

Technical Reference



WVR7100 Waveform Rasterizer Specifications and Performance Verification 071-1591-00

This document applies to firmware version 1.00 and above.

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.

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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.

Connect and Disconnect Properly. Do not connect or disconnect probes or test leads while they are connected to a voltage source.

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.

Powering Off. The power cord provides Mains disconnect.

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

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

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

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.

Symbols and Terms

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.*

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.

Symbols on the Product. The following symbols may appear on the product:



Preface

This manual contains specifications and performance verification procedures for the WVR7100 Waveform Rasterizers.

Related Documents

The following related user documents are also available for this product:

- *WVR7100 Waveform Rasterizers Quick Start User Manual*. This document provides detailed operating information.
- *WVR7100 Waveform Rasterizers Release Notes*. This document describes problems or behaviors that you might encounter while using the waveform rasterizer. This document is provided as a standard accessory when you order a new instrument. If you upgrade your instrument firmware from the Tektronix, Inc. website, an updated version of this document is provided.

Contacting Tektronix

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* **This phone number is toll free in North America. After office hours, please leave a voice mail message. Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.**

Specifications

This chapter contains specifications for the Tektronix WVR7100 waveform rasterizer. Items listed in the Performance Requirement column are generally quantitative, and are either tested by the *Performance Verification* procedure or are guaranteed by design.

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 +50 °C. The rated accuracies are valid when the instrument is calibrated in an ambient temperature range of +20 °C to +30 °C and has been operating continuously for at least 20 minutes within this range.

Electrical Specifications

Table 1-1: SDI Input waveform vertical characteristics

Characteristic	Performance requirement	Reference information
Displayed Vertical Gain Accuracy		YPbPr signal from a digital signal generator as measure in YPbPr mode. Limited by display resolution, measured using Graticules or Cursors. Any one of the three channels.
At X1	± 0.5% Gain of 700 mV full scale mode	
At X5	± 0.2% Gain of 700 mV full scale mode	
Variable Gain Range, Typical	0.25X to 10X	
Frequency Response		
HD		
Luminance Channel (Y)	to 30 MHz, ± 0.5%	RGB monochrome identical to Y channel
Chrominance Channels (Pb, Pr)	to 15 MHz, ± 0.5%	
SD ¹		
Luminance Channel (Y)	to 5.75 MHz, ± 0.5%	RGB monochrome identical to Y channel
Chrominance Channels (Pb, Pr)	to 2.75 MHz, ± 0.5%	

Table 1-1: SDI Input waveform vertical characteristics (Cont.)

Characteristic	Performance requirement	Reference information
Transient Response		
HD		
Preshoot	≤ 0.5% peak (2T30 bar)	
Overshoot	≤ 0.5% peak (2T30 bar)	
Sine-Squared Bars	≤ 0.5% peak (2T30 bar)	
Ringing	≤ 0.8% peak-peak (2T30 bar)	Pulse-to-bar ratio 0.99:1 to 1.01:1 on appropriate Sine-squared or Blackman 2T pulse
SD ¹		
Preshoot	≤ 0.3% peak (2T5 bar)	
Overshoot	≤ 0.3% peak (2T5 bar)	
Sine-Squared Bars	≤ 0.3% peak (2T5 bar)	
Ringing	≤ 0.8% peak-peak (2T5 bar)	Pulse-to-bar ratio 0.99:1 to 1.01:1 on appropriate Sine-squared or Blackman 2T pulse
Tilt, Typical		
Field Rate	< 0.1%	
Line Rate	< 0.1%	
Off Screen Recovery, Typical	< 0.1% variation in baseline of a 5 MHz modulated pulse when positioned anywhere on screen	X1, X5 or any variable gain setting
RGB Transcoder Accuracy		± 0.1%
Bit Integrity		Accurately shows both 8 and 10-bit signals

¹ Applies to Option SD-equipped rasterizers only

Table 1-2: Serial digital video (SDI inputs A and B) interface physical layer characteristics

Characteristic	Performance requirement	Reference information
Formats Supported		1485/1483 Mb/s component. Complies with SMPTE 292M
SD ¹		270 Mb/s component. Complies with SMPTE 259M and CCIR 656.
Input Level, includes Option SD	800 mV peak-to-peak ± 10%	Input voltages outside this range may cause reduced receiver performance
Input Type, includes Option SD		Passive loopthrough 75 Ω, compensated

Table 1-2: Serial digital video (SDI inputs A and B) interface physical layer characteristics (Cont.)

Characteristic	Performance requirement	Reference information
Return Loss	≥ 15 dB from 1 MHz to 1.5 GHz, power on ≥ 10 dB from 1 MHz to 1.5 GHz, power off ≥ 25 dB from 1 to 270 MHz, power on ≥ 15 dB from 1 to 270 MHz, power off	
Insertion Loss (Loopthrough)		≤ 4 dB to 1.5 GHz ≤ 1.2 dB to 270 MHz Checked indirectly via return loss and equalization range
Loopthrough Isolation	≥ 45 dB to 1 GHz ≥ 50 dB to 300 MHz	
Serial Receiver Equalization Range		
HD	Proper operation with up to 20.0 dB loss at 750 MHz using coaxial cable having $1/\sqrt{F}$ loss characteristics. 800 mV launch amplitude per SMPTE 292M.	Equivalent to approximately 80 meters of Belden 8281 coaxial cable. Typically operates to 130 meters.
SD ¹	Proper operation with up to 23.0 dB loss at 135 MHz using coaxial cable having $1/\sqrt{F}$ loss characteristics. 800 mV launch amplitude per SMPTE 259M.	275 meters using Belden 8281 coaxial cable, typical
Input Time Base Range		
HD	1483.51 Mbits/s \pm 50ppm 1485 Mbits/s \pm 50ppm	Many functions continue to operate to a wider range, typically 1000 ppm
SD ¹	270 Mbits/s \pm 50ppm	

¹ Applies to Option SD-equipped rasterizers only

Table 1-3: Composite analog input waveform vertical characteristics—Option CPS-equipped rasterizers only)

Characteristic	Performance requirement	Reference information
Displayed Vertical Gain Accuracy	$\pm 1\%$ all Gain settings	Measured using graticules
Variable Gain Range, Typical	0.25X to 10.0X	
Frequency Response	Flat to 5.75 MHz, $\pm 1\%$	
Delay Variation over Frequency	± 10 ns to 5.75 MHz	Typically $< \pm 2$ ns
Transient Response		Measured using Sine-squared 2T4 pulse and bar
Pulse-to-Bar Ratio	0.99:1 to 1.01:1	
Pre-shoot	$\leq 1\%$	

Table 1-3: Composite analog input waveform vertical characteristics—Option CPS-equipped rasterizers only) (Cont.)

