

# Test Equipment Solutions Datasheet

Test Equipment Solutions Ltd specialise in the second user sale, rental and distribution of quality test & measurement (T&M) equipment. We stock all major equipment types such as spectrum analyzers, signal generators, oscilloscopes, power meters, logic analysers etc from all the major suppliers such as Agilent, Tektronix, Anritsu and Rohde & Schwarz.

We are focused at the professional end of the marketplace, primarily working with customers for whom high performance, quality and service are key, whilst realising the cost savings that second user equipment offers. As such, we fully test & refurbish equipment in our in-house, traceable Lab. Items are supplied with manuals, accessories and typically a full no-quibble 2 year warranty. Our staff have extensive backgrounds in T&M, totalling over 150 years of combined experience, which enables us to deliver industry-leading service and support. We endeavour to be customer focused in every way right down to the detail, such as offering free delivery on sales, covering the cost of warranty returns BOTH ways (plus supplying a loan unit, if available) and supplying a free business tool with every order.

As well as the headline benefit of cost saving, second user offers shorter lead times, higher reliability and multivendor solutions. Rental, of course, is ideal for shorter term needs and offers fast delivery, flexibility, try-before-you-buy, zero capital expenditure, lower risk and off balance sheet accounting. Both second user and rental improve the key business measure of Return On Capital Employed.

We are based near Heathrow Airport in the UK from where we supply test equipment worldwide. Our facility incorporates Sales, Support, Admin, Logistics and our own in-house Lab.

All products supplied by Test Equipment Solutions include:

- No-quibble parts & labour warranty (we provide transport for UK mainland addresses).
- Free loan equipment during warranty repair, if available.
- Full electrical, mechanical and safety refurbishment in our in-house Lab.
- Certificate of Conformance (calibration available on request).
- Manuals and accessories required for normal operation.
- Free insured delivery to your UK mainland address (sales).
- Support from our team of seasoned Test & Measurement engineers.
- ISO9001 quality assurance.

Test equipment Solutions Ltd  
Unit 8 Elder Way  
Waterside Drive  
Langley  
Berkshire  
SL3 6EP

T: +44 (0)1753 596000  
F: +44 (0)1753 596001

Email: [info@TestEquipmentHQ.com](mailto:info@TestEquipmentHQ.com)  
Web: [www.TestEquipmentHQ.com](http://www.TestEquipmentHQ.com)



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## HP 54600-Series Oscilloscopes

Analog feel and digital power for precise, accurate troubleshooting at an affordable price

- 60/100/150/500 MHz bandwidth
  - Choice of: high sample rates, 4 channels, deep memory, or color display models
  - Real-time vector display
  - Automatic measurements
  - Pre-trigger viewing, trace storage
  - Optional remote control/hard copy
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### Enhance your troubleshooting capability at an affordable price

The HP 54600 family of oscilloscopes provide the familiar, easy-to-use controls and interactive displays you've grown accustomed to on analog scopes. Yet, to solve your most difficult test problems, these scopes provide powerful digital features, such as pre-trigger viewing, waveform storage, and measurement automation. The eight models in this family give you the features and performance you need for confidence in your critical measurements, at a fraction of the price you'd expect to pay.

### Displays you can trust

HP 54600-series oscilloscopes feature real-time vector displays that give you a clear and accurate picture of your waveforms. Like analog oscilloscope displays, these enhanced displays give you waveform slew rate information at a glance, with brighter traces representing more slowly changing waveforms and dimmer traces representing more rapidly changing waveforms. These trace intensity differences give you the visual information you need to quickly assess waveform slew rate, for faster, more effective troubleshooting.



The multi-processor architecture of HP 54600-series oscilloscopes delivers a display update rate of over 500,000 points per second (up to 3 million points per second on the HP 54645A). This fast display update means the oscilloscope screen reflects changes in the waveform instantaneously, giving you the display responsiveness you need to make adjustments quickly and see complex waveforms accurately.

In vector mode, HP 54600-series oscilloscopes, provide a fast screen refresh rate of 60 times/second, regardless of the number of waveforms displayed, and minimal display blind time so you can capture and display infrequent events that other scopes might miss.

### Powerful digital features

The digital architecture of HP 54600-series oscilloscopes gives you a multitude of features that help you get your job done easier and faster:

- Pre-trigger viewing capability lets you view events that you'd miss with an analog scope. This feature lets you see what happened before the trigger event, so you can troubleshoot more effectively.
- Autoscale frees you from resetting the scope every time you move the probe from test point to test point. You simply hit the autoscale button and it sets voltage, time and trigger parameters for you.

