveform monitor PIX MON output.
3. Connect the TG2000 AVG1 output to the waveform monitor CMPST A input, and terminate the loopthrough in 75 Ω.
4. Select an NTSC 100% Color Bar from the AVG1.
5. Press and hold the CONFIG button and select **Composite PixMon** from the **Outputs** menu.
6. Press the right arrow key to highlight **On**.
7. Connect the Y/G channel of the VGA to 5x BNC adapter cable to the test oscilloscope.
8. Check that the G waveform is 1 V_{p-p} ±5%, from sync tip to white.
9. Check that the blanking (black) level is 0 mV ±100 mV.
10. Record Pass or Fail in the test record.

Composite Analog Frequency Response

Use Cursors to measure the reference, and the largest and smallest packets on a multi-burst signal. The greatest deviation from reference is the frequency response.

1. Set the waveform monitor to the factory presets.
2. Connect the precision video generator to one of the CMPST A input connectors and terminate the other connector with the precision terminator.
3. Set the precision generator for 700 mV Multiburst. This signal is provided on the User Documentation CD.
4. Press the **FULL** button to make the WFM tile the full screen.
5. Adjust cursors to be near the top and zero portions of the waveform. Press the **CURSOR** button and use the **GENERAL** knob to adjust the **Volt1** or **Volt2** readouts. Use the arrow keys to select between them.
6. Press and hold the **GAIN** button, select **Gain Settings** and then **x5**.
7. Press the **GAIN** button to close the menu.
8. Adjust the lower cursor to align with the bottom of the reference step of the waveform.
9. Use the **Vertical** knob to move the top of the waveform to the 0 IRE graticule. The second cursor should also be near the zero graticule mark.
10. Use the **General** knob to adjust the upper cursor to align with the top of the reference step of the waveform.
11. Check the cursor delta readout of the magnitude of the reference step. Note this number. It should be near 98 IRE.
12. Next, adjust the upper cursor to align with the top of the largest packet of the waveform.
13. Use the **Vertical** knob to move the baseline of the waveform to the 0 IRE graticule. The other cursor should also be near the zero graticule mark.
14. Use the **General** knob to adjust the lower cursor to align with the bottom of the largest packet of the waveform.
15. Note the cursor delta value for the amplitude of the largest packet.
16. Adjust the lower cursor to align with the bottom of the smallest packet of the waveform.
17. Use the **Vertical** knob to adjust the vertical position to align the top of the waveform to the 0 IRE graticule.
18. Use the **General** knob to adjust the upper cursor to align with the top of the smallest packet of the waveform.
19. Note the cursor delta value for the amplitude of the smallest packet.
20. In the test record, record the deviation from reference that has the largest magnitude, either largest-reference or smallest-reference.

Adjust. If the Frequency Response is outside the specification, perform the following steps:

1. Press the **CONFIG** button.
2. Select **Utilities >Calibration**.
3. Press the **SEL** button.
4. Use the down arrow to navigate to **Composite Freq Peak**.
5. Follow the on-screen instructions to adjust the response.
6. Follow the instructions at the bottom of the screen to Save and Exit calibration mode.
7. Repeat the preceding test for Analog Frequency Response and record the new value in the test record.

Composite Analog Delay Variation Over Frequency (Group Delay)

Use a 5.75 MHz 5T multi-pulse signal and cursors to measure group delay. This signal is provided on the User Documents CD.

1. Set the waveform monitor to the factory presets.
2. Connect the precision video generator to one of the CMPST A input connectors and terminate the other connector with the precision terminator.
3. Set the precision generator for 5.75 MHz multi-pulse. This is a custom test signal with more packets for better coverage.
4. Press the **FULL** button to make the WFM tile the full screen display.
5. Press the **CURSOR** button to turn on the cursor controls.
6. Use the arrow keys to navigate to Volt1 and Volt2. Adjust the cursors to be near the zero portions of the waveform using the **GENERAL** knob.
7. Press and hold the **GAIN** button, select **Gain Settings**, and then select **x10**.
8. Press the **GAIN** button to close the menu.
9. Use the cursors to measure the peak-to-peak deviation in the baseline of the multipulse packets. Use the arrow keys to navigate between **Volt1** and **Volt2** and use the **GENERAL** knob to adjust them.
10. The peak-to-peak deviation of the baseline is 0.1% per ns. For example, for a 10 ns deviation on a 100 IRE signal yields a deviation of 1 IRE. Record the measured value in the test record.