Characteristic	Performance requirement	Reference information
Overshoot	$\leq 1\%$	
Ringing	$\leq 1\%$	
Tilt, Typical		
Field Rate	$< 0.5\%$	
Line Rate	$< 0.5\%$	
Off Screen Recovery, Typical		$< 0.5\%$ variation in baseline of a Chroma modulated pulse when positioned anywhere on screen X1, X5 or any variable gain setting

Table 1-4: Composite analog inputs A and B physical layer characteristics—Option CPS-equipped rasterizers only

Characteristic	Performance requirement	Reference information
Formats Supported	NTSC, NTSC no setup, and PAL, I, B, D, G, H. Complies with RS170A and 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	
Input Dynamic Range, typical		± 6 dB
Video Maximum Operating Amplitude, typical		-1.8 V to +2.2 V DC + peak AC (all inputs)
Maximum Absolute Video Input Amplitude		-8.0 V to +8.0 V DC + peak AC
Input Type	Passive loopthrough 75 Ω , compensated	
DC Input Impedance		20 k Ω
Return Loss	≥ 40 dB to 6 MHz, power on	Typically > 46 dB to 6 MHz, power on, > 35 dB to 6 MHz, power off for standard amplitude video
Video Input Cross-talk Between Channels		≥ 60 dB to 6 MHz
Loopthrough Isolation		≥ 70 dB to 6 MHz
DC Offset with Restore Off		≤ 10 mV typical, measured in full-screen mode at X5 vertical gain
DC Restore Modes	Fast, Slow, and Off modes	Slow has typical bandwidth of 10 Hz Fast has typical bandwidth of 500 Hz

Table 1-4: Composite analog inputs A and B physical layer characteristics—Option CPS-equipped rasterizers only (Cont.)

Characteristic	Performance requirement	Reference information
DC Restore Offset Error	≤ 2 mV	Registration between back porch and 0 V graticule
DC Offset Between Inputs	≤ 7 mV	With restore off
DC Restore 50 and 60 Hz Attenuation, typical	Fast Mode > 95% attenuation Slow Mode < 10% attenuation Off Mode	
Blanking Shift with 10 to 90% APL Change		≤ 1 IRE (7 mV PAL)
Blanking Shift with Presence and Absence of Burst		≤ 1 IRE (7 mV PAL) Typically 0 mV
Lock Range	± 50 ppm	Remains locked
Lock in Presence of Hum		± 1 V peak-to-peak On 0 dB signal, remains locked
Lock in Presence of White Noise		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 and burst is present	
Clamp Range		Can correct signals with backporch within 1 V of ground.
Sync AFC Speed		User selectable setting of Fast or Slow response to line rate variations. Typical bandwidth of 600 Hz (Fast) and 10 kHz (Slow)

Table 1-5: External reference characteristics

Characteristic	Performance requirement	Reference information
Formats Supported	Correct horizontal and vertical synchronization for composite sync signal of supported reference standard.	Supported Formats are listed in Table 1-6 on page 1-7.
Input Dynamic Range, Typical		± 6 dB
Absolute Maximum Input Voltage, Nominal		± 6.0 V DC plus Peak AC
Input Type		Passive loopthrough 75Ω , compensated
DC Input Impedance, Nominal	$20 \text{ k}\Omega$	
Return Loss	≥ 40 dB to 6 MHz, power on ≥ 35 dB to 30 MHz, power on	Typical: > 46 dB to 6 MHz, power on or off > 40 dB to 30 MHz, power on > 35 dB to 30 MHz, power off
Timing Shift with 10 to 90% APL Change	≤ 0.5 ns	
Timing Shift with Hum		≤ 40 ns with 0 dB hum
Lock Range	± 50 ppm, remains locked	
Lock in Presence of Hum Bi-level Tri-level		1.0 V peak-to-peak, on 0 dB signal, remains locked 0.5 V peak-to-peak, on 0 dB signal, remains locked
Lock in Presence of White Noise		Signal/Noise ratio of 32 dB, 5 MHz bandwidth on black burst, remains locked
Color Framing	Correct color framing detected for signals having $< 45^\circ$ SCH Phase Error and burst is present	
Sync AFC Speed		User selectable setting of Fast or Slow response to line rate variations. Typical bandwidth of 600 Hz (Fast) and 10 kHz (Slow).

Table 1-6: Signal Input-to-Reference Compatibility

Supported Input Formats	External Reference Inputs									
	NTSC	PAL	720p			1080p sF		1080i		
	59.94 Hz	50 Hz	50 Hz	59.94 Hz	60 Hz	23.98 Hz	24 Hz	50 Hz	59.94 Hz	60 Hz
NTSC 59.94 Hz ¹	x									
PAL 50 Hz ¹		x								
483i, 59.94 Hz (525), BT601 ²	x			x					x	
576i, 50 Hz (625), BT601 ²		x	x					x		
720p, 23.98 Hz	x			x		x			x	
720p, 24 Hz							x			x
720p, 25 Hz		x	x					x		
720p, 29.97 Hz	x			x					x	
720p, 30 Hz					x					x
720p, 50 Hz		x	x					x		
720p, 59.94 Hz	x			x		x			x	
720p, 60 Hz					x		x			x
1035i, 59.94 Hz	x			x					x	
1035i, 60 Hz					x					x
1080i, 50 Hz		x	x					x		
1080i, 59.94 Hz	x			x					x	
1080i, 60 Hz					x		x			x
1080p, 23.98 Hz	x			x		x			x	
1080p, 24 Hz							x			x
1080p, 25 Hz		x	x					x		
1080p, 29.97 Hz	x			x					x	
1080p, 30 Hz					x					x
1080sf, 23.98 Hz	x			x		x			x	
1080sf, 24 Hz							x			x
1080sf, 25 Hz		x	x					x		
1080sf, 29.97 Hz	x			x					x	
1080sf, 30 Hz					x					x

¹ Available for Option CPS-equipped instruments only.

