

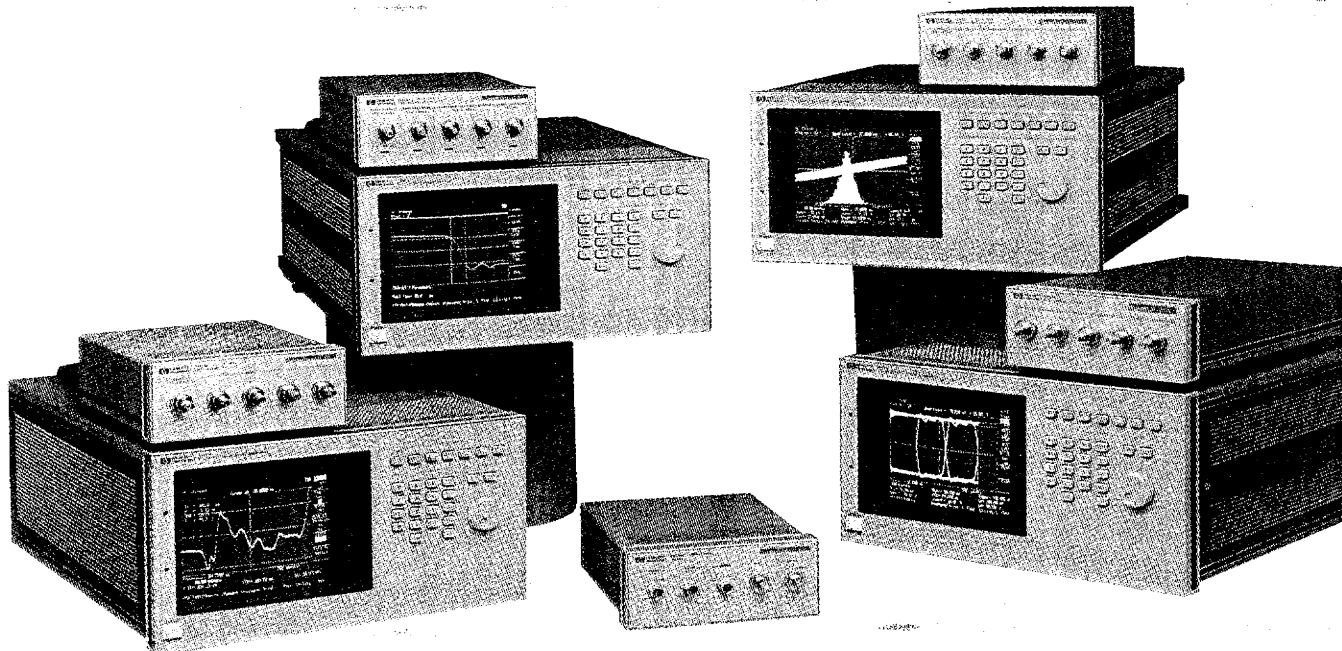
OSCILLOSCOPES

Digitizing Oscilloscopes

HP 54121T, 54122T, 54123T, 54124T

- 50/34-GHz, 34/20-GHz, 20/12.4-GHz, and 12.4/10-GHz bandwidths
- 0.25-ps timing resolution
- 2.5-GHz edge trigger

- 10-ps $\pm 0.1\%$ reading time interval accuracy
- Time domain reflectometry
- Normalization for removing test-system errors



The HP 54120 series of high-bandwidth digitizing oscilloscopes featuring digital feedback sampling for repeatable, accurate, and operator-independent measurement results.

HP 54120 Series High-Bandwidth Digitizing Oscilloscopes

The HP 54120 series of digitizing oscilloscopes combines high bandwidth, a time domain reflectometer (HP 54121T, HP 54123T, and HP 54124T only), four input channels, and superb stability in an easy-to-use, fully programmable oscilloscope that needs no manual loop gain adjustment. Whether your application involves a high-speed digital device, interconnect or circuit characterization, high-speed telecom analysis, or microwave design, the HP 54120 series of digitizing oscilloscopes gives you a new confidence in state-of-the-art measurements.

