Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

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Digitizing Oscilloscopes

HP 54501A, 54502A, 54503A, 54504A, 54510A

- Choice of 100 MHz, 250 MHz, 400 MHz, 500 MHz bandwidth
- Single-shot and repetitive signal performance
- Up to 4 channels
- Fully programmable
- Automatic pulse parameter measurements
- Dual-time-base windowing (except HP 54510A)
- Pan and zoom (HP 54510A)
- Automatic limit testing
- Three-year warranty
- Affordable

NEW

DESIGNED FOR HP-IB SYSTEMS

HP 54501A, 54502A, 54503A, 54504A, 54510A

The HP 54500 Family of Digitizing Oscilloscopes

A Family of Affordable Digitizing Oscilloscopes

There are 5 models in the HP 54500 family of digitizing oscilloscopes. For repetitive signals, the HP 54501A and 54503A offer 100 MHz and 500 MHz, respectively, and 4-channel, general-purpose performance. When single-shot capability is important, the HP 54502A and 54504A provide, respectively, 100 MHz and 50 MHz single-shot, and they both provide 400 MHz repetitive signal bandwidths. Using custom ADC design and other custom-integrated circuits, the HP 54510A boosts single-shot performance to 250 MHz as the first 1 gigasample-per-second portable oscilloscope. All these instruments deliver surprising performance at an affordable price.

The Digitizing Advantage

The HP 54500 family of oscilloscopes has features and functions that were previously available only on considerably higher-priced instruments. Like the HP 54100 series digitizing oscilloscopes, these instruments include all the digitizing advantages, such as autoscale, pushbutton hard-copy output, automatic measurements, nonvolatile setup and waveform memories,and full HP-IB programmability.

Affordable Automation

The HP 54500 family's fully programmable setup and data acquisition capabilities can be used with your HP Vectra PC, IBM PC, or other compatible personal computer. The built-in HP-IB interface, the simplified, self-documenting programming language, and the high data throughput rate provide a modestly priced yet powerful automated test system.

Easy to Use

All members of the HP 54500 family have a simplified user interface that makes them easy to operate. Adjustments are made with a single front-panel knob or numeric keypad. Automatic measurements, hard-copy output, and instrument setup are performed with simple keystrokes. Operation is intuitive and straightforward.

Advanced Logic and TV Triggering

Hewlett-Packard's advanced logic triggering is a standard feature in the HP 54500 family. Use it to trigger on a wide variety of user-specified conditions. Trigger on edge, pattern, state, or trigger-after-delay to capture such elusive events as timing violations or transient bus phenomena.

Select line and field for a variety of video waveforms. The 54500 family makes it easy to focus on the video information you need to capture.

Measurement Limit Test

Using measurement limit test, the HP 54500 family can automatically characterize a circuit or device over temperature or time—without human supervision. Specify upper and lower limits for any 3 of the instrument's automatic measurements, and leave it running unattended. If a measurement exceeds predefined limits, the violating waveform, measurements, and other display data can be automatically stored or transferred to an external printer or controller.

These instruments can automatically calculate maximum, minimum, average, and most recent values for all measurements, making device or circuit characterization even more accurate.

Dual-time-base Windowing[1]

Dual-time-base windowing lets you zoom in on fine details of the waveform you are measuring. Similar to the dual-delayed sweep feature found on some analog oscilloscopes, dual-time-base windowing gives you a time-expanded view of a smaller portion of the waveform, defined by you with the instrument's easy-to-use cursors.

Lightweight and Portable

Members of the HP 54500 family weigh only 22 pounds and are easily transported. Their small size allows them to fit easily in the trunk of a car, making them ideal for field applications. An optional soft carrying case is also available, as well as a sturdy transit case for safe shipment. See page 163 for accessories.

[1]The HP 54510A has "Pan and Zoom" in place of this feature (see page 149).

HP 54510A: 1 GSa/s Digitizing Oscilloscope

The HP 54510A is a 1 gigasample/second, 2-channel, portable digitizing oscilloscope with a memory depth of 8 k samples per channel. The HP 54510A retains all of the key features and user friendliness of other 54500 Series oscilloscopes. The HP 54510A adds waveform calculus, memory bar for pan and zoom, faster update rate, and faster throughput over HP-IB. The HP 54510A is an affordable high-performance oscilloscope for applications such as advanced hardware design and troubleshooting, high-energy research, and manufacturing test/ATE.

