Appendix B: Specification

This appendix begins with a general description of the traits of the TDS 520 and TDS 540 Digitizing Oscilloscope. Three subsections follow, one for each of three classes of traits: *nominal traits, warranted characteristics,* and *typical characteristics*.

General Product Description

The Tektronix TDS 520 and 540 Digitizing Oscilloscopes are both portable, four-channel instruments suitable for use in a variety of test and measurement applications and systems. Key differences between the two models are as follows:

- The TDS 540 supplies four full-featured vertical channels. The TDS 520 supplies two full-featured channels; the remaining two channels are auxiliary channels with fewer vertical scale factors.
- The TDS 540 acquires all four channels simultaneously; the TDS 520 can acquire any two channels at the same time.
- The TDS 540 has a maximum digitizing rate of 1 Gigasample/second with an analog bandwidth of 500 MHz; the TDS 520 has a maximum digitizing rate of 500 Megasample/second with an analog bandwidth of 500 MHz.

Key features they have in common are:

- Real time sampling, plus equivalent-time sampling on repetitive signals or interpolation of points sampled on non-repetitive signals. Both equivalent time and interpolation can increase the apparent sample rate on the waveform when maximum real-time rates are reached.
- Five acquisition modes: peak-detect, high-resolution, sample, envelope, and average modes
- Three horizontal display modes: main only, main intensified, and delayed only.
- Selectable record lengths of 500 to 15,000 points. A 50,000-point record length is available with the 1M option.
- Extensive triggering capabilities: such as edge, logic, and glitch.
- Full programmability and printer/plotter output.
- Advanced functions like continuously updated measurements.
- Specialized display modes, such as infinite and variable persistence.
- A unique graphical user interface (GUI), an on-board help mode, and a logical front-panel layout which combine to deliver a new standard in usability.

- Measurement aids, such as three types of cursors for making parametric measurements on displayed waveforms and Measure, which can automatically extract parameters from a signal and display them on screen.
- Our proprietary digital signal processor, the DSP. This dedicated processor supports advanced analysis of your waveforms when doing such compute-intensive tasks as interpolation, waveform math, and signal averaging. It also teams with a custom display system to deliver specialized display modes.
- Four nonvolatile REF (reference) memories for storing waveforms.
- The digitizing oscilloscope is fully controllable and capable of sending and receiving waveforms over its GPIB interface (IEEE Std 488.1-1987).
- Hardcopy output (no system controller is required) in variety of popular output formats.
- Flexible display options to control the intensity of the display elements, style of waveform display (vectors or dots, intensified or non-intensified samples, and infinite or variable persistence), and display format (XY or YT and graticule type).
- Zoom, for magnifying waveform features you wish to examine up close.

Nominal Traits

This subsection contains a collection of tables that list the various *nominal traits* that describe the TDS 520 and 540 Digitizing Oscilloscopes. (Traits that differ according to model or only apply to one model are preceded by the appropriate model number, TDS 520 or TDS 540, in the tables.) Included are electrical and mechanical traits.

Nominal traits are described using simple statements of fact such as “Four, all identical” for the trait “Input Channels, Number of,” rather than in terms of limits that are performance requirements.

Table A-7: Nominal Traits—Signal Acquisition System

Name	Description	
Bandwidth Selections	20 MHz, 100 MHz, and FULL (500 MHz)	
TDS 540: Digitizers, Number of	Four, all identical	
TDS 520: Digitizers, Number of	Two, both identical	
Digitized Bits, Number of	8 bits[1]	
TDS 540: Input Channels, Number of	Four, all identical	
TDS 520: Input Channels, Number of	Two full-featured (CH 1 and CH 2), plus two limited, auxiliary inputs (AUX 1 and AUX 2)	
Input Coupling[2]	DC, AC, or GND	
Input Impedance Selections	1 MΩ or 50 Ω	
TDS 540: Ranges, Offset, All Channels	**Volts/Div Setting**	**Offset Range**
	1 mV/div–99.5 mV/div	¿ V
	100 mV/div–995 mV/div	¿ V
	1 V/div–10 V/div	¿ V
TDS 520: Ranges, Offset, CH 1 and CH 2	Same as is listed for the TDS 540	
TDS 520: Ranges, Offset, AUX 1 and AUX 2	**Volts/Div Setting**	**Offset Range**
	100 mV/div	¿ V
	1 V/div	¿ V
	10 V/div	¿ V
Range, Position	¿ divisions	

