

# Technical Reference



## **WVR6100 and WVR7100 Waveform Rasterizers Specifications and Performance Verification 071-1591-01**

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.

**[www.tektronix.com](http://www.tektronix.com)**

Copyright © Tektronix, Inc. All rights reserved. Licensed software products are owned by Tektronix or its subsidiaries or suppliers, and are protected by national copyright laws and international treaty provisions.

Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supercedes that in all previously published material. Specifications and price change privileges reserved.

TEKTRONIX and TEK are registered trademarks of Tektronix, Inc.

## **Contacting Tektronix**

Tektronix, Inc.  
14200 SW Karl Braun Drive  
P.O. Box 500  
Beaverton, OR 97077  
USA

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

- In North America, call 1-800-833-9200.
- Worldwide, visit [www.tektronix.com](http://www.tektronix.com) to find contacts in your area.

## Warranty 2

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.



# Table of Contents

<b>General Safety Summary</b> .....	<b>v</b>
Preface .....	vii
Related Documents .....	vii

## Specifications

<b>Specifications</b> .....	<b>1-1</b>
WVR6100 and WVR7100 Common Characteristics .....	1-2
WVR7100 High Definition (HD) Characteristics .....	1-14
Standard Definition (SD) Characteristics .....	1-16
Option Characteristics .....	1-18
Alarms .....	1-30
Signal Input-to-Reference Compatibility Tables .....	1-33
Certifications and Compliances .....	1-35

## Performance Verification

<b>Performance Verification</b> .....	<b>2-1</b>
---------------------------------------	------------

## List of Tables

<b>Table 1-1: SDI input waveform vertical characteristics</b> .....	<b>1-2</b>
<b>Table 1-2: SDI -&gt; Composite mode filter characteristics</b> .....	<b>1-2</b>
<b>Table 1-3: Waveform sweep (horizontal) characteristics</b> .....	<b>1-2</b>
<b>Table 1-4: Component vector mode characteristics</b> .....	<b>1-3</b>
<b>Table 1-5: Diamond (RGB gamut) display characteristics</b> .....	<b>1-4</b>
<b>Table 1-6: Arrowhead display (SDI -&gt; Composite mode) characteristics</b> .....	<b>1-5</b>
<b>Table 1-7: Picture display mode characteristics</b> .....	<b>1-5</b>
<b>Table 1-8: Measure display characteristics</b> .....	<b>1-6</b>
<b>Table 1-9: Other display characteristics</b> .....	<b>1-6</b>
<b>Table 1-10: External reference characteristics</b> .....	<b>1-7</b>
<b>Table 1-11: Misc. measurements and displays characteristics</b> .....	<b>1-8</b>
<b>Table 1-12: Timecode characteristics</b> .....	<b>1-9</b>
<b>Table 1-13: General characteristics</b> .....	<b>1-9</b>
<b>Table 1-14: Program error alarms</b> .....	<b>1-10</b>
<b>Table 1-15: Ethernet</b> .....	<b>1-10</b>
<b>Table 1-16: XGA picture monitor output characteristics</b> .....	<b>1-11</b>
<b>Table 1-17: Ground closure remote / LTC time code input characteristics</b> .....	<b>1-11</b>
<b>Table 1-18: Power supply characteristics</b> .....	<b>1-11</b>
<b>Table 1-19: Physical characteristics</b> .....	<b>1-12</b>
<b>Table 1-20: Environmental characteristics</b> .....	<b>1-12</b>
<b>Table 1-18: HD waveform vertical characteristics, SDI inputs A and B (WVR7100 only)</b> .....	<b>1-14</b>
<b>Table 1-19: HD physical characteristics, SDI A and B inputs (WVR7100 only)</b> .....	<b>1-14</b>
<b>Table 1-20: Misc. measurements and displays (WVR7100 only)</b> ..	<b>1-15</b>
<b>Table 1-21: SD waveform vertical characteristics, SDI inputs A and B, (WVR7100 Option SD, WVR6100)</b> .....	<b>1-16</b>
<b>Table 1-22: SD physical characteristics, SDI inputs A and B (WVR7100 Option SD, WVR6100)</b> .....	<b>1-16</b>
<b>Table 1-23: Misc. measurements and displays (WVR7100 Option SD, WVR6100)</b> .....	<b>1-17</b>
<b>Table 1-28: Composite analog waveform vertical characteristics (Option CPS)</b> .....	<b>1-18</b>
<b>Table 1-29: Composite analog physical characteristics, composite inputs A and B characteristics (Option CPS)</b> .....	<b>1-19</b>

---

<b>Table 1-30: Alarms (Option CPS)</b> .....	<b>1-20</b>
<b>Table 1-31: Picture display mode characteristics (Option CPS)</b> ...	<b>1-20</b>
<b>Table 1-32: Composite vector mode characteristics (Option CPS)</b> .....	<b>1-20</b>
<b>Table 1-33: Audio bar displays (Option DS)</b> .....	<b>1-21</b>
<b>Table 1-34: Audio bar and aux displays (Option DS)</b> .....	<b>1-23</b>
<b>Table 1-35: Audio text displays (Option DS)</b> .....	<b>1-24</b>
<b>Table 1-36: AES audio inputs (Option DS)</b> .....	<b>1-24</b>
<b>Table 1-37: AES audio outputs (Option DS)</b> .....	<b>1-25</b>
<b>Table 1-38: Embedded audio extraction and monitoring on status bar (Option DS)</b> .....	<b>1-26</b>
<b>Table 1-39: Analog audio inputs (Option AD)</b> .....	<b>1-26</b>
<b>Table 1-40: Analog audio outputs (Option AD)</b> .....	<b>1-27</b>
<b>Table 1-41: Dolby Digital (AC-3) compressed audio monitoring (Option DD)</b> .....	<b>1-28</b>
<b>Table 1-42: Dolby E and extended dolby digital (AC-3) compressed audio monitoring (Option DDE)</b> .....	<b>1-29</b>
<b>Table 1-42: Common alarms (WVR6100 and WVR7100)</b> .....	<b>1-30</b>
<b>Table 1-43: HD specific alarms (WVR7100 only)</b> .....	<b>1-31</b>
<b>Table 1-44: SD specific alarms added with Option SD</b> .....	<b>1-31</b>
<b>Table 1-45: Composite specific alarms added with Option CPS</b> ...	<b>1-32</b>
<b>Table 1-46: Audio alarms added with options DS and AD</b> .....	<b>1-32</b>
<b>Table 1-47: Audio alarms added with option DDE</b> .....	<b>1-32</b>
<b>Table 1-48: 59.94, 29.97, 23.98 Hz input and reference format combinations</b> .....	<b>1-33</b>
<b>Table 1-49: 60, 30, 24 Hz input and reference format combinations</b> .....	<b>1-34</b>
<b>Table 1-50: 50, 25 Hz input and reference format combinations</b> ..	<b>1-34</b>





# 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 WVR6100 and WVR7100 Waveform Rasterizers.

## Related Documents

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

- *WVR6100 and WVR7100 Waveform Rasterizers Quick Start User Manual.* This document provides detailed operating information.
- *WVR6100 and 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.





# Specifications



# Specifications

This chapter contains specifications for the Tektronix WVR6100 and 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.

The characteristics are divided into the following sections:

- WVR6100 and WVR7100 Common Characteristics
- WVR7100 High Definition (HD) Characteristics
- Standard Definition (SD) Characteristics
- Options Characteristics

## WVR6100 and WVR7100 Common Characteristics

The characteristics in this section are common to both the WVR6100 and WVR7100 Waveform Rasterizers..