HP 54510A Specifications and Characteristics

Vertical (voltage)

Bandwidth: dc-coupled[1]	dc to 250 MHz (−3 dB) (300-MHz repetitive mode typical)
Switchable bandwidth limits	ac-coupled lower −3 dB frequency: 90 Hz LF reject lower −3 dB frequency: 450 Hz Bandwidth limit −3 dB frequency: 30 MHz
Rise time[2]	1.4 ns
Number of channels	2 (simultaneous)
Vertical sensitivity range	1 mV/div to 5 V/div
Vertical gain accuracy[3,4]	±1.25% of full scale
Vertical resolution[4]	8 bits over eight divisions (±0.4%) 10 bits via HP-IB w/averaging (±0.1%)
Maximum sample rate	1 GSa/s (2 ch. simultaneous)
Waveform record length[5]	8001 points (real time) 501 points (repetitive)
Input R (selectable)	1 MΩ ± 1% or 50 Ω ± 1%
Input C	7 pF nominal
Input coupling	ac, dc
Maximum input voltage	1 MΩ ± 250 V [dc + peak ac (<10 kHz)] 50 Ω: 5 V rms
Offset range	**Vertical Sensitivity** / Available Offset 1 mV to 50 mV/div: ± 2 V >50 mV to 250 mV/div: ± 10 V >250 mV to 1.25 V/div: ± 50 V >1.25 V to 5 V/div: ± 250 V
Offset accuracy[4]	±(1.0% of ch offset + 2% of full scale)
Dynamic range	±1.5 × full scale from center of screen
Channel-to-channel isolation	40 dB: dc to 50 MHz 30 dB: 50 MHz to 250 MHz
Voltage measurement accuracy[3,4]	
Dual cursor	±(1.25% of full scale +0.032 × V/div)
Single cursor	±(1.25% of full scale + offset accuracy + 0.016 × V/div)

Horizontal (time)

Time base range	1 ns/div to 5 s/div
Maximum time base resolution	20 ps
Delta-t accuracy[6]	
Repetitive	±(0.005% × delta t + 2(10⁻⁶) × delay setting + 100 ps)
Real time (single acquisition)	±(0.005% × delta t + 2(10⁻⁶) × delay setting + 150 ps)
Delay range (post-trigger)	10,000 × (s/div)
Delay range (pre-trigger)	Time/div Setting / Available Delay 100 ns to 5 s/div: −160 × (s/div) 1 ns to 50 ns/div: −8 μs

Triggering

Trigger sensitivity[4]	
Internal	
dc to 50 MHz	0.5 div
50 MHz to 250 MHz	1.0 div
External	
dc to 250 MHz	100 mv p-p into 50 Ω
Trigger pulse width (minimum)	
Internal	1.75 ns
External	2.8 ns
Trigger level range	
Internal: ± 1.5 × full scale from center screen	
External: ± 2 V	

Specifications valid for temperature range ± 10° C from software calibration temperature with eight or more averages selected.

[1] Upper bandwidth reduces by 2.5 MHz for each degree above 35° C.

[2] Rise times are calculated from $t_r = \frac{0.35}{\text{bandwidth}}$

[3] Accuracies decrease 0.08% of full scale per degree C from firmware calibration temperature and are valid for a temperature range ±10° C from firmware calibration temperature. These accuracies apply to both repetitive and real time (single acquisition modes).

[4] Expansion is used below 7 mV/div range, so resolution and accuracies are correspondingly reduced. Below 7 mV/div, full scale is defined as 56 mV.

[5] Available over HP-IB waveform record length is:
Real time: 8,000 points
Repetitive: 500 points

[6] Specification applies at the maximum sampling rate. At lower sampling rates specification should read ±(0.005% × delta t + 2(10⁻⁶) × delay setting + 0.15 × sample interval). For bandwidth limited signals tr = 1.4 × sample interval. Sample interval is defined as 1/sample rate. Specification also applies to those automatic measurements computing time intervals on similar slope edges (such as pos-pos, neg-neg).

Ordering Information

The HP 54510A Digitizing Oscilloscope comes with two HP 10430A 10:1 10 MΩ probes, a front-panel manual, a programming manual, a service manual, a miniature probe to BNC male adapter, a power cord, and a 3-year warranty.