² Available for Option SD-equipped instruments only.

Table 1-7: Waveform sweep (horizontal) characteristics

Characteristic	Performance requirement	Reference information
Sweep Timing Accuracy	± 0.1%	All Sweep and Mag modes, limited by display resolution, measured using graticules or cursors. Guaranteed by digital design. Input time base within ± 10 PPM.
Sweep Linearity	± 0.1%	Guaranteed by digital design

Table 1-7: Waveform sweep (horizontal) characteristics (Cont.)

Characteristic	Performance requirement	Reference information
Sweep Rates		1, 2, 3, or 4 line, or 1 field or 2 field, depending on mode
Mag		Mag occurs around center of sweep 2 line and 2 field Mag modes optimized to display blanking intervals
Horizontal Position Range, Nominal		Any portion of the synchronized sweep can be positioned on screen in all sweep modes. Any portion of the sweep can be set to the middle of the screen in non-mag mode.

Table 1-8: Waveform mode filter characteristics

Characteristic	Performance requirement	Reference information
Low Pass Filter Gain, Component	$1 \pm 0.1\%$ relative to flat gain	
Low Pass Filter Frequency Response, Component		
HD		≤ 3 dB attenuation at approximately 7 MHz
SD ¹	≤ 3 dB attenuation at 800 kHz ≥ 32 dB attenuation at 3 MHz	Filter meets STD-205.
Luma Filter Gain, Composite ²	$1 \pm 0.1\%$ relative to flat gain at 50 kHz	
Luma Filter Response, Composite ²	≤ 3 dB attenuation at 800 kHz ≥ 40 dB attenuation at F_{sc}	Same as component low pass filter Filter meets STD-205.
Chroma Filter Gain, Composite ²		$1 \pm 0.1\%$ relative to flat gain
Chroma Filter Response, Composite ²	3 dB bandwidth 1 MHz \pm 0.2 MHz	Centered on f_{sc} . Implemented digitally
Chroma Filter Attenuation at 2X F_{sc} , Composite ²	≥ 25 dB	Typically 28 dB for NTSC, 53 dB for PAL

¹ Available for Option SD-equipped instruments only.

² Applies to Option CPS-equipped rasterizers only

Table 1-9: Component vector mode

Characteristic	Performance requirement	Reference information
Vector Display	P_B is displayed on horizontal axis and P_R is displayed on vertical axis	
Vector Position Behavior	Graticules and waveform move together with position controls. Range sufficient to put any bar target in center of screen at all gains.	
Variable Gain Behavior	Variable affect waveform amplitude relative to graticules	
Displayed Horizontal and Vertical Gain Accuracy	X1 Gain $\pm 0.5\%$ X5 Gain $\pm 0.2\%$	Limited by display resolution, measured using graticules or cursors
Display to Graticule Registration	Centered in target ± 0.25 box diameter at 1X gain ± 0.1 box diameter at 5X gain	Boxes are 2% targets
Bandwidth, typical		
HD		4.5 MHz
SD ¹		800 kHz; Filter meets STD-205

¹ Applies to Option SD-equipped rasterizers only

Table 1-10: Composite vector mode characteristics

Characteristic	Performance requirement	Reference information
Displayed Horizontal and Vertical Gain Accuracy	X1 Gain $\pm 1\%$ X5 Gain $\pm 1\%$	
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		B-Y displayed on horizontal axis R-Y displayed on vertical axis
Bandwidth, typical		500 kHz
Horizontal to Vertical Bandwidth Matching		$< 2^\circ$ at 500 kHz and 2 MHz
Composite Vector Dot Reference		Shows "true" zero subcarrier reference
R-Y B-Y Axis Orthogonality		0.1° implemented digitally

Table 1- 11: Lightning and Diamond modes display

Characteristic	Performance requirement	Reference information																		
Displayed Horizontal and Vertical Gain Accuracy	± 0.5%, 1x and 5x gain	Limited by display resolution, measured using graticules																		
Diamond	GBR Deflection axis indicated																			
Lightning	Y is displayed vertically P _B is displayed horizontally on top half of display P _R is displayed horizontally on bottom half of display																			
Lightning Timing Marks		<p>Error in nanoseconds, as deflected from center mark:</p> <table border="1"> <thead> <tr> <th>Deflection</th> <th>SD</th> <th>HD</th> </tr> </thead> <tbody> <tr> <td>0 marks</td> <td>0 ns</td> <td>0 ns</td> </tr> <tr> <td>+/-1 mark</td> <td>20 ns</td> <td>2 ns</td> </tr> <tr> <td>+/-2 marks</td> <td>40 ns</td> <td>5 ns</td> </tr> <tr> <td>+/-3 marks¹</td> <td>74 ns</td> <td>13.5 ns</td> </tr> <tr> <td>+/-4 marks²</td> <td>148 ns</td> <td>27 ns</td> </tr> </tbody> </table> <p>¹ 1 Luma sample ² 1 Chroma sample</p> <p>If the transition bends in toward black, the color-difference signal is delayed with respect to luma</p> <p>If the transition bends out toward white, the color-difference signal is leading the luma signal</p> <p>Deflection calibrated for color bars with 200 ns luma rise time, and 400 ns chroma rise time</p>	Deflection	SD	HD	0 marks	0 ns	0 ns	+/-1 mark	20 ns	2 ns	+/-2 marks	40 ns	5 ns	+/-3 marks ¹	74 ns	13.5 ns	+/-4 marks ²	148 ns	27 ns
Deflection	SD	HD																		
0 marks	0 ns	0 ns																		
+/-1 mark	20 ns	2 ns																		
+/-2 marks	40 ns	5 ns																		
+/-3 marks ¹	74 ns	13.5 ns																		
+/-4 marks ²	148 ns	27 ns																		

Table 1- 12: RGB gamut error indication (Diamond displays)

Characteristic	Performance requirement	Reference information
Detection Level	Adjustable thresholds, 1% resolution: Upper: 630 to 756 mV Lower: -70 to +35 mV Default is nominally 103% of legal RGB: Upper: 721 mV Lower: -21 mV	
Detection Level Accuracy	± 5 mV	

Table 1-12: RGB gamut error indication (Diamond displays) (Cont.)

