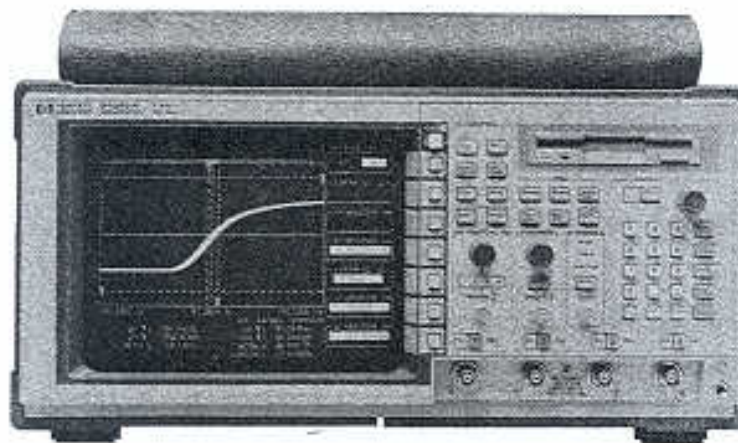


# OSCILLOSCOPES

## General-Purpose Oscilloscopes

HP 54501A, 54503A, 54504A, 54520A, 54522A, 54540A, 54542A

117



HP 54542A



### HP 54500 Family of Digitizing Oscilloscopes

The HP 54500 series of digitizing oscilloscopes offers you the performance you need at a price you can afford. Like Hewlett-Packard's other digitizing oscilloscopes, the HP 54500 series offers features such as auto-scale, pushbutton hardcopy, automatic measurements, nonvolatile setup and waveform memories, and full HP-IB programmability. The HP 54520A, 54522A, 54540A, and 54542A feature a new user interface with dedicated vertical, horizontal, and trigger knobs. These models have maximum sample rates from 500 MSa/s to 2 GSa/s, and offer several new features to make your testing easier, including an MS-DOS<sup>®</sup>-compatible disk drive.

### Reduce Hardware Design and Troubleshooting Time with HP 54500 Series Oscilloscopes

These powerful oscilloscopes speed hardware design and debugging with performance to match your needs: HP's advanced logic triggering is a standard feature in the HP 54500 series. 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. Some of the products within the HP 54500 series (see the table below) also offer glitch triggering to isolate and trigger on a glitch as narrow as 1 ns. To pinpoint infrequent events and determine their cause, use HP's advanced logic triggering in conjunction with up to four channels to quickly isolate anomalies. Triggering on an anomaly will allow you to

probe other points within the system during the failure condition to understand the cause of the problem quickly.

### Characterize Your Signals Accurately

Speed your characterization by using the automatic measuring capabilities offered by the HP 54500 series of oscilloscopes. You have a choice of up to 23 measurements based on standard or user-definable thresholds. Use measurement statistics to continuously display the maximum, minimum, and mean value for each measurement. Also available for characterization are the automask generator and waveform compare mode (see the table below). Put a reference waveform on screen and have the scope build a pass-fail mask around it with a test tolerance that you specify. Use the compare mode to test incoming waveforms against the mask. If the signal fails, the scope will store the failed waveform, with a time-date stamp, to either internal memory or an external printer or plotter. The fast Fourier transforms (FFTs), available in models shown in the table below, are also useful tools for characterizing signals. With the high sample rate of these oscilloscopes, you can now analyze your signal by using a single-shot FFT.

If you are characterizing several events separated in time, the sequential single-shot capability allows you to capture the pulses without dead time in between. You can then analyze the pulses individually or all together in normal, averaged, or envelope mode.