	Price
HP 54510A 1 GSa/s Digitizing Oscilloscope	$10,950
Opt 908 Rackmount Kit (5061-6175)	+$250
Opt 910 Additional front panel, programming and service manuals	+$75
Opt 090 Delete probes	−$200

OSCILLOSCOPES
Digitizing Oscilloscopes
HP 54504A

HP 54504A 400 MHz, 200 MSa/s Digitizing Oscilloscope with 8-bit Vertical Resolution

The HP 54504A is a 400 MHz, 200 MSa/s sample rate, 2-channel digitizing oscilloscope with 8-bit A/Ds designed for both repetitive and single-shot signals. In repetitive mode, the HP 54504A has 400 MHz bandwidth. In real-time mode, its 200 MSa/s sample rate provides a single-shot bandwidth of 50 MHz. Like other members of the HP 54500 family, the HP 54504A has all the digitizing advantages of oscilloscopes that are much higher in price. Its high repetitive/single-shot bandwidth, ease of use, HP-IB programmability, and HP 54500 family general-purpose features make it a powerful tool for both manual and automated test applications.

HP 54504A Specifications and Characteristics

Vertical (voltage)	Real-Time	Repetitive
Bandwidth (−3 dB) dc-coupled	dc to 50 MHz	dc to 400 MHz[1,5]
Switchable bandwidth limits	ac-coupled lower −3 dB freq.: 10 Hz LF reject lower −3 dB freq.: 450 Hz Bandwidth limit: dc to 30 MHz	
Rise time[2]	7.0 ns	875 ps
Number of channels	2 (simultaneous)	
Vertical sensitivity range	1 mV/div to 5 V/div	
Vertical gain accuracy (dc)[3,4]	±1.50% of full scale	
Vertical resolution[4]	±0.4% of full scale (8 bit A/D) ±0.1% of full scale (10 bits with ≥ 8 averages)	
Maximum sample rate	200 MSa/s	25 MSa/s
Waveform record length[6]	Normal: 501 points Extended: 2001 points Time/div: 5 ns to 5 s/div; 2 ns/div; 1 ns/div Rec length: 501 pts; 401 pts; 201 pts	
Input R (selectable)	1 MΩ ±1% or 50 Ω ±1%	
Input C	7 pF nominal	
Input coupling	ac, dc	
Maximum input voltage	1 MΩ: ±250 V [dc + peak ac (<10 kHz)] 50 Ω: 5 V rms	
Offset range	Vertical sensitivity: 1 to 50 mV/div >50 to 250 mV/div >250 mV to 1.25 V/div >1.25 to 5V/div	Available offset: ±2 V ±10 V ±50 V ±250 V
Offset accuracy[4]	±(+1.0% of ch. offset + 2% of full scale)	
Dynamic range	±1.5 × full scale from center of screen	
Channel-to-channel isolation (with channels at equal sensitivity)	40 dB: dc to 50 MHz N/A: 50 to 400 MHz	40 dB: dc to 50 MHz 30 dB: 50 to 400 MHz
Voltage measurement accuracy (dc)[3,4]		
Dual cursor:	±(1.5% of full scale + 0.032 × V/div)	
Single cursor:	±(1.5% of full scale + offset accuracy + 0.016 × V/div)	

Horizontal (time)	Real-Time		Repetitive
Time base range	1 ns/div to 5 s/div		
Time base reference accuracy	0.01%		
Maximum time base resolution	50 ps		
Delta-t accuracy	±(2% × s/div + 0.01% × delta t + 1 ns)		±(2% × s/div + 0.01% × delta t + 250 ps)
Delay range (post-trigger)	Time/div setting: 50 ms to 5 s/div 100 μs to 20 ms/div 1 ns to 50 μs/div		Available delay: 40 × (s/div) 1s 10,000 × (s/div)
Delay range (pre-trigger)	All time/div settings: 40 × (s/div)	Time/div setting: 1μs to 5 s/div 10 ns to 500 ns/div 1 ns to 5 ns/div	Available delay: −40 × (s/div) −80 μs −10,000 × (s/div)