Characteristic	Performance requirement	Reference information
Colorimetry		
HD		Defined in ITU 709-2 & SMPTE 240M
SD ¹		Defined in CCIR601

¹ Applies to Option SD-equipped rasterizers only

Table 1-13: Arrowhead mode (NTSC/PAL composite limit display of component input mode)

Characteristic	Performance requirement	Reference information
Signal to Graticule Accuracy (PAL values in parenthesis)	$\pm 1\%$, 100 IRE (700 mV) and 131 IRE (900 mV)	
Composite Limit Cursor Accuracy ¹ (PAL values in parenthesis)	2% at 100, 110, 120, and 131 IRE (700 and 900 mV) 2% at -24, -33, and -40 IRE (-230 and -300 mV)	
Detection Level	Adjustable thresholds, 1% steps	Out of limit signals are displayed as Red on the out-of-limit portion of the Arrowhead display
Composite Limit Detection Level Accuracy ² (PAL values in parenthesis)		± 7 mV Detection level can be set to 100, 110, 120, or 131 IRE (700 or 950 mV PAL)
Luma Limits		High 90 to 108% Low +5 to -6% 0.5% steps Default is nominally 103% and -1%.
Luma Limit Detection Level Accuracy		± 7 mV

¹ Applies to Option CPS-equipped rasterizers only

Table 1-14: Program error alarms and “Background Measurement Alarms”

Characteristic	Performance requirement	Reference information
Alarm Coverage		Alarms only reported on active input
Alarm Log Depth		10,000 Alarm entries Data is volatile and will be lost at power down

Table 1-14: Program error alarms and “Background Measurement Alarms” (Cont.)

Characteristic	Performance requirement	Reference information
Alarm Log Time Stamping	Time of day and selectable LTC or VITC	
Alarm Notification		All alarms can be configured to be reported to any or all of the following: XGA display icon or text, beeper, SNMP, ground closure alarm output, web-based user interface, alarm log.
SDI Alarms		
EDH Error ¹	Active picture and full field. Field rate resolution.	Uses CRC system. System is known as EDH (Error Detection and Handling) in industry literature. Complies with SMPTE RP 165.
Signal Loss	Reports absence of video signal for the currently selected input	
RGB and Composite Gamut Errors		User adjustable thresholds Alarm point may also be displayed in picture mode via bright-up near the location of the error
Audio Alarms		
Audio Level Alarms		Warns that an audio channel is at mute, clip, silence, or over after a user-definable period of time Mute and Clip are defined as minimum and maximum digital codes. Silence and Over are levels that can be set by the user.
Audio Error		Warns that an Audio CRC Error has occurred Does not apply to analog audio inputs
Audio Unlocked		Warns that an Audio AES clock is not present or out of frequency range
Composite Video Alarms ²		
Signal Loss Alarm		Reports absence of video signal for the currently selected input and External Reference if it is enabled
LTC and VITC		Warns that a break or discontinuity has occurred

¹ Applies to Option SD-equipped rasterizers only

² Applies to Option CPS-equipped rasterizers only

Table 1-15: Miscellaneous measurements and displays

Characteristic	Performance requirement	Reference information
Embedded Audio		Identifies the presence of up to 16 channels of embedded digital audio Alarms are triggered for lack of presence, checksum errors, buffer full/empty, or parity errors on up to 8 channels
EDH Error Statistics ¹		Displays asynchronous errored seconds. Active picture and full field statistics are separately compiled.
SDI Video Format ¹		Indicates whether the signal is 525 lines or 625 lines
Composite Video Format ²		Indicates whether the signal is NTSC or PAL "Forced Format" mode overrides
VITC		On screen readout of the VITC of the selected video input. Also displayed in the error logging information. Complies with SMPTE 12M.
LTC		On screen readout of the LTC on GC Remote Connector. Also displayed in the error logging information. Complies with SMPTE 12M.

¹ Applies to Option SD-equipped rasterizers only

² Applies to Option CPS-equipped rasterizers only

Table 1-16: Picture display mode

Characteristic	Performance requirement	Reference information
Modes		Color Only, internally referenced with 60 Hz refresh.
Full-screen Mode	Under scan image with and without blanking displayed	Close to 1 pixel per input sample but interpolated as needed to get correct aspect ratio. Composite picture with blanking displayed does not show sync and burst but does show vertical interval signals such as VITS, teletext and closed caption.
Tiled Modes		Decimated with correct aspect ratio
Composite Decoder		Adaptive Comb

Table 1-17: Measure display

Characteristic	Performance requirement	Reference information
Input Timing Relative to External Reference		Display of Vertical and Horizontal timing offset
Timing Display Zero Definition (When <i>Relative to</i> : is set to <i>Rear Panel</i> .)		<p>For vertical timing conform to SMPTE168 - 2002</p> <p>For Horizontal timing, zero delay analog signals have coincident syncs. For digital signals, timing is such that if converted to analog via a WFM601a then the resultant analog signal is coincident with the reference.</p> <p>Timing zero is equivalent to nominal zero delay on TG700. Also agrees with timing that has minimal shift on the waveform display when going from internal to external.</p> <p>Vertical timing as per SMPTE168 specifies that the first lines that contain broad pulses are aligned.</p>

Table 1-18: Other display

Characteristic	Performance requirement	Reference information
LTC Waveform	Displays voltage versus time waveform of LTC input	Timing derived from currently selected video timing. Mutually exclusive to Stair Step mode.
LTC Waveform Vertical Accuracy, Typical		± 5%
LTC Waveform DC Offset, Typical		± 100 mV
LTC Waveform Time Base, Typical		<p>3 ms/division for NTSC, 4 ms/div for PAL</p> <p>Runs in 2-field sweep mode only, triggered by field one to allow verifying audio to video synchronization</p>