The HP 54500 Series of Digitizing Oscilloscopes

	HP 54501A	HP 54503A	HP 54504A	HP 54522A/54542A	HP 54520A/54540A
Bandwidth					
Repetitive	100 MHz	500 MHz	400 MHz	500 MHz	500 MHz
Single shot	1 MHz	2 MHz	50 MHz	500 MHz	125 MHz (2 ch), 250 MHz (1 ch)/125 MHz (4 ch), 250 MHz (2 ch), 500 MHz (1 ch)
Sample rate (max)	10 MSa/s	20 MSa/s	200 MSa/s	2 GSa/s	1 GSa/s/2 GSa/s
No. of channels	4 (2+2)	4	2	2/4	2/4
Memory/channel	501 samples	501 samples	2001 samples	32,768 samples	32,768 samples
Dual timebase window	Yes	Yes	Yes	No	No
Pan and zoom	No	No	No	Yes	Yes
Advanced logic trigger	Yes	Yes	Yes	Yes	Yes
Glitch trigger	No	No	No	Yes	Yes
Measurement limit test	Yes	Yes	Yes	Yes	Yes
Mask generator	No	No	No	Yes	Yes
Waveform compare	No	No	No	Yes	Yes
Sequential single shot	No	No	No	Yes	Yes
Automatic hard copy	Yes	Yes	Yes	Yes	Yes
Peak detect	No	No	No	Yes	Yes
FFT	No	No	No	Yes	Yes
1.44 MB disk drive	No	No	No	Yes	Yes
See page no.	121	121	120	118, 119	118, 119

4

# OSCILLOSCOPES

## General-Purpose Oscilloscopes

### HP 54501A, 54503A

121



### HP 54501A and 54503A Oscilloscopes

The HP 54501A and 54503A are four-channel oscilloscopes designed primarily for repetitive signal applications. These units feature two-channel simultaneous sampling, ease of use, dual-time-base windowing, advanced logic triggering, automatic measurements, and full HP-IB programmability, making them powerful tools for both manual and automatic testing.

The HP 54501A is a 100-MHz, four-channel oscilloscope with a 2 + 2 channel configuration. It offers the powerful digitizing features of the HP 54500 series including advanced logic triggering, at a very low price.

The HP 54503A is a 500-MHz, four-channel oscilloscope with four full-featured attenuators. It has two-channel simultaneous sampling and the features of other oscilloscopes that are much higher in price.

### Specifications and Characteristics

	HP 54503A	HP 54501A
<b>Vertical (voltage)</b>		
<b>Bandwidth (-3dB) dc-coupled</b>		
Repetitive	dc to 500 MHz <sup>2</sup>	dc to 100 MHz
Single-shot	dc to 2 MHz	dc to 1 MHz
<b>Switchable bandwidth limits (-3db)</b>		
ac-coupled	10 Hz	10 Hz
LF reject	450 Hz	
BW limit	30 MHz	
<b>Rise time</b>	700 ps	3.5 ns
Calculated from rise time = 0.35/BW		
<b>Number of channels<sup>3</sup></b>	4	4 (2 + 2) Channels 2 and 3 are limited attenuator inputs, optimized for digital signals.
<b>Vertical sensitivity range</b>	1 mV/div to 5 V/div	5 mV/div to 5 V/div
<b>Vertical gain accuracy (dc)<sup>4</sup></b>	± 1.25%	± 1.5%
<b>Vertical resolution<sup>5</sup></b>	± 0.4% (8-bit A/D) ± 0.1% (10 bits via HP-IB with averaging)	
<b>Maximum sample rate</b>	20 MSa/s	10 MSa/s
<b>Waveform record length</b>	501 points (display) 1024 points (via HP-IB)	
<b>Input B</b>	1 MΩ or 50 Ω (selectable)	1 MΩ
<b>Input C</b>	7 pF nominal	18 pF nominal
<b>Input coupling</b>	ac, dc	
<b>Maximum input voltage</b>	1 MΩ: ± 250 V (dc + peak ac < 10 Hz) 50 Ω: 5 V rms (54503A only)	
<b>Offset range</b>	Vertical sensitivity/div	Vertical sensitivity/div
	Available offset	Available offset
	1 mV to 50 mV ± 2 V	5 mV to 50 mV ± 2 V
	50 mV to 250 mV ± 10 V	0.1 V to 1 V ± 20 V
	250 V to 1.25 V ± 50 V	1 V to 5 V ± 200 V
	1.25 V to 5 V ± 250 V	
<b>Offset accuracy<sup>6</sup></b>	± (2% of full scale + 0.5% of offset)	
<b>Dynamic range (for dc + peak ac input)</b>	± 12 divisions from center of screen	
<b>Channel-to-channel isolation (with channels at equal sensitivity)</b>	40 dB: dc to 100 MHz 30 dB: 100 to 500 MHz	40 dB: dc to 20 MHz 30 dB: 20 to 100 MHz
<b>Horizontal (time)</b>		
<b>Time base range</b>	200 ps/div to 5 s/div	2 ns/div to 5 s/div
<b>Time base reference accuracy</b>	0.005%	
<b>Maximum time base resolution</b>	20 ps	100 ps