**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. Applies to all three channels.
At X1	$\pm 0.5\%$	
At X5	$\pm 0.2\%$	
Variable Gain Range	0.25X to 10X	
Line Rate Tilt	< 0.1%, guaranteed by digital design.	
Off Screen Recovery	< 0.1% variation in baseline of a 5 MHz modulated pulse when positioned anywhere on screen.  X1, X5, or with any variable gain setting.	
RGB Transcoder Accuracy	$\pm 0.1\%$	
Bit Integrity	Accurately shows both 8 and 10 bit signals.	

**Table 1-2: SDI -> Composite mode filter characteristics**

Characteristic	Performance requirement	Reference information
Luma Filter Gain	1 + 0.1% relative to Flat (no filter) gain.	
Luma Filter Response	< 3 dB attenuation at 800 KHz. > 32 dB attenuation at $F_{SC}$ .	Filter meets STD-205.
Chroma Filter Response	Selecting Chroma filter switches off displayed luma.	

**Table 1-3: Waveform sweep (horizontal) characteristics**

Characteristic	Performance requirement	Reference information
Sweep Timing Accuracy	$\pm 0.1\%$	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	$\pm 0.1\%$	Guaranteed by digital design.



**Table 1-3: Waveform sweep (horizontal) characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
Sweep Rates	1, 2, 3 or 4 line, or field, or 2 fields, depending on mode.	Some rates only available in parade modes.  1 Field sweep displays one full field, including field rate sync. 2 Field sweep displays two full fields and the field rate sync between them.
Sweep Rates, Mag	Mag occurs around center of sweep.	Two line and two field Mag. modes optimized to display blanking intervals.  Mag from 8X to 50X for line sweeps, depending on format and mode. Mag is 20X for field sweeps.
Horizontal Position Range	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 1-4: Component vector mode characteristics**

Characteristic	Performance requirement	Reference information
Vector Display	$P_B$ is displayed on horizontal axis and $P_R$ is displayed on vertical axis.	
Vector Position	Graticules and waveform move together with position controls.  Range sufficient to put any bar target in center of screen at all gains.	
Variable Gain	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, $\pm 0.25$ box diameter at 1x gain, $\pm 0.1$ box diameter at 5X gain.  Graticules expand when in x5 mode.	Boxes are 2% targets.
Bandwidth, typical		SD filter meets STD-205.
SD	800 kHz	
HD	4.5 MHz	

**Table 1-4: Component vector mode characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
Lightning Display	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 mark delay values	Deviation of the G/Mg transition from center indicates chroma-luma delay. Deflection calibrated for color bars with 200 ns luma rise time, and 400 ns chroma rise time.	If the transition bends in toward black, the color-difference signal is delayed with respect to luma. If the transition bends out toward white, the color difference signal is leading the luma signal.
SD (WVR7100 option SD, WVR6100)		
1 <sup>st</sup> tic mark from center	20 ns	
2 <sup>nd</sup> tic mark	40 ns	
3 <sup>rd</sup> tic mark	74 ns (1 luma sample)	
4 <sup>th</sup> tic mark	148 ns (1 chroma sample)	
HD (WVR7100)		
1 <sup>st</sup> tic mark from center	2 ns	
2 <sup>nd</sup> tic mark	5 ns	
3 <sup>rd</sup> tic mark	13.5 ns (1 luma sample)	
4 <sup>th</sup> tic mark	27 ns (1 chroma sample)	

**Table 1-5: Diamond (RGB gamut) display characteristics**

Characteristic	Performance requirement	Reference information
Displayed Horizontal and Vertical Gain Accuracy	$\pm 0.5\%$ , 1x and 5x gain.	Limited by display resolution.
Diamond	GBR Deflection axis indicated.	
Detection Level	Adjustable thresholds, 1% resolution.	Default is nominally 103% of legal RGB.
Upper	630 mV to 756 mV.	Upper detection level: 721 mV.
Lower	-70 mV to +35 mV.	Lower Detection level: -21 mV.
Detection Level Accuracy	$\pm 5$ mV	
Colorimetry	Defined in CCIR601 for SD. Defined in ITU 709-2 and SMPTE 240M for HD.	

**Table 1-6: Arrowhead display (SDI -> Composite mode) characteristics**

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 (PAL values in parenthesis)	$\pm 1\%$ at 100, 110, 120, 131 IRE (700 and 950 mV).	
Detection Level	Adjustable thresholds, 1% steps.	
Composite Limit Detection Level Accuracy (PAL values in parenthesis)	Detection level = $\pm 7$ mV of cursor level. Detection level can be set to 100, 110, 120, or 131 IRE (700 or 950 mV PAL).	

**Table 1-7: Picture display mode characteristics**

Characteristic	Performance requirement	Reference information
Modes	Color only, internally referenced with 60 Hz vertical refresh.	
Full Screen Modes	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.	
Safe Area Graticule, standards-based	Displays safe action and safe title area graticules per SMPTE RP218, ARIB TR-B4 V1.1, and ITU.	Includes requirements of BBC (BBC Technical Standards for Network Television Program Delivery).
Safe Area Graticule, custom		Displays safe action and safe title area graticules with user-adjustable height, width, vertical offset and horizontal offset.
Height and width adjustment range	0% to 100%.	
Offset adjustment range	-50% to 50%.	
Adjustment resolution	1%	
EIA608 (Closed Caption) Signal Types		Capability added by options is in addition to base unit capability.
WVR7100	EIA608 ancillary data in HD. EIA608 in EIA708 ancillary data in HD.	
WVR7100 option SD, WVR6100	EIA608 line 21 on 525/270 SD. EIA608 ancillary data in SD. EIA608 in EIA708 ancillary data in SD.	
Option CPS	EIA608 line 21 on composite analog.	

**Table 1-7: Picture display mode characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
EIA608 Data Types Displayed		
Required Services	CC Channels 1-4 Text Channels 1-4	
XDS Data	Current Program Content Advisory (VCHIP) Transmission Signal Identifier (TSID)	
Closed Caption		
EIA608 line 21 line selection range	Lines 5 through 25, manual or automatic mode.	
EIA608 line 21 decoding timing range (typical)		Normal setting exceeds requirements of EIA608 decoder specification by 60%. Early and late settings provided to allow decoding of even more extreme signals.
Normal setting	9.7 $\mu$ s to 11.3 $\mu$ s	
Early setting	8.9 $\mu$ s to 10.5 $\mu$ s	
Late setting	10.3 $\mu$ s to 11.8 $\mu$ s	

**Table 1-8: Measure display characteristics**

Characteristic	Performance requirement	Reference information
Input timing relative to External Reference	Display of V & H timing offset graphically and numerically. One clock cycle resolution.	Patented proprietary display.
Timing Display Zero Definition	Vertical timing conforms to SMPTE168-2002.	Timing zero is equivalent to nominal zero delay on TG700. Also agrees with signal that shows minimal shift on the waveform display when go from internal to external.

**Table 1-9: Other display characteristics**

Characteristic	Performance requirement	Reference information
LTC Waveform	Displays voltage vs. time waveform of LTC input.	Timing derived from currently selected video timing.  AC coupled only. Graticule with volts and audio dBu scale.
LTC Waveform Vertical Accuracy, typical	$\pm 5\%$	
LTC Waveform DC Offset, typical	$\pm 100$ mV	

**Table 1-9: Other display characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
LTC Waveform Time Base, typical	3 ms/division for NTSC, 4ms/div for PAL.	Runs in 2 field sweep mode only, triggered by field one to allow verifying audio to video synchronization.
Operating Input Voltage Range, typical	13.6 V <sub>p-p</sub> if driven differentially, 6.5 V <sub>p-p</sub> on either input if driven single-ended.	AC coupled so always displayed symmetrically about center. Waveform will shift up or down if overdriven.
Maximum absolute input voltage range		± 12 V on both inputs.

