The HP 54750A is a modular system designed to meet the stringent demands of today's engineers. Up to four high-bandwidth channels and time domain reflectometry (TDR) are supported by the mainframe. The modular design allows for expansion to meet changing needs.

The HP 54750A high-bandwidth digitizing oscilloscope offers the highest throughput and richest feature set in the industry. An engineer's time is maximized by more than 50 built-in parametric measurements. Fast acquisition and processing provides exceptional speed in both front panel operation and in automated test systems controlled by computers.

The 20-GHz or 50-GHz bandwidth and the low-noise specifications allow very precise measurements on low-level, high-speed signals. Timebase stability, accuracy, and resolution allow characterization of jitter in the most demanding applications.
HP 54750A Mainframe Specifications

• 62.5-fs Resolution
• 10-ps Accuracy

Time Base (Horizontal)

<table>
<thead>
<tr>
<th>Scale Factor</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 ps/division</td>
<td>1 s/division</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delay</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time offset relative to trigger</td>
<td>22 ns</td>
<td>1000 screen diameters or 10 seconds, whichever is smaller</td>
</tr>
</tbody>
</table>

| Time Interval Accuracy | ≤ 10 ps ±0.1% of reading (Dual marker measurement) |

| Time Interval Resolution | ≤ (screen diameter) / (record length) or 62.5 fs, whichever is larger |

Trigger-External Input Only

Sensitivity

dc to 100 MHz: 40 mV peak-to-peak
100 MHz to 2.5 GHz: Increasing linearly from 40 mV at 100 MHz to 200 mV at 2.5 GHz

Pulse Width Required: >200 ps
Pulse Amplitude Required: >200 mV

Bandwidth Limit: Trigger bandwidth reduced to approximately 100 MHz

Jitter

(trigger and time base combined) ≤ 2.5 ps + 5E-5 x delay setting (Tested using a 2.5-GHz synthesized source at 200 mV)

Trigger Input:

Maximum safe: ±2 Vdc
Nominal Impedance: 50 Ω
Percent Reflection Connector: ≤ 10% for 100-ps rise time [1]

Calibrator:

Adjustable Output range: –2.5 V to +2.5 V when terminated into 50 Ω
Output Delta Voltage Accuracy: ±(0.2% of settings)

[1] With non TDR plug-ins, ≤10% for 200 ps rise time with TDR plug-ins (HP 54754A and 54755A).

Plug-In Modules for the HP 54750A

<table>
<thead>
<tr>
<th>Number</th>
<th>Bandwidth GHz</th>
<th>Unfiltered BW GHz (typical)</th>
<th>Number of Filters</th>
<th>Data Rates Mbit/s</th>
<th>Fiber Input Type</th>
<th>Wavelength (smallest power for mask test)</th>
<th>Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 54751A</td>
<td>2</td>
<td>12 or 20</td>
<td>2.5 (&gt;3.0)</td>
<td>2</td>
<td>155 and 622</td>
<td>9/125 μm</td>
<td>1000 to 1600 nm</td>
</tr>
<tr>
<td>HP 54752A</td>
<td>2</td>
<td>26.5 or 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP 54752B</td>
<td>1</td>
<td>26.5 or 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP 54753A</td>
<td>1</td>
<td>TDR/1 Electrical</td>
<td>12 or 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Electrical</td>
<td>12 or 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP 54754A</td>
<td>2</td>
<td>TDR/2 Electrical</td>
<td>12 or 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP 83481A</td>
<td>1</td>
<td>12 or 20</td>
<td>2.5 (&gt;3.0)</td>
<td>2</td>
<td>155 and 622</td>
<td>9/125 μm</td>
<td>1000 to 1600 nm</td>
</tr>
<tr>
<td>HP 83482A</td>
<td>1</td>
<td>18 or 40</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP 83485A</td>
<td>1</td>
<td>12 or 20</td>
<td>20</td>
<td>1</td>
<td>155/622 or 2488</td>
<td>9/125 μm</td>
<td>1000 to 1600 nm</td>
</tr>
<tr>
<td>HP 83485B</td>
<td>1</td>
<td>18 or 40</td>
<td></td>
<td>1</td>
<td>9953</td>
<td>9/125 μm</td>
<td>1000 to 1600 nm</td>
</tr>
<tr>
<td>HP 83486A</td>
<td>1</td>
<td>12 or 20</td>
<td>2.5 (&gt;2.7)</td>
<td>2</td>
<td>155/622 or 1063/1250</td>
<td>62.5/125 μm</td>
<td>1000 to 1600 nm</td>
</tr>
<tr>
<td>HP 83487A</td>
<td>1</td>
<td>12 or 20</td>
<td>2.5 (&gt;2.7)</td>
<td>2</td>
<td>1063/1250</td>
<td>62.5/125 μm</td>
<td>750 to 870 nm</td>
</tr>
</tbody>
</table>

