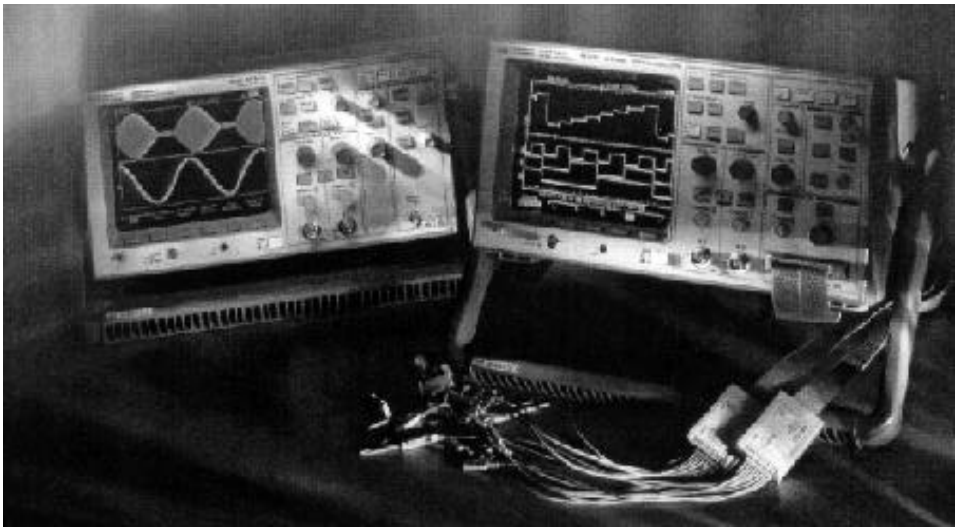
Hewlett Packard
HP 54645 Mixed-Signal Oscilloscope
Specifications



HP 54645A/D Oscilloscopes

Number of Channels	2 Analog—labeled 1 and 2 on HP 54645A, A1 and A2 on HP 54645D
Probes	10074A
Range	1 mV/div - 5 V/div
Vernier calibrated	± 3%
Position (offset) range	± 8 divisions minimum ± 2V on ranges < 200 mV/div ± 40V on ranges > 200 mV/div
Dynamic Input Range	Lesser of ± 8 div or ± 32 V
DC Vertical Gain Accuracy	
1, 2, 5 sequences	± 1.5% of full scale
Vernier	± 3% of full scale
DC Vertical Offset Accuracy	
serial prefix < US3707	± 1% of full scale ± 0.5% of position value
serial prefix ≥ US3707	± 1% of full scale ± 0.5% of position value (≥ 10 mV/div) ± 2% of full scale ± 0.5% of position value (< 10 mV/div)
Single-Cursor Accuracy	DC vertical gain accuracy + DC vertical offset accuracy ± 1/2 LSB (LSB=0.4% of full scale)
Dual-Cursor Accuracy	DC vertical gain accuracy ± 1 LSB
Bandwidth (3dB)	
Repetitive	100 MHz @ ≥ 10 mV/div (75 MHz @ < 10 mV/div)
Single shot	50 MHz
Bandwidth limit	(~ 20 MHz)
Rise Time (calculated)	~3.5 ns @ > 10 mV/div ~3.9 - 4.6 ns @ < 10 mV/div
Coupling	AC, DC, GND
AC Coupling Corner Frequency	~1.5 Hz
Input Impedance	1 MΩ, ± 1%, ~13 pF
Maximum Input	400 V (DC + peak AC)
Probe ID (HP & Tek compatible)	1X, 10X, 20X, 100X
ESD Tolerance	± 2 kV
Channel Isolation (with channels at the same v/div)	DC to 20 MHz > 40 dB 20 MHz to 100 MHz > 30 dB
Noise Peak-to-Peak	≤3Q levels or 1 mV, whichever is greater
Common Mode Rejection Ratio	20 dB @ 50 MHz
XY Bandwidth	
Bandwidth	100 MHz
Phase error @ 1 MHz	1.8 degrees

[1]Performance specification, tested by threshold test. See "Testing, Adjusting, and Troubleshooting."

HP 54645D Digital Channels

Number of Channels	16 Digital—labeled D0-D15
Threshold Selections	D0-D7, D8-D15
Maximum Input Voltage	± 40 V peak
Threshold Range	± 6.0 V in 50-mV increments
Threshold Accuracy[1]	±(100 mV + 3% of threshold setting)
Input Dynamic Range	± 10 V about threshold
Minimum Input Voltage Overdrive	Greater of 250 mV or 30% of input amplitude. Assumes threshold accuracy is perfect. Input voltage ≥ (threshold value + 30% * Input Voltage) when threshold > 0.84 V or < -0.84 V.
Minimum Input Voltage Swing	500 mV peak-to-peak
Input Capacitance	~8 pF
Input Resistance	100 k Ω, ± 2% at probe tip
Channel-to-Channel Skew	2 ns typical, 3 ns maximum
Predefined Thresholds	TTL=1.4 V, CMOS=2.5 V, ECL=-1.3V
Cable Specifications	Input Z 100 kΩ, ~8 pF, maximum input ± 40 V

[1]Performance specification, tested by threshold test. See "Testing, Adjusting, and Troubleshooting."