- With autostore, the waveform displays at full brightness while all previously acquired waveforms remain on the scope's screen at half brightness. This lets you see a history of waveform activity while simultaneously viewing the live waveform. You can use this tool to analyze worst-case jitter and noise, or to permanently capture infrequent waveform anomalies.
- Automatic measurements of voltage, frequency and time, plus user-defined cursor measurements, make waveform characterization fast and easy.
- With peak detect, you won't have to worry about missing narrow glitches.

### **Choose from models designed to meet your needs**

The HP 54600 series includes eight models designed to meet your needs and your budget.

#### **HP 54600B 100 MHz oscilloscope**

With 100 MHz bandwidth, two input channels and sweep speeds from 2ns/div to 5 s/div, the HP 54600B is ideal for production, test, field service and education, or anywhere you need a solid, dependable scope.

#### **HP 54645A MegaZoom oscilloscope**

The HP 54645A oscilloscope brings the advantages of deep memory with none of the disadvantages usually associated with this class of oscilloscopes. The HP 54645A is a dual-channel 100 MHz oscilloscope with 200 MSa/s and a full 1 MB of memory behind each of its channels. Through the application of MegaZoom technology, this deep memory oscilloscope has a high speed/low dead time display and a highly responsive front panel. Unlike all other deep memory

scopes which force the user to choose between fast response and deep memory, the MegaZoom technology gives you a scope that is always fast and deep. Pan and zoom operation is as simple as turning the time/division knob. No special menus or controls are required to take full advantage of the HP 54645A's deep memory.

A powerful glitch trigger extends the power of the MegaZoom technology in solving your toughest troubleshooting problems. Simply set-up the desired pulse width that represents a worse case situation and after the scope finds it, pan and zoom through the deep waveform record to find out exactly what was going on in your circuit that caused the problem.

#### **HP 54602B 4-channel oscilloscope**

When you need more bandwidth than the HP 54600B and HP 54645A provide, take a closer look at the HP 54602B scope. You get the same capabilities as with the HP 54600B but with the added advantage of a 150 MHz bandwidth, 4 (2+2) channels and 1mV/div sensitivity.

#### **HP 54603B 60 MHz oscilloscope**

For colleges and universities with tight budgets, this scope is a great way to introduce students to the world of professional test equipment. Students can use the 60 MHz, 2-channel HP 54603B to understand circuit operation and learn standard measurement practices on the same type of equipment they are likely to use when they graduate. Sweep speed varies from 5 ns/div to 5s/div.

#### **HP 54610B 500 MHz oscilloscope**

Even though the HP 54610B is the least expensive 500 MHz oscilloscope on the market, it has analog performance that is similar

to higher cost oscilloscopes. The HP 54610B is ideal for many production line test applications. This 2-channel, delayed sweep scope offers a viewable external trigger and horizontal accuracy of +0.001%. Sweep speeds range from 1ns/div to 5s/div.

#### **HP 54615B 1 GSa/s oscilloscope**

With the HP 54615B you can capture narrow glitches and subtle details of your signal. This 2-channel scope combines 500 MHz bandwidth, 1 GSa/s sample rate and 1 nanosecond peak detection on both channels. The HP 54615B peak detection allows the scope to maintain a 1 GSa/s sample rate at all sweep speeds. A horizontal accuracy of 0.005% means you can make critical timing measurements with confidence.

#### **HP 54616B 2 GSa/s oscilloscope**

The top-of-the line HP 54616B offers the same benefits as the 54615B but with twice the sample rate—2GSa/s sampling rate, 500 MHz bandwidth and 1 nanosecond peak detection. Whether you need to verify a one time, 1 ns edge or view the envelope of a modulated waveform, the HP 54616B has the power and flexibility to get the job done. And, the intuitive front panel and responsive display makes this the scope of choice for everyday troubleshooting.

#### **HP 54616C color oscilloscope**

The HP 54616C color display makes viewing more interesting and easier when you are viewing multiple waveforms.

#### **3-year warranty**

All HP 54600-series oscilloscopes include a full 3-year warranty with optional 5-year warranty coverage. Each scope includes two 1.5 meter 10X voltage probes, a user's guide, and a power cord.

