

Appendix A: Specifications

This appendix contains the oscilloscope, DMM, and general specifications for the THS710A, THS720A, THS730A, and THS720P TekScope instruments. All specifications are guaranteed unless noted as “typical.” Typical specifications are provided for your convenience but are not guaranteed. Specifications that are marked with the ✓ symbol are checked in *Appendix D: Performance Verification*.

All specifications apply to all the TekScope instruments unless noted otherwise. All specifications assume horizontal MAG is off, unless noted otherwise. To meet specifications, two conditions must first be met:

- The TekScope instrument must have been operating continuously for ten minutes within the operating temperature range specified.
- You must perform the Compensate Signal Path operation described on page 2–11. If the operating temperature changes by more than 5° C, you must perform the Compensate Signal Path operation again.

Oscilloscope Specifications

Acquisition		
Acquisition Modes	Sample (Normal), Peak detect, Envelope, and Average	
Acquisition Rate, typical	Up to 25 waveforms per second (2 channels, sample acquisition mode, MAG on, no measurements)	
Single Sequence	<i>Acquisition Mode</i>	<i>Acquisition Stops After</i>
	Sample, Peak Detect	Single acquisition, one or two channels simultaneously
	Average, Envelope	N acquisitions, one or two channels simultaneously, N is settable from 2 to 256 or ∞

Oscilloscope Specifications (Cont.)

Inputs		
Input Coupling	DC, AC, or GND	
Input Impedance, DC Coupled	1 M Ω \pm 1% in parallel with 25 pF \pm 2 pF	
Maximum Voltage Between Signal and Common at Input BNC	<i>Overvoltage Category</i>	<i>Maximum Voltage</i>
	CAT II Environment (refer to page A-19)	300 V _{RMS}
	CAT III Environment (refer to page A-19)	150 V _{RMS}
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 100 kHz to 13 V _{pk} at 3 MHz and above. Also, refer to Overvoltage Category description on page A-19.	
Maximum Voltage Between Common and Earth Ground at BNC	600 V _{RMS} (CAT II) or 300 V _{RMS} (CAT III), using rated connectors or accessories	
	30 V _{RMS} , 42.4 V _{pk} , using noninsulated connectors or accessories	
Maximum Voltage, Channel-to-Channel Commons	30 V _{RMS} , 42.4 V _{pk} , using noninsulated connectors or accessories	
Channel-to-Channel Common Mode Rejection, typical	100:1 at frequencies \leq 50 MHz, measured on MATH Ch1 – Ch2 waveform, with test signal applied between signal and common of both channels, and with the same VOLTS/DIV and coupling settings on each channel	
Channel-to-Channel Crosstalk, typical	\geq 100:1 at 50 MHz, measured on one channel, with test signal applied between signal and common of the other channel, and with the same VOLTS/DIV and coupling settings on each channel	
Common to Chassis Capacitance, typical	55 pF	

Oscilloscope Specifications (Cont.)

Vertical				
Number of Channels	2			
Digitizers	8 bit resolution, separate digitizers for each channel sample simultaneously			
VOLTS/DIV Range	5 mV/div to 50 V/div at input BNC			
Polarity	Normal and Invert			
Position Range	±10 divisions			
✓ Analog Bandwidth at BNC, DC Coupled (typical at 5 mV/div; guaranteed at all other settings)	<i>THS710A</i>	<i>THS720A</i>	<i>THS720P</i>	<i>THS730A</i>
	60 MHz at input BNC	100 MHz at input BNC (90 MHz above 35° C)	100 MHz at input BNC (90 MHz above 35° C)	200 MHz at input BNC (180 MHz above 35° C)
Peak Detect or Envelope Bandwidth, typical (25 MS/s or slower)	<i>THS710A</i>	<i>THS720A</i>	<i>THS720P</i>	<i>THS730A</i>
	50 MHz	75 MHz	75 MHz	85 MHz
Analog Bandwidth Limit, typical	Selectable between 20 MHz or full			
Lower Frequency Limit, AC Coupled, typical	≤10 Hz at BNC, reduced by a factor of ten when using a 10X passive probe			
Rise Time at BNC, typical	<i>THS710A</i>	<i>THS720A</i>	<i>THS720P</i>	<i>THS730A</i>
	5.8 ns	3.5 ns	3.5 ns	1.75 ns
Peak Detect or Envelope Pulse Response, typical	Captures 50% or greater amplitude of pulses ≥ 8 ns wide (≥ 20 ns wide at 500 ns/div)			
DC Gain Accuracy	±2% for Sample or Average acquisition mode			
Position Accuracy	±[0.4% × (position × volts/div) + (0.1 div × volts/div)]			