HP 54750A System Characteristics

Channels (Vertical)

Scale Factors: Adjustable from 1 mV/div to 100 mV/div in a 1-2-5-10 sequence from the front panel knob or the INC/DEC keys. Also adjustable over the range in 0.1-mV increments from the numeric keypad.

Attenuation Factors: Factors may be entered to scale the oscilloscope for external attenuators connected to the channel inputs. The range is from 0.0001:1 to 1,000,000:1.

Noise: Averaging reduces noise by 1/(n)1/2, where n is the number of averages, until a system limitation of approximately 25 μV (low BW mode) or 50 μV (high BW mode) is reached.

Channel-to-channel isolation: >60 dB

Bandwidth: You may select between a high (20 GHz/50 GHz) or low (12.4 GHz/26.5 GHz) bandwidth mode. The sampler is biased differently for the two modes. Typically high and low bandwidth noise is ~1/2 the specified maximum noise.

Time Base (Horizontal)

Delay Between Channels: The difference in delay between channels can be nulled out with 1-ps resolution to compensate for differences in input cables or probe length. Up to 100 μs of skew can be nulled out.

Reference Location: The reference point can be located at the left edge or center of the display. The reference point is the point where the time is offset from the trigger by the delay time. The reference point is also the point that the time base sensitivity expands and contracts around as the time base is changed.

Triggered Mode: Causes the scope to trigger synchronously to the trigger input signal.

Freerun: Causes the scope to generate its own triggers.
HP 54750A
System Characteristics (cont’d)

Typical Timing Accuracy: The time base uses a series of 4-ns blocks. Time base linearity and small discontinuities across these blocks contribute to the 8-ps accuracy specification.

When operating within 4 ns blocks, the typical accuracy is shown by the following graph. The graph below is a result of many measurements on multiple instruments.

Because averaging implies single-valued waveforms, the Best Flatness control takes advantage of this to further improve flatness. This is done by taking a sample with the samplers turned on and then with samplers turned off. The two results are then subtracted, thereby removing the residual nonflatness.

Display Colors: You may choose a default color selection, or select your own colors from the front panel, or via HP-IB. Different colors are used for display background, channels, functions, background text, highlighted text, advisory, markers, overlapping waveforms, and memories.

Documentation Aids

Waveforms, scaling information, and measurement results can be transferred directly to HP-IB or Centronics graphics printers.

Waveforms may also be stored on the internal MS-DOS® compatible disk in PCX or TIFF format. This allows moving screen data into word processors for documentation.

Programmability

Instrument settings and operating modes, including automatic measurements, may be remotely programmed via HP-IB (IEEE 488.2). HP-IB programming complies with the recommendations of the IEEE 488.2 standards. The HP 54750A can be programmed to take data only at specified time points, or to return only measurement results (such as, tr, tf, and frequency) to speed up data acquisition.

Data Transfer Rate: 550 Kbytes/s typical.

Data Record Length: 25 automatic measurements per second typical.

Measurement Aids

Dual voltage or time markers can be used for a variety of time and voltage measurements. Voltage markers can be assigned to channel data, measurements, functions, FFTs, histograms, color-graded displays, and memories.

Automatic Pulse Parameter Measurements

Functions

<table>
<thead>
<tr>
<th>Mag</th>
<th>Differentiate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invert</td>
<td>Min</td>
</tr>
<tr>
<td>Add</td>
<td>Max</td>
</tr>
<tr>
<td>Subtract</td>
<td>FFTmag</td>
</tr>
<tr>
<td>Multiply</td>
<td>Histograms</td>
</tr>
<tr>
<td>Divide</td>
<td>Measurement limit testing</td>
</tr>
<tr>
<td>Versus</td>
<td>Waveform mask testing</td>
</tr>
<tr>
<td>Integrate</td>
<td>Color-graded display</td>
</tr>
<tr>
<td>Bw limit</td>
<td></td>
</tr>
</tbody>
</table>