[1]**Displayed vertically with 25 digitization levels (DLs) per division and 10.24 divisions dynamic range with zoom off. A DL is the smallest voltage level change that can be resolved by the 8-bit A-D Converter, with the input scaled to the volts/division setting of the channel used. Expressed as a voltage, a DL is equal to 1/25 of a division times the volts/division setting.**

[2]**The input characteristics *(Input Coupling, Input Impedance Selections, etc.)* apply to both full-featured and auxiliary inputs except where otherwise specified.**

Table A-7: Nominal Traits—Signal Acquisition System (Cont.)

Name	Description
TDS 540: Range, Sensitivity, All Channels	1 mV/div to 10 V/div[3]
TDS 520: Range, Sensitivity, CH 1 and CH 2	Same as listed for the TDS 540
TDS 520: Range, Sensitivity, AUX 1 and AUX 2	100 mV/div, 1 V/div, and 10 V/div[4]

[3]The sensitivity ranges from 1 mV/div to 10 V/div in a 1–2–5 sequence of coarse settings. Between a pair of adjacent coarse settings, the sensitivity can be finely adjusted. The resolution of such a fine adjustment is 1% of the more sensitive of the pair. For example, between 50 mV/div and 100 mV/div, the volts/division can be set with 0.5 mV resolution.

[4]There is no fine adjustment between the three sensitivity selections for AUX 1 and AUX 2.

Table A-8: Nominal Traits—Time Base System

Name	Description		
TDS 540: Range, Sample-Rate[1,3]	**Number of Channels On**	**Sample-Rate Range**	
	1	5 Samples/s–1 GSample/s	
	2	5 Samples/s–500 MSamples/s	
	3 or 4	5 Samples/s–250 MSamples/s	
TDS 520: Range, Sample-Rate[1,3]	**Input Channel**	**Number of Channels On**	**Sample-Rate Range**
	CH 1 or CH 2	1	5 Samples/s–500 MSamples/s
	CH 1 or CH 2	2	5 Samples/s–250 MSamples/s
	AUX 1 or AUX 2	Doesn't matter	5 Samples/s–250 MSamples/s
Range, Equivalent Time or Interpolated Waveform Rate[2,3]	500 MSamples/s to 100 GSamples/s (2 ns/Sample to 1 ps/Sample)		
Range, Seconds/Division	500 ps/div to 10 s/div		
Range, Time Base Delay Time	16 ns to 250 seconds		
Record Length Selection[4]	500 points, 1000 points, 2500 points, 5000 points, 15000 points. A record length 50000 points is available with Option 1M.		

[1]The range of real-time rates, expressed in samples/second, at which a digitizer samples signals at its inputs and stores the samples in memory to produce a record of time-sequential samples

[2]The range of waveform rates for equivalent time or interpolated waveform records.

[3]The Waveform Rate (WR) is the equivalent sample rate of a waveform record. For a waveform record acquired by real-time sampling of a single acquisition, the waveform rate is the same as the real-time sample rate; for a waveform created by interpolation of real-time samples from a single acquisition or by equivalent-time sampling of multiple acquisitions, the waveform rate is faster than the real time sample rate. For all three cases, the waveform rate is 1/(Waveform Interval) for the waveform record, where the waveform interval (WI) is the time between the samples in the waveform record.

[4]The maximum record length of 15,000 points (50,000 points with Option 1M) is selectable with all acquisition modes except Hi Res. In Hi Res, the maximum record length is 5,000 points (15,000 points with Option 1M).

