OSCILLOSCOPES & WAVEFORM ANALYZERS

Digitizing Oscilloscopes

Models 54100A/D, 54110D

- 1 GHz bandwidth
- Auto pulse parameter and time interval measurements
- Digital storage
- Available with color or monochrome display
- Pre-trigger viewing
- Logic triggering capability

HP 54110D

DESIGNED FOR HP-IB SYSTEMS

HP 54100A/D and HP 54110D

As the speeds of analog and digital logic continue to increase, board and system designers need to pay even closer attention to high-frequency and transmission-line characteristics of their circuits. Design requirements are rigorous. Subnanosecond technology creates narrow and elusive pulses.

High Bandwidth

The HP 54100/110 unite a powerful 1 GHz bandwidth with a random repetitive sampling technique for viewing rarely occurring narrow waveforms. These oscilloscopes have 0.002% time base accuracy, 50 ps aperture jitter, and 10 ps resolution for confident measurements of critical timing parameters in high-speed circuitry.

With random repetitive sampling, you can capture waveforms that occur thousands of screen diameters before the trigger event. This gives an effective memory depth of millions of bytes for finding causes of failures that occur long before the trigger.

High Resolution

Analyze pertubations within a waveform with high resolution. With vertical magnification and waveform averaging, small signal details can be viewed and measured with 10 bits of effective resolution.

Flexible Analysis

Only the HP 54100A/D and HP 54110D allow the display of either vertical channel versus the other. The 1 GHz bandwidth makes this feature valuable in measuring high-speed I-V device characteristics and transfer functions high-speed converters.

The HP 54100A/D

When a monochrome display is preferred, for example in a totally automatic test application, choose the HP 54100A or HP 54100D oscilloscope. These units require less rack height (7″) than the HP 54110D (8.75″) and have all of the same measurement features and specifications. The HP 54100A has one external trigger input, while the HP 54100D and HP 54110D have two.

Ordering Information	Price
HP 54100A 1GHz Digitizing Oscilloscope	$13,900
Opt W30 Service Extension	$325
HP 54100D 1GHz Digitizing Oscilloscope	$18,500
Opt W30 Service Extension	$440
HP 54110D 1GHz Digitizing Oscilloscope with color display	$22,900
Opt W30 Service Extension	$550

Input Pods and Probes	Price
HP 54001A 1 GHz miniature active probe pod	$765
HP 54002A 50 ohm BNC input pod	$130
HP 54003A 1-megohm, 10:1 probe pod	$665

A Choice of Input Pods and Probes

The HP 54100/110 inputs are configured with removable pods that can be chosen according to the application. Pods can be changed quickly and easily, and they occupy a minimum of storage space.

- 50 ohm inputs and probes for a wide variety of environments, without the expense of amplifier plug-ins.
- 1 GHz miniature active probes for densely packed, high-speed logic circuits.
- 1 Mohm probes for circuits sensitive to resistive loading.
- 50 ohm BNC inputs for measurements where terminated lines are important.
- 100:1 probes for extended dynamic range.

For more information on the HP 54100/110's probing system, please refer to page 64.

- 2 Gigasample/second, one channel when used with HP 54114A
- 500 MHz repetitive bandwidth
- 8k memory depth
- PaintJet color hardcopy output

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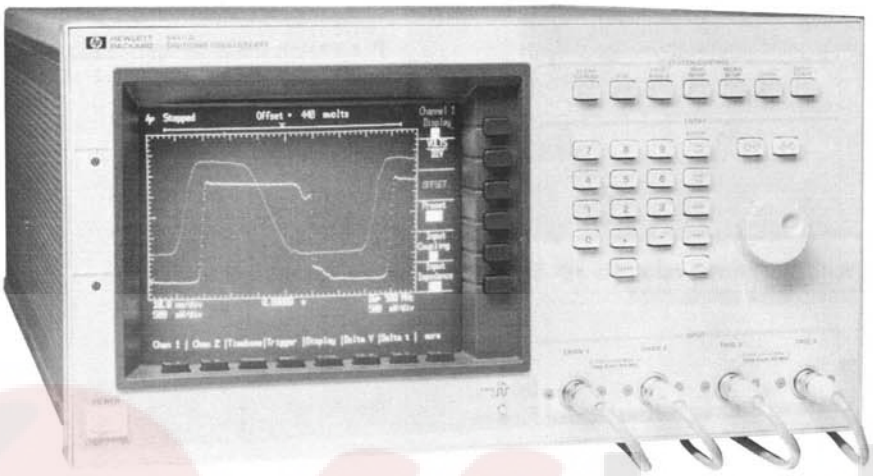


The HP 54111D features a 2 gigasample/second digitizing rate and a 500 MHz bandwidth.