Measurements

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vampf</td>
<td>freq</td>
</tr>
<tr>
<td>Vbase</td>
<td>Tfall</td>
</tr>
<tr>
<td>Vtop</td>
<td>Trias</td>
</tr>
<tr>
<td>Preshoot</td>
<td>Tmax</td>
</tr>
<tr>
<td>Overshoot</td>
<td>Tmin</td>
</tr>
<tr>
<td>Vp-p</td>
<td>Tvolt</td>
</tr>
<tr>
<td>Vtme</td>
<td>Vavg</td>
</tr>
<tr>
<td>Vmin</td>
<td>Vupper</td>
</tr>
<tr>
<td>Vmax</td>
<td>Vmiddle</td>
</tr>
<tr>
<td>Vrms</td>
<td>Vlower</td>
</tr>
<tr>
<td>Width</td>
<td>FFTfreq</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>FFTmag</td>
</tr>
<tr>
<td>Delta time</td>
<td>FFT delta freq</td>
</tr>
<tr>
<td>Period</td>
<td>FFT delta mag</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>TDR min reflection</td>
</tr>
<tr>
<td>TDR max reflection</td>
<td>TDT prop delay</td>
</tr>
<tr>
<td>TDT gain</td>
<td></td>
</tr>
</tbody>
</table>

Histograms

P-P

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td></td>
</tr>
<tr>
<td>Std Dev</td>
<td></td>
</tr>
<tr>
<td>Sigma 1</td>
<td></td>
</tr>
<tr>
<td>Sigma 2</td>
<td></td>
</tr>
<tr>
<td>Sigma 3</td>
<td></td>
</tr>
<tr>
<td>Hits</td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td></td>
</tr>
</tbody>
</table>

Limit Test

Signals can be tested by up to four automatic parametric measurements and compared to user-defined test boundaries. Failures tolerances can be selected independently for each of the parametric tests.

On failure actions:
1) Save channel data to memory, disk or printer
2) Save screen to pixel memory, disk or printer
3) Save a text log summary of all failures with time tagging to disk or printer.

Limit test can be set to run continuously for a user-selected number of waveforms, or for a defined number of failures.

Mask Test

Acquired signals are tested for fit outside areas defined by up to eight polygons. Any samples that fall within the polygon boundaries result in test failures. Masks can be loaded from disk, HP-IB, or created automatically or manually.
Data collected during test:
Total number of waveforms examined
Number of failed waveforms
Total number of samples taken
Number of failed samples
Number of hits within each polygon boundary

Auto Mask Creation
Masks are created automatically for single-valued voltage signals. Both delta X and delta Y tolerances can be specified.

The failure actions are identical to those of Limit Testing. Both mask testing and limit testing may be used independently or simultaneously.

FFT
Up to three fast Fourier transforms can be run simultaneously. The three built-in filters (Hanning, rectangular, and flattop) allow optimization of frequency resolution, transients, and amplitude accuracy. Automatic measurements can be made on frequency, delta frequency, magnitude, and delta magnitude.

Frequency Span = Sample rate /2 = record length/(2 * time base range)
Frequency Resolution = Time base range/record length

Color Graded Display
Infinite persistence display mode where color differentiates the number of times any individual pixel has been acquired. All points acquired are added to a database and then displayed as one of eight colors depending upon the frequency of acquisition.

Automatic parametric measurements may be taken on the Color-Graded Display allowing parametric evaluation of multivalued (eye diagram) waveforms.

Autoscale: Can find repetitive signals:
> 50 Hz
duty cycle > 1%
amplitude > 10 mV p-p vertical
50 mV p-p trigger

Waveform Math: Two functions can be specified and displayed. Functions may be defined as:
- magnify versus
- invert integrate
- add differentiate
- subtract minimum
- multiply maximum
- divide fft magnitude

Waveform Save: Four waveforms may be stored in four nonvolatile memories. They may also be stored to the internal MS-DOS compatible 1.44 Mbyte disk.

Setup Aids
Autoscale: Pressing the Autoscale key automatically adjusts the vertical of all channels, the horizontal scale factors, and the trigger level for a display appropriate to the applied signals.

Channel Autoscale: Autoscale can be performed on individual channels. This mode only sets the vertical for the channel selected, therefore saving time and keeping the automatic feature from changing other user-selected settings.

Save/Recall: Up to 10 complete instrument setups may be stored in the internal nonvolatile memory. Additionally, many more setups can be stored on the internal MS-DOS compatible disk.