Composite Analog Pulse to Bar Ratio

Apply a pulse and bar signal and use cursors to measure the difference between the pulse and the bar.

1. Set the waveform monitor to the factory presets.
2. Connect the precision video generator to one of the CMPST A input connectors and terminate the other connector with the precision terminator.
3. Set the precision generator for a 2T Pulse and Bar.
4. Press the **FULL** button to make the WFM tile the full screen display.
5. Press the **CURSOR** button to turn on the cursor controls.
6. Use the arrow keys to navigate between **Volt1** and **Volt2** and adjust the cursors to be near the top portions of the waveform. Use the **GENERAL** knob to adjust them.
7. Use the vertical knob to move the top of the waveform to the zero graticule.
8. Press and hold the **GAIN** button, select **Gain Settings**, and then **x10**.
9. Press the **GAIN** button to close the menu.
10. Place one cursor on the top of the “Bar.” Use the **GENERAL** knob to adjust **Volt1** in the WFM tile.
11. Use the horizontal knob to put the “pulse” on the dotted line at the center of the screen.
12. Press and hold the **MAG** button and select **x50** to expand the pulse horizontally.
13. Press the **MAG** button to close the menu.
14. Position the second cursor on the top of the pulse. Select **Volt2** using the arrow keys and use the **GENERAL** knob to adjust it.
15. Record the cursor delta in the test record.

Composite Analog Field Rate Tilt

Apply a field rate square wave and use cursors to measure the tilt.

1. Set the waveform monitor to the factory presets.
2. Connect the precision video generator to one of the CMPST A input connectors and terminate the other connector with the precision terminator.
3. Set the precision generator for Field Square Wave.
4. Press the **FULL** button to make the WFM tile the full screen display.
5. Press the **CURSOR** button to turn on the cursor controls.
6. Use the arrow keys to select **Volt1** and **Volt2** and adjust the cursors to be near the top of the waveform using the **GENERAL** knob.
7. Use the vertical knob to move the top of the waveform to the zero graticule.
8. Press and hold the **GAIN** button, select Gain Settings, and then select **x5**.
9. Press the **GAIN** button to close the menu.
10. Press the **LINE SEL** button use the left and right arrow keys to select **ALL**.
11. Use the **GENERAL** knob to set the line select to a line number between 72 and 202.
12. Press the **LINE SELECT** button to close the menu.
13. Use the arrow keys to select **Volt1** and **Volt2** and use cursors to measure the tilt in the waveform using the **GENERAL** knob to adjust them.
14. Record the value in the test record.

Composite Analog Line Rate Tilt

Apply a field rate square wave and use cursors to measure the tilt.

1. Set the waveform monitor to the factory presets.
2. Connect the precision video generator to one of the CMPST A input connectors and terminate the other connector with the precision terminator.
3. Set the precision generator for 100% Flat Field.
4. Press the **FULL** button to make the WFM tile the full screen display.
5. Press the **CURSOR** button to turn on the cursor controls.
6. Use the arrow keys to select **Volt1** or **Volt2** and adjust cursors to be near the top of the waveform using the **GENERAL** knob.
7. Use the **VERTICAL** position knob to move the top of the waveform to the zero graticule.
8. Press and hold the **GAIN** button, select **Gain Settings**, and then select **x5**.
9. Press the **GAIN** button to close the menu.
10. Use the cursors to measure the tilt in the waveform, excluding the first and last 5 µs of the bar.
11. Record the value in the test record.

Composite Analog Input Return Loss Input A & B

This test uses a network analyzer to check the reflections from the input. You can also use the Spectrum Analyzer, tracking generator, and return loss bridge to make this measurement.