Table A-9: Nominal Traits—Triggering System

Name	Description		
Range, Delayed Trigger Time Delay	16 ns to 250 seconds		
Range, Events Delay	2 to 10,000,000		
Range (Time) for Pulse-Glitch or Pulse-Width Triggering	2 ns to 1 s		
Ranges,Trigger Level or Threshold	**Source**	**Range**	
	Any Channel	¿	screen
	Auxiliary (TDS 540 only)	¿ V	
	Line	¿ V	

Table A-10: Nominal Traits—Display System

Name	Description
Video Display Resolution	640 pixels horizontally by 480 pixels vertically in a display area of 5.2 inches horizontally by 3.9 inches vertically
Waveform Display Graticule	Single Graticule: 401 × 501 pixels/8 × 10 divisions, where divisions are 1 cm by 1 cm
Waveform Display Grey Scale	Sixteen levels in infinite-persistence and variable persistence display styles

Table A-11: Nominal Traits—Interfaces, Output Ports, and Power Fuse

Name	Description
Interface, GPIB	GPIB interface complies with IEEE Std 488.1-1987 and IEEE Std 488.2-1987
Interface, RS-232 (Option 13 only)	RS-232 interface complies with EIA/TIA 574
Interface, Centronics (Option 13 only)	Centronics interface complies with Centronics interface standard C332-44 Feb 1977, REV A
Logic Polarity for Main- and Delayed-Trigger Outputs	Negative TRUE. High to low transition indicates the trigger occurred.
Fuse Rating	Either of two fuses[1] may be used: a 0.25″ × 1.25″ (UL 198.6, 3AG): 6 A FAST, 250 V, or a 5 mm × 20 mm, (IEC 127): 5 A (T), 250 V

[1]**Each fuse type requires its own fuse cap.**

Table A-12: Nominal Traits—Mechanical

Name	Description
Cooling Method	Forced-air circulation with no air filter
Construction Material	Chassis parts constructed of aluminum alloy; front panel constructed of plastic laminate; circuit boards constructed of glass-laminate. Cabinet is aluminum and is clad in Tektronix Blue vinyl material.
Finish Type	Tektronix Blue vinyl-clad aluminum cabinet
Weight	Standard digitizing oscilloscope 12.3 kg (27 lbs), with front cover. 20.0 kg (44 lbs), when packaged for domestic shipment Rackmount digitizing oscilloscope 12.3 kg (27 lbs) plus weight of rackmount parts, for the rackmounted digitizing oscilloscope (Option 1R). 20.5 kg (45 lbs), when the rackmounted digitizing oscilloscope is packaged for domestic shipment Rackmount conversion kit 2.3 kg (5 lbs), parts only; 3.6 kg (8 lbs), parts plus package for domestic shipping
Overall Dimensions	Standard digitizing oscilloscope Height: 193 mm (7.6 in), without the accessories pouch installed Width: 445 mm (17.5 in), with handle Depth: 432 mm (17.1 in), with front cover installed Rackmount digitizing oscilloscope Height: 178 mm (7.0 in) Width: 483 mm (19.0 in) Depth: 558.8 mm (22.0 in)

Warranted Characteristics

This subsection lists the various *warranted characteristics* that describe the TDS 540 and 520 Digitizing Oscilloscopes. (Characteristics that differ according to model or only apply to one model are preceded by the appropriate model number, TDS 520 or TDS 540, in the tables.) Included are electrical and environmental characteristics.

Warranted characteristics are described in terms of quantifiable performance limits which are warranted.

NOTE

In these tables, those warranted characteristics that are checked in the Performance Verification *manual, appear in* ***boldface type*** *under the column* **Name**.

As stated above, this subsection lists only warranted characteristics. A list of *typical characteristics* starts on page A-21.

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 0°C and +50°C (unless otherwise noted).