Triggering		
Internal trigger coupling	Line trigger Low-frequency reject (−3dB 50 KHz)	
Trigger sensitivity[4]		
Internal:		
dc to 50 MHz	0.5 div	0.5 div
50 MHz to 100 MHz	not applicable	0.5 div
100 MHz to 400 MHz	not applicable	1.25 div
External:		
dc to 250 MHz	100 mV peak-to-peak into 50 Ω	
Trigger pulse width (minimum):		
Internal:	14.0 ns	1.75 ns
External:	2.8 ns	2.8 ns
Trigger level range	Internal: ±1.5 × full scale from center of screen External: ±2V	

Power requirements: Voltage: 115/230 Vac, −25% to +15% 48 to 66 Hz. Power 350 VA maximum.
Weight: Net: approximately 10 kg (22 lb). Shipping: approximately 20 kg (44 lb).
Size: 194.3 mm H × 422.3 mm W × 355.6 mm D (7.65 in × 16.62 in × 14 in) Does not include front panel protrusions

Specifications valid for temperature range ±10°C from software calibration temperature with 8 or more averages selected.

[1]Upper bandwidth reduces by 2.5 MHz for each °C above +35°C.
[2]Rise times are calculated from:

$$t_r = \frac{0.35}{\text{bandwidth}}$$

[3]Vertical gain accuracy decreases 0.08% per °C from software calibration temperature.
[4]Expansion is used below 7 mV/div range so vertical resolution and accuracies are correspondingly reduced. Below 7mV/div full scale is defined as 56 mV.
[5]On time/div settings 1 μs/div and slower, bandwidth in repetitive mode is 50 MHz.
[6]Available over HP-IB waveform record length is:
Real-time normal: 500 points; extended: 2000 points.
Repetitive 10 ns to 5 s/div: 1024 pts.
5 ns/div: 1000 pts.
2 ns/div: 400 pts.
1 ns/div: 200 pts.

Ordering Information

The HP 54504A digitizing oscilloscope comes complete with two HP 10430A 10:1 10 MΩ probes, a front panel manual, a programming manual, a service manual, a power cord, and a three-year warranty.

		Price
HP 54504A Digitizing Oscilloscope	qty 1	$6,750 ☎
	qty ≥ 2 (each)	$6,549 ☎
Opt 908 Rack Mount Kit (5061-6175)		+$250
Opt 910 Additional Front-Panel, Programming, and Service Manual (54504-90901, 54504-90902)		+$75
Opt 090 Delete Probes		−$200

☎ For off-the-shelf shipment, call 800-452-4844.

HP 54503A 500 MHz 4-Channel Digitizing Oscilloscope

The HP 54503A is a 500 MHz, 4-channel digitizing oscilloscope designed primarily for repetitive signal applications. All 4 channels have full-featured attenuators. Like all of the HP 54500 family oscilloscopes, the 54503A features 2-channel simultaneous sampling and has the digitizing advantages of oscilloscopes much higher in price. Its 4 channels, 500 MHz repetitive signal bandwidth, ease of use, HP-IB programmability, and HP 54500 family general-purpose features make it a powerful tool for both manual and automated test applications.

HP 54503A Specifications and Characteristics

Vertical (voltage)

Bandwidth: (−3 dB) dc-coupled	
Repetitive:[1]	dc to 500 MHz
Single-shot:	dc to 2 MHz (based on 10 points per period of input signal)
Switchable bandwidth limits	ac-coupled lower −3 dB frequency: 10 Hz LF reject lower −3 dB frequency: 450 Hz Bandwidth limit upper − 3 db frequency: 30 MHz
Rise time	700 ps (calculated from: rise time = 0.35/BW)
Number of channels[2]	4
Vertical sensitivity range (all channels)	1 mV/div to 5 V/div
Vertical gain accuracy dc[3,4]	± 1.25%
Vertical resolution[4]	± 0.4% (8 bit A/D) ± 0.1% (10 bits via HP-IB with averaging)
Maximum sample rate	20 MSa/s
Waveform record length[5]	501 points (display) 1024 points (via HP-IB)
Input R (selectable)	1 MΩ ± 1% or 50 Ω ± 1%
Input C	7 pF nominal
Input coupling	ac, dc
Maximum input voltage	1MΩ: ± 250V [dc + peak ac <10 kHz] 50 Ω: 5V rms
Offset range	Vertical sensitivity: / Available offset: 1mV to 50 mV/div / ± 2V > 50 mV to 250 mV/div / ± 10V > 250 mV to 1.25 V/div / ± 50V > 1.25 V to 5 V/div / ± 250V
Offset accuracy[4]	± (2% of full scale + 0.5% of offset)
Dynamic range	(dc + peak ac) ± 1.5 × full scale from center of screen
Channel-to-channel Isolation	40 dB: dc to 100 MHz 30 dB: 100 to 500 MHz (with channels at equal sensitivity)
Voltage measurement accuracy	
Dual cursor:[3,4]	± (1.25% of full scale + 0.032 div)
Single cursor:	± (1.25% of full scale + offset accuracy + 0.016 div)