Vertical Software Calibration: Changes in the environmental conditions can be accommodated by performing a software calibration on the plug-ins. The calibration resets the plug-in for the current mainframe and plug-in operating temperature. Software vertical calibration is recommended prior to taking measurements requiring the best possible accuracy.

Digitizer Converter: 12-bit successive approximation A/D converter.

Resolution: Up to 15 bits with averaging. Variable IF gain assures that resolution is ≥9 bits on all ranges (11 on most).

Digitizing Rate: The signal is sampled and digitized at a rate dictated by the trigger repetition rate and the time base range. If data acquisition is not trigger rate limited, the maximum sample rate is 40 KHz.

Reflection Measurements
Source: Measurements are made using the Channel step source or a user supplied external source.

Calibration: A reference plane is defined by calibrating the reflection channel with a short placed at the point where the device under test (DUT) will be connected. The short calibration is followed with a 50-Ω calibration. These calibrations derive the normalization filter.

Cursor: Reads out the percent reflection, impedance, time, and distance from the reference plane to the cursor.

Percent Reflection: Automatic measurements provided to calculate the maximum positive and negative percent reflections of the waveform shown onscreen.

Normalization Filter: Applies a firmware digital filter to the measured data. The rise time of the filter may be varied to allow the user to simulate the edge speeds that would be seen by the device under actual operating conditions. Normalization uses the Bracewell transform, which is under license from Stanford University. See TDR output specifications for allowable rise time values.

Variable Bandwidth Limit
Changing the rise time of the normalization filter requires that a short and 50-Ω load be placed at the launch point. When this is not possible or differential TDR is used then a variable bandwidth limit filter can be used. The variable bandwidth limit function is located in the waveform math menu.

Percent Reflection Measurements: Used to quantify reactive peaks and valleys of the TDR display. Impedance measurements are valid only for resistive, horizontal flat-line TDR displays. Because the accuracy depends on the measurement being made, percent reflection and impedance accuracies are not specified. Percent reflection and impedance measurements are ratios of voltage measurements whose accuracies are specified.

Percent Reflection (p) = (Vcursor - Vtop) / (Vtop - Vbase)
Impedance (Z) = 50 Ω x (1 + p) / (1 - p)

Where Vcursor = voltage at the cursor
Vtop = high level of incident step
Vbase = low level of incident step
and is determined during the reflection calibration

Distance measurements are subject to the accuracy of the velocity factor or dielectric constant that you enter. Because the HP 54753A and 54754A have no control over the accuracy of these numbers, distance accuracy is not specified. Distance is derived from time interval measurements whose accuracies are specified.
Distance (d) = 1/2 x \(\Delta t\) x Velocity Constant,
where \(\Delta t\) = time from the reference plane to the cursor.
Dielectric constant = \(\frac{(3 \times 10^8 \text{ m/s})^2}{\text{Velocity Constant}^2}\)
where you enter either a relative Dielectric Constant or a Velocity constant.

The TDR’s ability to resolve the distance between two discontinuities is limited to 1/2 the system rise time. Without normalization, this is approximately 1/2 x 45 ps or 7 mm in air. For the distance resolution in your media, divide 7 mm by the square root of eff of your media. With normalization, the system rise time can be 10 ps yielding 1.5 mm of resolution in air.

The maximum length the TDR can measure is subject to media loss. For a lossless vacuum, and using a 50-Hz TDR repetition rate, the system can measure 1500 km. Actual maximum lengths will generally be limited by the losses of the media under test.

Excess L/C
Once a calibration plane is established, the excess L/C feature will compute the series L or shunt C equivalent to the area between cursors. The result is the equivalent L or C that causes a discontinuity with equal area to that measured.

Scaling
The vertical scaling allows scaling in either percent reflection or ohms. Cursors will also read in voltage or ohms. A reference plane calibration must be performed to utilize these scales.

Differential TDR
The differential and common stimulus are generated by staggered rising edges from two independent TDR step generators. Hardware setup remains fixed and therefore the skew for both differential and common measurements. The response to either differential or common mode stimulus may be viewed simultaneously as differential or common mode.

All waveform math functions are automatic. Both the differential and common mode responses are computed without user intervention.

Differential TDR Timing Deskew
For accurate differential TDR measurements it is essential that the TDR steps are coincident at the reference plane and the reflected steps are coincident at the samplers. Ideally, this is accomplished by using electrically matched launch cables. When this is not possible, the TDR channels must be deskewed.

