Warranted Characteristics

Warranted characteristics are described in terms of quantifiable performance limits that are warranted. This subsection lists only warranted characteristics.

NOTE

In these tables, those warranted characteristics that are checked in the Performance Tests*, starting on page 6-11, appear in* ***boldface type*** *under the column* **Name.**

Performance Conditions

The electrical characteristics found in these tables of warranted characteristics apply when the oscilloscope has been adjusted at an ambient temperature between +20° C and +30° C, has had a warm-up period of at least 20 minutes, and is operating at an ambient temperature between −10° C and +55° C (unless otherwise noted).

Table 4-1: Warranted Characteristics — Signal Acquisition System

Name	Description	
Accuracy, DC Voltage Measurement, Average Acquisition Mode	**Measurement Type**	**DC Accuracy**
	Average of ≥16 waveforms	±(2.0% × |(reading − Net Offset)| + Offset Accuracy + 0.1 div)
	Delta volts between any two averages of ≥16 waveforms acquired under the same setup and ambient conditions	±(2.0% × |reading| + 0.15 div + 0.3 mV)
Accuracy, DC Gain, Sample or Average Acquisition Modes	±2%	
Pulse Response, Peak Detect and Envelope Mode	**Sec/Div Setting**	**Minimum Pulse Width**
	5 s/div − 25 µs/div	10 ns
	TDS 310: 10 µs/div − 10 ns/div TDS 320: 10 µs/div − 5 ns/div TDS 350: 10 µs/div − 2.5 ns/div	The greater of 10 ns or .02 × sec/div setting

Table 4-1: Warranted Characteristics — Signal Acquisition System (Cont.)

Name	Description	
Accuracy, Offset	**Volts/Div Setting**	**Offset Accuracy**
	2 mV/div – 99.5 mV/div	±(0.4% × |Net Offset[1]| + 3 mV + 0.1 div × V/div setting)
	100 mV/div – 995 mV/div	±(0.4% × |Net Offset[1]| + 30 mV + 0.1 div × V/div setting)
	1 V/div – 10 V/div	±(0.4% × |Net Offset[1]| + 300 mV + 0.1 div × V/div setting)
Analog Bandwidth, DC Coupled	TDS 310: DC – ≥50 MHz TDS 320: DC – ≥100 MHz TDS 350: DC – ≥200 MHz; DC – ≥180 MHz for 2 mV/div	
Cross Talk (Channel Isolation)	≥100:1 at 50 MHz with equal Volts/Div settings on each channel	
Input Impedance, DC-Coupled	1 MΩ ±1% in parallel with 20 pF ±2.0 pF	
Input Voltage, Maximum	±400 V (DC + peak AC); derate at 20 dB/decade above 100 kHz to 13 V peak AC at 3 MHz and above	
Lower Frequency Limit, AC Coupled[2]	≤10 Hz	

[1]Net Offset = Offset – (Position × Volts/Div). Net offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.

[2]The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X, passive probes are used.

Table 4-2: Warranted Characteristics — Time Base System

Name	Description
Accuracy, Long Term Sample Rate and Delay Time	±100 ppm over any ≥1 ms interval
Accuracy, Delta Time Measurements[1, 2]	For single-shot acquisitions using sample acquisition mode and a bandwidth limit setting of FULL: ±(1 WI + 100 ppm × |Reading| + 0.6 ns) For repetitive acquisitions using average acquisition mode with ≥16 averages and a bandwidth limit setting of FULL: ±(1 WI + 100 ppm × |Reading| + 0.4 ns)

[1]For input signals ≥5 divisions in amplitude and a slew rate of ≥2.0 divisions/ns at the delta time measurement points. Signal must be acquired at a volts/division setting ≥5 mV/division.
[2]The WI (waveform interval) is the time between the samples in the waveform record. Also, see the footnotes for *Sample Rate Range* and *Equivalent Time or Interpolated Waveform Rates* in Table 4-11 on page 4-12.

