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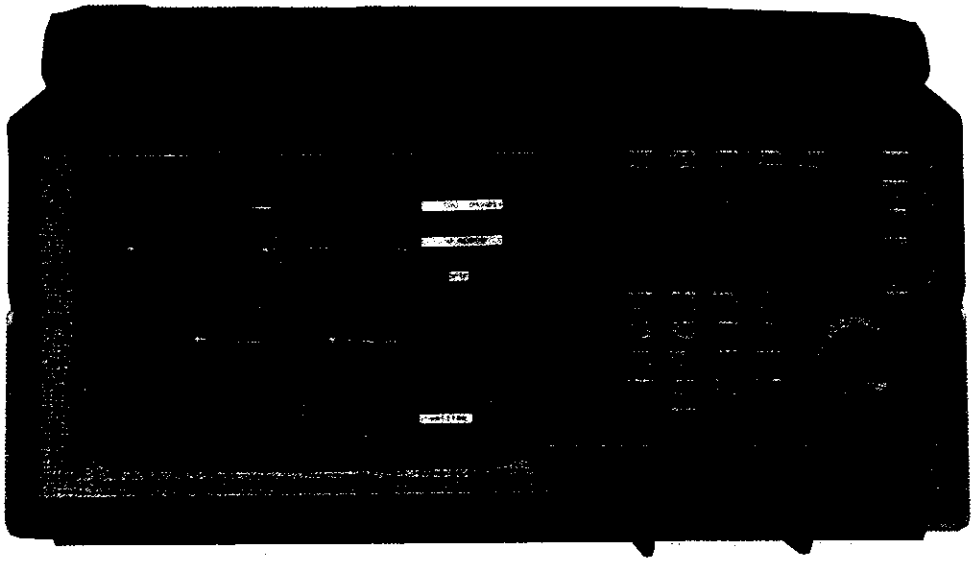
OSCILLOSCOPES

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).

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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

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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[1,3]
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[5]	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: 2 mV to 50 mV/div >50 mV to 250 mV/div >250 mV to 1.25 V/div >1.25 V to 5V/div		Available offset: ±2 V ±10 V ±50 V ±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 30 dB: 50 to 100 MHz (with channels at equal sensitivity)		40 dB: dc to 50 MHz 30 dB: 50 to 400 MHz
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: 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)
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: External:	7.0 ns 2.8 ns		1.75 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 00 automates many of the mask measurements that are time-consumin with analog oscilloscopes. Pass-fail accuracy and repeatability ar improved through the use of automatic measurements, eliminatin 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 she 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 least two zeroes, followed by a one, followed by at least two zeroes.

Ordering Information

The HP 54502A digitizing oscilloscope comes complete with t HP 10430A 10:1 1 MΩ probes, a front panel manual, a programm manual, a service manual, a power cord, and a three-year warrant

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

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