

OSCILLOSCOPES

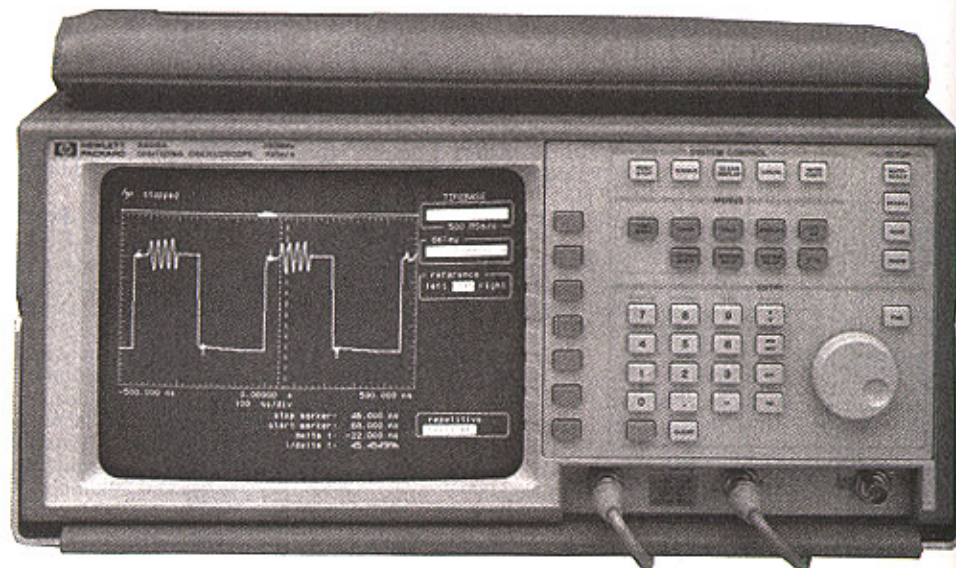
Digitizing Oscilloscopes

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



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*

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.

*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 M Ω ± 1% or 50 Ω ± 1%	
Input C	7 pF nominal	
Input coupling	ac, dc	
Maximum input voltage	1 M Ω ± 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 ¹	± (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 ⁹) × delay setting + 100 ps)	
Real time	± (0.005% × delta t + 2(10 ⁹) × delay setting + 150 ps)	
(single acquisition)	-	
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 ⁷		
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(10⁹) × delay setting + 0.15 × sample interval). For bandwidth limited signals $t_r = 1.4 \times \text{sample interval}$. 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 M Ω 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.

HP 54510A 1 GSa/s Digitizing Oscilloscope

Opt 908 Rackmount Kit (5061-6175)

Opt 910 Additional front panel, programming and service manuals

Opt 090 Delete probes

Price

\$10,950

+ \$250

+ \$75

- \$200