Table 4-3: Warranted Characteristics — Triggering System

Name	Description	
Accuracy, Trigger Level, DC Coupled	**Trigger Source**	**Sensitivity**
	CH1 or CH2	±(3% of |Setting − Net Offset[1]| + 0.2 div × volts/div setting + Offset Accuracy)
	External	±(6% of |Setting| + 20 mV)
	External/10	±(6% of |Setting| 200 mV)
Sensitivity, Edge-Type Trigger, DC Coupled	**Trigger Source**	**Sensitivity**
	CH1 or CH2	TDS 310: 0.35 division from DC to 20 MHz, increasing to 1 div at 50 MHz
		TDS 320: 0.35 division from DC to 50 MHz, increasing to 1 div at 100 MHz
		TDS 350: 0.35 division from DC to 50 MHz, increasing to 1 div at 200 MHz
	External	TDS 310: 50 mV from DC to 20 MHz, increasing to 150 mV at 50 MHz
		TDS 320: 50 mV from DC to 50 MHz, increasing to 150 mV at 100 MHz
		TDS 350: 50 mV from DC to 50 MHz, increasing to 150 mV at 200 MHz
	External/10	TDS 310: 500 mV from DC to 20 MHz, increasing to 1.5 V at 50 MHz
		TDS 320: 500 mV from DC to 50 MHz, increasing to 1.5 V at 100 MHz
		TDS 350: 500 mV from DC to 50 MHz, increasing to 1.5 V at 200 MHz
Input Impedance, External Trigger	1 MΩ ±2% in parallel with 20 pF ±2 pF	
Maximum Input Voltage, External Trigger	±400 V (DC + peak AC); derate at 20 dB/decade above 100 kHz to 13 V peak AC at 3 MHz and above	

[1]Net Offset = Offset − (Position × Volts/Div). Net Offset is the voltage level at the center of the A-D converter dynamic range. Offset Accuracy is the accuracy of this voltage level.

Table 4-4: Power Requirements

Name	Description
Source Voltage and Frequency	90 to 132 VAC_{RMS}, continuous range, for 47 Hz through 440 Hz 132 to 250 VAC_{RMS}, continuous range, for 47 Hz through 63 Hz
Power Consumption	≤65 Watts (120 VA)

Table 4-5: Warranted Characteristics — Environmental, Safety, and Reliability

Name	Description
Atmospherics	Temperature: −10° C to +55° C, operating; −51° C to +71° C, non-operating Relative humidity: to 95%, at or below +40° C; to 75%, +41° C to +55° C Altitude: To 15,000 ft (4570 m), operating; to 40,000 ft (12190 m), non-operating
Dynamics	Random vibration: 0.31 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis, operating; 2.46 g_{RMS}, from 5 to 500 Hz, 10 minutes each axis, non-operating
Emissions[1]	Meets or exceeds the requirements of the following standards: EN 50081−1 European Community Requirements EN 55022 radiated emissions EN 55022 Class B conducted emissions EN 60555−2 power harmonics VFG 0243 FCC Rules and Regulations, 47 CFR, Part 15, Subpart B, Class A
Susceptibility[2]	TDS 310 and TDS 320: ≤±0.2 division waveform displacement, or ≤0.4 division increase in p-p noise. TDS 350: ≤±0.2 division waveform displacement, or ≤0.4 division increase in p-p noise below 200 MHz. ≤±0.3 division waveform displacement, or ≤±0.6 division increase in p-p noise from 200 MHz to 500 MHz. The instruments are subjected to the EMI specified in the following standards: EN 50082−1 European Community Requirements IEC 801−3 radiated susceptibility IEC 801−4 fast transients IEC 801−5 AC surge

[1]To maintain emission requirements when connecting to the I/O interface of this oscilloscope, use only a high-quality, double-shielded (braid and foil) cable. The cable shield must have low impedance connections to both connector housings. The VGA cable must also have ferrite cores at either end. Acceptable cables are listed in Table 1-6 on page 1-6.

[2]Susceptibility test run with both channel inputs terminated with grounding caps, both channels set to 2 mV/Div, DC Coupling, the trigger source set to Line, the Acquisition Mode set to Peak Detect, and the time base set to 25 µs/Div.