Key Contributions

- The HP 54120 series oscilloscopes offer:
- DC to 50-GHz bandwidth (HP 54124T), 7.0-ps rise time
 - DC to 34-GHz bandwidth (HP 54123T), 10.3-ps rise time
 - DC to 20-GHz bandwidth (HP 54121T), 17.5-ps rise time
 - DC to 12.4-GHz bandwidth (HP 54122T), 28.2-ps rise time
 - 10-ps time interval accuracy
 - 10 ps per division to 1 s per division
 - 0.4% vertical accuracy
 - 32- μ V vertical resolution
 - 1 mV per division to 80 mV per division (HP 54121T, HP 54123T, and HP 54124T)
 - 1 mV per division to 2.4 V per division (HP 54122T)
 - Fully HP-IB programmable
 - Four input channels
 - Step generator with 35-ps rise time and 1% flatness (HP 54121T, HP 54123T, and HP 54124T)
 - Reflection (TDR)/transmission (TDT) normalization* (HP 54121T, HP 54123T, and HP 54124T)
 - Time and voltage histograms

*Normalization uses the Bracewell transform, which is under license from Stanford University.

Picosecond Measurements

The HP 54120 series offers 0.25-ps time interval resolution, 10-ps time interval accuracy (1 ps typical). Combined with high bandwidth, these features reduce the scopes' contribution to error in digital timing measurements in semiconductor and computer applications.

Quantify Noise and Jitter

Time and voltage histograms, which quantify noise and jitter measurements, characterize the eye patterns in data communication applications. Eye height and width and the location of one and zero are easily found with histograms. And with no loop gain control, you can obtain repeatable results that do not vary between operators or between scopes over the entire input dynamic range of the oscilloscope.

Eliminate Reflections with TDR

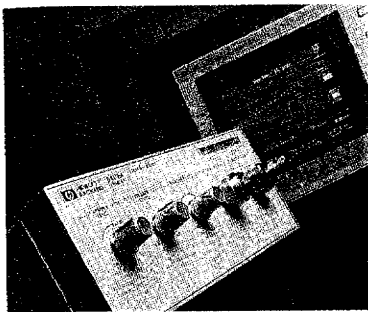
Ringings and waveform distortion can be reduced or eliminated using time domain reflectometry to locate and remove discontinuities in transmission line systems. Normalization allows analysis at a defined rise time for modeling discontinuities at speed.

Key Literature

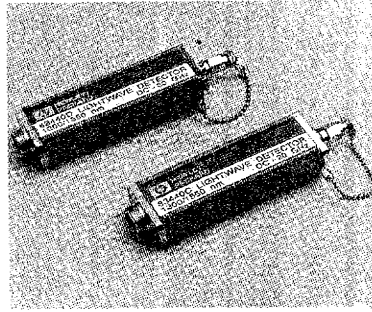
Model HP 54120 Series Digitizing Oscilloscope and TDR, p/n 5952-7084.
Model HP 54124T, 50-GHz Digitizing Oscilloscope, p/n 5952-1171.

OSCILLOSCOPE

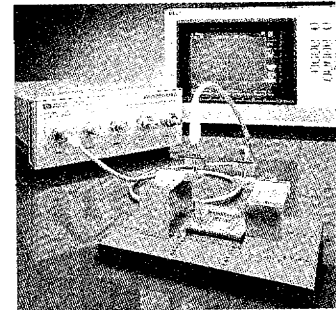
Accessories: HP 54750A and HP 54120 Series Digitizing Oscilloscope
HP 54006A, 54007A, 54008A, 54118



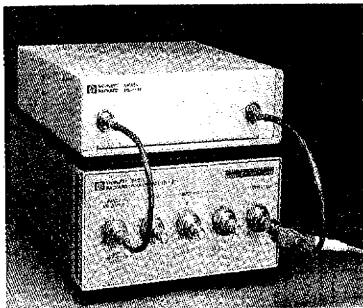
HP 54118A 18-GHz trigger



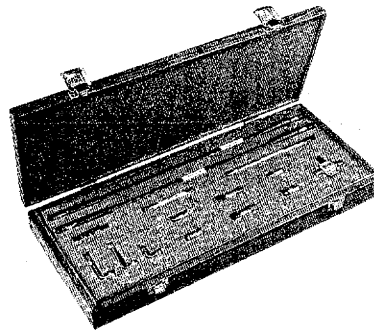
HP 83440C/D lightwave detector
O/E converters