**Table 1-10: External reference characteristics**

Characteristic	Performance requirement	Reference information
Formats supported	See <i>Signal Input-to-Reference Compatibility Tables</i> beginning on page 1-33.	In Ext Ref mode, waveform display and line select function derive timing from the Reference input. Reference must have a frame rate compatible with the input as listed in the <i>Signal Input-to-Reference Compatibility Tables</i> . Picture mode does not use timing from the Reference input.
Input Dynamic Range, typical	+ 6 dB range	
Absolute Maximum Input Voltage	± 8.5 V DC plus 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. > 35 dB to 30 MHz with power on.  Typically > 46 dB to 6 MHz with power on or off. Typically > 40 dB to 30 MHz with power on. Typically > 35 dB to 30 MHz with power off.	Loop through terminated in 75 Ω, power on or off.
Timing Shift with 10 to 90% APL Change, typical	< 0.5 ns	
Timing Shift with Hum, typical	< 20 ns with 0 dB hum on WFM mode, 2 deg on Vector mode.	
Lock Range	± 50 ppm, remains locked.	
Lock in Presence of Hum		
Bi-level sync	Remains locked with < 1.0 V <sub>p-p</sub> on 0 dB signal.	
Tri-level sync	Remains locked with < 0.5 V <sub>p-p</sub> on 0 dB signal.	

**Table 1-10: External reference characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
Lock in Presence of White Noise	Remains locked on black burst with Signal/Noise ratio of 32 dB, 5 MHz bandwidth.	
Color Framing	Correct color framing detected for composite signals with burst present and having < 45 °SCH Phase error.	Also applies to internal mode.

**Table 1-11: Misc. measurements and displays characteristics**

Characteristic	Performance requirement	Reference information
352M Payload	Displays the payload type as indicated by SMPTE 352M ancillary data.	Shown in the Video Session display.
Ancillary Data	Identifies the presence of ancillary data (other than EDH).	Shown in the Video Session display.
SDI Video Format	Indicates SDI video format listed in section <i>Signal Input-to-Reference Compatibility Tables</i> beginning on page 1-33.	Shown in the Video Session display.
Stuck Bits	Displays the state of unchanging bits in the SDI data stream.	Shown in the Video Session display.
Gamut Error Statistics	Displays errored seconds and fields, and percentage of fields with errors for RGB, Composite and Luma Gamut errors. See Table 1-21 on page 1-14 for description of error conditions.	Shown in the Video Session display.
Closed Caption Type	Indicates closed caption types detected.	Shown in the Auxiliary Data Status display.
V-Chip Rating	Displays the Content Advisory Rating from the selected EIA608 data stream.	Shown in the Auxiliary Data Status display.
CC Services	Lists the Closed Caption Services present in the selected EIA608 data stream.	Shown in the Auxiliary Data Status display.
Transmission Signal Identifier	Displays the TSID present in the selected EIA608 data stream.	Shown in the Auxiliary Data Status display.

**Table 1-12: Timecode characteristics**

Characteristic	Performance requirement	Reference information
Display	Onscreen readout from the selected timecode type and source appears in the status bar and in the Error Log.	
VITC signal type	Vertical Interval Time Code as defined by SMPTE 12M.	
LTC signal type	Linear Time Code as defined by SMPTE 12M.	
ANC TC signal type	Ancillary Data Timecode was defined by SMPTE RP 188-1999.	
Supported Time Code Signal Types and Sources		
WVR7100	LTC from Remote connector. ANC TC from HD.	
WVR7100 option SD	VITC from 525/270 SDI. ANC TC from SD.	
WVR6100	VITC from 525/270 SDI. LTC from Remote connector. ANC TC from SD.	
WVR7100 and WVR6100 Option CPS	VITC from composite.	

**Table 1-13: General characteristics**

Characteristic	Performance requirement	Reference information
Presets	5 user presets and a Factory default.	
Real Time Clock	Time settable by user, used for log time stamps.	
Field Upgradeable SW and FPGA	All code except for boot flash can be upgraded.	
Battery life and retention time, typical	10 years for normal operation, 5 years worst case.	Battery not drained while instrument is off, drain higher at elevated temperature.
Low light illumination, typical	“Off” leds optionally driven at user selectable level from 1 to 10%.	
Preset Parameters	Covers all parameters except configure/utilities menu items.	
Line Select Function	Any one tile may be in line select for waveform, vector, arrowhead, diamond, or lightning.	

**Table 1-13: General characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
Line Select Bright-up	Selected line is indicated with a cursor in picture and field sweeps.	Picture cursor can be disabled.
Line Select Range	Any line, numbered according to appropriate standard, frame and color frame structure.	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, rear 39, side 38 dB(A) for standing location at 25 °C ambient. Front 41, rear 45, 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.

**Table 1-14: Program error alarms**

Characteristic	Performance requirement	Reference information
Alarm Coverage	Alarms only reported on selected input. See Table 1-42 on page 1-30 for names and descriptions of common alarms.	
Alarm Log Depth	10,000 alarm entries.	Volatile
Alarm Log Time stamping	Time of Day, and Selectable LTC, VITC, or ATC (Ancillary Time Code).	
Alarm Notification	All alarms may 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.	

**Table 1-15: Ethernet**

Characteristic	Performance requirement	Reference information
SNMP	For instrument control & feedback of status. Complies with SNMP version 2.	
IP Address Mode	Supports manual and DHCP.	
Connector	RJ-45 LAN connector supporting 10/100 BaseT.	The 10/100Base-T Ethernet port connector arrangements: The RJ-45 connector has built in LEDs. The Green LED indicates an active connection. The Yellow LED indicates speed. ON = 100, OFF = 10.



**Table 1-16: XGA picture monitor output characteristics**

Characteristic	Performance requirement	Reference information
Amplitude, typical	Can switch between 1 V and 0.7 V.	
Resolution	1024 x 768 with 16 colors.	

**Table 1-17: Ground closure remote / LTC time code input characteristics**

Characteristic	Performance requirement	Reference information
LTC Input Connector	Balanced, un-terminated via rear panel GC remote connector.	
LTC Input Impedance	Greater than 10 k $\Omega$ .	
LTC Signal Characteristics	Linear Time Code per IEC Publication 461.	
LTC Signal Amplitude Range, typical	0.2 V <sub>p-p</sub> to 5.0 V <sub>p-p</sub> balanced differential or single-ended.	
Ground Closure Input signaling	TTL thresholds, 5 V max input, -0.5 V min input. Pull low to assert.	Has internal 10 k $\Omega$ pull-up to 5 V on each input.
Ground Closure Output characteristics	Open collector output, 30 V maximum, 100 mA maximum, 300 mW maximum.	

**Table 1-18: Power supply characteristics**

Characteristic	Performance requirement	Reference information
Electrical Rating, typical	100-240 VAC $\pm$ 10%, 50/60 Hz, 100 watts maximum.	Continuous range from 90 to 264 VAC.
Supply Type	Single Phase	
Supply Connection, typical	Detachable cord set with lock.	
Power Consumption, typical	< 90 VA (50 watts).	
Fuse	Primary Fuse value 3.15 AH (20 mm x 5 mm).	Not operator replaceable please refer to qualified personnel.

**Table 1-19: Physical characteristics**

Characteristic	Performance requirement	Reference information
Dimensions, typical		Fits 19 inch rack, 1 RU high. Comes with rack slides installed on chassis.
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, typical		
Net	8 pounds 12 oz (4.0 kilograms).	
Shipping	15.7 pounds (7.2 kilograms) approximate.	