Oscilloscope Specifications (Cont.)

Vertical				
✓ DC Measurement Accuracy, Average Acquisition Mode Using ≥16 Waveforms	Measurement Type		Accuracy	
	Absolute voltage measurements		±[2% × reading + (position × volts/div) + (0.1 div × volts/div)]	
	Delta voltage between any two waveforms acquired under same setup		±[2% × reading + (0.05 div × volts/div)]	
DC Measurement Accuracy, Sample Acq. Mode, typical	±[2% × reading + (position × volts/div) + (0.15 div × volts/div) + 0.6 mV]			
Horizontal				
Sample Rate Range	THS710A	THS720A	THS720P	THS730A
	5 S/s to 250 MS/s, in a 1.25, 2.5, 5 sequence	5 S/s to 500 MS/s, in a 1.25, 2.5, 5 sequence	5 S/s to 500 MS/s in a 1.25, 2.5, 5 sequence	5 S/s to 1 GS/s in a 1.25, 2.5, 5 sequence
Record Length	2500 samples for each channel			
SEC/DIV Range (including MAG)	THS710A	THS720A	THS720P	THS730A
	10 ns/div to 50 s/div	5 ns/div to 50 s/div	5 ns/div to 50 s/div	2 ns/div to 50 s/div
✓ Sample Rate and Delay Time Accuracy	±200 ppm over any ≥1 ms time interval			
Delay Time Range	Zero to 50 s			

Oscilloscope Specifications (Cont.)

Internal Trigger		
✓ Trigger Sensitivity, Edge Trigger Type (THS710A, THS 720A, and THS720P)	<i>Coupling</i>	<i>Sensitivity</i>
	DC	0.35 div from DC to 50 MHz, increasing to 1 div at 100 MHz (90 MHz above 35° C)
✓ Trigger Sensitivity, Edge Trigger Type (THS730A)	<i>Coupling</i>	<i>Sensitivity</i>
	DC	0.35 div from DC to 50 MHz, increasing to 1.5 div at 200 MHz (180 MHz above 35° C)
Trigger Sensitivity, Edge Trigger Type, typical	<i>Coupling</i>	<i>Sensitivity</i>
	NOISE REJ	3.5 times the DC-coupled limits
	HF REJ	1.5 times the DC-coupled limit from DC to 30 kHz, attenuates signals above 30 kHz
	LF REJ	1.5 times the DC-coupled limits for frequencies above 1 kHz, attenuates signals below 1 kHz
Trigger Level Range	±4 divisions from center of screen	
Motor Trigger Level Range (THS720P)	0.1 to 5 divisions from center of screen, polarity depends on slope selection	
Trigger Level Accuracy, typical	±0.2 divisions, for signals having rise and fall times ≥20 ns	
SET LEVEL TO 50%, typical	Operates with input signals ≥50 Hz	

Oscilloscope Specifications (Cont.)

Internal Trigger		
Width Range, Pulse Trigger Type, typical	99 ns to 1 s, with resolution of 33 ns or approximately 1% of setting (whichever is greater)	
Width Tolerance Range, Pulse Trigger Type, typical	5%, 10%, 15%, or 20%	
Sensitivity, Video Trigger Type, typical	Composite video signal with negative sync pulse amplitude from 0.6 to 2.5 divisions	
Signal Formats and Field Rates, Video Trigger Type	Broadcast systems	Supports NTSC, PAL, and SECAM
	Interlaced	Trigger on selected line of odd field, selected line of even field, or any line
	Noninterlaced	Trigger on selected line or any line
	Line Rates	15 kHz to 65 kHz, in five ranges
Holdoff Range	495 ns to 10 s	

Oscilloscope Specifications (Cont.)