## Technical Specifications

HP 54600B, HP 54602B, HP 54603B, HP 54610B, HP 54615B, HP 54645A and HP 54616B/C Oscilloscopes

	HP 54603B	HP 54600B	HP 54645A	HP 54602B	HP 54610B	HP 54615B/16B/16C
<b>Bandwidth</b> CH 1 & 2 ac coupled CH 3 & 4	dc–60 MHz 10 Hz–60 MHz NA	dc–100 MHz 10 Hz–100 MHz NA	dc–100 MHz tt 1.5 Hz–100 MHz tt NA	dc–150 MHz* 10 Hz–150 MHz* dc–250 MHz	dc–500 MHz 10 Hz–500 MHz NA	dc–500 MHz 10 Hz–500 MHz NA
<b>Single-shot bandwidth</b>	dc–2 MHz	dc–2 MHz	dc–20 MHz	dc–2 MHz	dc–2 MHz	HP 54615B 250 MHz HP 54616B 500 MHz
<b>Number of channels</b>	2	2	2	4 (2 + 2)	2	2
<b>Sensitivity</b> CH 1 & 2 CH 3 & 4	2 mV/div to 5 V/div NA	2 mV/div to 5 V/div NA	1 mV/div to 5 V/div NA	1 mV/div to 5 V/div 0.1 & 0.5 V/div	2 mV/div to 5 V/div NA	2 mV/div to 5 V/div NA
<b>dc gain accuracy</b>	±2%	±1.5%	±1.5%	±1.5%	±2%	±2%
<b>Rise time (calculated)</b> CH 1 & 2 CH 3 & 4	<5.83 ns NA	<3.5 ns NA	<3.5 ns NA	<2.33 ns <1.4 ns	<700 ps NA	<700 ps NA
<b>Input impedance</b>	1 MΩ, approx. 13 pF	1 MΩ, approx. 13 pF	1 MΩ, approx. 13 pF	1 MΩ, approx. 13 pF	1 MΩ, approx. 9 pF or 50 Ω selectable	1 MΩ, approx. 9 pF or 50 Ω selectable
<b>Input coupling</b> CH 1 & 2 CH 3 & 4	dc, ac or ground NA	dc, ac or ground NA	dc, ac or ground NA	dc, ac or ground dc, ground	dc, ac or ground NA	dc, ac or ground NA
<b>Maximum input (dc + peak ac)</b>	400 V	400 V	400 V	400 V	250 V or 5 Vrms in 50 Ω mode	250 V or 5 Vrms in 50 Ω mode
<b>Timebase range (main &amp; delayed)</b>	5 s/div to 5 ns/div	5 s/div to 2 ns/div	50 s/div to 2 ns/div	5 s/div to 2 ns/div	5 s/div to 1 ns/div	5 s/div to 1 ns/div
<b>Trigger sources</b>	CH 1, 2, line, or ext.	CH 1, 2, line, or ext.	CH 1, 2, line, or ext.	CH 1, 2, 3, 4, or line	CH 1, 2, line, or ext.	CH 1, 2, line, or ext.
<b>Horizontal accuracy</b>	±0.01%	±0.01%	±0.01%	±0.01%	±0.01%	±0.005%
<b>Horizontal resolution</b>	100 ps	100 ps	40 ps	100 ps	100 ps	20 ps
<b>Trigger sensitivity</b> dc to 25 MHz dc to max. bandwidth	0.35 div or 3.5 mV 1 div or 10 mV	0.35 div or 3.5 mV 1 div or 10 mV	0.35 div or 3.5 mV 1 div or 10 mV	0.35 div or 0.7 mV 1 div or 2 mV**	0.5 div or 2.5 mV*** 1 div or 5 mV†	0.5 div or 3.5 mV*** 1 div or 7 mV†
<b>Maximum sample rate</b> single shot repetitive	20 MSa/s 10 GSa/s	20 MSa/s 10 GSa/s	200 MSa/s >10 GSa/s	20 MSa/s 10 GSa/s	20 MSa/s 10 GSa/s	HP 54615 1 GSa/s HP 54616 2 GSa/s >10 GSa/s
<b>Record length (maximum)</b> single shot	4,000 points 2,000 points	4,000 points 2,000 points	1M points 1M points	4,000 points 2,000 points	4,000 points 2,000 points	5,000 points 5,000 points
<b>Max. display update rate</b>	1,500,000 points/sec	1,500,000 points/sec	3,000,000 points/sec	1,500,000 points/sec	1,500,000 points/sec	500,000 points/sec
<b>Resolution</b>	8 bits					
<b>Power</b>	Voltage: 100–240 Vac, 48–440 Hz, 300 VA maximum					
<b>Net weight</b>	Approx. 6.2 kg (14 lbs)					
<b>Size (excl. handle)</b>	172 mm H x 322 mm W x 317 mm D (6.8 x 12.7 x 12.5 in)					
<b>Warranty</b>	3 years					

\* Maximum bandwidth on CH 1 & 2 is 100 MHz at 1, 2, and 5 mV/div.