Table A-13: Warranted Characteristics—Signal Acquisition System

Name	Description	
Accuracy, DC Gain	¿ %	
Accuracy, DC Voltage Measurement, Averaged[3]	**Measurement Type**	**DC Accuracy**
	Average of ≥16 waveforms	¿ 1.0% × (reading – Net Offset[1]) + Offset Accuracy + 0.06 div)
	Delta volts between any two averages of ≥16 waveforms[2]	¿ 1.0% × reading + 0.1 div + 0.3 mV)

[1]Net Offset = Offset – (Position x 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 samples must be acquired under the same setup and ambient conditions.

[3]To ensure the most accurate measurements possible, run an SPC calibration first. When using the TDS 520 and/or TDS 540 Digitizing Oscilloscope at a Volts/Div setting ≤ 5 mV/div, an SPC calibration should be run once per week to ensure that instrument performance levels meet specifications.

Table A-13: Warranted Characteristics—Signal Acquisition System (Cont.)

Name	Description	
TDS 540: Accuracy, Offset	**Volts/Div Setting**	**Offset Accuracy**
	1 mV/div – 99.5 mV/div	¿ Offset[1] + 1.5 mV + 0.1 div)
	100 mV/div – 995 mV/div	¿ Offset[1] + 15 mV + 0.1 div)
	1 V/div – 10 V/div	¿ Offset[1] + 150 mV + 0.1 div)
TDS 520: Accuracy, Offset (CH 1 and CH 2)	Same as is listed for the TDS 540	
TDS 520: Accuracy, Offset (AUX 1 and AUX 2)	¿ Offset[1] + 0.1 div)	
Analog Bandwidth, DC-50 Ω Coupled	**Volts/Div**	**Bandwidth[2]**
	5 mV/div – 10 V/div	DC – 500 MHz
	2 mV/div – 4.98 mV/div	DC – 350 MHz
	1 mV/div – 1.99 mV/div	DC – 250 MHz
Cross Talk (Channel Isolation)	≥100:1 at 100 MHz and ≥30:1 at the rated bandwidth (see above) for any two channels having equal volts/division settings	
Delay Between Channels, Full Bandwidth, Equivalent Time	≤250 ps for any two channels with equal volts/division and coupling settings	
Input Impedance, DC-1 MΩ Coupled	1 MΩ ¿ ¿ pF	
Input Impedance, DC-50 Ω Coupled	50 Ω ¿ with VSWR ≤1.3:1 from DC – 500 MHz	
Input Voltage, Maximum, DC-1 MΩ, AC-1 MΩ, or GND Coupled	¿ MHz	
Input Voltage, Maximum, DC-50 Ω or AC-50 Ω Coupled	5 V_{rms}, with peaks less than or equal to ¿ V	
Lower Frequency Limit, AC Coupled	≤10 Hz when AC-1 MΩ Coupled; ≤200 kHz when AC-50 Ω coupled[3]	

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

[2]The limits given are for the ambient temperature range of 0°C to +30°C. Reduce the upper bandwidth frequencies by 2.5 MHz for each °C above +30°C.

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

Table A-14: Warranted Characteristics—Time Base System

Name	Description
Accuracy, Long Term Sample Rate and Delay Time	¿ 5 ppm over any ≥1 ms interval
TDS 540: Accuracy, Delta Time Measurement	For single-shot acquisitions using sample or high-resolution acquisition modes: **Channels On/Bandwidth Selected** — **Measurement Accuracy[1,2]** 1 or 2 channels/100 MHz — ¿ (1 WI + 25 ppm of Reading + 500 ps) 3 or 4 channels/20 MHz — ¿ (1 WI + 25 ppm of Reading + 1.3 ns) For repetitive acquisitions using average acquisition mode with ≥8 averages: **Channels On/Bandwidth Selected** — **Measurement Accuracy[1,2]** 1 to 4 Channels/Full Bandwidth — ¿ (1 WI + 25 ppm of Reading + 200 ps)
TDS 520: Accuracy, Delta Time Measurement	For single-shot acquisitions using sample or high-resolution acquisition modes on CH 1 and/or CH 2: **Channels On/Bandwidth Selected** — **Measurement Accuracy[1,2]** 1 channel/100 MHz — ¿ (1 WI + 25 ppm of Reading + 500 ps) 2 channels/20 MHz — ¿ (1 WI + 25 ppm of Reading + 1.3 ns) For repetitive acquisitions using average acquisition mode with ≥8 averages: **Channels On/Bandwidth Selected** — **Measurement Accuracy[1,2]** 1 to 2 Channels/Full Bandwidth — ¿ (1 WI + 25 ppm of Reading + 200 ps)