**Table 1-20: Environmental characteristics**

Characteristic	Performance requirement	Reference information
Temperature (operating), typical	0 to +50 °C.	Exceeds Mil-PRF-28800F for a class 5 product.
Temperature (non-operating), typical	-40 to +75 °C.	Exceeds Mil-PRF-28800F for a class 5 product.
Altitude (operating), typical	3000 meters (10,000 ft).	Exceeds Mil-PRF-28800F for a class 5 product.
Altitude (non-operating), typical	12000 meters (40,000 ft).	Exceeds Mil-PRF-28800F for a class 5 product.

**Table 1-20: Environmental characteristics (Cont.)**

Characteristic	Performance requirement	Reference information
Vibration, typical Operating	Tektronix Class 5 Random Vibration Operating Test: For Laboratory / Benchtop Products.	Meets Mil-PRF-28800F Class 3.
Power spectral density	0.00015 g <sup>2</sup> /Hz from 5 to 350 Hz. -3 dB/octave from 350 to 500 Hz. 0.000105 g <sup>2</sup> /Hz at 500 Hz. Overall level of 0.27 g <sub>RMS</sub> , 10 minutes per axis.	
Non-operating	Tektronix Class 5 Random Vibration Non-operating Test: For Laboratory / Benchtop Products.	
Power spectral density	0.0175 g <sup>2</sup> /Hz from 5 to 100 Hz. -3 dB/octave from 100 to 200 Hz. 0.00875 g <sup>2</sup> /Hz from 200 - 350 Hz. -3 dB/octave from 350 - 500 Hz. 0.006132 g <sup>2</sup> /Hz at 500 Hz. Overall level of 2.28 g <sub>RMS</sub> , 10 minutes per axis.	
Mechanical Shock, typical Non-operating	30 g 1/2 sine, 11 ms duration, 3 shocks per surface (18 total).	Meets International Safe Transit Association Test Procedure 1A, April 1996, Category II for Vibration, Impact (24 inch drop), and Compression.
Humidity, typical	Proper operation 5% to 93% Relative Humidity.	Do not operate with visible moisture on the circuit boards. Exceeds Mil-PRF-28800F for a class 5 product.

## WVR7100 High Definition (HD) Characteristics

The characteristics in this section apply to the WVR7100 Waveform Rasterizer.

**Table 1-21: HD waveform vertical characteristics, SDI inputs A and B (WVR7100 only)**

Characteristic	Performance requirement	Reference information
Frequency Response		
Luminance channel (Y) to 30 MHz	$\pm 0.5\%$	RGB Monochrome identical to Y channel.
Color difference channels ( $P_B$ & $P_R$ ) to 15 MHz	$\pm 0.5\%$	
Transient Response	Pulse-to-bar ratio 0.99:1 to 1.01:1 on appropriate Sine-Squared or Blackman 2T pulse.	
Pre-shoot, Over-shoot, Sine-Squared Bars: 2T30 bar	$\leq 0.5\%$ peak	
Ringing: Sine-Squared Bars: 2T30	$\leq 0.8\%$ p-p	
Low Pass Filter Frequency Response	$\leq 3$ dB attenuation at 4 MHz. $\geq 25$ dB attenuation at 15 MHz.	Response provides conventional noise reduction.

**Table 1-22: HD physical characteristics, SDI A and B inputs (WVR7100 only)**

Characteristic	Performance requirement	Reference information
Formats Supported	1485/1483 Mbit/s component.  See <i>Signal Input-to-Reference Compatibility Tables</i> beginning on page 1-33 for supported input and reference format combinations.	Auto detect of input standard
Input Level	800 mV <sub>p-p</sub> $\pm 10\%$  Input voltages outside this range may cause reduced receiver performance.	
Input Type	Passive loop through 75 $\Omega$ compensated.	
Return Loss		
Power on	$\geq 15$ dB 1-1500 MHz	
Power off	$\geq 10$ dB 1-1500 MHz	
Insertion Loss (Loop Through)	$\leq 4$ dB to 1500 MHz	
Loop Through Isolation	$\geq 45$ dB to 1 GHz	
Serial Receiver Equalization Range	Proper operation with up to 20.0 dB loss at 750 MHz using coaxial cable having loss characteristics of  $1/\sqrt{F}$  800 mV launch amplitude per SMPTE 292M.	Equivalent to approximately 80 meters of Belden 8281. Typically operates to 130 meters.

**Table 1-22: HD physical characteristics, SDI A and B inputs (WVR7100 only) (Cont.)**

Characteristic	Performance requirement	Reference information
Jitter Tolerance	0.35 UI <sub>p-p</sub> above 1 MHz. 5 UI <sub>p-p</sub> at 10 kHz.	
Input Timebase Range	1485 Mbit/s $\pm$ 50 ppm, or 1483.51 Mbit/s $\pm$ 50 ppm.	Many functions continue to operate over a much wider range, typically 10,000 ppm.

**Table 1-23: Misc. measurements and displays (WVR7100 only)**

Characteristic	Performance requirement	Reference information
Errors and Alarms	See Table 1-43 on page 1-31 for additional error conditions detected by the WVR7100.	
Error Statistics	Displays errored seconds and fields, and percentage of fields with errors for Y and C CRC Errors and Y and C Anc Checksum errors.	Shown in Video Session display.

## Standard Definition (SD) Characteristics

The characteristics in this section are common to the WVR6100 Waveform Rasterizer and to the WVR7100 Waveform Rasterizer with Option SD.

**Table 1-24: SD waveform vertical characteristics, SDI inputs A and B, (WVR7100 Option SD, WVR6100)**

Characteristic	Performance requirement	Reference information
Frequency Response		RGB Monochrome identical to Y channel.
Luminance channel (Y)	5.75 MHz $\pm$ 0.5%	
Color difference channels (P <sub>B</sub> & P <sub>R</sub> )	2.75 MHz $\pm$ 0.5%	
Transient Response		
Pre-shoot, Over-shoot (Sine-Squared Bars)	2T5 bar $\leq$ 0.3% peak	
Ringing (Sine-Squared Bars)	2T5 $\leq$ 0.8% <sub>p-p</sub>	
Pulse-to-bar ratio	0.99:1 to 1.01:1 on appropriate Sine-Squared or Blackman 2T pulse.	
Low Pass Filter Frequency Response, SDI Component Only	$\leq$ 3 dB attenuation at 800 kHz. $\geq$ 32 dB attenuation at 3 MHz.	Response meets STD-205.

**Table 1-25: SD physical characteristics, SDI inputs A and B (WVR7100 Option SD, WVR6100)**

Characteristic	Performance requirement	Reference information
Formats Supported	270 Mbit/s component. <i>See Signal Input-to-Reference Compatibility Tables beginning on page 1-33.</i>	Auto detect of input standard.
Input Level	800 mV <sub>p-p</sub> $\pm$ 10% Input voltages outside this range may cause reduced receiver performance.	
Input Type	Passive loop through 75 $\Omega$ compensated.	
Return Loss		
Power on	$\geq$ 25 dB 1-270 MHz	
Power off	$\geq$ 15 dB 1-270 MHz	
Insertion Loss (Loop Through)	$\leq$ 1.2 dB to 270 MHz	
Loop Through Isolation	$\geq$ 50 dB to 300 MHz	

**Table 1-25: SD physical characteristics, SDI inputs A and B (WVR7100 Option SD, WVR6100) (Cont.)**

Characteristic	Performance requirement	Reference information
Serial Receiver Equalization Range	Proper operation with up to 23.0 dB loss at 135 MHz using coaxial cable having loss characteristics of $1/\sqrt{F}$ 800 mV launch amplitude per SMPTE 292M.	Typically 275 meters using Belden 8281 coaxial cable.
Jitter Tolerance	0.4 UI <sub>p-p</sub> above 1 MHz. 5 UI <sub>p-p</sub> at 10 kHz.	
Input Timebase Range	270 Mbit/s $\pm$ 50ppm	Many functions continue to operate to much wider range, typically 10,000 ppm.