\*\* HP 54602B, for ranges 1, 2, and 5 mV/div, sensitivity between 25 MHz and 100 MHz on CH 1 & 2 is 2 div or 4 mV.

\*\*\* Trigger sensitivity from dc to 100 MHz.

† Trigger sensitivity from 100 MHz to max. bandwidth.

tt Maximum bandwidth on CH 1 & 2 is 75 MHz at 1, 2 and 5 mV/div.



<b>Vertical System</b>	<b>(HP 54600B, 54645A, 54602B, 54603B)</b>
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Bandwidth Limit	≈ 20 MHz
Inversion	CH 1 & CH 2
CMRR	≈ 20 dB at 50 MHz
Dynamic Range	± 8 div from center screen
Input R&C	1 MΩ, ≈ 13 pf
Maximum Input	400 V (dc + peak ac)
<b>Math Functions</b>	CH 1 + or – CH 2

<b>Cursor Accuracy [1][2]</b>	
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Single Cursor	Vert. Acc. ± 1.2% of full scale, ± 0.5% of position value
Dual Cursor	Vert. Acc. ± 0.4% of full scale

<b>Vertical System</b>	<b>(HP 54610B, 54615B, 54616B/C)</b>
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Bandwidth Limit	≈ 30 MHz
Inversion	CH 1 & CH 2
CMRR	≈ 20dB at 50 MHz
Dynamic Range	± 12 div from center screen
Input R&C	1 MΩ, ≈ 9 pf or 50Ω selectable
Maximum Input	250 V (dc + peak ac) or 5 Vrms in 50Ω mode
50Ω Protection	Protects 50Ω load from excessive voltage
Time Skew	Adjustable over a range of ± 25ns to remove effects of cabling
Probe Sense	Automatic readout of 1X, 10X, 20X, 50X and 100X probes
<b>Math Functions</b>	CH 1 + or – CH 2

<b>Cursor Accuracy [1][2]</b>	
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Single Cursor	Vert. Acc. ± 1.2% of full scale, ± 0.5% of position value
Dual Cursor	Vert. Acc. ± 0.4% of full scale

<b>Horizontal System</b>	
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<b>Cursor Accuracy</b> (Δt & 1/Δt) [3]	± 0.01% ± 0.2% of full scale ± 200 ps
<b>Delay Jitter</b>	10 ppm 1 ppm (54615B, 54616B/C)
<b>Pretrigger Delay</b> (Negative time)	≥ 10 div
<b>Posttrigger Delay</b> (Trigger to start of sweep)	at least 2,560 div or 50 ms. Not to exceed 100 s.

<b>Delayed Sweep</b>	
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<b>Main Sweep</b>	<b>Delayed Sweep</b>
5 s/div to 10 ms/div	up to 200X main
5 ms/div and faster	up to 2 ns/div
54610B, 15B/16B/16C	up to 1ns/div

<b>Trigger System</b>	
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<b>Coupling</b>	ac, dc, LF reject, HF reject, & noise reject. LF & HF: -3db at ≈ 50 kHz
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<b>Modes</b>	Auto, Autolevel, Normal, Single, & TV
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HP 54645A Glitch triggering	Minimum width 8 ns, Operators: <, >, or range
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<b>TV Triggering</b>	TV line and field, 0.5 div of composite sync for stable display (Ch1 & Ch2)
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<b>TV Functions</b>	
Line Counting	Delay time calibrated in NTSC and PAL line numbers