HP 54111D: High-speed General-Purpose Scope

The HP 54111D is a 2 gigasample/second, one channel digitizing oscilloscope with a memory depth of 8k samples per channel. The HP 54111D retains all of the key features and user friendliness of the HP 54100/110 oscilloscopes . . . such as automatic measurements, autoscaling, cursors, and a color display. Plus, the HP 54111D adds features necessary for controlling and managing the added memory depth, such as scroll, zoom, and memory bar.

Key Contributions

- 2 gigasamples/second digitizing rate (maximum)
- 500 MHz bandwidth
- 8k memory per channel
- Up to eight bits of vertical resolution with bandwidth limits
- Two channels of simultaneous capture at up to 1 GSa/s
- Pre-trigger information
- Automatic measurements
- Fully HP-IB programmable
- Advanced Logic triggering capabilities
- Instant hardcopy output

General-purpose to Special Applications

With a 2 gigasample/second digitizing rate, the HP 54111D gives you the fastest sampling rate available in a general-purpose digitizing oscilloscope. However, the HP 54111D is much more than an instrument for capturing fast single-shot transients. With random repetitive sampling, this instrument provides a bandwidth of 500 MHz for high-speed circuit design and test.

In addition to its single-shot and repetitive capabilities, the HP 54111D provides flexible input coupling with a side dynamic range for viewing and analyzing a variety of signals. Use this scope for just about any general-purpose application from very slow to very high-speed repetitive or non-repetitive waveforms.

Memory Bar Simplifies Data Viewing

The HP 54111D provides 8k samples of memory per channel. This results in 16 screens of waveform information in each real-time or single-shot acquisition cycle. To simplify management of all this data, the HP 54111D displays a memory bar. The memory bar is displayed along the top edge of the graticule and shows the portion of memory being viewed relative to the entire memory record. In addition, the trigger point is also shown along the memory bar.

Ultra High Digitizing Rate

No longer do you need a manual analog storage oscilloscope to capture high-speed single-shot phenomena found in:

- high-speed pulse analysis
- nuclear test studies
- plasma discharge
- high voltage arcing
- high frequency bursts

All these single-shot events can be captured easily at 2 GSa/s, with 4 μs of data stored for review and analysis. (8 μs over HPIB).

High-speed ECL Design

Non-repetitive glitches appearing on the clock signal can be captured easily with the 500 MHz single-shot performance of the HP 54111D with the HP 54114A two gigasample/second test set. Four μs of pre-trigger data is invaluable for determining the cause of the glitch.

High-speed Semiconductor Design

Single-shot performance of 500 MHz permits you to measure the outputs from latches (i.e., one-time events for multiple clock periods in ECL circuits).

Laser and High Energy Research

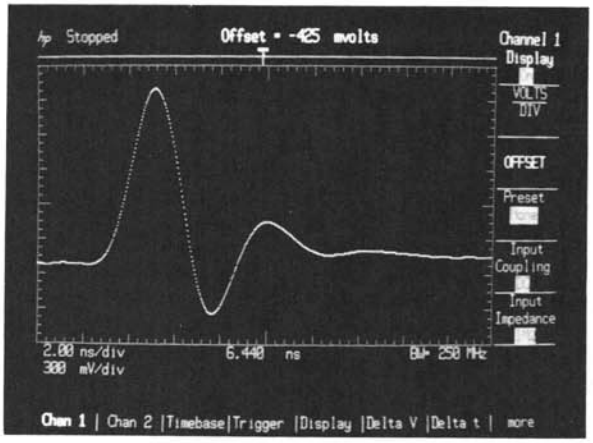
Photo detector pulses can be measured via single-shot capture using the 2 GHz sampling rate and built-in automatic measurements. Infinite persistence can also be used to show and measure maximum variations of the waveform to the 500 MHz bandwidth.

The HP 54111D's two simultaneous 1 gigasample/second channels give you the single-shot performance of the most advanced analog storage oscilloscopes, but with all the advantages and ease of use of a digitizing oscilloscope. And with a staggered over-sampling technique, the HP 54111D provides this single-shot performance with up to eight bits of non-blooming vertical resolution.

OSCILLOSCOPES & WAVEFORM ANALYZERS

Digitizing Oscilloscopes (cont'd)

Models 54100A/D, 54110D



With its 1 gigasample/second digitizing rate, the HP 54111D was able to capture this laser pulse single-shot.

Data Communications

Combine 1 gigasample/second digitizing rate with eight kbytes of memory depth per channel, and you have an invaluable tool for analyzing high-speed serial waveforms such as data communications or radar testing.