**Table 1-26: Misc. measurements and displays (WVR7100 Option SD, WVR6100)**

Characteristic	Performance requirement	Reference information
Errors and Alarms	See Table 1-44 on page 1-31 for additional error conditions.	
EDH Error Statistics	Displays errored seconds and fields, and percentage of fields with errors for Active Picture CRC, Full Field CRC, and EDH Error conditions.	

## Option Characteristics

The characteristics in this section are option specific and apply to both the WVR6100 and WVR7100 waveform rasterizers equipped with the option.

**Option CPS** Option CPS (Analog Composite) is available for both the WVR6100 and WVR7100. Tables 1-27 through 1-31 list the the characteristics specific to Option CPS.

**Table 1-27: Composite analog waveform vertical characteristics (Option CPS)**

Characteristic	Performance requirement	Reference information
Displayed Vertical Measurement Accuracy	$\pm 1\%$ all gain settings.	Measured using cursors.
Frequency Response	Flat to 5.75 MHz $\pm 1\%$ . Typically +0.4% to 5.75 MHz.	
Delay Variation over Frequency	$\pm 10$ ns to 5.75 MHz.	Typically $< \pm 2.0$ ns.
Transient Response on sine squared 2T4 pulse		
Pulse-to-Bar Ratio	0.99:1 to 1.01:1	
Pre-shoot	$\leq 1\%$	
Overshoot	$\leq 1\%$	
Ringing	$\leq 1\%$	
Luma Filter Gain	$1 \pm 0.1\%$ relative to flat gain at 50 kHz.	
Luma Filter Response	$< 3$ dB attenuation at 800 KHz. $> 32$ dB attenuation at FSC.	Filter meets STD-205.
Chroma Filter Gain	$1 \pm 1.0\%$ , relative to flat gain.	
Chroma Filter Response	3 dB bandwidth 3.3 MHz for PAL, 2.4 MHz for NTSC $\pm 0.3$ MHz.	F <sub>SC</sub> auto selected based on input standard, Implemented digitally, may not be centered on Fsc.
Chroma Filter Attenuation at 2X FSC, Composite only	$\geq 25$ dB	Implemented Digitally, Typically 28 dB for NTSC, 53 dB for PAL.
Field Rate Tilt	$< 0.5\%$ with DC restore Fast or Off.	
Line Rate Tilt	$< 0.5\%$	
Off Screen Recovery	$\leq 0.5\%$ variation in baseline of a Chroma modulated pulse when positioned anywhere on screen. X1, X5, or any variable gain setting.	



**Table 1-28: Composite analog physical characteristics, composite inputs A and B characteristics (Option CPS)**

Characteristic	Performance requirement	Reference information
Formats supported	NTSC, NTSC no setup, and PAL, I, B, D, G, H Complies with RS170A & 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)	$\pm 6$ dB range	
Video Maximum Operating Amplitude (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 $\Omega$ compensated	
DC Input Impedance	20 k $\Omega$	
Return Loss	$\geq 40$ dB to 6 MHz with power on. Typically > 46 dB to 6 MHz; > 40 dB to 10 MHz. Typically 35 dB with power off for standard amplitude video.	
Video Input Cross-talk Between Channels	$\geq 60$ dB to 6 MHz.	
Loop through Isolation	$\geq 70$ dB to 6 MHz.	
DC Offset with Restore Off (typical)	$\leq 10$ mV	Measured in full screen mode at x5 vertical gain.
DC Restore Modes	Fast, Slow, and Off modes.	Slow has a typical bandwidth of 10 Hz, Fast has a typical bandwidth of 500 Hz.
DC Restore Offset Error	<2 mV	Registration between back porch and 0 V graticule.
DC Offset between Inputs with restore off (typical)	<7 mV	
DC Restore 50 and 60 Hz Attenuation		
Fast Mode	>95% attenuation	
Slow Mode	<10% attenuation, <10% peaking. Slow mode typical peaking 8% at 50 and 60 Hz.	
Blanking Shift with 10 to 90% APL Change	$\leq 1$ IRE (7 mV PAL)	
Blanking Shift with Presence and Absence of Burst	$\leq 1$ IRE (7 mV PAL). Typically 0 mV.	
Lock Range	$\pm 50$ ppm, remains locked.	Vector typically OK to $\pm 80$ ppm. WFM display typically locked to $\pm 200$ ppm.

**Table 1-28: Composite analog physical characteristics, composite inputs A and B characteristics (Option CPS) (Cont.)**

Characteristic	Performance requirement	Reference information
Lock in Presence of Hum	$\pm 1.0$ V <sub>p-p</sub> , 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 with burst present.	
Clamp Range (typical)	Signals with back porch within $\pm 1$ V range.	Clamp can keep signal in this range displayed at correct position on screen. Signals outside this range may be displayed offset upward or downward.

**Table 1-29: Alarms (Option CPS)**

Characteristic	Performance requirement	Reference information
Errors and Alarms	See Table 1-45 on page 1-32 for additional error conditions detected.	

**Table 1-30: Picture display mode characteristics (Option CPS)**

Characteristic	Performance requirement	Reference information
Composite Decoder	Adaptive Comb	

**Table 1-31: Composite vector mode characteristics (Option CPS)**

Characteristic	Performance requirement	Reference information
Displayed Horizontal and Vertical Gain Accuracy	1% for X1 Gain or X5 Gain.	
Display to Graticule Registration	Centered in target, $\pm 0.5$ box diameter.	With the color bar black/white display dot centered in target. Boxes are 2% targets.
Vector Display	B-Y is displayed on horizontal axis and R-Y is displayed on vertical axis.	
Bandwidth (typical)	500 kHz	
Horizontal to Vertical Bandwidth Matching	< 0.5° at 500 kHz and 2 MHz.	

**Table 1-31: Composite vector mode characteristics (Option CPS) (Cont.)**

Characteristic	Performance requirement	Reference information
Composite Vector Dot Reference	Shows “true” zero subcarrier reference.	
DG/DP Graticule	Graticule includes markings for measurement of differential gain and differential phase.	

**Option DS** Option DS (Digital Audio) is available for both the WVR6100 and WVR7100. Tables 1-32 through 1-34 list the the characteristics specific to Option DS.

**Table 1-32: Audio bar displays (Option DS)**

Characteristic	Performance requirement	Reference information
Modes	The user may configure the response dynamics (ballistics), reference levels, peak hold, offset, and scale of the meters to suit the monitoring needs of the particular installation or situation. Each pair has a phase correlation meter.	
Pair Mode	Any 4 channel pairs with phase correlation meters.	
Surround Mode	Left, Right, Center, Low-frequency-effects, 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	Selected from AES A inputs, AES B inputs embedded audio.	
Level Meter Resolution	0.056 dB steps @ 30 dB scale, for from full scale to –20 dB FS.  0.20 dB Steps @ 0 to –70 dB scale, for signals above –20 dB FS, Tiled display.	