All Field Trigger (both fields selected, 54602B and 54610B)	Oscilloscope triggers on the vertical sync pulse in both fields, allowing use with noninterlaced video.
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<b>Holdoff</b>	Adjustable from 200 ns to ≈ 13 s
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<b>External Trigger (54600B, 54603B, 54645A)</b>	
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<b>Range Sensitivity</b>	±18V dc to 25MHz: <50mV dc to 100 MHz: <100mV
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<b>Coupling</b>	dc, HF reject and noise reject
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<b>Input R&amp;C</b>	1MΩ, ≈ 13pf
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<b>Maximum Input</b>	400 V (dc + peak ac)
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<b>External Trigger (54610B, 54615B, 54616B/C)</b>	
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<b>Range Sensitivity</b>	±18V dc to 100MHz: <75mV dc to 500 MHz: <150mV
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<b>Coupling</b>	dc and ground
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<b>Input R&amp;C</b>	1MΩ, ≈ 12pf or 50Ω selectable
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<b>Maximum Input</b>	250 V (dc + peak ac) or 5 Vrms in 50Ω mode
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<b>Trigger View</b> (HP 54610B only)	External trigger is viewable. Bandwidth is >350MHz
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<b>X-Y Operation</b>	
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<b>Z-Blanking</b>	TTL high blanks trace (not available on 54615B, 54616B/C)
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<b>Bandwidth</b>	X & Y same as vertical system
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<b>Phase Difference</b>	± 3 degrees at 100 kHz ± 3 degrees at 10 MHz (54615B, 54616B/C)
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<b>Display System</b>	
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<b>Display</b>	7-inch Raster CRT
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<b>Resolution</b>	255 vertical by 500 horizontal points
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<b>Controls</b>	Front-panel intensity control
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<b>Graticule</b>	8 X 10 grid or frame
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<b>Autostore</b>	Autostore saves previous sweeps in half bright display and the most recent sweep in full bright display.
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<b>Display (54616C)</b>	5.8 inch Active Matrix Color LCD Display
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[1] Temperature ± 10°C from calibration

[2] Use full scale at 80mV for 2mV/div and 5 mV/div ranges

[3] Use full scale of 50 ns for 2 ns/div

## Acquisition System

### Simultaneous Channels

HP 54600B/54610B, 54615B, 54616B	Channels 1 & 2
HP 54602B	Channels 1 & 2 or 3 & 4

<b>Record Length</b>	4,000 points Vectors off and/or Vectors on
HP 54615B, 54616B/C	5,000 points
HP 54645A	1 million points

<b>Max Update Rate</b>	Vectors off: 1,500,000 points/sec Vectors on: 60 full screens/sec, independent of number of waveforms being displayed
HP 54615B, 54616B/C	500,000 points/sec
HP 54645A	3,000,000 points/sec

<b>Usable Single-Shot Bandwidth</b>	2 MHz, single channel 1 MHz, dual channel
HP 54615B	250 MHz
HP 54616B/C	500 MHz
HP 54645A	20 MHz

<b>Peak Detect</b>	50 ns glitch capture (100 ns dual channel) at sweep speeds of 50 $\mu$ s/div and greater
HP 54615B, 54616B/C	1 ns glitch capture
HP 54645A	5 ns

<b>Average</b>	Number of averages selectable at 8, 64, 256
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## Advanced Functions

<b>Automatic Measurements</b>	Measurements are continuously updated
Voltage	Vavg, Vrms, Vpp, Vtop, Vbase, Vmin, & Vmax
Time	Frequency, Period, + Width, - Width, Duty Cycle, Rise Time, & Fall Time
Cursors	Manually or automatically placed

<b>Setup Functions</b>	
Autoscale	Sets the vertical and horizontal deflection and the trigger level
Save/Recall	10 front-panel setups
Trace Memory	Two volatile pixel memories

## General

### Power Line Requirements

Line Voltage Range	100 Vac to 240 Vac
Line Voltage Selection	Automatic
Line Frequency	45 Hz to 440 Hz
Max Power	220 VA
Consumption	300 VA (54615B, 54616B/C)

<b>Environmental Characteristics</b>	The instrument meets the requirements of MIL-T-28800D for Type III, Class 3, Style D equipment as described below.
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<b>Ambient Temperature</b>	
Operating	-10 °C to +55 °C
Nonoperating	-51 °C to +71 °C

<b>Humidity [1]</b>	
Operating	95% RH at 40°C for 24 Hrs
Nonoperating	90% RH at 65°C for 24 Hrs

<b>Altitude</b>	
Operating	to 4,500 m (15,000 ft)
Nonoperating	to 15,000 m (50,000 ft)

<b>EMI (Commercial)</b>	Meets FTZ 1046 Class B
<b>EMI (MIL-T-28800D)</b>	Meets requirements in accordance with Paragraph 3.8.3, EMI Type III, and MIL-STD-461C as modified by Table XII.