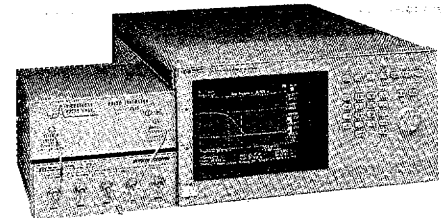
Inter-Continental Microwave
TDR launching probes



HP 54008A 20-GHz delay line



HP 54007A RF accessory kit



PicoSecond Pulse Labs Model 4015B

Hewlett-Packard has a large number of accessories for use with wideband digital sampling oscilloscopes. These accessories will help you build a multigigahertz system tailored to your unique needs.

HP 54118A, 500-MHz to 18-GHz Trigger Simple/Stable Triggering at Microwave Frequencies

For applications requiring more than 2.5-GHz trigger bandwidth, use the HP 54118A 18-GHz trigger. The HP 54118A gives your HP 54750/54120 series oscilloscope true event triggering from 500 MHz to 18 GHz, with less than 1.7 ps of rms jitter at 18 GHz. This powerful and versatile accessory extends the oscilloscope's measurement capabilities to applications in lightwave communications, pulsed RF, gigabit logic, pseudo-random bit-stream eye patterns, and other microwave signals.

HP 83441A/B/D SONET/SDH Reference Receivers

HP 83440C/D Nonamplified Lightwave Receivers

HP 83442A and HP 11982A Amplified Lightwave

Receivers

Wide-Range Optical-to-Electrical Converters for Characterizing SONET/SDH Optical Waveforms

Optical pulse and eye diagram measurements are easy with a variety of HP lightwave receivers. Designed especially for use with high-speed single-shot and sampling oscilloscopes, the HP 83441 series receivers provide the sensitivity and bandwidth necessary for pulse parameter measurements on SONET/SDH optical waveforms. The HP 83440 series of nonamplified lightwave converters provides exceptional pulse response and up to 32-GHz bandwidth to measure pulse parameters on high-speed optical signals. The HP 83442A and HP 11982A amplified receivers make pulse parameter measurements on optical signals that require amplification. See page 475 of this catalog for additional information.

Launching and Probing Solutions from Inter-Continental Microwave (ICM)

ICM offers both fixed- and variable-spacing 50- Ω TDR/TDT probe assemblies for launching a TDR pulse into transmission systems under test, such as in a PC board trace. These probes can be handheld or placed in a manipulator. The model A0112322 probe adjusts for spacings between 0.05 inch and 0.176 inch; the A0113734 probe adjusts

between 0.14 inch and 1.0 inch. ICM also offers a universal platform (UTP-3000) with accessories for component and package measurements. Contact Werner Schuerch at ICM, 1515 Wyatt Santa Clara, CA 95054-1524; (408) 727-1596.

HP 54008A 22-ns Delay Line Viewing the Trigger Signal

The HP 54008A delay line provides 22 ns of delay with a useful frequency response of 20 GHz. By adding this accessory to your HP 54750/54120 oscilloscope system, you will be able to view the trigger event. The HP 54008A has enough delay to view the trigger event with the HP 54118A trigger installed in the trigger path also.

HP 54007A Accessory Kit Low-Loss Measurements for HP 54120 Oscilloscope Systems

The HP 54007A accessory kit provides an assortment of parts: 3.5-mm connectors for low-loss measurements. This kit is highly recommended for low-loss reflection and transmission measurements. It also includes semi-rigid coax, formed for use with HP 11667B power splitter.