External Trigger	
External Trigger, Maximum Input Voltage	600 V _{RMS} CAT II, 300 V _{RMS} CAT III (refer to page A-19)
External Trigger Coupling	DC only
External Trigger Levels	+0.2 V or +2 V, selectable
External Trigger Sensitivity	500 mV _{p-p} from DC to 1 MHz, increasing to 1 V _{p-p} at 5 MHz, with signal centered at selected trigger level. TTL compatible using +2 V trigger level.
Measurements	
Cursors	Voltage difference between cursors (ΔV) Time difference between cursors (ΔT) Reciprocal of ΔT in Hertz ($1/\Delta T$) Phase difference between cursors (Δ Degrees)
Automated Measurements	Amplitude, Burst Width, Cycle Mean, Cycle RMS, Fall Time, Frequency, High, Low, Max, Mean, Min, Negative Duty Cycle, Negative Overshoot, Negative Width, Pk – Pk, Period, Positive Duty Cycle, Positive Overshoot, Positive Width, Rise Time, and RMS

Oscilloscope Specifications (Cont.)

Voltage and Current Harmonics (THS720P)				
Number of Harmonics	First 31 harmonics of signal with fundamental frequency between 30 Hz and 450 Hz			
Harmonics Amplitude Accuracy	Accuracies below are stated as a percent of the fundamental amplitude and are valid only if peak-to-peak amplitude is ≥ 4 divisions and number of averages ≥ 16			
	<i>Fundamental</i>	<i>2 – 11</i>	<i>12 – 21</i>	<i>22 – 31</i>
	$\pm 2.5\%$	$\pm 2.5\%$	$\pm 4\%$	$\pm 4\%$
Harmonics Phase Accuracy	<i>Fundamental</i>	<i>2 – 11</i>	<i>12 – 21</i>	<i>22 – 31</i>
	—	$\pm 4^\circ$	$\pm 8^\circ$	$\pm 8^\circ$
THD-F Measurement	Total harmonic distortion relative to the fundamental amplitude $THD-F = \frac{\sqrt{V_{RMS}^2 - V_f^2}}{V_f} \quad \text{or} \quad \frac{\sqrt{A_{RMS}^2 - A_f^2}}{A_f}$			
THD-F Accuracy	$\pm 4\%$			
THD-R Measurement	Total harmonic distortion relative to the RMS amplitude $THD-R = \frac{\sqrt{V_{RMS}^2 - V_f^2}}{V_{RMS}} \quad \text{or} \quad \frac{\sqrt{A_{RMS}^2 - A_f^2}}{A_{RMS}}$			
THD-R Accuracy	$\pm 4\%$			
Frequency Accuracy	$\pm 0.2\%$ of reading			

Oscilloscope Specifications (Cont.)

Power Measurements (THS720P)	
True Power Measurement	$W = \frac{1}{n} \times \sum_n V_n \times A_n$ <i>measured over an integral number of cycles that contain n sample points</i>
Apparent Power Measurement	$VA = V_{RMS} \times A_{RMS}$
Reactive Power Measurement	$VAR = \sqrt{(VA)^2 - W^2}$
Power Measurements Accuracy	±4% at the BNCs (not including probe uncertainty)
PF Measurement	$\text{Power factor (PF)} = \frac{\text{true power}}{\text{apparent power}} = \frac{W}{VA}$
θ Measurement	θ is the phase difference between the fundamental components of voltage and current. Positive angle means voltage leads current. Negative angle means voltage lags current.
DPF Measurement	<i>Displacement power factor (DPF) = cos θ</i>
Power Factor Measurements Accuracy	±0.05

Oscilloscope Specifications (Cont.)