High Bandwidth Applications

Not only is the HP 54111D digitizing oscilloscope useful for single-shot phenomena, but it also samples repetitively, giving you 500 MHz bandwidth with high signal fidelity. Use this scope for just about any general-purpose application from very slow to very high-speed repetitive or non-repetitive waveforms.

Computer-aided Test

The HP 54111D has many features that make it an excellent tool in computer-aided test. Its repetitive bandwidth and digitizing rate allow it to cover a wide range of automatic measurement applications. In addition, this instrument has many features that enhance test throughput time, such as built-in automatic measurements, fast acquisition cycles, and deep memory.

Input Range and Conditioning

The HP 54111D has the widest input dynamic range and coupling capabilities of any of our digitizing oscilloscopes. The input sensitivity can be set from 1 mV/div to 5 V/div. In addition, all input coupling is internal and programmable. The selections include: ac, dc, 1 megohm, 50 ohms, and GND. These input signal conditioning features make the HP 54111D more general-purpose for the circuit designer and test engineer.

HP 54111D Specifications

Vertical (Voltage)

Channels: 2

	Single-shot		Repetitive
	two channel	one channel with HP 54114A	
Bandwidth	250 MHz	500 MHz	500 MHz
Transition Time	1.4 ns	700 ps	700 ps
Resolution/BW	8 bits/25 MHz, 7 bits/100 MHz 6 bits/250 MHz	8 bits/50 MHz 7 bits/200 MHz 6 bits/500 MHz#	6 bits, 8 bits with averaging

Gain Accuracy: ±2% of full-scale**

Dc Offset Accuracy: ±1.5% of setting

Measurement Accuracy

Single data point: ±gain acc ± offset acc ± resolution
Between data points on the same waveform: ±gain acc ±2 x resolution

Dc Offset Range: ±200 mV (1 mV/div to 4.9 mV/div)
±1 V (5 mV/div to 49 mV/div)
± 10 V (50 mV/div to .49 V/div)
± 100 V (.5 V/div to 5 V/div)

Input Coupling: ac/dc/dc-50 ohms/Gnd

Input Impedance: 1 Mohm at 6.5 pF or 50 ohm (dc)

Maximum Safe Input Voltage: ±40 V at 1 Mohm (dc + peak ac), 5 V rms at 50 ohms

Horizontal (Time)

Digitizing Rate: 1 gigasamples/second to 50 samples/second

Deflection Factor: 500 ps/div to 1 s/div

Memory Depth Per Channel: 8k (8 μs at 1 gigasample/second), single-shot only.

Pre-trigger Delay Range: −8 μs at timebase settings 50 us/div and less, increasing to −160 seconds at 1 s/div.

Post-trigger Delay Range: .16 seconds at timebase settings .5 μs/div and less, increasing to 10k seconds at 1 s/div.

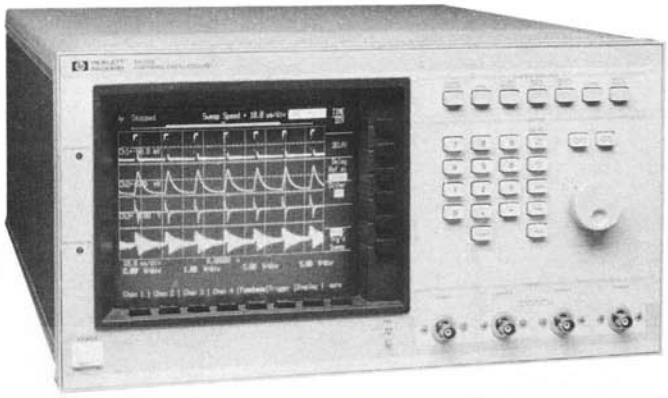
Time Measurement Accuracy	Single-shot	Repetitive
single channel	±300 ps ±.03% of reading	±100 ps ±.03% of reading
dual channel	±600 ps ±.03% of reading	±200 ps ±.03% of reading
Triggering		
Sources	Internal Chan 1,2	Ext. Inputs 3,4
Sensitivity		
single-shot	0.1 of full scale, dc to 200 MHz***	15 mV (1:1), dc to 200 MHz
repetitive	0.2 of full scale, 200 MHz to 500 MHz ***	45 mV (1:1), 200 MHz to 500 MHz
Trigger Level Range	±3 x full scale	±1 V (1:1)
Input Resistance	NA	1 Mohm
Maximum Input Safe Voltage	NA	±10 V, dc + peak ac
Input Operating Range	NA	±1 V(1:1), dc + peak ac