[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 have been 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 A-8 on page A-13.

Table A-15: Warranted Characteristics—Triggering System

Name	Description		
Accuracy (Time) for Pulse-Glitch or Pulse-Width Triggering	**Time Range**	**Accuracy**	
	2 ns to 1 µs	¿	ns)
	1.02 µs to 1 s	¿	setting)
Accuracy, Trigger Level or Threshold, DC Coupled[1]	**Trigger Source**	**Accuracy**	
	Any Channel	¿	Offset[2]) + 0.3 div × volts/div setting + Offset Accuracy)
	Auxiliary (TDS 540 only)	¿	100 mV)
TDS 520: Sensitivity, Edge-Type Trigger, DC Coupled[3]	**Trigger Source**	**Sensitivity**	
	CH 1 and CH 2	0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz	
	AUX 1 and AUX 2	0.55 division from DC to 50 MHz, increasing to 1.5 division at 500 MHz	
TDS 540: Sensitivity, Edge-Type Trigger, DC Coupled[3]	**Trigger Source**	**Sensitivity**	
	Any Channel	0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz	
	Auxiliary	0.25 volts from DC to 50 MHz	
Width, Minimum Pulse and Rearm, for Pulse Triggering	**Pulse Class**	**Minimum Pulse Width**	**Minimum Rearm Width**
	Glitch	2 ns	2 ns + 5% of Glitch Width Setting
	Runt	2.5 ns	2.5 ns
	Width	2 ns	2 ns + 5% of Width Upper Limit Setting

[1]For input signals having rise and fall times of ≥20 ns.

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

[3]The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower.

Table A-16: Warranted Characteristics—Output Ports, Probe Compensator, and Power

Name	Description	
TDS 540: Logic Levels, Main- and Delayed-Trigger Outputs	**Characteristic**	**Limits**
	Vout (HI)	≥2.5 V open circuit; ≥1.0 V into a 50 Ω load to ground
	Vout (LO)	≤0.7 V into a load of ≤4 mA; ≤0.25 V into a 50 Ω load to ground

Table A-16: Warranted Characteristics—Output Ports, Probe Compensator, and Power

Name	Description		
Output Voltage and Frequency, Probe Compensator	**Characteristic**	**Limits**	
	Voltage		
	TDS 520 (B021799 and below); TDS 540 (B022999 and below):	0.5 V (base-top) into load; 0.25 V (base-top) into a 50 Ω load	1 MΩ
	TDS 520 (B021800 and above); TDS 540 (B023300 and above):	0.5 V (base-top) into load to ground	50 Ω
	Frequency	1 kHz	
TDS 540: Output Voltage, Channel 3 Signal Out	20 mV/division into a 1 MΩ load; 10 mV/division into load		50 Ω
Source Voltage	90 to 250 VAC_{rms}, continuous range		
Source Frequency	47 Hz to 63 Hz		
Power Consumption	≤300 W (450 VA)		