**Table 1-32: Audio bar displays (Option DS) (Cont.)**

Characteristic	Performance requirement	Reference information
Correlation Meter Speed	User selectable 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.	
Peak Program Meter (PPM)	PPM Type I (IEC Type I, essentially the same as DIN 45406 and Nordic N-9). PPM Type II (IEC Type II, the same as IEEE Std 152-1991).	PPM Type I has a slightly faster attack time and a faster return time, 1.7 seconds to fall 20 dB as opposed to 2.8 seconds for Type II.
True Peak	PPM decay characteristics, no attack delay.	Factory Default ballistic.
Extended VU	A VU meter as defined in IEEE 152-1991, but with an extended dB-linear scale.	
Peak Hold	Indicated peaks held for user selected time. Adjustable from 1 to 10 seconds.	
Clip Indication Delay Count (not analog)	Consecutive FS samples for Clip Indication, user selectable Off or 1 to 100. Factory default set to 1 "0" is off.	
Mute Indication Delay Count (not analog)	Consecutive "0" samples for Mute Indication, user selectable, Off or 1 to 100. Factory default set to 10 "0" is off.	
Clip/Mute error readout Hold Time	1 to 30 seconds, user selectable, factory default set to 2.	
Silence Indication Threshold	Audio level below which the signal will be considered "silent". Used to trigger on screen indication and alarms.	

**Table 1-32: Audio bar displays (Option DS) (Cont.)**

<b>Characteristic</b>	<b>Performance requirement</b>	<b>Reference information</b>
Silence Indication Delay	Off or 1 to 60 seconds, user selectable. Indication and alarm will not be asserted until threshold has been exceeded for this number of consecutive seconds. Factory default set to 10. "0" is off.	
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, user selectable. Indication and alarm will not be asserted until threshold has been exceeded for this number of consecutive seconds. Factory default set to 2. "0" is off.	
Adjustable Peak Program level (dBFS)	Range 0 to -30.	Peak Program level is the level relative to digital full scale that the user chooses as the maximum desired level for monitored programs. The meter bars change to red above Peak Program level.
Adjustable Test Level (dBFS)	Range 0 to -30.	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	Select dBFS, Peak Program level, or Test level.	Use this item to number the meter scale relative to Digital Full 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 <sub>r</sub> , relative to the 0 dB level; units above the selected 0 dB mark are positive, while units below it are negative.

**Table 1-33: Audio bar and aux displays (Option DS)**

<b>Characteristic</b>	<b>Performance requirement</b>	<b>Reference information</b>
Phase Display AGC	AGC (automatic gain control) may be configured 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.
Phase Display Manual Scaling	When AGC is off, level at perimeter of display follows Program Level on Bar display.	

**Table 1-33: Audio bar and aux displays (Option DS) (Cont.)**

Characteristic	Performance requirement	Reference information
Phase Display Source Selection	Provides independent selection of any two channels of the selected audio input.	
Surround Display	Provides a dynamic graphic display of multi-channel surround sound with integrated indicators for levels, correlations and dominant location. Provided with permission of RTW RADIO-TECHNISCHE WERKSTAETTEN GmbH & Co.).	
Surround Dominance Indicator	Selectable on or off.	
Surround Sound Filter	Selectable Linear (RMS) or A-Weighted. A-Weighting filter conforms to IEC651 Type 0.	

**Table 1-34: Audio text displays (Option DS)**

Characteristic	Performance requirement	Reference information
Session Log	List of significant audio events with time stamps. Depending on input, may include clips, mutes, silence, over.	

**Table 1-35: AES audio inputs (Option DS)**

Characteristic	Performance requirement	Reference information
Inputs	2 sets with 8 Channels each, 32, 44.1, 48, and 96 kHz, 24-bit, Meets Requirements of AES 3'-ID and SMPTE 276M-1995.	
Input Connector	BNC, terminated, unbalanced.	
Input Impedance	75 $\Omega$	
Return loss	> 25 dB Relative to 75 $\Omega$ from 0.1 to 6 MHz. Typically better than 30 dB to 12 MHz.	Input A has passive terms and so are they 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 (typical)	0.2 V to 2 V <sub>p-p</sub> .	
Input Sample rate	32k, 44.1k, 48k, and 96k samples/sec	

**Table 1-35: AES audio inputs (Option DS) (Cont.)**

Characteristic	Performance requirement	Reference information
Input Lock Range (typical)	Greater than $\pm 5\%$ of nominal sample rate.	This means that exceeding 5%, the instrument may search again for a new lock point. Typically stays locked to 12.5%.
Level Meter Accuracy over Frequency (typical)	0.2 dB from 20 Hz to 20 kHz 0 to $-40$ dBFS sine wave, peak Ballistic mode.	
Audio Levels	Bars display signals up to 0 dBFS.	

**Table 1-36: AES audio outputs (Option DS)**

Characteristic	Performance requirement	Reference information
Sources	AES A or embedded. Any audio source may be configured to drive AES B outputs but the outputs must be driven from the currently selected source.	
Number of Outputs	Up to 8 Channels.	
Output Format	Meets Requirements of SMPTE 276M-1995 (AES 3-ID).	
Output Connector	BNC, terminated, unbalanced.	
Output Impedance	75 $\Omega$	
Return loss	> 25 dB Relative to 75 $\Omega$ from 0.1 to 6 MHz, Typically better than 30 dB to 12 MHz.	Tested in input mode.
Output Amplitude Range	0.9 V to 1.1 V <sub>p-p</sub> into 75 $\Omega$ .	
Output Sample Rate	Depends on source.	
AES A	Output sample rate is same as the corresponding AES A input sample rate.	
Analog (requires option AD or higher)	Output sample rate is 48 kHz.	
Embedded	Output sample rate is 48 kHz locked to embedded audio sample rate.	
Output Jitter (typical)	< 3.5 ns peak with 700 Hz high pass as per AES specification.	AES3 rev 1997 spec is 4.1 ns peak for 48 kHz audio.
Rise and Fall Time (typical)	37 ns 10% to 90% as per SMPTE 276M.	

**Table 1-37: Embedded audio extraction and monitoring on status bar (Option DS)**

Characteristic	Performance requirement	Reference information
Embedded Audio Detection	Identifies the presence or absence of up to 16 channels of Embedded digital audio.	
Embedded Audio Formatting SD (WVR7100 Option SD, WVR6100)	Extracts 20-bit audio formatted according to SMPTE 272M operation Levels A and B (48 kHz audio sampling rate synchronized with video).	For SD, 24-bit Embedded audio is not supported (no AUX bits are extracted) only 20 most significant bits are extracted.
HD (WVR7100)	Extracts 24-bit audio formatted according to SMPTE 299M preferred implementation (48 kHz audio sampling rate synchronized with video).	
Channel Numbering	Channel numbers per SMPTE 272M and SMPTE 299M (1 through 16) will be correctly shown on all displays.	
Number of Channels monitored for presence	16 channels are monitored for presence.	
Audio Levels	Bars display signals up to 0 dBFS.	Must not exceed max power specification on analog outputs. Configure output attenuation if necessary.

**Option AD** Option AD (Analog Audio) is available for both the WVR6100 and WVR7100. Tables 1-38 through 1-39 list the the characteristics specific to Option AD.

Option AD additionally includes all the functions and characteristics of Option DS.

**Table 1-38: Analog audio inputs (Option AD)**

Characteristic	Performance requirement	Reference information
Number of Channels	Provides up to two sets of six channels of professional balanced differential inputs for each video input, 12 channels total.	
Input Connector	Balanced, unterminated via rear panel connector.	
Level Meter Accuracy over Frequency	$\pm 0.5$ dB from 20 Hz to 20 kHz 0 to $-40$ dBFS sine wave, Peak Ballistic mode.	
Cross Talk (typical)	$\leq -80$ dB, typically $\leq -90$ dB from 20 Hz to 20 kHz, inputs driven from $<600 \Omega$ source impedance.	Defined as the displayed bar level in any channel that results from a full scale signal on a different input pair in that input.
Maximum Input Levels	+24 dBu	Must not exceed max power specification on analog outputs. Configure output attenuation if necessary.