With P6117 Probe				
Analog Bandwidth, DC Coupled	THS710A	THS720A	THS720P	THS730A
	60 MHz	100 MHz (90 MHz above 35° C)	100 MHz (90 MHz above 35° C)	200 MHz (180 MHz above 35° C)
Probe Attenuation	10X			
Maximum Voltage Between Probe Tip and Reference Lead	Overvoltage Category		Maximum Voltage	
	CAT II Environment (refer to page A–19)		300 V _{RMS}	
	CAT III Environment (refer to page A–19)		150 V _{RMS}	
	For steady-state sinusoidal waveforms, derate at 20 dB/decade above 900 kHz to 13 V _{RMS} at 27 MHz and above. Also, refer to Overvoltage Category description on page A–19.			
Maximum Voltage Between Reference Lead and Earth Ground Using P6117 Probe	30 V _{RMS} , 42.4 V _{pk}			
Maximum Voltage, Channel-to-Channel Reference Leads Using P6117 Probes	30 V _{RMS} , 42.4 V _{pk}			

Oscilloscope Specifications (Cont.)

With P5102 Probe				
Analog Bandwidth, DC Coupled	<i>THS710A</i>	<i>THS720A</i>	<i>THS720P</i>	<i>THS730A</i>
	60 MHz	100 MHz (90 MHz above 35° C)	100 MHz (90 MHz above 35° C)	100 MHz
Probe Attenuation	10X			
Maximum Voltage Between Probe Tip and Reference Lead, DC Coupled	<i>Overvoltage Category</i>		<i>Maximum Voltage</i>	
	CAT II Environment (refer to page A-19)		1000 V _{RMS}	
	CAT III Environment (refer to page A-19)		600 V _{RMS}	
Maximum Voltage Between Probe Tip and Reference Lead, AC Coupled	<i>Overvoltage Category</i>		<i>Maximum Voltage</i>	
	CAT II Environment		±1000 V _{DC}	
	CAT III Environment		±600 V _{DC}	
Maximum Voltage Between Reference Lead and Earth Ground	<i>Overvoltage Category</i>		<i>Maximum Voltage</i>	
	CAT II Environment		600 V _{RMS}	
	CAT III Environment		300 V _{RMS}	

DMM Specifications

General		
Resolution	3 ³ / ₄ digit, 4000 count full scale reading except as noted	
Input Resistance, AC or DC Voltage	10 M Ω \pm 10%	
Input Capacitance, AC or DC Voltage, typical	\leq 100 pF	
Maximum Voltage Between DMM and COM Inputs	<i>Overvoltage Category</i>	<i>Maximum Voltage</i>
	CAT I Environment (refer to page A-19)	640 V _{RMS} (880 V _{DC})
	CAT II Environment (refer to page A-19)	600 V _{RMS}
	CAT III Environment (refer to page A-19)	300 V _{RMS}
Maximum Voltage Between DMM or COM Input and Earth Ground	<i>Overvoltage Category</i>	<i>Maximum Voltage</i>
	CAT I Environment (refer to page A-19)	640 V _{RMS} (880 V _{DC})
	CAT II Environment (refer to page A-19)	600 V _{RMS}
	CAT III Environment (refer to page A-19)	300 V _{RMS}
DC Voltage		
Ranges and Resolution	<i>Range</i>	<i>Resolution</i>
	400.0 mV	0.1 mV
	4.000 V	1 mV
	40.00 V	10 mV
	400.0 V	100 mV
	880 V	1 V

DMM Specifications (Cont.)

DC Voltage		
✓ Accuracy	±(0.5% of reading + 5 counts)	
Normal Mode Rejection, typical	Rejects AC signals by >60 dB at 50 Hz or 60 Hz (user selectable)	
Common Mode Rejection, typical	Rejects AC signals by >100 dB at 50 Hz or 60 Hz (user selectable)	
AC Voltage		
Conversion Type	AC conversions are true RMS. The AC measurement is based on the AC and DC components of the signal as shown below: <i>AC Measurement = RMS(AC+DC) – DC</i>	
Ranges and Resolution	<i>Range</i>	<i>Resolution</i>
	400.0 mV	0.1 mV
	4.000 V	1 mV
	40.00 V	10 mV
	400.0 V	100 mV
	640 V	1 V
✓ Accuracy (40 Hz to 500 Hz)	<i>Input Waveform</i>	<i>Maximum Error</i>
	Sinusoidal waveforms with no DC component	±(2% of reading + 5 counts)
	Nonsinusoidal waveforms with crest factor up to 3 and no DC component	±(4% of reading + 5 counts)
Common Mode Rejection, typical	Rejects AC signals by >60 dB at DC, 50 Hz, and 60 Hz	

DMM Specifications (Cont.)