HP 54645A/D Oscilloscope Digitizing System

Vertical Resolution	8 bits on all settings except 7 bits on < 2 mV/div to 1 mV/div
Horizontal Resolution	500 (displayed points)
Sample Rate	200 MSa/s maximum per channel
Sample Rate Accuracy	0.01%
Peak Detection	5 ns digital
Averages	4, 8, 16, 32, 64, 128, 256, Smoothing—selectable
Memory Depth	1 M maximum
Data Throughput	Up to 3.0 million samples per second with sufficient trigger rate, and not using averaging, time base vernier, waveform math, or vectors.

HP 54645D Logic Digitizing System

Vertical Resolution	1 bit
Maximum Horizontal Resolution	500 (displayed points)
Sample Period	2.5 ns maximum
Glitch Detection	5 ns
8 channels	2.5 ns
16 channels	5 ns
Memory Depth per Channel	2 M maximum
Sample Period Accuracy	0.01%
Simultaneous Capture	Available on all channels.
≤8 channels on same pod	400 MSa/s
> 8 channels	200 MSa/s
any 2 channels on 2 pods	200 MSa/s
Acquire	
All channels off	channels 0-7 @ 400 MSa
0-7 on, 8-15 off	channels 0-7 @ 400 MSa
8-15 on, 0-7 off	channels 8-15 @ 400 MSa
All on	channels 0-15 @ 200 MSa
Data Throughput	Up to 1.5 million samples per second with sufficient trigger rate, and not using time base vernier.

HP 54645A/D Time Base

Range	2 ns/div to 50 s/div (HP 54645A) 5 ns/div to 50 s/div (HP 54645D)
Resolution	40 ps
Vernier	1-2-5 increments when Off, 25 minor increments between major settings when On
Reference Positions	Left, Center, Right
Random Repetitive	Stop freezes display
Pan and Zoom (Random Repetitive)	Shows only 1 trigger
Delay Range	
Pre-trigger (negative delay)	1 screen or 2.5 ms (the greater running repetitively)
Post-trigger (positive delay)	500 seconds
Scope delta t accuracy	(non-vernier ranges)
Same channel	± 0.01% reading ± 0.2% screen width ± 40 ps
Channel-to-Channel	± 0.01% reading ± 0.2% screen width ± 80 ps
Logic delta t accuracy	(non-vernier ranges)
Same channel	± 0.01% reading ± 0.2% screen width ± (1 logic sample period, 2.5 or 5 ns) ± chan-to-chan skew
Channel-to-channel	± 0.01% reading ± 0.2% screen width ± (1 logic sample period, 2.5 or 5 ns) ± chan-to-chan skew
Delay Jitter	10 ppm
RMS Jitter	0.025% screen width + 100 ps pp
Entrance to Delayed Sweep	Not allowed when using any analog channels and > 8 digital channels.

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HP 54645A/D Oscilloscope Trigger System

Sources	Channels 1 and 2, line, and EXT (on HP 54645A only)
Range (Internal)	± 6 div
Edges	Either rising or falling
Sensitivity	
< 10 mV/div, DC to 25 MHz	≤ 1 div or 2 mV
< 10 mV/div, 25 MHz to 100 MHz	≤ 1.5 div or 3 mV
> 10 mV/div, DC to 25 MHz	≤ .35 div or 3.5 mV
> 10 mV/div, 25 MHz to 100 MHz	≤ 1 div or 10 mV
Coupling	AC, DC, HF reject (~50 kHz), LF reject (~50 kHz), noise reject
Maximum Input	400 V (DC + peak AC)
Range (External)	± 18 V
Sensitivity	dc to 25 MHz, < 50 mv 25 MHz to 100 MHz, < 100 mV
Coupling	DC, HF reject (~50 kHz), noise reject
Modes	Auto, Auto level, Triggered (normal), Basic TV (Line, Field), pattern/logic (on HP 54645D only).
Holdoff Time	~200 ns to ~25 seconds

HP 54645A Oscilloscope Trigger System

Trigger System	Source, Mode/Coupling, Slope/Glitch Holdoff, Level Channels 1 and 2, Line, EXT (no trigger out) Either rising or falling (not both) Enhanced TV/Video Trigger, Basic TV (Line, Field)
Glitch Triggering	< and > duration, in range, out of range,
Minimum duration time	8 ns
Maximum duration time	100 seconds