To accomplish this, it is necessary to have both TDR step time skew and channel skew capabilities. Each of the TDR steps may be moved ± 400 ps. When used in conjunction with the channel skew control, then 1.6 ns of timing delta can be removed. Depending upon the cable, this equates to approximately 1 foot of cable length difference that can be electrically removed.

Transmission Measurements
Source: Measurements are made using the channel step source or a user-supplied external source.

Calibration: A calibration with a straight-through path or through your standard device determines reference amplitude levels and reference time and distances of the signal path. These reference levels are used for gain and propagation delay measurements.

Cursor: Reads out time referenced to the calibration edge and gain referenced to the transmission calibration results. (See Note 1)

Propagation Delay and Gain: Automatically calculates the difference in time and distance between the calibration signal path the test signal path. Also calculates the ratio of the test signal amplitude to the calibration signal amplitude. (See Note 1)

Normalization Filter: Applies a firmware digital filter to the measured data. The rise time of the filter may be varied to allow you to simulate the edge speeds which would be seen by the device under actual operation. See TDR output specifications for allowable rise time values.

Note 1:
\[\Delta t = \text{Time of the cursor (50%) - Time of reference edge (50%).}\]
\[\text{Gain} = \frac{(V_{\text{top}} - V_{\text{base}})_{\text{signal}}}{(V_{\text{top}} - V_{\text{base}})_{\text{reference}}}\]
\[\text{Prop Delay} = \text{Time of test edge (50%) - Time of reference edge (50%).}\]

Distance (d) = Prop delay x Velocity Constant.
where \(V_{\text{top}}\) = High level of waveform and \(V_{\text{base}}\) = Low level of waveform.
Meets Hewlett-Packard’s environmental specification (section 750) for class B-1 products with exceptions as described for temperature and condensation. Contact your local HP field engineer for complete details.

### Temperature

<table>
<thead>
<tr>
<th></th>
<th>Operating</th>
<th>Non-operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>+10 °C to +40 °C</td>
<td>-40 °C to +70 °C</td>
</tr>
</tbody>
</table>

### Humidity

<table>
<thead>
<tr>
<th></th>
<th>Operating</th>
<th>Non-operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>Up to 90% relative humidity (non-condensing) at +35 °C</td>
<td>Up to 90% relative humidity at +65 °C</td>
</tr>
</tbody>
</table>

### Altitude

<table>
<thead>
<tr>
<th></th>
<th>Operating</th>
<th>Non-operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>Up to 4,600 meters (15,000 ft)</td>
<td>Up to 15,300 meters (50,000 ft)</td>
</tr>
</tbody>
</table>

### Vibration

<table>
<thead>
<tr>
<th></th>
<th>Operating</th>
<th>Non-operating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>Random vibration 5 to 500 Hz, 10 minute per axis, 0.3 g(rms).</td>
<td>Random vibration 5 to 500 Hz, 10 minute per axis, 2.41 g(rms); resonant search, 5 to 500 Hz swept sine, 1 Octave/minute sweep rate, 0.75g, 5 minute resonant dwell at 4 resonances/axis.</td>
</tr>
</tbody>
</table>

### Environmental Conditions

**Power Requirements**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Voltage</th>
<th>Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 54750A</td>
<td>90 to 132 or 198 to 264 Vac, 48 to 66 Hz</td>
<td>1200 VA; 650 W</td>
</tr>
<tr>
<td>HP 54701A</td>
<td>±17 Vdc</td>
<td>110 mA</td>
</tr>
</tbody>
</table>

**Model Number**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Approximate Net Weight</th>
<th>Approximate Shipping Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP 54750A</td>
<td>24.5 kg (54 lbs)</td>
<td>31.8 kg (70 lbs)</td>
</tr>
<tr>
<td>HP 54751A</td>
<td>1.1 kg (2.4 lbs)</td>
<td>2.0 kg (4.4 lbs)</td>
</tr>
</tbody>
</table>

Dimensions are for general information only. If greater accuracy is required, contact your HP field engineer.
Plug-in Modules for the HP 54750A

• HP 54751A Plug-in

The HP 54751A plug-in offers two 20 GHz bandwidth channels. The two-wide configuration allows up to four channels in the HP 54750A mainframe. The bandwidth of each channel may be selected independently from the channel menu as either 20 GHz or 12.4 GHz. The bandwidth of the channel is altered by changing the bias on the sampling bridge.