Ω/Resistance		
Ranges and Resolution	<i>Range</i>	<i>Resolution</i>
	400.0 Ω	0.1 Ω
	4.000 kΩ	1 Ω
	40.00 kΩ	10 Ω
	400.0 kΩ	100 Ω
	4.000 MΩ	1 kΩ
	40.00 MΩ	10 kΩ
✓ Accuracy	<i>Range</i>	<i>Maximum Error</i>
	All ranges except 40 MΩ	±(0.5% of reading + 2 counts)
	40 MΩ	±(2% of reading + 5 counts) for ≤60% relative humidity
Bias Voltage for Full Scale Resistance Measurement, typical	<i>Range</i>	<i>Full Scale Bias Voltage</i>
	400.0 Ω	350 mV
	4.000 kΩ	200 mV
	40.00 kΩ	350 mV
	400.0 kΩ	350 mV
	4.000 MΩ	400 mV
	40.00 MΩ	1.10 V
Open Circuit Voltage, typical	<i>Range</i>	<i>Open Circuit Voltage</i>
	400.0 Ω	4.8 V
	All other ranges	≤1.2 V

DMM Specifications (Cont.)**Continuity Check**

Indication, typical	An audible tone is generated when measured resistance is below 50 Ω
Open Circuit Voltage, typical	4 V
Test Current, typical	1 mA

Diode Check

Range	Zero to 2 V, measures forward voltage drop of semiconductor junction
Voltage Accuracy, typical	$\pm 25\%$
Open Circuit Voltage, typical	4 V
Test Current, typical	1 mA

Data Logger

Horizontal Scale Range	30 s/div to 24 hours/div (4 minutes to 8 days, full scale)
Vertical Zoom Range	2X, 5X, or 10X

General Specifications**Display**

Display Type	4.7 in (120 mm) diagonal liquid crystal
Display Resolution	320 horizontal by 240 vertical pixels
Display Contrast	Adjustable, temperature compensated
Backlight Intensity, typical	35 cd/m ²

General Specifications (Cont.)

RS-232 Interface			
Device Type	DTE, at RJ-45 connector		
Pinout	<i>Signal</i>	<i>Pin Number at 9-pin Null Modem Adapter</i>	<i>Pin Number at RJ-45 Connector</i>
	RTS out	1	8
	TXD out	2	6
	RXD in	3	5
	GND	5	4
	DTR out	6	3
	CTS in	7	7
	RTS out	8	8
	DSR in (not used)	4	2
	DCD in (not used)	7	1
Probe Compensator Output			
Output Voltage, typical	5.0 V into $\geq 1\text{ M}\Omega$ load		
Frequency, typical	1.2 kHz		

General Specifications (Cont.)

Power Source		
Battery	Replaceable Ni-Cd battery pack	
Battery Life, typical	Approximately two hours of continuous use from a full charge	
Low Battery Indication, typical	Low battery message first appears approximately ten minutes before the instrument powers off automatically	
Battery Saver	Standby Time-out and Backlight Time-out extend battery life. Time-out ranges from 1 minute to 15 minutes, or off.	
Battery Charging Time, typical	With TekScope instrument operating	9 hours
	With TekScope instrument turned off	9 hours
	In external charger	1.5 hours
External Power	<p>12 VDC nominal, center positive; Operates with input from 10 VDC to 15 VDC</p> <p>The DC INPUT disconnects itself automatically if >15 VDC is applied. If this occurs, disconnect the overvoltage and then reconnect to a voltage in the proper range.</p>	
Memory Retention, typical	All memory is retained indefinitely with battery removed and without external power applied.	
Fuse	This instrument has no user-replaceable fuses	

General Specifications (Cont.)