HP 54645D Mixed-Signal Oscilloscope Trigger System

Trigger System	Edge, Pattern, Advancd, Mode/Coupling Holdoff, Analog Level Channels A1 and A2, and D0-D15 (no trigger out)
Edge Trigger	Edge on any one source, not multiple sources. Oscilloscope channels: rising or falling edge. Digital channels: rising or falling edge.
Pattern Trigger	High, Low, Don't Care on all sources; optionally combined with simple edge on one source. The simple edge is ANDed with highs, lows, and don't cares. If no edge is present, trigger is on entrance to pattern.
Advanced Trigger	Glitch, Adv Pattern, and TV types
Support	Basic TV (Line, Field)
Glitch Triggering	< and > duration, in range, out of range,
Minimum duration time	8 ns
Maximum duration time	100 seconds
Advanced Pattern	2 patterns and 2 edge terms. Logic operators AND, OR, Then Pattern entered, exited Edge occurs Pattern duration <, >, range

HP 54645A/D Setup Functions

Save/Recall	10 front-panel setups can be stored and recalled from non-volatile memory.
Trace Memory	Two volatile pixel memories allow storage of Autostore waveforms.
Channel Labels (HP 54645D only)	Each channel may be identified with a six-character label. Labels can be created from a front-panel label generator and a library of up to 75 preset and user-defined labels.
Probe Calibrator	Amplitude 5.0 V, Frequency ~1.2 kHz

HP 54645A/D Power Requirements

Line Voltage Range	88 to 250 Vac
Line Frequency	45 to 440 Hz
Power Usage	~90 W

HP 54645A/D General Characteristics

Environmental Characteristics	Meets the requirements of MIL-T-28800D for Type III, Class 3, Style D equipment as described here.	
	Safety	CSA Certification & IEC 1010
	Ambient Temperature	Operating: –10°C to +55°C Non operating: –51°C to +71°C
	Humidity[1]	Operating: 95% RH at 40°C for 24 h Non operating: 90% RH at 65°C for 24 h
	Altitude	Operating to 4,570 m (15,000 ft) Non-operating to 15,244 m (50,000 ft)
	Vibration	Operating 15 min along each of the three major axes; 0.025-in peak-to-peak displacement, 10 Hz to 55 Hz in 1-minute cycles. Held for 10 min at 55 Hz (4 g at 55 Hz).
	Shock	HP class B1 and MIL-T-28800 Style D, Class 3. Operating 30 g, 1/2 sine, 11-ms duration. 3 shocks/axis along major axis. Total of 18 shocks.
Physical	Size	35.26 cm wide x 17.27 cm high x 31.75 cm deep (without handle)
	Display	Viewable area: ~10 cm V x ~13 cm H
	Resolution	313 V x 512 H (pixels)
	Weight	~14 lbs
EMI Commercial	Meets FTZ 1046 class B.	
EMI, Military	MIL-T-28800D	Meets the requirements in accordance with paragraph 3.8.3 EMI Type III, and MIL-STD-461C as modified by table XII.
	CE01, CE03, CS01, CS02, CS06	
	RE01	15 dB relaxation to 0 kHz; exceptioned from 20 kHz to 50 kHz.
	RE02 (with Opt 2)	Full limits of class A1c and A1f.
	RE02 (no Opt 2)	10 dB relaxation from 14 kHz to 100 kHz
	RS02	Exceptioned
	RS03 (with Opt 1)	Slight trace shift from 80 MHz to 200 MHz

[1]Tested to Hewlett-Packard environmental specification section 758 for class B-1 products.

Option 005 General Performance Characteristics

Video Standards	NTSC, PAL, PAL-M, SECAM, Generic
Video Trigger Modes:	
Line	Field 1, Field 2, Alternate Fields
All Lines	
Field 1	Defined as that field with the 3 lines of vertical sync starting at line 4. Is actually color field 1 or color field 3.
Field 2	Defined as that field with the 3 lines of vertical sync starting at the midpoint of line 3. Is actually color field 2 or color field 4.
All Fields	

Option 005 Trigger System

Internal trigger	
Sensitivity	Performance remains unchanged
Coupling	Performance remains unchanged
Modes	Performance remains unchanged
Holdoff	Performance remains unchanged
TV triggering	Available on channels 1 and 2 only
TV line and field	0.5 division of composite sync for stable display
External trigger	Performance remains unchanged
Vertical output	
Connector	Rear panel BNC (f)
Source Impedance	50 Ω (nominal)
Signal source	Selected by internal trigger source
Amplitude	Approximately 90 mV_{p-p} into 50 Ω for a full-scale display at full bandwidth of the oscilloscope
TV Trigger output	Active only in TV mode
Connector	Rear panel BNC (f)
Amplitude	TTL
Pulse width	A function of TV trigger mode, Minimum approximately 5 µs in line modes to the width of a field in field modes
Delay from Vertical Output	Approximately 400 ns