The low-noise characteristic of the plug-in gives an RMS noise level of <1.0 mV in the high-bandwidth mode and <0.5 mV in the low-bandwidth mode. With exceptionally low noise and a minimum sensitivity of 1 mV/div, the HP 54751A is ideally suited for evaluation of low-level signals.

The plug-in provides a single external trigger input of 2.5 GHz. Triggering to 18 GHz is possible by using the HP 54118A.

<table>
<thead>
<tr>
<th>Channels (Vertical)[1]</th>
<th>20-GHz Bandwidth Mode</th>
<th>12.4-GHz Bandwidth Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transition Time</td>
<td>≤ 17.5 ps</td>
<td>≤ 28.2 ps</td>
</tr>
<tr>
<td></td>
<td>(10% to 90%) (calculated from Tr = 35/BW)</td>
<td></td>
</tr>
<tr>
<td>Maximum Noise (RMS)</td>
<td>≤ 1 mV</td>
<td>≤ 0.5 mV</td>
</tr>
<tr>
<td>Scale Factor</td>
<td>(fullscale is 8 divisions)</td>
<td>(fullscale is 8 divisions)</td>
</tr>
<tr>
<td>Minimum</td>
<td>1 mV/div</td>
<td>1 mV/div</td>
</tr>
<tr>
<td>Maximum</td>
<td>100 mV/div</td>
<td>100 mV/div</td>
</tr>
<tr>
<td>dc Accuracy</td>
<td>± 0.4% of fullscale or marker reading (whichever is greater) ± 2 mV or 1.2% of (reading-channel offset) [5]</td>
<td></td>
</tr>
<tr>
<td>Single Voltage Marker</td>
<td>± 0.4% of fullscale or marker reading (whichever is greater) ± 2 mV or 0.6% of (reading-channel offset) [5]</td>
<td></td>
</tr>
<tr>
<td>dc Difference</td>
<td>± 0.8% off fullscale or delta marker reading (whichever is greater) ± 1.2% of delta marker reading [5]</td>
<td></td>
</tr>
<tr>
<td>Voltage Accuracy</td>
<td>± 0.8% off fullscale or delta marker reading (whichever is greater) ± 0.6% of delta marker reading [5]</td>
<td></td>
</tr>
<tr>
<td>(Using Two Voltage Markers on The Same Channel) [3]</td>
<td>Channel offset ± 500mV</td>
<td>Channel offset ± 500mV</td>
</tr>
<tr>
<td>Programmable dc Offset [4]</td>
<td>Channel offset ± 500mV</td>
<td>Channel offset ± 500mV</td>
</tr>
</tbody>
</table>

Inputs:
- Number: Two
- Dynamic Range: ± 400 mV relative to channel offset
- Maximum Safe Input Voltage: ± 2 Vdc
- Nominal Impedance: 50 Ω
- Percent Reflection Connectors: ≤ 5% for 30-ps rise time

[1] When operated within ± 5 °C(± 9 °F) of the temperature of the last plug-in calibration. See the Operating Characteristics for additional information on vertical software calibration.
[2] The input samplers are biased differently for increased bandwidth in the 50 GHz bandwidth mode.
[4] An effective offset of ± 900 mV can be achieved using ± 500 mV of channel offset and adding ± 400 mV of offset using the waveform math offset scaling function.
[5] When operated within ± 5 °C(± 9 °F) of the temperature of the last plug-in calibration. When operated within ± 5 °C(± 9 °F) of the temperature of the last plug-in calibration, the final term in the dc accuracy specification is 2.5 times higher.

• HP 54752A and 54752B Plug-ins

The HP 54752A has two 50 GHz bandwidth channels and the HP 54752B provides a single cost-effective channel. Both plug-ins use 2.4 mm connectors to provide the highest fidelity from the DUT.

These plug-ins also feature a dual bandwidth scheme which can be selected independently from the mainframe. The low-bandwidth mode bandlimits the signal to 26.5 GHz. The high-bandwidth mode RMS noise performance is <1.5 mV and the low-bandwidth mode is <0.75 mV.