Horizontal (time)

Time base range	200 ps/div to 5 s/div
Time base reference accuracy	0.005%
Maximum time base resolution	20 ps
Delta-t accuracy	± 2% of s/div ± 0.005% × delta t ± 100 ps
Delay range (post-trigger)	Time/div setting: / Available delay: 50 ms to 5 s/div / 40 × (s/div) 100μ to 20 ms/div / 1 s 200 ps to 50 μs/div / 10,000 × (s/div)
Delay range (pre-trigger)	5 μs to 5s / −39.96 × (s/div) 10 ns to 2μs / −99.9 μs 200 ps to 5 ns / −10,000 × (s/div)

Triggering	**Real-time**	**Repetitive**
Trigger sensitivity		
≥ 5 mV/div:	dc to 100 MHz	0.063 of full-scale
	100 to 500 MHz	0.156 of full scale
< 5mV/div:	dc to 100 MHz	2.5 mV
	100 to 500 MHz	6 mV
Trigger pulse width (minimum)	1.5 ns	
Trigger level range	± 1.5 × full scale from center of screen	

Power Requirements: Voltage: 115/230 Vac, −25% to +15% 48 to 66 Hz. Power 350 VA maximum.
Weight: Net: approximately 10 kg (22 lb). Shipping: approximately 20 kg (44 lb).
Size: 194.3 mm H × 422.3 mm W × 355.6 mm D (7.65 in × 16.62 in × 14 in); does not include front panel protrusions

Specifications valid for temperature range ± 10° C from software calibration temperature with 8 averages selected and channel(s) in sensitivity range 1, 2, or 5.

[1]Upper bandwidth reduces by 2.5 MHz for each degree centigrade above +35° C.
[2]Simultaneous acquisition on two channels. Channels 1 and 4 are acquired simultaneously. If four channels are used, data is acquired alternately by channels 1 and 4, then 2 and 3.
[3]Accuracy reduces by ±0.08% for each degree centigrade away from software calibration temperature.
[4]Expansion is used below 7 mV/div range so vertical resolution and accuracies are correspondingly reduced.
[5]For single-shot via HP-IB, waveform record length is 500 points. In repetitive mode: 200 ps/div time base range, waveform record length is 100points. 500 ps/div time base range, waveform record length is 250 points. 1ns/div time base range, waveform record length is 500 points. ≥2 ns/div time base range, waveform record length is 1000 points.

HP 54503A Telecommunications Mask Template Test Option

Make telecom mask template measurements to ANSI, CCITT, and ISDN standards without using Mylar overlays. HP 54503A Option 001 automates many of the mask measurements that are time-consuming with analog oscilloscopes. Pass-fail accuracy and repeatability are improved through the use of automatic measurements, eliminating human error.

HP 54503A Option 001 Features

- 16 standard telecom signal mask templates stored in ROM
- Positive and negative templates
- Automatic triggering on positive "isolated ones"[6] in live traffic for many standard telecom signals
- Automatic best-fit of test signals to positive mask templates
- Automatic pass-fail comparison of mask templates with corresponding input signals
- Automatic storage, printing, or plotting of failed signals
- User-defined pass-fail tolerance
- Memory protection for user mask templates, waveforms, and front panel setups

For more information on this option and a technical data sheet, contact your local HP sales office (see page 684).

[6]For the HP 54503A Option 001, the term "isolated ones" is defined as a pulse sequence of at least two zeroes followed by a one, followed by at least two zeroes.

Ordering Information

The HP 54503A digitizing oscilloscope comes complete with two HP 10430A 10:1 10 MΩ probes, a front-panel manual, a programming manual, a service manual, a power cord, and a three-year warranty.