Delay range (post-trigger)	HP54503A		HP 54501A	
	Time/div setting	Available delay	Time/div setting	Available delay
50 ns to 5 s	40 (x/div)	40 (x/div)	50 ns to 5 s	40 (x/div)
	100 μs to 20 ms	1 s	100 μs to 20 ms	1 s
	200 ps to 50 μs	10,000 (x/div)	2 ns to 50 μs	10,000 (x/div)
Delay range (pre-trigger)	5 μs to 5 s	-40 (x/div)	10 μs to 5 s	-40 (x/div)
	10 ns to 2 μs	-100 μs	20 ns to 5 μs	-200 μs
	200 ps to 5 ns	-10,000 (x/div)	2 ns to 10 ns	-10,000 (x/div)
<b>Triggering</b>				
<b>Trigger sensitivity</b>				
≤ 5 mV/div	dc to 100 MHz	2.5 mV	dc to 20 MHz	4 mV
	100 to 500 MHz	6 mV	20 to 100 MHz	10 mV
	dc to 100 MHz	(0.06)	dc to 20 MHz	(0.06)
> 5 mV/div	100 to 500 MHz	full scale	20 to 100 MHz	full scale
		(0.156) full scale		(0.128) full scale
<b>Trigger pulse width (minimum)</b>				
	1.5 ns		7 ns	
<b>Trigger level range</b>				
	± 12 div from center of screen		± 6 div 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:** 422.3 mm W × 194.3 mm H × 355.6 mm D (16.62 in × 7.65 in × 14 in); does not include front panel protrusions.

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

<sup>1</sup>Upper bandwidth reduces by 2.5 MHz for each degree centigrade above + 35° C.

<sup>2</sup>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, and then 2 and 3.

<sup>3</sup>Expansion is used below 7 mV/div range on vertical resolution and accuracies are correspondingly reduced.

<sup>4</sup>Accuracy reduces by ± 0.08% for each degree centigrade away from software calibration temperature.

### HP 54503A Telecommunications Test Masks

Make telecom mask template measurements to ANSI, CCITT, and ISDN standards without using Mylar overlays. The HP 54503A 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 Telecommunications Test Masks Features

- Sixteen standard telecom signal mask templates stored in ROM
- Positive and negative templates
- Automatic triggering on positive "isolated ones" 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

<sup>1</sup>The term "isolated ones" is defined as a pulse sequence of at least two zeros followed by a one, followed by at least two zeros.

### Ordering Information

The HP 54501A and HP 54503A oscilloscopes come complete with two probes; operating, programming, and service manuals; a power cord; and a three-year warranty.

The HP 54501A includes HP 10432A 10:1 10 MΩ probes. The HP 54503A includes HP 10430A 10:1 1 MΩ probes.

	Price
<b>HP 54501A Oscilloscope</b>	\$4,820
<b>HP 54503A Oscilloscope</b>	\$6,560
<b>Opt 908 Rack Mount Kit (5061-6175)</b>	\$255
<b>Opt 910 Additional Front Panel, Programming, Manual and Service Manual</b>	\$77
(HP 54501A: 54501-90901, 54501-90906, 54501-90907)	
(HP 54503A: 54503-90901, 54503-90902, 54503-90908)	
<b>Opt 090 Delete Probes</b>	-\$200

For the most current price and product information, contact your local Hewlett-Packard sales office.