Table 1-19: Audio bar displays—(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Modes		User can configure the response dynamics (ballistics), reference levels, peak hold, offset, and scale of the meters to suite the monitoring needs of their installation or situation. Each pair has a phase correlation meter.
8-Channel		Any four channel pairs with phase correlation meters. Only six channels active with analog audio input.
Surround		Left, Right, Center, Lfe, Left surround, Right surround meters, and an extra channel pair. Phase correlation meters between the two left-right pairs and the extra pair.
Audio Sources		Monitors the signal levels and stereo phase of AES/EBU digital audio, digital audio embedded in serial digital video and analog audio inputs.
Level Meter Resolution		0.056 dB steps on 30 dB scale, from full scale to -20 dB FS 0.20 dB steps on 0 to -70 dB scale, for signals above -240 dB FS, tiled display
Correlation Meter Speed	User selectable from 1 to 20 Factory default set to 8	Speed 1 averages over 0.0167 s. Speed 2 averages over 0.0333 s. Speed 3 averages over 0.0667 s. Speed 4 averages over 0.133 s. Speed 5 averages over 0.267 s. Speed 6 averages over 0.533 s. Speed 7 averages over 1.0 s. Speed 8 averages over 1.5 s. Speed 9 averages over 2.0 s. Speed 10 averages over 2.5 s. Speed 11 averages over 3.0 s. Speed 12 averages over 3.5 s. Speed 13 averages over 4.0 s. Speed 14 averages over 4.5 s. Speed 15 averages over 5.0 s. Speed 16 averages over 5.5 s. Speed 17 averages over 6.0 s. Speed 18 averages over 6.5 s. Speed 19 averages over 7.0 s. Speed 20 averages over 7.5 s.
Metering Ballistics		Selectable from True Peak, PPM Type 1, PPM Type 2, and Extended VU.

Table 1-19: Audio bar displays—(Applies to Option DA and/or Option DG- equipped instruments only) (Cont.)

Characteristic	Performance requirement	Reference information
Peak Program Meter PPM Type 1		Equivalent to IEC 60268-10 Type I, DIN 45406, and Nordic N-9
PPM Type 2		Equivalent to IEEE Std. 152-1991 and IEC 60268-10 Type II
True Peak		PPM decay characteristics, no attack delay. Shows actual signal peaks regardless of duration This is the factory default ballistic
Extended VU		A VU meter as defined in IEEE Std. 152-1991 but an extended dB-linear scale
Peak Hold	Adjustable from 1 to 10 seconds Default is 2 seconds	Indicated Peaks held for selected time
Clip Indication Delay Count		Consecutive FS samples for Clip indication, user selectable Off or 1 to 100. Factory default set to 1
Mute Indication Delay Count		Consecutive "0" samples for Mute indication, user selectable Off or 1 to 100. Factory default set to 10
Clip/Mute Hold Time		User selectable from 1 to 30 seconds. Factory default set to 2
Silence Indication Threshold		Audio level below which the signal is considered "silent". Used to trigger on-screen indication and alarms
Silence Indication Delay		Off or 1 to 60 seconds selectable. Indication and alarm will not be asserted until threshold has been exceeded for the set number of seconds. Factory default is set to 10
Over Indication Threshold		Audio level above which the signal will be considered "over". Used to trigger on-screen indication and alarms
Over Indication Delay		Off or 1 to 30 seconds selectable. Indication and alarm will not be asserted until threshold has been exceeded for the set number of seconds. Factory default is set to 2

Table 1-19: Audio bar displays—(Applies to Option DA and/or Option DG- equipped instruments only) (Cont.)

Characteristic	Performance requirement	Reference information
Adjustable Peak Program Level (dBFS)		Range: 0 to -30 dB Peak program level is the level (relative to digital full scale) that you choose as the maximum desired level for monitored programs. The meter bars change to red between the Peak program level.
Adjustable Test Level (dBFS)		Range: 0 to -30 dB. Test level is the level (relative to digital full scale) that you choose as the test or “line up” level for your system. The meter bars change to yellow between the Test and Peak program levels.
Set 0 dB Mark	Selectable from Top of Scale, Peak Program Level, or Test Level	Use this item to number the meter scale relative to top of scale or to one of the two user-adjustable levels. When the zero mark is set to either Peak program or Test level, the scale units are dB _r , relative to the 0 dB level; units above the selected 0 dB mark are positive, while units below it are negative.

Table 1-20: Audio bar and lissajous displays —(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Description		In combination with Bar mode can have Lissajous in one tile.
Automatic Gain Control	Gain control can be on or off	AGC time constant: 0.5 sec to expand display after a 0 to -40 level transition, 0.05 sec to reduce gain after a -40 to 0 dB level transition.
Manual Scaling		When AGC is off, level at perimeter of display follows Program level on Bar display.

Table 1-21: Audio text displays —(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Session Log (audio and video)		List of Significant audio events with time stamps. Depending on input may include Clips, mutes, Silence, over.

Table 1-22: AES audio inputs—(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Inputs		2 sets with 8 channels each, 24-bit. Meets requirements of AES 3-ID
Input Connector		BNC, terminated, unbalanced
Input Impedance		75 Ω
Return Loss		> 25 dB relative to 75 Ω , 0.1 to 6 MHz, typically better than 25 dB to 12 MHz Input A has passive terms and so are the same with power on or off. Input B has active terms that go to a higher impedance with the power off.
Input Amplitude Range		0.2 V to 2 V peak-to-peak
Input Sample Rate		32 kHz, 44.1 kHz, 48 kHz, and 96 kHz
Input Lock Range		> $\pm 5\%$ (when exceeding 5%, the instrument may search again for a new lock point. Typically stays locked to 12.5%.)

Table 1-22: AES audio inputs—(Applies to Option DA and/or Option DG- equipped instruments only) (Cont.)