1. Turn on the network analyzer and set it for return loss, the S11 measurement.
2. Set the frequency range for approximately 300 kHz to 10 MHz.
3. Calibrate the network analyzer, with one of the BNC cables attached, using the 75 Ω calibration kit.
4. Connect the calibrated end of the cable to one of the CMPST A input connectors and terminate the other connector.
5. Measure the return loss from 300 kHz to 6 MHz. Record the lowest return loss value (biggest reflection) over the frequency range in the test record.
6. Repeat steps 4 and 5 for the CMPST B input. (Press the Input **B** button to select Composite B).

Composite Analog Input DC Offset Restore Off

Measure the displayed offset when the input is not driven and DC Restore is off.

1. Set the waveform monitor to the factory presets.
2. Apply an NTSC signal from the AVG1 output to the CMPST A input of the waveform monitor. Terminate the other CMPST A input with a precision termination.
3. Terminate one side of the Composite B input with a precision termination.
4. Switch DC Restore off:
   a. Press the **CONFIG** button.
   b. Select **Composite Input**, **DC Restore**, and then select **Off**.
5. Press the **FULL** button to make the WFM tile the full screen display.
6. Press the Input **B** button to select the Composite B input.
7. Press and hold the **GAIN** button, select **Gain Settings**, and then select **x5**.
8. Press the **GAIN** button to close the menu.
9. Press the **CURSOR** button to turn on the cursor controls.
10. Set the cursor to the center of the flat-line waveform. Note the waveform offset indicated by the cursor readout.
11. Connect the NTSC signal from the AVG1 output to the Composite B input.
12. Press the Input **A** button to select the Composite A input.
13. Set the cursor to the center of the flat-line waveform. Note the waveform offset indicated by the cursor readout.
14. Record the larger of the two waveform offset values in the test record.

Adjust. If the Offset is outside the specification, perform the following steps:

1. Press the **CONFIG** button.
2. Select **Calibration**.
3. Press the **SEL** button.
4. Use the down arrow to navigate to **Composite**.
5. Follow the on-screen instructions to automatically adjust the offset.
6. Follow the instructions at the bottom of the screen to Save and Exit calibration mode.
7. Repeat the preceding test and record the new value in the test record.

Composite Analog Input Clamp Off Check

Apply a small DC voltage and verify it is not clamped to zero.

1. Set the waveform monitor to the factory presets.
2. Disconnect all cables and terminators from the Composite inputs.
3. Connect a cable from a CMPST A input connector to the retractable hook clip.
4. Switch DC Restore off:
   a. Press the **CONFIG** button.
   b. Select **Composite Input**, **DC Restore**, and then select **Off**.
5. Press the Input **A** button to select the Composite A input.
6. Press the **FULL** button to make the WFM tile the full screen display.
7. Press and hold the **GAIN** button.
8. Select **VAR Gain** and press the right arrow key to select **Enable**.
9. Press the **GAIN** button to close the menu.
10. Use the **GENERAL** knob to reduce the gain to 0.5X.
11. Hold the hook tips on a battery (D, C, or AA), red to positive, black to negative.
12. Verify that the waveform is offset up by about 1.5 volts and is not being clamped to ground.
13. Record Pass or Fail in the test record.

Composite Analog Input DC Restore Hum Attenuation

Apply hum, and then measure the attenuation with clamp in all three modes.

1. Set the waveform monitor to the factory presets.
2. Connect an NTSC color bar signal to the video input of the AVC1. Route the video output of the AVC1 (not the precision video output) to the CMPST A input of the waveform monitor, and terminate the loopthrough in 75 Ω.
3. Press the Input **A** button.
4. Press the **FULL** button to make the WFM tile the full screen display.
5. Set the AVC1 for 0 dB of 60 Hz hum.
6. Press and hold the **SWEEP** button and select **2F**. If you cannot get 2 field, make sure the display style is set to Overlay (press and hold the WFM button and select Overlay).
7. Select input and switch DC Restore off:
   a. Press the **CONFIG** button.
   b. Select **Composite Input**, **DC Restore**, and then select **Off**.

c. Press the **CONFIG** button to close the menu.