Table A-17: Warranted Characteristics—Environmental, Safety, and Reliability

Name	Description
Atmospherics	Temperature: 0°C to +50°C, operating; –40°C to +75°C, non-operating Relative humidity: 0 to 95%, at or below +40°C; 0 to 75%, +41°C to 50°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; 3.05 g rms, from 5 to 500 Hz, 10 minutes each axis, non-operating
Emissions	Meets or exceeds the requirements of the following standards: MIL-STD-461C CE-03, part 4, curve #1, RE-02, part 7 VDE 0871, Category B FCC Rules and Regulations, Part 15, Subpart J, Class A
User-Misuse Simulation	Electrostatic Discharge Susceptibility: Up to 8 kV with no change to settings or impairment of normal operation; up to 15 kV with no damage that prevents recovery of normal operation

Typical Characteristics

This subsection contains tables that lists the various *typical characteristics* that describe the TDS 520 and 540 Digitizing Oscilloscope.(Characteristics that differ according to model or only apply to one model are preceded by the appropriate model number, TDS 520 or TDS 540, in the tables.)

Typical characteristics are described in terms of typical or average performance. Typical characteristics are not warranted.

This subsection lists only typical characteristics. A list of warranted characteristics starts on page A-16.

Table A-18: Typical Characteristics—Signal Acquisition System

Name	Description	
Accuracy, DC Voltage Measurement, Not Averaged	**Measurement Type**	**DC Accuracy**
	Any Sample	± 1.0% × (reading – Net Offset[1]) + Offset Accuracy + 0.13 div + 0.6 mV)
	Delta Volts between any two samples[2]	± 1.0% × reading + 0.26 div + 1.2 mV)
TDS 540: Frequency Limit, Upper, 100 MHz Bandwidth Limited (All Channels)	100 MHz	
TDS 520: Frequency Limit, Upper, 100 MHz Bandwidth Limited (CH 1 and CH 2 only)	Same as listed for the TDS 540	
TDS 540: Frequency Limit, Upper, 20 MHz Bandwidth Limited (All Channels)	20 MHz	
TDS 520: Frequency Limit, Upper, 20 MHz Bandwidth Limited (CH 1 and CH 2 only)	Same as listed for the TDS 540	

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

[2]The samples must be acquired under the same setup and ambient conditions.

Table A-18: Typical Characteristics—Signal Acquisition System (Cont.)

Name	Description				
Nonlinearity	<1 DL, differential; ≤1 DL, integral, independently based				
TDS 540: Step Response Settling Errors	**Volts/Div Setting**	**Step Amplitude**	**Settling Error (%)[3]**		
			20 ns	**100 ns**	**20 ms**
	1 mV/div–99.5 mV/div	≤2 V	≤0.5	≤0.2	≤0.1
	100 mV/div–995 mV/div	≤20 V	≤1.0	≤0.5	≤0.2
	1 V/div–10 V/div	≤200 V	≤1.0	≤0.5	≤0.2
TDS 520: Step Response Settling Errors (CH 1 and CH 2 only)	Same as is listed for the TDS 540				
Calculated Rise Time[4]	**Volts/Div Setting**	**Rise Time**			
	5 mV/div–10 V/div	800 ps			
	2 mV/div–4.98 mV/div	1.2 ns			
	1 mV/div–1.99 mV/div	1.6 ns			

[3]The values given are the maximum absolute difference between the value at the end of a specified time interval after the mid-level crossing of the step, and the value one second after the mid-level crossing of the step, expressed as a percentage of the step amplitude.

[4]The numbers given are valid 0°C to +30°C and will increase as the temperature increases due to the degradation in bandwidth. Rise time is calculated from the bandwidth. It is defined by the following formula:

$$Rise\ \ Time\ \ (ns) = \frac{400}{BW\ \ (MHz)}$$

Note that if you measure rise time, you must take into account the rise time of the test equipment (signal source, etc.) that you use to provide the test signal. That is, the measured rise time (RT_m) is determined by the instrument rise time (RT_i) and the rise time of the test signal source (RTgen) according to the following formula:

$$RT_m^{\ 2} = RT_i^{\ 2} + RT_{gen}^{\ 2}$$

Table A-19: Typical Characteristics—Time Base System

Name	Description
Aperture Uncertainty	≤(50 ps + 0.03 ppm × Record Duration) rms, for real-time or interpolated records having duration ≤1 minute; ≤(50 ps + 0.06 × WI[1]) rms, for equivalent time records

[1]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 A-8 on page A-13.