	Price
HP 54503A Digitizing Oscilloscope qty 1	$5,950 ☎
qty ≥ 2 (each)	$5,773 ☎
Opt 001 Telecommunications Mask Template Test Option	+$500
Opt 908 Rack Mount Kit (5061-6175)	+$250
Opt 910 Additional Front-Panel, Programming and Service Manual (54503-90901, 54503-90902)	+$75
Opt 090 Delete Probes	−$200

☎ For off-the-shelf shipment, call 800-452-4844.

OSCILLOSCOPES
Digitizing Oscilloscopes
HP 54502A

HP 54502A 400 MHz, 400 MSa/s Digitizing Oscilloscope

The HP 54502A is a 400 MHz, 400 MSa/s sample rate, 2-channel digitizing oscilloscope designed for both repetitive and single-shot signals. In repetitive mode, the HP 54502A has a 400 MHz bandwidth. In real-time mode, its 400 MSa/s sample rate provides a single-shot bandwidth of 100 MHz. Like other members of the HP 54500 family, the HP 54502A has all the digitizing advantages of oscilloscopes that are much higher in price. Its high repetitive/single-shot bandwidth, ease of use, HP-IB programmability, and HP 54500 family general-purpose features make it a powerful tool for both manual and automated test applications.

HP 54502A Specifications and Characteristics

	Real-Time	Repetitive
Bandwidth (−3 dB) dc-coupled	dc to 100 MHz	dc to 400 MHz[1,5]
Switchable bandwidth limits	ac-coupled lower −3 dB freq.: 10 Hz LF reject lower −3 dB freq.: 450 Hz Bandwidth limit: dc to 30 MHz	
Rise time[2]	3.5 ns	875 ps
Number of channels	2 (simultaneous)	
Vertical sensitivity range	2 mV/div to 5 V/div	
Vertical gain accuracy (dc)[3,4]	±2.0% of full scale	
Vertical resolution[4]	±1.6% of full scale (6 bit A/D) ±0.4% of full scale (8 bits with ≥ 8 averages)	
Maximum sample rate	400 MSa/s	25 MSa/s
Waveform record length[6]	Normal: 501 points Extended: 2001 points	Time/div — Rec length 5 ns to 5 s/div — 501 pts 2 ns/div — 401 pts 1 ns/div — 201 pts
Input R (selectable)	1 MΩ ±1% or 50 Ω ±1%	
Input C	7 pF nominal	
Input coupling	ac, dc	
Maximum input voltage	1 MΩ: ±250 V [dc + peak ac (<10 kHz)] 50 Ω: 5 V rms	
Offset range	Vertical sensitivity: — Available offset: 2 mV to 50 mV/div — ±2 V >50 mV to 250 mV/div — ±10 V >250 mV to 1.25 V/div — ±50 V >1.25 V to 5V/div — ±250 V	
Offset accuracy[4]	±(2 mV + 2% of ch. offset + 2.5% of full scale)	
Dynamic range	±1.5 × full scale from center of screen	
Channel-to-channel isolation	40 dB: dc to 50 MHz — 40 dB: dc to 50 MHz 30 dB: 50 to 100 MHz — 30 dB: 50 to 400 MHz (with channels at equal sensitivity)	
Voltage measurement accuracy (dc)[3,4]		
Dual cursor:	±(2.0% of full scale + 0.032 × V/div)	
Single cursor:	±(2.0% of full scale + offset accuracy + 0.016 × V/div)	
Time base range	1 ns/div to 5 s/div	
Time base reference accuracy	0.01%	
Maximum time base resolution	50 ps (maximum)	
Delta-t accuracy	±(2% × screen diameter + 0.01% × delta t + 500 ps)	±(2% × screen diameter + 0.01% × delta t + 250 ps)
Delay range (post-trigger)	Time/div setting: — Available delay: 50 ms to 5 s/div — 40 × (s/div) 100 μs to 20 ms/div — 1s 1 ns to 50 μs/div — 10 000 × (s/div)	