CE01, CE03	Full limits
CS01, CS02, CS06	Full limits
RE01	15 dB relaxation to 20 kHz; exceptioned from 20 kHz to 50 kHz
RE02 (With Opt 002)	Full limits of class A1c and A1f
(Without Opt 002)	10 dB relaxation from 14 kHz to 100 kHz
RS02	Exceptioned
RS03 (With Opt 001)	Slight trace shift from 80 MHz to 200 MHz

<b>Vibration</b>	Operating: 15 minutes along each of the 3 major axes; 0.025 inch p-p displacement, 10 Hz to 55 Hz in one-minute cycles. Held for 10 minutes at 55 Hz (4 g at 55 Hz).
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<b>Shock</b>	Operating: 30 g, 1/2 sine, 11 ms duration, 3 shocks per axis along major axis. Total of 18 shocks
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<b>Size (excluding handle)</b>	Height: 172 mm (6.8 in) Width: 322 mm (12.7 in) Depth: 317 mm (12.5 in)
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<b>Weight</b>	6.2 kg (14 lbs)
<b>Safety</b>	CSA Certification, IEC 348, UL 1244 listed

<b>Warranty</b>	3 years
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## Expandable feature set to meet your changing needs

HP 54600-series oscilloscopes can be easily and inexpensively upgraded with add-on modules and software links to provide advanced analysis capability. Accessories and modules available include:

- Interface modules for remote control and hard-copy output to RS-232, HP-IB and parallel printers and plotters. With the addition of these modules, the scope's two trace memories become nonvolatile.
- Add FFT capability and unattended signal monitoring along with the rest of the basic interface module benefits. Catching intermittent failures is easy with unattended waveform monitoring. The nonvolatile memory can store up to 100 traces.
- HP BenchLink Scope software for transferring screen images and waveform data to Windows applications for further analysis or to create polished reports and presentations. HP BenchLink Scope also lets you store instrument setups.

## Enhanced TV/video trigger

With Option 005, six of the HP 54600-series scopes gain the ability to trigger and perform highly detailed measurements on the video components of your system. You can order this option for HP 54602B, HP 54610B, HP 54615B, HP 54616B/C, and HP 54645A oscilloscopes. For more information about this option, request data sheet 5965-1100 EN.

[1] Tested to Hewlett-Packard Environmental Specification Section 758 for Class B-1 products

### HP 54650A HP-IB Interface Module

Provides full remote control and hard copy to HP-IB printers and plotters. Programming is in accordance with IEEE 488.2. With the addition of this module, the scope's two pixel memories become non-volatile. An operating and programming manual and a programming examples disk are supplied.

**Specifications** The interface capabilities of the HP 54600 series oscilloscope with this module installed are as defined by IEEE 488.1 as SH1, AH1, T5, L4, SR1, RL1, PP1, DC1, DT1, C0 and E2.

**Printer/Plotter Supported** HP ThinkJet, HP QuietJet, HP PaintJet, and HP LaserJet; HP-GL compatible plotters.

### HP 54652B RS-232/Parallel Interface Module

Provides full remote control via RS-232 and printing via parallel in one module. The RS-232 can also be configured for printing when not being used for remote control.

**Specifications**

Connector Type	9 pin (m) DTE Port, works with HP 34398A RS-232 cable.
Protocols	Xon/Xoff, hardware
Data Bits	8
Parity	None
Baud Rates	1200, 2400, 9600, or 19200
Printer/Plotter Support	HP ThinkJet, HP QuietJet, HP PaintJet, and HP LaserJet; HP-GL compatible plotters.

**Specifications**

Connector Type	25 pin (F) connector, works with HP C2950A parallel printer cable.
Supported Printers:	Epson FX-80 or HP PCL compatible printers.

### HP 54657A and 54659B Measurement/Storage Modules

With the addition of either the HP 54657A module with HP-IB interface or the HP 54659B module with RS-232 and parallel interface, the HP 54600 series oscilloscope will provide all of the following features.

**19 Automatic Measurements consisting of:**

Voltage	Vamp, Vavg, Vrms, Vpp, Vpre, Vovr, Vtop, Vbase, Vmin, and Vmax
Time	Delay, Duty Cycle, Frequency, Period, Phase Angle, Rise Time, Fall Time, + width, and - width
Thresholds	User selectable among 10%/90%, 20%/80%, or absolute voltage levels.

<b>Cursor Readout Modes</b>	Voltage or percentage Time or phase angle
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<b>Waveform Math Functions</b>	
Function 1	Addition, subtraction, and multiplication
Function 2	Differentiation, integration, and FFT

<b>FFT Windows</b>	Exponential, flat top, Hanning and rectangular
Samples	1024 points

<b>Trace Memory</b>	up to 100 nonvolatile memories
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Memories 1 – 3	High speed storage without compression.
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Memories 4 – 100	Storage with compression. Storage time is approximately 7 seconds. Number of traces that can be stored is a function of complexity, with the minimum being 4 highly complex traces and the maximum being 96.
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Memory Labeling	An onscreen text editor is provided for creating labels up to 20 characters. Each label contains the date and time it was saved.
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Real Time Clock	24-hour format with battery back-up. Can be set from front panel.
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### Unattended Waveform Monitoring

Testing Method	Comparison to waveform mask.
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Number of Masks	2
Mask Generation and Operation	Automask, controlled from the front panel, generates mask from displayed waveform with selectable tolerance. Mask editor function allows pixel-by-pixel editing and line drawing. Smoothing function performs a running average of 3 pixels.