*Bandwidth for settings 1 mV/div to 4.9 mV/div is reduced to 150 MHz.
**When calibrated to probe tip using front panel calibration source. Applies to major ranges (5 mV/div, 10 mV/div, 20 mV/div, 50 mV/div, 100 mV/div, 200 mV/div, 500 mV/div, 1 V/div, and 2 V/div). All continuous settings between these ranges are ± 3% of full-scale.
***Applies to settings 5 mV/div and above.
#Raw Data

Ordering Information

	Price
HP 54111D 1 gigasample/second digitizing oscilloscope	$26,900
Opt W30 Service Extension	$675

- 64k memory depth per channel
- Quad 400 megasamples per second digitizers
- Four channels.
- 100 MHz bandwidth (single-shot and repetitive)
- PaintJet color hardcopy output



HP 54112D

DESIGNED FOR HP-IB SYSTEMS

HP 54112D: Four Channel Deep Memory Scope

The HP 54112D is a 400 megasample per second, four channel digitizing oscilloscope with 64k samples of memory depth per channel. The HP 54112D retains all the key features and the user friendliness of the HP 54100 series scopes. These features include automatic measurements, autoscaling, cursors, functional color display, scroll, zoom, and memory bar.

Key Contributions

- 400 megasamples per second digitizing rate
- 100 MHz repetitive and single-shot bandwidth
- 64k memory per channel
- Four channels of simultaneous capture at the full digitizing rate
- 160 μs of pre- or post-trigger information minimum
- Automatic measurements
- Fully programmable
- Advanced Logic triggering capabilities
- Instant hardcopy output

Automatic Test Environment

The English-like commands and logical structure of HPOL (Hewlett-Packard Oscilloscope Language) make programming the 54100 series scopes in computer aided test a much easier task. The learning curve is greatly reduced.

The four channels, built-in automatic measurements and very deep memory of the 54112D improve the throughput of ATE systems. Data that used to take many acquisitions passes can now be captured in one.

General Purpose Inputs

The fully programmable input impedance and coupling of the four channels allow the user to choose 1 megohm impedance AC or DC coupled or 50 ohm DC coupled on each channel.

HP 54112D Specifications

Vertical (Voltage)

Channels: 4

Bandwidth	Single-shot	Repetitive
dc-coupled	dc to 100 MHz	dc to 100 MHz
ac-coupled	10 Hz to 100 MHz	10 Hz to 100 MHz
Transition Time (10% to 90%)	3.5 ns (nominal)	3.5 ns (nominal)
Deflection Factor (full scale=8 div)	5 mV/div to 5 V/div continuous	
Resolution	6 bits	6 bits, 8 bits with averaging

Gain Accuracy: ±2% of full-scale*
Dc Offset Accuracy: ±1.5% of setting
Measurement Accuracy
single data point: ±gain acc±offset acc±resolution.
between data points on same waveform: ±gain acc ±2 x resolution.
Dc Offset Range: ±1 V (5 mV/div to 49 mV/div)
±10 V (50 mV/div to .49 V/div)
±40 V (.5 V/div to 5 V/div)
Input Coupling: ac/dc/dc-50 ohms
Input Impedance: 1 Mohms at 6.5 pf or 50 ohms
Maximum Safe Input Voltage: ±40 V at 1 Mohm (dc + peak ac)
5 V rms at 50 ohms

* When calibrated to probe tip using front panel calibration source. Applies to major ranges (5 mV, 10 mV, 20 mV, 50 mV, 100 mV, 200 mV, 500 mV, 1 V and 2 V). All continuous settings between these ranges are ±3% of full scale.

Horizontal (Time)
Digitizing Rate: 400 Megasamples/second to 50 samples/second.
Memory Depth Per Channel: selectable either 64k or 8k in single-shot only.
Pre-trigger Delay Range: −160 μsec at timebase settings of 125 ns/div and less, increasing to −1200 seconds at 1 second/div.
Post-trigger Delay Range: .16 sec at timebase settings .5 μsec/div and less, increasing to 10,000 seconds at 1 s/div.

Time Measurement Accuracy	
single channel	±500 ps ±.002% of reading
dual channel	±1 ns ±.002% of reading

Triggering
Sources: internal chan. 1,2,3,4 and external input.
Sensitivity
Internal: 0.1 of full-scale
External: 10 mV (1:1)
Trigger level range:
Internal: ±3 x full scale
External: ±5 V (1:1)
External trigger input
Input resistance: 200k ohms
Maximum input safe voltage: ±40 V dc + peak ac.
Input operating range: ±5 V (1:1) dc + peak ac.

Ordering Information

	Price
HP 54112D 4 channel 64k memory/channel digitizing oscilloscope.	$22,900
Opt W30 Service Extension	[illegible]