	Real-Time		Repetitive
Delay range (pre-trigger)	All time/div settings: 40 × (s/div)	Time/div setting: 1 μs to 5 s/div 10 ns to 500 ns/div 1 ns to 5 ns/div	Available delay: −40 × (s/div) −80 μs −10 000 × (s/div)
Internal trigger coupling	Line trigger Low-frequency reject (−3dB 50 KHz)		
Trigger sensitivity[4]			
Internal			
dc to 100 MHz	0.5 div	0.5 div	
100 MHz to 400 MHz	N/A	1.25 div	
External			
dc to 250 MHz	100 mV peak-to-peak into 50 Ω		
Trigger pulse width (minimum):			
Internal:	7.0 ns		1.75 ns
External:	2.8 ns		2.8 ns
Trigger level range	Internal: ±1.5 × full scale from center of screen External: ±2V		

Power requirements: Voltage: 115/230 Vac, −25% to +15% 48 to 66 Hz. Power 350 VA maximum.

Weight: Net: approximately 10 kg (22 lb). Shipping: approximately 20 kg (44 lb).

Size: 194.3 mm H × 422.3 mm W × 355.6 mm D (7.65 in × 16.62 in × 14 in); does not include front panel protrusions.

Specifications valid for temperature range ±10° C from software calibration temperature with 8 or more averages selected.

[1] Upper bandwidth reduces by 2.5 MHz for each °C above +35° C.

[2] Rise times are calculated from:

$$t_r = \frac{0.35}{\text{bandwidth}}$$

[3] Vertical gain accuracy decreases 0.08% per °C from software calibration temperature.

[4] Expansion is used below 7 mV/div range so vertical resolution and accuracies are correspondingly reduced. Below 7mV/div full scale is defined as 56 mV.

[5] On time/div settings 1 μs/div and slower, bandwidth in repetitive mode is 100 MHz.

[6] Available over HP-IB waveform record length is:
Real-time normal: 500 points, extended: 2000 points.
Repetitive 10 ns to 5 s/div: 1024 pts. — 2 ns/div: 400 pts.
5 ns/div: 1000 pts. — 1 ns/div: 200 pts.

HP 54502A Telecommunications Mask Template Test Option

Make telecom mask template measurements to ANSI, CCITT, and ISDN standards without using Mylar overlays. HP 54502A Option 001 automates many of the mask measurements that are time-consuming with analog oscilloscopes. Pass-fail accuracy and repeatability are improved through the use of automatic measurements, eliminating human error.

HP 54502A Option 001 Features

- 16 standard telecom signal mask templates stored in ROM
- Positive and negative templates
- Automatic triggering on positive "isolated ones"[1] in live traffic for many standard telecom signals
- Automatic best-fit of test signals to positive mask templates
- Automatic pass-fail comparison of mask templates with corresponding input signals
- Automatic storage, printing or plotting of failed signals
- User-defined pass-fail tolerance
- Memory protection for user mask templates, waveforms and front panel setups

For more information on this option and a technical data sheet, contact your local HP sales office (see page 684).

[1] For the HP 54502A Option 001, the term "isolated ones" is defined as a pulse sequence of at least two zeroes, followed by a one, followed by at least two zeroes.

Ordering Information

The HP 54502A digitizing oscilloscope comes complete with two HP 10430A 10:1 1 MΩ probes, a front panel manual, a programming manual, a service manual, a power cord, and a three-year warranty.

		Price
HP 54502A Digitizing Oscilloscope	qty 1	$7,450
	qty ≥ 2 (each)	$7,228
Opt 001 Telecommunications Mask Template Test Option		+$500
Opt 908 Rack Mount Kit (5061-6175)		+$250
Opt 910 Additional Front-Panel, Programming, and Service Manual		+$75
Opt 090 Delete Probes		−$200

☎ For off-the-shelf shipment, call 800-452-4844.

HP 54501A 100 MHz, 4-Channel Digitizing Oscilloscope

The HP 54501A is a 100 MHz, 4-channel digitizing oscilloscope designed primarily for repetitive signal applications. It has all the digitizing advantages of oscilloscopes much higher in price. Ease of use and general-purpose features such as TV trigger, dual-time-base windowing, advanced logic triggering, automatic measurements and full HP-IB programmability make it a powerful tool for both manual and automated test applications.

HP 54501A Specifications and Characteristics

Vertical (voltage)

Bandwidth

dc-coupled	
Repetitive:	dc to 100 MHz (−3dB)
Single-shot:	dc to 1 MHz (Based on 10 points per period of input signal.)
ac-coupled	
Repetitive:	10 Hz to 100MHz (−3dB)
Single-shot:	10 Hz to 1 MHz (Based on 10 points per period of input signal.)