Action on Failure	<ul style="list-style-type: none"> <li>• Save failed trace to memory with date and time of the failure</li> <li>• Print failed trace with date and time of the failure</li> <li>• Count the failure and maintain pass/fail statistics while continuing the test</li> </ul>
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<b>Hard Copy and Programmability Interface</b>	<p>HP 54657A HP-IB (For HP-IB specifications see HP 54650A)</p> <p>HP 54658A RS-232 (For RS-232 specifications see HP 54652B)</p>
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10442A fine pitch probe



10070A rugged probe

**Specifications for HP 54600-Series Scope Probes**

Probe Model Number	Bandwidth	Division Ratio	Approx. length	Input R	Approx. Input C	Rise-time	Max input dc + peak ac	Scope Compatibility
10070A	20 MHz	1:1	1.5m	1 M $\Omega$	70 pF	< 17.5 ns	400 V	HP 54600-series
10071A	150 MHz	10:1	1.5m	10 M $\Omega$	15 pF	< 2.33 ns	450 V	HP 54600/02/03/45B
10073A	500 MHz	10:1	1.5m	1 M $\Omega$	12 pF	< 0.7 ns	450 V	HP 54610/15/16B
10074A	150 MHz	10:1	1.5m	10 M $\Omega$	12 pF	< 2.33 ns	450 V	HP 54645A
10442A	1 GHz	10:1	2.0m	500 $\Omega$	1.2 pF	$\approx$ 0.35 ns	10 V	scopes with 50 $\Omega$ inputs
10444A	500 MHz	10:1	1.6m	1 M $\Omega$	6-15 pF	< 0.7 ns	450 V	HP 54610/15/16B
1137A	1 MHz	1000:1	1.5m	500 M $\Omega$	3 pF	< 35 ns	5 KV	scopes with 1m $\Omega$ inputs

**Probe Accessories**

HP 10072A

**SMT Probe tips for HP 1007X probes**

This accessory adapts this series of rugged probes to HP logic analyzer style grabbers that can be used in SMT probing applications. Supplied with 8 grabbers.

HP 5081-7705

**BNC Adapter for HP 1007X probes**

This accessory clips on the end of the probe and allows the probe to mate with BNC (f) connectors.

HP 5081-7690

**Replacement Accessory Kit for HP 1007X probes**

This kit contains replacement Hook Tip, IC Tip, Ground Bayonet, Ground Lead, Adjustment Tool, and Probe Identification Tags.

**Additional Measurement Accessories**

HP 10100C

50  $\Omega$   $\pm$  1% Feedthrough Termination BNC (f) to BNC (m), Frequency range dc-300 MHz, Max. VSWR 1.1:1

HP 11094B

75  $\Omega$   $\pm$  0.2% Feedthrough Termination BNC (f) to BNC (m), maximum power 1 Watt

HP 1251-2277

Dual Banana(m) to BNC (f) Adapter

HP 10110B

Dual Banana(m) to BNC (m) Adapter

**Additional Accessories**

HP 10098A

**Front Panel Cover and Pouch Kit**

This kit will add the Option 101 front panel cover and pouch to any 54600-series oscilloscope

HP 1183A

**Testmobile Scope**

Cart for HP 54600-series scopes





## Ordering Information

### HP 54600-Series Oscilloscopes

HP 54600B Two-channel, 100 MHz Oscilloscope

HP 54602B Four-channel, 150 MHz Oscilloscope

HP 54603B Two-channel, 60 MHz Oscilloscope

Each of the above oscilloscopes comes with two 1.5 meter 10X probes (HP 10071A), a user's and service guide, and power cord.

HP 54610B Two-channel, 500 MHz, 20 MSa/s Oscilloscope

HP 54615B Two-channel, 500 MHz, 1 GSa/s Oscilloscope

HP 54616B Two-channel, 500 MHz, 2 GSa/s Oscilloscope

HP 54616C Color two-channel, 500 MHz, 2 GSa/s Oscilloscope

HP 54645A Two-channel, 100 MHz, 200 MSa/s Oscilloscope

Each of the above oscilloscopes comes with two 1.5 meter 10X probes (HP 10073A), a user's and service guide, and power cord.