Characteristic	Performance requirement	Reference information
Audio Levels	Bars display signals up to 0 dBFS.	Not to exceed max analog output power specification. If necessary, configure the output attenuation.
Level Meter Accuracy over Frequency	<p>0.2 dB from 20 Hz to 20 kHz 0 to -40 dBFS sine-wave, Peak Ballistic mode. Except for within 5 Hz of some submultiples of the sampling frequency, 32, 44.1 and 48 kHz input.</p> <p>96 kHz inputs follow 48 kHz exceptions (no up sampling). For example:</p> <p>1/7th of rate -0.25 dB (for 48 kHz this is 6.857 kHz + 5 Hz)</p> <p>1/6th of rate -0.3 dB (for 48 kHz this is 8 kHz + 5 Hz)</p> <p>1/5th of rate -0.5 dB (for 48 kHz this is 9.6 kHz + 5 Hz)</p> <p>1/4th of rate -0.7 dB (for 48 kHz this is 12 kHz + 5 Hz)</p> <p>2/7th of rate -0.25 dB (for 48 kHz this is 13.714 kHz + 5 Hz)</p> <p>1/3rd of rate -1.3 dB (for 48 kHz this is 16 kHz + 5 Hz)</p> <p>4/10th of rate -0.5 dB (for 48 kHz this is 19.2 kHz + 5 Hz)</p>	<p>Worst case examples are shown, other rates with minor exceptions exist.</p> <p>Note that all exceptions are above 6 kHz so on impact accuracy on harmonics of normal audio content.</p>

Table 1-23: AES audio outputs—(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Source		From embedded audio only.
Number of Outputs		Up to 8 channels
Output Format		Stereo Output, 48 kHz, 20 bit, Meets requirements of SMPTE 276M-1995 (AES 3-ID)
Output Connector		BNC, terminated, unbalanced
Output Impedance		75 Ω
Return Loss		> 25 dB relative to 75 Ω , from 0.1 to 6 MHz Tested in Input mode
Output Amplitude Range		0.9 V to 1.1 V peak-to-peak into 75 Ω

Table 1-23: AES audio outputs—(Applies to Option DA and/or Option DG- equipped instruments only) (Cont.)

Characteristic	Performance requirement	Reference information
Output Sample Rate		Locked to embedded sample rate (nominally 48 kHz)
Output Jitter, Typical		3.5 ns with 700 Hz high pass as per AES specification AES3 rev 1997 specification is 4.1 ns for 48 kHz audio
Rise and Fall Times, Typical		37 ns 10 to 90% as per AES3

Table 1-24: Embedded audio extraction and monitoring on status bar —(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Embedded Audio Formatting HD		Extracts 24-bit embedded audio formatted according to the SMPTE 299M preferred implementation (48 kHz audio sampling rate synchronized with video)
SD ¹		Extracts 20-bit embedded audio formatted according to SMPTE 272M Operation Level B (48 kHz audio sampling rate synchronized with video)
Channel Numbering		Displays channel number per SMPTE 299M or SMPTE 272M (Option SD)
Number of Channels Monitored for Presence		16 channels are monitored for presence

¹ Applies to Option SD-equipped rasterizers only

Table 1-25: Analog audio inputs —(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Number of Channels		Provides up to two sets of six channels of professional, balanced, differential inputs, 12 channels total
Input Connector		Balanced, unterminated, located on rear panel Use 37 pin, 2 row, DSUB connector

Table 1-25: Analog audio inputs (Cont.)—(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Level Meter Accuracy over Frequency	<p>0.5 dB from 20 Hz to 20 kHz 0 to -40 dBFS sine-wave, Peak Ballistic mode. Except for within 5 Hz of some submultiples of the sampling frequency for 32, 44.1 and 48 kHz input.</p> <p>96 kHz inputs follows the 48 kHz exceptions since it is not up sampled. For example:</p> <p>1/7th of rate -0.75 dB (for 48 kHz this is 6.857 kHz + 5 Hz)</p> <p>1/6th of rate -0.8 dB (for 48 kHz this is 8 kHz + 5 Hz)</p> <p>1/5th of rate -1.0 dB (for 48 kHz this is 9.6 kHz + 5 Hz)</p> <p>1/4th of rate -1.2 dB (for 48 kHz this is 12 kHz + 5 Hz)</p> <p>2/7th of rate -0.75 dB (for 48 kHz this is 13.714 kHz + 5 Hz)</p> <p>1/3rd of rate -1.8 dB (for 48 kHz this is 16 kHz + 5 Hz)</p> <p>4/10th of rate -1.0 dB (for 48 kHz this is 19.2 kHz + 5 Hz)</p>	<p>Worst case examples are shown, other rates with minor exceptions exist</p> <p>Note that all exceptions are above 6 kHz so on impact accuracy on harmonics of normal audio content</p>
Cross Talk		<p>≤ -80 dB, typically ≤ -90 dB from 20 Hz to 20 kHz. Inputs driver from $< 600 \Omega$ source impedance</p> <p>Defined as the displayed bar level in any channel that results from a Full scale signal on a different input pair in that input</p>
Maximum Input Levels	+24 dBu referenced to level Meter Accuracy over Frequency above.	Must not exceed max power specification on analog outputs. Configure output attenuation if necessary
Resolution Sampling, Nominal		24 bits at 48 kHz
Input Impedance, Typical		35 k Ω
Off Isolation		<p>≤ -80 dB, from 20 Hz to 20 kHz. Unused input driven from $< 600 \Omega$ source impedance</p> <p>Defined as the displayed bar level that results from a Full scale signal on any pair of the unused input</p>

Table 1-26: Analog audio outputs —(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Audio Modes		
Balanced		Provide a full-scale output of 24 dBu and is intended for professional balanced applications
Unbalanced		Intended to drive the unbalanced inputs of consumer amplifiers in which case one side of the line must be grounded
Audio Sources		The channels routed to the line outputs can include the following: <ul style="list-style-type: none"> ■ Embedded audio source ■ AES audio source ■ Analog audio source
Number of Channels		Provides up to 6 channels
Output Connections		Balanced, unterminated connector located on rear panel Use 37 pin, 2 row, DSUB connector. Ground negative output to support unbalanced mode
Maximum Output Levels		
Balanced		+24 dBu \pm 0.5 dB
Unbalanced		-10 dBV \pm 0.5 dB When grounding one output to achieve unbalanced mode, the other output will be driven to a larger amplitude You can reduce the output level by adjusting attenuation in the Configuration menu Do not exceed maximum rated power for either mode
Input to Output Gain		0 dB to -120 dB in 0.5 dB steps
Digital-Input-to-Analog-Output Gain Accuracy Over Frequency	\pm 0.5 dB, 20 Hz to 20 kHz, 0 to -40 dBFS, 20 or 24 bit input.	
Analog-Input-to-Analog-Output Gain Accuracy Over Frequency	\pm 1 dB, 20 Hz to 20 kHz, 24 dBu to -16 dBu	