Rise time 3.5 ns

Calculated from: Rise time = $\frac{0.35}{\text{bandwidth}}$

Number of channels 4 (2 + 2)
Channels 2 and 3 are limited attenuator inputs, optimized for digital signals.

Simultaneous channels 2 + 2
Channels 1 and 4 are acquired simultaneously. If four channels are used, data is acquired alternately by channels 1 and 4, then 2 and 3.

Vertical sensitivity range 5 V/div to 5 mV/div

Vertical gain accuracy (dc) ± 1.5%

Vertical resolution ± 0.4% – 8 bit A/D
(Since expansion is used for 5 mV/div range, A/D resolution is 7 bits 0.8% in that range.)
± 0.1% – 10 bits via HP-IB (with averaging)

Maximum sample rate 10 Megasamples/second

Memory depth 501 points (display)
1024 points (via HP-IB)
For single-shot via HP-IB, maximum memory depth is 501 points.
For 2ns/div time base range, memory depth is 200 points.
For 5ns/div time base range, maximum memory depth via HP-IB is 501 points.

Input RC (nominal) 1 MΩ, 16 pF

Input coupling ac, dc

Max input voltage ± 250 V [dc + peak ac (<10 kHz)]

Offset range

Sensitivity range:	Available offset:
5 to 50 mV/div	±2V
0.1 to 1 V/div	±20V
1 to 5 V/div	±200V

Offset accuracy ± 2% of offset ± 0.2 X (V/div)
± 0.075 division/Δ° C from calibration temperature

Dynamic range ± 16 divisions from center operating range for dc + peak ac input.

Channel-to-channel isolation 40 dB dc to 20 MHz
30 dB 20 MHz to 100 MHz
(with channels at equal sensitivity)

Voltage measurement accuracy

Single cursor:	gain accuracy + offset accuracy + A/D resolution
Dual cursor:	gain accuracy + (2 × A/D resolution) (single channel)

Horizontal (time)

Time base range 2 ns/div to 5 s/div

Time base accuracy 0.005%

Maximum time base resolution 100 ps

Delta-t accuracy 1 ns ± (5E-5) × delta t ± 0.02 × (t/div)
Delta-t accuracy for dual-cursor, single-channel measurement, or for channel-to-channel measurement after visual time null calibration has been performed.

Delay range (post-trigger)

Time base setting	Available delay
50 ms to 5 s	40 × (s/div)
100 μs to 20 ms	1 s
2 ns to 50 μs	10,000 × (s/div)

Delay range (pre-trigger)

10 μs to 5 s	−40 × (s/div)
20 ns to 5 μs	−200 μs
2 ns to 10 ns	−10,000 × (s/div)

Triggering

Trigger sensitivity

5mV/div:	dc to 20MHz, 0.1 × full-scale 20MHz to 100MHz, 0.25 × full-scale
All Other:	dc to 20MHz, 0.05 × full-scale 20MHz to 100MHz, 0.125 × full-scale

Trigger pulse width (minimum) 7 ns

Trigger level range ± 6 div from center

Specifications valid for temperature range ±10° C from calibration temperature with 8 averages selected and channel(s) in sensitivity range 1, 2, or 5.

Power requirements: Voltage: 115/230 V ac, −25% to +15% 48 to 66 Hz. Power 350 VA maximum.

Weight: Net: approximately 10 kg (22 lb). Shipping: approximately 20 kg (44 lb).

Size: 194.3 mm H × 422.3 mm W × 355.6 mm D (7.65 in × 16.62 in × 14 in). Does not include front panel protrusions.

Ordering Information

The HP 54501A digitizing oscilloscope comes complete with two HP 10432A 10:1 10 MΩ probes, an operating and programming manual, a service manual, a power cord, and a three-year warranty.

		Price
HP 54501A Digitizing Oscilloscope	qty 1	$3,990 ☎
	qty ≥ 2 (each)	$3,872 ☎
Opt 908 Rack Mount Kit (5061-6175)		+$250
Opt 910 One Additional Operating/Programming Manual (54501-90901) and One Additional Service Manual (54501-90902)		+$75
Opt 090 Delete Probes		−$200

☎ For off-the-shelf shipment, call 800-452-4844.