Contents of the HP 54007A Accessory Kit

17-in (43.18 cm) cable, APC 3.5 (f-f)	17-in (43.18 cm) cable, APC 3.5 (m-f)
Coaxial short, APC 3.5 (f)	Coaxial short, APC 3.5 mm (m)
50- Ω termination, APC 3.5 (m)	50- Ω termination, APC 3.5 (f)
7.5-cm "airline," APC 3.5 (m-f)	Power splitter, APC 3.5 mm (m-m)
6-cm semi-rigid "L," SMA (m-m)	3-cm semi-rigid "L," SMA (m-m)
6-dB attenuator, APC 3.5 (m-f)	40-dB attenuator, APC 3.5 (m-f)
Adapter, APC 3.5 mm (m-m)	

PicoSecond Pulse Labs 4015B 15-ps, 9 V External TDR or TDT Source

The PicoSecond Pulse Labs model 4015B pulse generator extends the TDR/TDT performance of the HP 54750/54120 series oscilloscopes. The pulse generator produces a 15-ps fall time with an amplitude of 9 V, which can be triggered by any HP 54120 series TDR generator. Contact Dr. Jim Andrews at PSPL, P.O. Box 44, Boulder CO 80306; (303)443-1249.

OSCILLOSCOPES

Digitizing Oscilloscopes/Ordering Information
 HP 54121T, 54122T, 54123T, 54124T

HP 54120 Series Specifications*

Vertical	HP 54121T	HP 54122T	HP 54123T	HP 54124T
DC-coupled bandwidth (-3 dB)				
High bandwidth				
Channel 1	18.0 GHz	12.4 GHz	20.0 GHz	20.0 GHz
Channel 2	20.0 GHz	12.4 GHz	34.0 GHz	34.0 GHz
Channel 3, 4	20.0 GHz	12.4 GHz	34.0 GHz	50.0 GHz
Low bandwidth				
Channel 1	12.4 GHz	10.0 GHz	12.4 GHz	12.4 GHz
Channel 2	12.4 GHz	10.0 GHz	18.0 GHz	18.0 GHz
Channel 3, 4	12.4 GHz	10.0 GHz	18.0 GHz	26.5 GHz
Rise time (calculated)				
High bandwidth				
Channel 1	19.4 ps	28.2 ps	17.5 ps	17.5 ps
Channel 2	17.5 ps	28.2 ps	10.3 ps	10.3 ps
Channel 3, 4	17.5 ps	28.2 ps	10.3 ps	7.0 ps
Low bandwidth				
Channel 1	28.2 ps	35.0 ps	28.2 ps	28.2 ps
Channel 2	28.2 ps	35.0 ps	19.4 ps	19.4 ps
Channel 3, 4	28.2 ps	35.0 ps	19.4 ps	13.2 ps
Noise (RMS)				
High bandwidth	2 mV	2 mV	2 mV	2 mV
Low bandwidth	1 mV	1 mV	1 mV	1 mV
DC accuracy (single voltage marker)	Average mode: ±0.4% of full-scale or marker reading (whichever is greater), ±2 mV × attenuation factor			
Dynamic range	±320 mV relative to channel offset	±320 mV × attenuation factor	±320 mV relative to channel offset	±320 mV relative to channel offset
Connectors	3.5 mm (m)	3.5 mm (m)	3.5 mm (m)	3.5 mm (m) and 2.4 mm (m)

TDR System (except HP 54122T)

	Oscilloscope/TDR Performance	Normalized Characteristics
Rise time	< 45 ps	Adjustable from larger of 10 ps or 0.08 × time/div to 5 × time/div
Flatness	< +1%, after 1 ns from edge; < +5%, -3% to 1 ns from edge	< 0.1%
Low level	0 V ± 2 mV	+200 mV ± 2 mV
High level	0 V ± 2 mV	+200 mV ± 2 mV

Time Base

Scale factor	10 ps/div to 1 s/div
Time interval accuracy (dual marker)	< 10 ps ± 0.1% of reading
Time interval resolution	0.25 ps or 0.02 div, whichever is larger
Time base delay	16 ns to the smaller of 1000 screen diameters or 10 s

External Trigger Input

Sensitivity	40 mVpp from dc to 100 MHz, increasing linearly to 200 mVpp from 100 MHz to 2.5 GHz
Pulse width	200 ps > 200 mV
High frequency reject	Trigger bandwidth reduced to approximately 100 MHz
Trigger and time base jitter (RMS)	< 2.5 ps + 5E-5 × delay setting
Connector	3.5 mm (m)

*For additional information on specifications, see the feature comparison chart on page 107 or the data sheets, HP p/n 5952-7084(D) and 5952-1171(D).