Table 1-26: Analog audio outputs (Cont.)—(Applies to Option DA and/or Option DG- equipped instruments only)

Characteristic	Performance requirement	Reference information
Output Impedance, Nominal		50 Ω Intended to drive 600 Ω load. Drivers are capable of driving a minimum load impedance of 300 Ω but may overheat. Do not exceed maximum rated power.
Digital-Input-to-Analog-Output Distortion (THD + N), Typical		< 0.02%, From full scale to -30 dBFS , 20 Hz to 20 kHz
Analog-Input-to-Analog-Output Distortion (THD + N), Typical		< 0.05%, From full scale to -30 dBFS , 20 Hz to 20 kHz
Analog or Digital-Input-to-Analog Output Crosstalk, Typical		< -82 dB, 20 Hz to 20 kHz 24 dBu or 0 dBFS input < -100 dB, 20 Hz to 2 kHz 24 dBu or 0 dBFS input
Output Power Capability, Typical		Capable of continuously driving a -10 dBFS sine wave into 600 Ω or -13 dB into 300 Ω This output level is equivalent is 25 mW RMS in the load per output pair. Live audio may reach full voltage level as long as the duty cycle is such that the RMS power is less than 25 mW averaged over any 10 second period. Exceeding this limit at high ambient temperature may cause the output circuit to overheat and damage the instrument.

Table 1-27: Ground closure Remote/LTC input

Characteristic	Performance requirement	Reference information
LTC Input Connector		Balanced, unterminated via rear panel GC remote connector
LTC Input Impedance		> 10 k Ω
LTC Signal Characteristics		Longitudinal Time Code per IEC Publication 461
LTC Signal Amplitude Range		0.2 to 5.0 V _{p-p} balanced, differential, or single-ended

Table 1-27: Ground closure Remote/LTC input (Cont.)

Characteristic	Performance requirement	Reference information
Ground Closure Input Signaling		TTL thresholds, 5 V maximum input, -0.5 V minimum input. Pull low to assert. Instrument has an internal 10 kΩ pull-up resistor on each input
Ground Closure Output Characteristics		Open collector output, 30 V maximum, 100 mA maximum, 300 mW maximum

Table 1-28: VITC Decoding

Characteristic	Performance requirement	Reference information
VITC Sources		
SD ¹		Use SDI input A or B
Composite ²		Use Composite input A or B
HD		None
Ancillary Time Code		
HD		Use SDI A or B
SD ¹		Use SDI A or B

- ¹ Applies to Option SD-equipped rasterizers only
- ² Applies to Option CPS-equipped rasterizers only

Table 1-29: Ethernet characteristics

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

Table 1-30: XGA Picture monitor output

Characteristic	Performance requirement	Reference information
Amplitude		Can switch between 1 V and 0.7 V
Resolution		1024 x 768

Table 1-31: General characteristics

Characteristic	Performance requirement	Reference information
Presets		Five user presets; one factory default preset
Real Time Clock		Time set can be adjusted by the user; used for logging time stamps.
Field Upgradable Software and FPGA		All code except for boot flash can be upgraded
Battery Life and Retention Time		5 years worst case, 10 years typical. (The battery is not user replaceable.)
Low Light Illumination		“OFF” LEDs optionally illuminated at user selectable level from 1 to 10%
Preset Parameters		All instrument settings except those under CONFIG > Utilities are saved as part of the Preset
System Log		Stores diagnostic messages, accessed from CONFIG menu
Line Select Function		Any one tile can be in line select for waveform, vector, arrowhead, diamond, or lightning.
Cursor Styles		Cursor style - Voltage, Time or Voltage + Time. Available in Waveform Display only. Independent cursors can be in multiple tiles of WFM display.
Cursor Range		Cursors can be placed on any portion of the valid Waveform range.
Line Select Bright-up		Selected line appears as a bright line on picture and in WFM displays set to Field Sweep. Can be disabled in CONFIG > Graticules > Picture Line Select Cursor and Field Sweep Select Cursor.

Table 1-31: General characteristics (Cont.)

Characteristic	Performance requirement	Reference information
Line Select Range		Any line in SDI-525 (1 to 525), SDI-625 (1 to 625), NTSC (1 to 1050), PAL (1 to 2500). Fields greater than 1 display the line number in the field and the line number in the frame or color frame.
Acoustic Noise Level, Typical		Front 40 dB(A), Rear 38 dB(A), Side 38 dB(A) for standing location at 25 °C ambient Front 41 dB(A), Rear 45 dB(A), Side 38 dB(A) for sitting location at 25 °C ambient Measured as per ISO7779. Unit placed on desk, measure in operator location. Fan speed and noise increase at higher temperature.
Freeze Mode		Global and Tile by tile freeze modes. The frozen trace is displayed in a different color than the live trace. All display modes can be frozen; Configuration or other menus cannot be frozen.
Freeze Display Modes		Each tile can be independently set to display frozen only, live only, or live overlaid with frozen. Note that the Overlay mode is not supported for Status displays, the Timing Display or Audio level bars.

Table 1-32: Power supply

Characteristic	Performance requirement	Reference information
Electrical Rating	100 - 240 VAC ± 10%, 50/60 Hz, 100 W maximum	Continuous range from 90 - 264 VAC
Supply Type		Single phase
Supply Connection		Detachable cord set with lock
Power Consumption, Typical		< 90 VA (50 Watts)
Fuse	UL/IEC127 F3.15A H, 250 VAC (5 x 20 mm)	To be replaced by service personnel only. The fuse is not user replaceable.