Environmental		
Temperature	Operating	–10° C to +50° C
	Nonoperating	–20° C to +60° C
Humidity	+40° C or below	≤95% relative humidity
	+41° C to +50° C	≤75% relative humidity
Altitude	Operating	2,000 m
	Nonoperating	15,000 m
Random Vibration	Operating	2.66 g _{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis
	Nonoperating	3.48 g _{RMS} from 5 Hz to 500 Hz, 10 minutes on each axis
Drop Resistance, typical	Survives a 30 in (76 cm) drop onto concrete with only cosmetic damage	
Moisture Resistance	Meets IEC529, IP43 with DC input hole plug, I/O port hole plug, and battery door installed.	

General Specifications (Cont.)

Mechanical		
Size	Height	8.53 in (217 mm)
	Width	6.95 in (177 mm)
	Depth	2.00 in (50.8 mm)
Weight	With battery installed	3.2 lbs (1.5 kg)
	With all standard accessories in soft carry case	7.5 lbs (3.4 kg)
	When packaged for domestic shipment	9.0 lbs (4.1 kg)
Certifications and Compliances		
Certifications	Listed UL3111-1 and CAN/CSA-C22.2 No. 1010.1-92, complies with EN61010-1 /A2	
Overvoltage Category	<i>Category</i>	<i>Examples</i>
	CAT III	A typical CAT III environment is the power distribution system within a building or factory. These environments are somewhat protected from lightning strikes, but susceptible to switching transients and other disturbances that may generate high voltage impulses.
	CAT II	A typical CAT II environment is the 120/240 V distribution system within a lab or office. These environments are fairly well protected from external high voltage disturbances.
	CAT I	A typical CAT I environment is circuitry inside electrical or electronic equipment that is powered by a power supply or a battery.

General Specifications (Cont.)

Certifications and Compliances																			
EC Declaration of Conformity	<p>Meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility and Low-Voltage Directive 73/23/ECC for Product Safety as amended by 93/68/EEC. Compliance was demonstrated to the following specifications as listed in the official Journal of the European Communities:</p> <table> <tr> <td>EN 55011 Class A:</td><td>Radiated and Conducted Emissions^{1 3}</td></tr> <tr> <td>EN 50081–1 Emissions:</td><td></td></tr> <tr> <td> EN 60555–2</td><td>Power Harmonics</td></tr> <tr> <td>EN 50082–1 Immunity:</td><td></td></tr> <tr> <td> IEC 801–2</td><td>Electrostatic Discharge</td></tr> <tr> <td> IEC 801–3</td><td>RF Radiated²</td></tr> <tr> <td> IEC 801–4</td><td>Fast Transients</td></tr> <tr> <td> IEC 801–5</td><td>Surge³</td></tr> <tr> <td>EN 61010–1 /A2 Safety</td><td></td></tr> </table> <p>¹ Tektronix-supplied ferrite bead required on instrument end of RS-232 cable</p> <p>² Performance criteria: ≤ 5.0 div increase in peak-to-peak noise (Sample acquisition mode, full bandwidth); otherwise, ≤ 1.0 div increase in peak-to-peak noise</p> <p>³ Applies to instrument operating from Tektronix-supplied AC adapter</p>	EN 55011 Class A:	Radiated and Conducted Emissions ^{1 3}	EN 50081–1 Emissions:		EN 60555–2	Power Harmonics	EN 50082–1 Immunity:		IEC 801–2	Electrostatic Discharge	IEC 801–3	RF Radiated ²	IEC 801–4	Fast Transients	IEC 801–5	Surge ³	EN 61010–1 /A2 Safety	
EN 55011 Class A:	Radiated and Conducted Emissions ^{1 3}																		
EN 50081–1 Emissions:																			
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IEC 801–4	Fast Transients																		
IEC 801–5	Surge ³																		
EN 61010–1 /A2 Safety																			
Adjustment Interval																			
The recommended adjustment interval is one year																			