<table>
<thead>
<tr>
<th>Channels (Vertical)[1]</th>
<th>50-GHz Bandwidth Mode</th>
<th>26.5-GHz Bandwidth Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth [2] (~3dB)</td>
<td>dc to 50 GHz</td>
<td>dc to 26.5 GHz</td>
</tr>
<tr>
<td>Transition Time</td>
<td>≤ 7.0 ps</td>
<td>≤ 13.2 ps</td>
</tr>
<tr>
<td></td>
<td>(10% to 90%) (calculated from Tr=0.35/BW)</td>
<td></td>
</tr>
<tr>
<td>Maximum Noise (RMS)</td>
<td>≤ 1.5 mV</td>
<td>≤ 0.75 mV</td>
</tr>
<tr>
<td>Scale Factor</td>
<td>(fullscale is 8 div)</td>
<td>(fullscale is 8 div)</td>
</tr>
<tr>
<td>Minimum</td>
<td>1 mV/div</td>
<td>1 mV/div</td>
</tr>
<tr>
<td>Maximum</td>
<td>100 mV/div</td>
<td>100 mV/div</td>
</tr>
<tr>
<td>dc Accuracy</td>
<td>± 0.4% of fullscale or marker reading (whichever is greater) ± 2 mV or 2% of reading-channel offset [5]</td>
<td></td>
</tr>
<tr>
<td>Single Voltage Marker</td>
<td>± 0.4% of fullscale or marker reading (whichever is greater) ± 2 mV or 1.2% of reading-channel offset [5]</td>
<td></td>
</tr>
<tr>
<td>dc Difference</td>
<td>± 0.8% of fullscale or delta marker reading (whichever is greater) ± 2% of delta marker reading [5]</td>
<td></td>
</tr>
<tr>
<td>Voltage Accuracy</td>
<td>± 0.8% of fullscale or delta marker reading (whichever is greater) ± 1.2% of delta marker reading [5]</td>
<td></td>
</tr>
<tr>
<td>(Using Two Voltage Markers on The Same Channel) [3]</td>
<td>Channel offset ± 500 mV</td>
<td>Channel offset ± 500 mV</td>
</tr>
<tr>
<td>Programmable dc Offset [4]</td>
<td>Channel offset ± 500 mV</td>
<td>Channel offset ± 500 mV</td>
</tr>
</tbody>
</table>

Inputs:
- Number: One HP 54752B
- Two HP 54752A
- Dynamic Range: ± 400 mV relative to channel offset
- Maximum Safe Input Voltage: ± 2 Vdc
- Nominal Impedance: 50 Ω
- Percent Reflection Connectors: ≤ 5% for 20-ps rise time

[1] When operated within ± 5 °C(± 9 °F) of the temperature of the last plug-in calibration. See the Operating Characteristics for additional information on vertical software calibration.
[2] The input samplers are biased differently for increased bandwidth in the 50 GHz bandwidth mode.
[4] An effective offset of ± 900 mV can be achieved using ± 500 mV of channel offset and adding ± 400 mV of offset using the waveform math offset scaling function.
[5] When operated within ± 5 °C(± 9 °F) of the temperature of the last plug-in calibration. When operated within ± 5 °C(± 9 °F) of the temperature of the last plug-in calibration, the final term in the dc accuracy specification is 2.5 times higher.
**HP 54753A Plug-in**

The HP 54753A is a two-channel vertical plug-in with a TDR step generator built into channel one. The bandwidth of the TDR/vertical channel is 18 GHz. The bandwidth of channel two is 20 GHz.

The step generator provides a 200 mV TDR step with a system rise time of <45 ps. The system has the ability to normalize the TDR by applying a digital filter. Normalization removes errors caused by loss or imperfect launchers or cables.

The rise time of the normalization filter may be varied to allow you to simulate the edge speeds found in your system. You may also push the rise time up to 10 ps. Unlike the HP 54120 series, the normalization filter when activated processes every acquisition so you see changes as the DUT is adjusted.

The HP 54753A provides support for external step generators, such as the PicoSecond Pulse Labs 4015C.

<table>
<thead>
<tr>
<th>Channels (Vertical)</th>
<th>18/20 GHz Bandwidth Mode</th>
<th>12.4 GHz Bandwidth Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth [2] (-3db)</td>
<td>HP 54753A and HP 54754A</td>
<td>HP 54753A and HP 54754A</td>
</tr>
<tr>
<td></td>
<td>dc to 18 GHz TDR channel</td>
<td>dc to 12.4 GHz TDR channel</td>
</tr>
<tr>
<td></td>
<td>HP 54753A non-TDR channel</td>
<td>HP 54753A non-TDR channel</td>
</tr>
</tbody>
</table>

| Transition Time | ≤ 19.4 ps | ≤ 28.2 ps |
| (10% to 90%) (calculated from Tr=0.35/BW) | HP 54753A non-TDR channel | HP 54753A non-TDR channel |