### Options

Opt. 001 RS-03 Magnetic interface shielding added to CR

Opt. 002 RE-02 Display shield added to CRT to reduce radiated interface

Opt. 005 Enhanced TV/video triggering (not HP 54600B/03B)

Opt. 090 Delete probes (for HP 54600/02/03B)

Opt. 090 Delete probes (for HP 54610B, 54615B, 54616B/C)

Opt. 101 Accessory pouch and front panel cover (HP 10098A)

Opt. 102 Two additional HP 10071A probes (HP 54602B only)

Opt. 103 Operator training kit (includes training signal board & lab workbook)

Opt. 104 Carrying case (protects scope for shipping or baggage checking)

Opt. 106 HP BenchLink Scope software for Windows (HP 34810B)

Opt. 1CM Rack Mount Kit (P/N 5062-7345)

Opt. W50 Additional 2-year warranty (5-year total), starting at

### Manual options (please specify one)

ABA US English

ABD German

ABE Spanish

ABF French

ABZ Italian

ABO Taiwan Chinese

ABJ Japanese

AB1 Korean

### HP 54650-series enhancement modules

HP 54650A HP-IB interface module

HP 54652A Parallel interface module

HP 54652B RS-232 and parallel interface module

HP 54655A HP-IB test automation module (compatible only with 54600/03/02/10B)

HP 54656A RS-232 test automation module (compatible only with 54600/03/02/10B)

HP 54657A HP-IB measurement/storage module

HP 54659B RS-232 and parallel measurement/storage module

Each module includes user's and programmer's guides; HP 54656A includes HP 98561-61604 RS-232 adapter cable and one 2-meter RJ-45 cable.

Modules with product numbers ending in "A" are compatible with HP 54600A-series and HP 54600B-series scopes. Modules ending in "B" are compatible with the HP54600-B-series only. The HP 54620A logic analyzer can use any of these modules, but it uses the modules for I/O only.

### Additional oscilloscope accessories, probes and terminations

HP 10070A 1:1 probe

HP 10071A 10:1 probe

HP 10072A SMT probing adapters

HP 10073A 10:1 500 MHz probe with readout

HP 10074A 10:1 150 MHz probe with readout

HP 10442A 10:1 GHz probe for 50  $\Omega$  inputs.

HP 10444A 10:1 500 MHz mini-probe with readout

HP 1137A 1000:1 high-voltage probe

HP 10100C 50  $\Omega$  feedthrough termination

HP 5081-7690 HP 1007X probe accessory kit

HP 5081-7705 HP 1007X probe-to-BNC (m) adapter

HP 10098A Front panel cover and pouch kit

HP 34327A Inverter, 12 Volt dc to 115 V ac

### HP 34810-Series BenchLink Software

HP 34810B BenchLink Scope Software

Includes software on 3.5" disk, user's guide. (all languages)  
HP-IB or RS-232 module needed for connection to scope.

**For more information on Hewlett-Packard Test and Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via the Web through AccessHP at <http://www.hp.com>. If you do not have access to the internet, please contact one of the HP centers below and they will direct you to your nearest HP representative.**

### United States:

Hewlett-Packard Company  
Test and Measurement Organization  
23 Inverness Way East  
Englewood, CO 80112  
1 800 452 4844

### Canada:

Hewlett-Packard Canada Ltd.  
5150 Spectrum Way  
Mississauga, Ontario  
L4W 5G1  
(905) 206 4725

### Europe:

Hewlett-Packard  
European Marketing Centre  
P.O. Box 999  
1180 AZ Amstelveen  
The Netherlands

### Japan:

Hewlett-Packard Japan Ltd.  
3-29-21 Takaido-higashi  
Suginami Ku  
Tokyo 168, Japan  
Tel: (81-333) 31-6111  
Fax: (81-333) 35-1478

### Latin America:

Hewlett-Packard  
Latin American Region Headquarters  
5200 Blue Lagoon Drive, 9th Floor  
Maimi, FL 33126 U.S.A.  
(305) 267 4245/4220

### Australia/New Zealand:

Hewlett-Packard Australia Ltd.  
31-41 Joseph Street, Blackburn  
Victoria 3130, Australia  
131 347 Ext. 2902

### Asia Pacific:

Hewlett-Packard Asia Pacific Ltd.  
17-21/F Shell Tower, Time Square  
1 Matheson Street, Causeway Bay  
Hong Kong  
(852) 2599 7070

## *Within Budget.*

## *Without Compromise.*

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