Accys Included

Items Included in Product Purchase

HP 54120B Includes:

Color mainframe, interface cable, power cord, and service manual for the HP 54120B

All HP 54120 Series Test Sets Include:

Operating and programming and service manuals

The HP 54121A, HP 54122A, or HP 54123A Test Sets Include:

Five adapters, APC-3.5 (f-f) (p/n 5061-5311)
 Five coaxial shorts, SMA (m) (p/n 0960-0055)
 One anti-static mat with wrist strap (p/n 9300-1484)

The HP 54124A Test Set Includes:

Three adapters, APC-3.5 (f-f) (p/n 5061-5311)
 Three coaxial shorts, SMA (m) (p/n 0960-0055)
 Two adapters, 2.4 mm (f-f) (p/n 11900B)
 Two coaxial caps, 2.4 mm (p/n 54124-24101)
 One anti-static mat with wrist strap (p/n 9300-1484)

RF Accessories Included with the HP 54121T, HP 54123T, or HP 54124T (p/n 54121-68701):

Five 20-dB attenuators, APC-3.5 (f-m) (HP 33340C Opt 020)
 Three 50-Ω cables, SMA (m-m) (p/n 8120-4948)
 Two SMA (m) to BNC (f) adapters (p/n 1250-1200)
 One 50-Ω termination, SMA (m) (p/n 1250-2153)
 One 50-Ω termination, SMA (f) (p/n 1250-2151)
 One coaxial short, SMA (f) (p/n 1250-2152)

RF Accessories Included with the HP 54122T (p/n 54122-68701):

One 20-dB attenuator, APC 3.5 (f-m) (p/n 33340C Opt 020)
 Three 50-Ω cables, SMA (m-m) (p/n 8120-4948)
 Five SMA (m) to BNC (f) adapters (p/n 1250-1200)

Ordering Information

Item	Price
HP 54120B Digitizing Oscilloscope Mainframe	\$13,650
HP 54121A 20-GHz Four-Channel Test Set	\$19,550
Opt 090 Delete RF Accessories	-\$1,800
HP 54123A 34-GHz Four-Channel Test Set	\$26,150
Opt 090 Delete RF Accessories	-\$1,800
HP 54124A 50-GHz Four-Channel Test Set	\$34,850
Opt 090 Delete RF Accessories	-\$1,800
HP 54122A 12.4-GHz Four-Channel Test Set	\$21,950
Opt 090 Delete RF Accessories	-\$700

HP 54121T, 54122T, 54123T, 54124T Digitizing Oscilloscope Systems

All HP 54120 Series digitizing oscilloscope systems consist of the HP 54120B and an HP 54120 series test set.

HP 54121T 20-GHz Digitizing Oscilloscope	\$33,200
Opt 090 Delete RF Accessories	-\$1,800
HP 54123T 34-GHz Digitizing Oscilloscope	\$39,800
Opt 090 Delete RF Accessories	-\$1,800
HP 54124T 50-GHz Digitizing Oscilloscope	\$48,500
Opt 090 Delete RF Accessories	-\$1,800
HP 54122T 12.4-GHz Digitizing Oscilloscope	\$35,600
Opt 090 Delete RF Accessories	-\$700

Accessories

HP 54006A 6-GHz Resistive Divider Probe	\$1,100
HP 54007A RF Accessory Kit	\$6,000
HP 54008A 22-GHz Delay Line	\$2,600
HP 54118A 18-GHz Trigger	\$10,800
Opt 090 Delete RF Accessories	-\$1,250
HP 10086A ECL Terminator	\$63

Accys not included
 AS with opt 090

Non-standard accys
 sold seperately