Table A-20: Typical Characteristics—Triggering System

Name	Description	
TDS 540: Input, Auxiliary Trigger	The input resistance is ≥1.5 kΩ; the maximum safe input voltage is AC).	
Error, Trigger Position, Edge Triggering	**Acquire Mode**	**Trigger-Position Error[1,2]**
	Sample, Hi-Res, Average	WI + 1 ns)
	Peak Detect, Envelope	ns)
Holdoff, Variable, Main Trigger	Minimum: For any horizontal scale setting, *minimum* holdoff is10 × that setting, but is never less than 1 µs or more than 5 s. Maximum: For any horizontal scale setting, *maximum* holdoff is at least 2 times the minimum holdoff for that setting, but is never more than 10 times the minimum holdoff for that setting.	
Lowest Frequency for Successful Operation of "Set Level to 50%" Function	30 Hz	
Sensitivity, Edge Trigger, Not DC Coupled[3]	**Trigger Coupling**	**Typical Signal Level for Stable Triggering**
	AC	Same as DC-coupled limits[4] for frequencies above 60 Hz. Attenuates signals below 60 Hz.
	Noise Reject	Three and one half times the DC-coupled limits.[4]
	High Frequency Reject	One and one half times times the DC-coupled limits[4] from DC to 30 kHz. Attenuates signals above 30 kHz.
	Low Frequency Reject	One and one half times the DC-coupled limits[4] for frequencies above 80 kHz. Attenuates signals below 80 kHz.

[1]The trigger position errors are typically less than the values given here. These values are for triggering signals having a slew rate at the trigger point of division/ns.

[2]The waveform interval (WI) is the time between the samples in the waveform record. Also, see the footnote for the characteristics *Sample Rate Range* and *Equivalent Time or Interpolated Waveform Rates* in Table A-8 on page A-13.

[3]The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower.

[4]See the characteristic *Sensitivity, Edge-Type Trigger, DC Coupled* in Table A-15, which begins on page A-19.

Table A-20: Typical Characteristics—Triggering System

Name	Description
Sensitivities, Logic-Type Trigger Events-Delay, DC Coupled[5]	1.0 division, from DC to 100 MHz with a minimum slew rate of 25 div/μs at the trigger level or the threshold crossing
Sensitivities, Pulse-Type Runt Trigger[5]	1.0 division, from DC to 200 MHz with a minimum slew rate of 25 div/μs at the trigger level or the threshold crossing
Sensitivities, Pulse-Type Trigger Width and Glitch[5]	1.0 division with a minimum slew rate of 25 div/μs at the trigger level or the threshold crossing. For <5 nsec pulse width or rearm time, 2 divisions are required.
TDS 520: Sensitivity, Derating Aux Channel Trigger	All trigger sensitivity specifications are derated by 50% for AUX 1 and AUX 2 inputs.
Width, Minimum Pulse and Rearm, for Logic Triggering or Events Delay[6]	5 ns

[5]The minimum signal levels required for stable logic or pulse triggering of an acquisition or for stable counting of a DC coupled events delay signal. (Stable counting of events is counting that misses no events.)

[6]The minimum pulse width and rearm width required for logic-type triggering or events delaying to occur.

Table A-21: Typical Characteristics—Data Handling

Name	Description
Time, Data-Retention, Nonvolatile Memory[1,2]	5 years

[1]The time that reference waveforms, stored setups, and calibration constants are retained when there is no power to the digitizing oscilloscope.

[2]Data is maintained by small lithium-thionyl-chloride batteries internal to the memory ICs. The amount of lithium is so small in these ICs that they can typically be safely disposed of with ordinary garbage in a sanitary landfill.