8. Press the **CURSOR** button to turn on the cursor controls.
9. Use the arrow keys to select **Volt1** or **Volt2** and measure the peak-to-peak hum with the cursors. Use the **GENERAL** knob to adjust them. The measurement should be about 100 IRE. Record Pass or Fail in the test record.
10. Switch DC Restore to Fast:
    a. Press the **CONFIG** button.
    b. Select **Composite Input**, **DC Restore**, and then select **Fast**.
11. Press and hold the **GAIN** button, select **GAIN Settings** and then **x10**. Then select **VAR Gain**, press the right arrow key to highlight **Enable**.
12. Press the **GAIN** button twice and then use the **GENERAL** knob to adjust the gain to **x4.00**.
13. Use the arrow keys to select **Volt1** or **Volt2** and measure the peak-to-peak hum with the cursors by pressing the **CURSOR** button. Use the **GENERAL** knob to adjust the cursors. The measurement should be less than 5% of the measurement in step 9 (less than ~5 IRE).
14. Record the value in the test record.
15. Press and hold the **GAIN** button, select **Gain Settings**, and then select **x2** by pressing the **GAIN** button twice.
16. Select **VAR Gain**, press the right arrow key to highlight **Enable**, and use the **GENERAL** knob to adjust the gain to **x1.25**.
17. Switch DC Restore to Slow:
    a. Press the **CONFIG** button.
    b. Select **Composite Input**, **DC Restore**, and then select **Slow**.
18. Measure the peak-to-peak hum with the cursors by pressing the **CURSOR** button and then selecting **Volt1** or **Volt2**. Use the **GENERAL** knob to adjust the cursors. It should be between 90% and 110% of the measurement in step 9.
19. Record the value in the test record.

Composite Analog Vertical Measurement Accuracy

Use 100% white and cursors to measure gain.

1. Set the waveform monitor to the factory presets.
2. Connect the precision video generator to one of the CMPST A input connectors and terminate the other connector with the precision terminator.
3. Set the Precision generator for a 100% Flat Field.
4. Press the Input **A** button to select the Composite A input.
5. Press the **FULL** button to make the WFM tile the full screen display.
6. Press the **CURSOR** button.
7. Use the arrow keys to select **Volt1** or **Volt2**. Use the **GENERAL** knob to adjust the cursors to be near the top and zero portions of the waveform.
8. Press and hold the **GAIN** button, select **Gain Settings**.
9. Press the **GAIN** button to close the menu.
10. Position the lower cursor on to the backporch of the waveform.
11. Press and hold the **GAIN** button, select **Gain Settings**, and then **x2** and adjust the vertical position to locate the top of the waveform at the 0 mV graticule. The second cursor should also be near the zero graticule.
12. Position the upper cursor to be centered on the top of the waveform by pressing **CURSOR** button.
13. Cursor delta displays the magnitude of the waveform. It should be within 1% of nominal 714.86 mV. Record the amplitude in the test record.

External Reference Lock Range

Vary the time base of the reference to measure lock range.

1. Set the waveform monitor to the factory presets.
2. Connect the TG2000 AVG1 to one of the CMPST A inputs, and loop the other CMPST A input to the Ref input. Terminate the other side of the Reference loop through.
3. Press the Input **A** button to select the Composite A input.
4. Press the **EXT REF** button to activate external reference mode.
5. Adjust the AVG1 time base offset to –50 ppm. Confirm the VECTOR and WFM displays are stable and that the readout in the upper-left corner of the display does not indicate an unlocked signal. (It is normal for the system to momentarily lose lock when the time base is changed.)
6. Increase the negative time base offset until the system cannot sustain lock. Record the maximum offset capability in the test record.
7. Repeat steps 5 and 6 for positive time base offsets.

VITC Decoding Functionality

Apply an NTSC signal with VITC and verify the VITC is correctly decoded.

1. Set the waveform monitor to the factory presets.
2. Route the NTSC signal from the AVG1 to the VITC encoder.
3. Connect the output of the VITC encoder to one of the CMPST A input connectors and terminate the other connector.
4. Press the Input **A** button to select the Composite A input.
5. Press the **FULL** button to make the WFM tile the full screen display.
6. Set the timecode source to VITC:
   a. Press the **CONFIG** button.
   b. Select **Aux Data Settings**.
   c. Select **Timecode Display if present**.
   d. Select **VITC**.
7. Verify that Decoded VITC is displayed in the lower-right corner of the waveform monitor display.
8. Verify that the VITC is correct and record Pass or Fail in the test record.