**Table 1-38: Analog audio inputs (Option AD) (Cont.)**

Characteristic	Performance requirement	Reference information
Sampling Resolution	24 bits at 48 kHz.	
Input Impedance (typical)	24 k $\Omega$ , balanced.	Unbalanced input impedance is typically 18 k $\Omega$ .
Off Isolation (typical)	$\leq -80$ dB, from 20 Hz to 20 kHz. Unused input terminated by <math>600 \Omega</math> source impedance.	

**Table 1-39: Analog audio outputs (Option AD)**

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.	Outputs are to drive line level inputs. Not intended to drive speakers directly.
Audio Sources	The channels routed to the line outputs may include:  Embedded audio source AES audio source Analog audio source	
Number of Channels	Provides up to eight channels.	
Output Connections	Balanced, un-terminated via rear panel connector.	
Maximum Output Levels		When grounding one output to achieve unbalanced mode, the other output will be driven to a larger amplitude. You may reduce the level by adding attenuation in the configuration menu. Do not exceed maximum rated power in either mode.
Balanced	+24 dBu $\pm$ 0.5 dB	
Unbalanced	+10 dBV $\pm$ 0.5 dB	
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 1-39: Analog audio outputs (Option AD) (Cont.)**

Characteristic	Performance requirement	Reference information
Output Impedance (typical)	50 $\Omega$ , balanced.	Intended to drive a high impedance load. Drivers are capable of driving a minimum load impedance of 300 $\Omega$ but may overheat. Do not exceed the maximum rated power.
Digital Input to Analog Output Distortion (THD+N) (typical)	$\leq 0.02\%$ 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 Cross-talk (typical)	$< -82$ dB 20 Hz to 20kHz 24 dBu or 0 dBFS input. $< -100$ dB 20 Hz to 2kHz 24 dBu or 0 dBFS input.	
Output Power Capability (typical)	Capable of continuously driving a $-10$ dBFS sine wave into 600 $\Omega$ or $-13$ dB into 300 $\Omega$ .	This is 25 mW <sub>RMS</sub> in the load per output pair. Live audio may reach full voltage level as long as 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.

**Option DD** Option DD (Dolby Digital Audio) is available for both the WVR6100 and WVR7100. Table 1-40 lists the the characteristics specific to Option AD.

Option DD additionally includes all the functions and characteristics of Option AD.

**Table 1-40: Dolby Digital (AC-3) compressed audio monitoring (Option DD)**

Characteristic	Performance requirement	Reference information
Compressed Audio Input Format	Decodes audio and metadata from Dolby data stream transported via AES or 48 kHz embedded audio source.	Supports 32-bit professional and consumer modes on stream zero only.
Decoded Audio Outputs	A single selectable Dolby Digital decoded channel pair may be output on AES B 1-2 and Analog Outputs 1 & 2.	Limited to a single channel pair by license requirements.
Dolby Audio Status Display	Displays basic Dolby Digital status and bit stream meta-data.	

**Option DDE** Option DDE (Extended Dolby Digital Audio) is available for both the WVR6100 and WVR7100. Table 1-41 lists the characteristics specific to Option DDE.

Option DDE additionally includes all the functions and characteristics of Option DD.

**Table 1-41: Dolby E and extended dolby digital (AC-3) compressed audio monitoring (Option DDE)**

Characteristic	Performance requirement	Reference information
Compressed Audio Input Format	Decodes audio and metadata from Dolby data stream transported via AES or 48 kHz embedded audio source.	Supports 32-bit professional and consumer modes as well as 16-bit professional mode on Channel 1 or Channel 2, stream 0 through 7.
Decoded Audio Outputs	Up to eight decoded channels including all surround sound channels plus down mix may be output on AES B or Analog Outputs.	
Dolby Audio Status Display	Displays extensive Dolby D and Dolby E status and bit stream meta-data.	
Alarms	See Table 1-47 on page 1-32 for added error indicators.	

## Alarms

The tables in this section provide a list of all the WVR6100 and WVR7100 alarms.

**Table 1-42: Common alarms (WVR6100 and WVR7100)**

Alarm	Description
HW Fault	Indicates a system fault occurred. May require service.
SDI Input Missing	Indicates that no signal is detected on the selected SDI input.
SDI Input Signal Lock	Indicates unable to lock to selected SDI input signal.
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.
RGB Gamut Error	Indicates that the selected video input signal contains colors that violate the configured Diamond gamut thresholds.
Composite Gamut Error	Indicates that the selected video input signal contains colors that violate the configured Arrowhead gamut thresholds.
Luma Gamut Error	Indicates that the selected video input signal contains luminance levels that violate the configured Luma gamut thresholds.
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 or that the format detected differs from that indicated by the signal's SMPTE 352 payload identifier.
Vid/Ref Mismatch	Indicates that the Ref signal format is not compatible with the Input signal format.  <i>See <a href="#">Signal Input-to-Reference Compatibility Tables</a> beginning on page 1-33.</i>
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.
EAV Place Error	Indicates that the location of the EAV timing reference signal differs from that expected for the detected video format.
SAV Place Error	Indicates that the location of the SAV timing reference signal 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.
Timecode Anc Missing	Indicates that a break or discontinuity in the ANC timecode has occurred.
Timecode Anc Invalid	Indicates that the ANC timecode was lost for one frame but has reappeared.
Closed Caption Missing	Indicates that the configured Closed Caption Transport stream or streams are not present in the selected video input signal.

**Table 1-42: Common alarms (WVR6100 and WVR7100) (Cont.)**

<b>Alarm</b>	<b>Description</b>
CC Service(s) Missing	Indicates that one or more configured EIA 608 Required Services is not present in the closed caption data stream.
EIA608 Caption Error	Indicates a data error in an EIA608 data stream, excluding Extended Data Services and EIA708 Caption Data Packet errors.
V-Chip Presence Error	Indicates that no content advisory packet has been detected in the selected video input signal for at least 4 seconds.
V-Chip Format Error	Indicates that a content advisory packet contained illegal data or was formatted incorrectly.
Extended Data Services Error	Indicates a data error in Extended Data Services of an EIA608 data stream.
Caption Data Packet Error	Indicates a Caption Data Payload error in the EIA708 stream carrying EIA608 data.
Line 21 presence Error	Indicates no VBI caption signal was found on the configured Line and Timing of the selected video input signal.
ANC CC Presence Error	Indicates no caption ancillary data (SMPTE334M) was found in the selected video input signal.
TSID Missing	Indicates no Transmission Signal Identifier was found in the selected video input signal.
TSID Format Error	Indicates detected Transmission Signal Identifier is not an allowed value.

**Table 1-43: HD specific alarms (WVR7100 only)**

<b>Alarm</b>	<b>Description</b>
Video Not HD	Indicates that the selected SDI video input signal is not an HD format.
Line Number Error	Indicates that the encoded line number differs from the counted line number.
Y Chan CRC Error	Indicates that the encoded CRC for a line's Y (luminance) samples differs from the calculated CRC.
C Chan CRC Error	Indicates that the encoded CRC for a line's C (chrominance) samples differs from the calculated CRC.
Y Anc Checksum Error	Indicates that the encoded checksum in a Y (luminance) ancillary data packet differs from the calculated checksum.
C Anc Checksum Error	Indicates that the encoded checksum in a C (chrominance) ancillary data packet differs from the calculated checksum.