Physical Specifications

Table 1-33: Physical characteristics

Characteristic	Standard
Dimensions	
Height	1.72 inches (43.7 millimeters)
Width	19 inches (482.6 millimeters) measured at front trim
Depth	20.25 inches (514.4 millimeters) including rack handles and BNCs
Weight	
Net	8.75 pounds (4 kilograms)
Shipping	15.7 pounds (7.2 kilograms) approximate

Table 1-34: Environmental performance

Category	Standards or description
Temperature	Operating: 0 to +50 °C Nonoperating: -40 to +75 °C
Humidity	Proper operation from 5% to 93% Relative Humidity. Do not operate with visible moisture on circuit boards. Exceeds Mil-PRF-28800F for a class 5 product.
Vibration	Tektronix Class 5 Random Vibration Operating Test: For Laboratory / Benchtop Products (instrument meets brief operational performance checks at these levels): Power Spectral Density of: 0.00015 g ² /Hz from 5 to 350 Hz, -3 dB/octave from 350 to 500 Hz. 0.000105 g ² /Hz at 500 Hz. Overall level of 0.27 GRMS, 10 minutes per axis. Tektronix Class 5 Random Vibration Non-operating Test: For Laboratory / Benchtop Products: Power Spectral Density of: 0.0175 g ² /Hz from 5 to 100 Hz, -3 dB/octave from 100 to 200 Hz. 0.00875 g ² /Hz from 200 to 350 Hz, -3 dB/octave from 350 to 500 Hz. 0.006132 g ² /Hz at 500 Hz. Overall level of 2.28 GRMS, 10 minutes per axis. Meets Mil-PRF-28800F for a Class 3 product.
Mechanical Shock	Nonoperating: 50 g, half-sine, 11 ms duration, 3 shocks per surface (18 total).

Table 1-34: Environmental performance (Cont.)

Category	Standards or description
Transportation	Meets International Safe Transit Association Test Procedure 1A, April 1996, Category II for Vibration, Impact (24 inch drop), and Compression.
Altitude	Operating: Up to 3000 meters (10,000 feet). Nonoperating: Up to 12,192 meters (40,000 feet).

Certifications and Compliances

Table 1-35: Certifications and compliances

Category	Standards or description
EC Declaration of Conformity - EMC	<p>Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EN 55103 Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.¹</p> <p>Environment E2 - commercial and light industrial</p> <p>Part 1 Emission</p> <p>EN 55022 Class B radiated and conducted emissions</p> <p>EN 55103-1, Annex A Radiated magnetic field emissions</p> <p>EN 55103-1, Annex B Inrush current; I peak = 4.82 amps</p> <p>EN-55103-1, Annex E Conducted emissions, signal/control ports</p> <p>Part 2 Immunity</p> <p>IEC 61000-4-2 Electrostatic discharge immunity</p> <p>IEC 61000-4-3 RF electromagnetic field immunity</p> <p>IEC 61000-4-4 Electrical fast transient / burst immunity</p> <p>IEC 61000-4-5 Power line surge immunity</p> <p>IEC 61000-4-6 Conducted RF Immunity</p> <p>IEC 61000-4-11 Voltage dips and interruptions immunity</p> <p>EN 55103-2, Annex A Radiated magnetic field immunity</p> <p>EN 55103-2, Annex B Balanced ports common mode immunity</p> <p>EN 61000-3-2 AC power line harmonic emissions</p>
Australia / New Zealand Declaration of Conformity - EMC	<p>Complies with EMC provision of Radiocommunications Act per the following standard(s):</p> <p>AS/NZS 2064.1/2 Industrial, Scientific, and Medical Equipment: 1992</p>
FCC Compliance	Emissions comply with FCC Code of Federal Regulations 47, Part 15, Subpart B, Class A Limits.

Table 1-35: Certifications and compliances (Cont.)

Category	Standards or description
EC Declaration of Conformity - Low Voltage	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC, amended by 93/68/EEC</p> <p>EN 61010-1:2001 Safety requirements for electrical equipment for measurement control and laboratory use.</p>
U.S. Nationally Recognized Testing Laboratory Listing	<p>UL61010B-1 Standard for electrical measuring and test equipment.</p>
Canadian Certification	<p>CAN/CSA C22.2 No. 1010.1 Safety requirements for electrical equipment for measurement, control, and laboratory use.</p>
Additional Compliance	<p>IEC61010-1:2001 Safety requirements for electrical equipment for measurement, control, and laboratory use.</p> <p>ISA S82.02.01:1999 Safety standard for electrical and electronic test, measuring, controlling, and related equipment.</p>
Installation (Overvoltage) Category Descriptions	<p>Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:</p> <p>CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location.</p> <p>CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected.</p> <p>CAT I Secondary (signal level) or battery operated circuits of electronic equipment.</p>
Pollution Degree	Pollution Degree 2
Pollution Degree Descriptions	<p>A measure of the contaminates that could occur in the environment around and within a product. Typically the internal environment inside a product is considered to be the same as the external. Products should be used only in the environment for which they are rated.</p> <p>Pollution Degree 1 No pollution or only dry, nonconductive pollution occurs. Products in this category are generally encapsulated, hermetically sealed, or located in clean rooms.</p> <p>Pollution Degree 2 Normally only dry, nonconductive pollution occurs. Occasionally a temporary conductivity that is caused by condensation must be expected. This location is a typical office/home environment. Temporary condensation occurs only when the product is out of service.</p> <p>Pollution Degree 3 Conductive pollution, or dry, nonconductive pollution that becomes conductive due to condensation. These are sheltered locations where neither temperature nor humidity is controlled. The area is protected from direct sunshine, rain, or direct wind.</p> <p>Pollution Degree 4 Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.</p>
Equipment type	Test and Measurement
Safety Class	Class I

Table 1-35: Certifications and compliances (Cont.)

Category	Standards or description
Overvoltage Category	CAT II

¹ Use only high-quality shielded cables.

Performance Verification

A Performance Verification of the *WVR7100 Waveform Rasterizer* was not available at product release and, therefore, is not included in this document. When available, it will be included in the latest revision of this document on the Tektronix Website:

www.tektronix.com/manuals

When there, use Tektronix part number **071-1591-01**.