**Table 1-44: SD specific alarms added with Option SD**

<b>Alarm</b>	<b>Description</b>
AP CRC Error	Indicates that encoded AP (active picture) CRC differs from the calculated CRC.
FF CRC Error	Indicates that encoded FF (full field) CRC differs from the calculated CRC.
EDH Error	Indicates that EDH (error detection and handling) has detected an error.

**Table 1-45: Composite specific alarms added with Option CPS**

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

**Table 1-46: Audio alarms added with options DS and AD**

Alarm	Description
Over	Indicates that the signal has exceeded the level specified by the Over Level setting for the period of time specified by the Duration for Over setting.
Silence	Indicates that the signal has fallen below the level specified by the Silence Level setting for the period of time specified by the Duration for Silence setting.
Clip	Indicates that the number of consecutive, full-scale digital audio samples monitored has exceeded the value specified by the #Samples for Clip setting.
Mute	Indicates that the number of consecutive, "0" digital audio samples monitored has exceeded the #Samples for Mute setting.
AES Unlocked	Indicates unlocked condition of an AES input.
CRC Error	Indicates that the AES channel status CRC as calculated by the instrument does not agree with the CRC embedded in the channel status bytes.
V Bit	Indicates that the Validity bit is set high for one or more AES audio samples. In the AES/EBU standard, a set validity bit indicates that the sample is not suitable for conversion to audio
AES Parity	Indicates incorrect parity in one or more AES audio samples.
AES Sync Error	Indicates a timing error of greater than 25% of an audio frame between the monitored AES input and the selected AES reference input.
Emb. Audio Presence	Indicates that no embedded audio stream is detected in the selected SDI input.
(Embedded) Checksum	Indicates that the checksum present in the embedded audio stream does not match the calculated checksum.
(Embedded) Parity	Indicates incorrect parity in one or more embedded audio samples.
Emb. Group Sample Phase	Indicates embedded audio streams are not time-aligned due to asynchronous audio or data error.

**Table 1-47: Audio alarms added with option DDE**

Alarm	Description
Dolby Format	Indicates Dolby audio Format differs from the configured Dolby Format Expected.
Dolby E /Video Frame Rate Error	Indicates that the Dolby E stream frame rate is not the same as the video frame rate.

## Signal Input-to-Reference Compatibility Tables

**Table 1-48: 59.94, 29.97, 23.98 Hz input and reference format combinations**

Input Format		Reference Format								
		NTSC	720p			1080p	1080sf	1080p	1080sf	1080i
			23.98	29.97	59.94	23.98	23.98	29.97	29.97	59.94
720p, 23.98 Hz	3	X			X	X	X			X
720p, 29.97 Hz	3	X			X					X
720p, 59.94 Hz	3	X			X	X	X			X
1080p, 23.98 Hz	3	X			X	X	X			X
1080sf, 23.98 Hz	3	X			X	X	X			X
1080p, 29.97 Hz	3	X			X					X
1080sf, 29.97 Hz	3	X			X					X
1035i, 59.94 Hz	3	X			X					X
1080i, 59.94 Hz	3	X			X					X
483i, 59.94 Hz (525)	2	X			X					X
NTSC 59.94 Hz	1	X								

<sup>1</sup> Available with Option CPS.

<sup>2</sup> Available with WVR7100 Option SD or with WVR6100.

<sup>3</sup> Available with WVR7100.

**Table 1-49: 60, 30, 24 Hz input and reference format combinations**

Input Format		Reference Format							
		720p			1080p	1080sf	1080p	1080sf	1080i
		24	30	60	24	24	30	30	60
720p, 24 Hz	1			X	X	X			X
720p, 30 Hz	1			X					X
720p, 60 Hz	1			X	X	X			X
1080p, 24 Hz	1			X	X	X			X
1080sf, 24 Hz	1			X	X	X			X
1080p, 30 Hz	1			X					X
1080sf, 30 Hz	1			X					X
1035i, 60 Hz	1			X	X	X			X
1080i, 60 Hz	1			X	X	X			X

<sup>1</sup> Available with WVR7100.

**Table 1-50: 50, 25 Hz input and reference format combinations**

Input Format		Reference Format					
		PAL	720p		1080p	1080sf	1080i
			25	50	25	25	50
720p, 25 Hz	3	X		X			X
720p, 50 Hz	3	X		X			X
1080p, 25 Hz	3	X		X			X
1080sf, 25 Hz	3	X		X			X
1080i, 50 Hz	3	X		X			X
576i, 50 Hz (625)	2	X		X			X
PAL 50 Hz	1	X					

<sup>1</sup> Available with Option CPS.

<sup>2</sup> Available with WVR7100 Option SD or with WVR6100.

<sup>3</sup> Available with WVR7100.



## Certifications and Compliances

### EC Declaration of Conformity - EMC

Meets 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:

**EN 55103.** Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use.<sup>1</sup>

- Environment E2 — commercial and light industrial
- Part 1 Emission
  - EN 55022. Class B radiated and conducted emissions
  - EN 55103-1 Annex A. Radiated magnetic field emissions
  - EN 55103-1 Annex B. Inrush current <sup>2</sup>
- Part 2 Immunity
  - IEC 61000-4-2. Electrostatic discharge immunity
  - IEC 61000-4-3. RF electromagnetic field immunity
  - IEC 61000-4-4. Electrical fast transient / burst immunity
  - IEC 61000-4-5. Power line surge immunity
  - IEC 61000-4-6. Conducted RF Immunity
  - IEC 61000-4-11. Voltage dips and interruptions immunity
  - EN 55103-2 Annex A. Radiated magnetic field immunity
  - EN 55103-2 Annex B. Balanced ports common mode immunity

**EN 61000-3-2.** AC power line harmonic emissions

**EN 61000-3-3.** Voltage changes, fluctuations, and flicker

<sup>1</sup> Use only high quality shielded cables.

<sup>2</sup> Peak Inrush current: 1.85 A

**Australia / New Zealand  
Declaration of Conformity  
- EMC**

Complies with EMC provision of Radiocommunications Act per these standard(s):

- AS/NZS 3548. Information Technology Equipment: 1995

**EMC Compliance**

Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility when it is used with the product(s) stated in the specifications table. Refer to the EMC specification published for the stated products. May not meet the intent of the directive if used with other products.

**EC Declaration of  
Conformity - Low Voltage**

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:

Low Voltage Directive 73/23/EEC, amended by 93/68/EEC.

**U.S. Nationally  
Recognized Testing  
Laboratory Listing**

- UL 61010B-1:2003. Standard for electrical measuring and test equipment.

**Canadian Certification**

- CAN/CSA C22.2 No. 1010.1:1997. Particular requirements for electrical equipment for measurement, control, and laboratory use. Part 1.

**Additional Compliance**

- IEC 61010-1:2001. Safety requirements for electrical equipment for measurement, control, and laboratory use.

**Equipment Type**

Test and measuring equipment.

**Safety Class**

Class 1 - grounded product

**Pollution Degree  
Descriptions**

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.

- 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.
- 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.

- 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.

**Pollution Degree** Pollution Degree 2 (as defined in IEC 61010-1). Note: Rated for indoor use only.

**Installation (Overvoltage) Category Descriptions** Terminals on this product may have different installation (overvoltage) category designations. The installation categories are:

- Measurement Category III. For measurements performed in the building installation.
- Measurement Category II. For measurements performed on circuits directly connected to the low-voltage installation.
- Measurement Category I. For measurements performed on circuits not directly connected to MAINS.

**Overvoltage Category** Overvoltage Category II (as defined in IEC 61010-1)





# Performance Verification



# Performance Verification

A Performance Verification of the WVR7100 and WVR6100 Waveform Rasterizers 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](http://www.tektronix.com/manuals)

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