<table>
<thead>
<tr>
<th>Maximum Noise (RMS)</th>
<th>≤1 mV</th>
<th>≤0.5 mV</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Scale Factor</th>
<th>(fullscale is 8 div)</th>
<th>(fullscale is 8 div)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum</td>
<td>1 mV/div</td>
<td>1 mV/div</td>
</tr>
<tr>
<td>Maximum</td>
<td>100 mV/div</td>
<td>100 mV/div</td>
</tr>
</tbody>
</table>

**dc Accuracy**

<table>
<thead>
<tr>
<th>Marker [3]</th>
<th>± 0.4% of fullscale or marker reading (whichever is greater)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>± 2 mV ± 1.2% of (reading-channel offset) [5]</td>
</tr>
</tbody>
</table>

**dc Difference**

<table>
<thead>
<tr>
<th>Voltage Accuracy</th>
<th>± 0.8% of fullscale or delta marker reading (whichever is greater)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>± 2 mV ± 0.8% of (reading-channel offset) [5]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Using Two Voltage Markers on The Same Channel [3]</th>
<th>± 1.2% of delta marker reading [5]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>± 0.6% of delta marker reading [5]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programmable dc Offset [4]</th>
<th>Channel offset ± 500 mV</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Inputs:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Two</td>
</tr>
<tr>
<td>TDR Step Generators</td>
<td>One 54753A</td>
</tr>
<tr>
<td>Dynamic Range</td>
<td>± 400 mV relative to channel offset</td>
</tr>
<tr>
<td>Maximum Safe</td>
<td>±2 Vdc</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>Nominal Impedance</td>
</tr>
<tr>
<td>Percent Reflection</td>
<td>≤ 5% for 30 ps rise time</td>
</tr>
<tr>
<td>Connectors</td>
<td>3.5 mm(m)</td>
</tr>
</tbody>
</table>

---

**HP 54754A Plug-in**

The HP 54754A has two independent vertical channels and two step generators. The bandwidth of both channels is 18 GHz. The step generators may be operated singly, simultaneously but independently, differentially, or as common-mode stimulus.

The TDR results may be viewed as common mode or differentially and displayed simultaneously. Once selected, the display mode is computed automatically, freeing the user from setting up mathematical functions.

Each step may be skewed separately in time. Coupled with the ability to skew the vertical channels, it is possible to accurately perform differential TDR when the launch cables are not the same electrical length.

<table>
<thead>
<tr>
<th>TDR System</th>
<th>Combined Oscilloscope and TDR Performance</th>
<th>Normalized Characteristics [1]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise time [1]</td>
<td>&lt; 45 ps [3]</td>
<td>Adjustable: allowable values based on time base setting. Minimum: 10 ps or 0.08 x Time/div, whichever is greater. Maximum: 5 x Time/div</td>
</tr>
</tbody>
</table>

| Flatness [2] | < ± 1% after 1 ns from edge; < +5%, –3% to 1 ns from edge | <0.1% |

<table>
<thead>
<tr>
<th>Levels:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0.00 V ± 2 mV</td>
</tr>
<tr>
<td>High</td>
<td>+200 mV ± 2 mV</td>
</tr>
</tbody>
</table>

| [1] Normalized information is a characteristic, not a specification. The information is presented here for comparison only. Normalization characteristics are achieved only with the use of the normalization calibrations and firmware routines. |
| [3] The rise time of the generator is less than 35 ps, as calculated by: |

\[
T_r = \sqrt{\frac{(T_r \text{ Generator})^2 + (T_r \text{ Scope})^2}{2}}
\]

---

[1] When operated within ± 5 °C (± 9 °F) of the temperature of the last plug-in calibration. See the Operating Characteristics for additional information on vertical software calibration.
[2] The input sampler are biased differently for increased bandwidth in the 18/20 GHz bandwidth mode.
[4] An effective offset of ± 900 mV can be achieved using the ± 500 mV of channel offset and adding ± 400 mV of offset using the waveform math offset scaling function.
[5] When operated within ± 2 °C (± 3.6 °F) of the temperature of the last plug-in calibration. When operated within ± 5 °C (± 9 °F) of the temperature of the last plug-in calibration, the final term in the dc accuracy specification is 2.5 times higher.
HP 54118A Trigger

• 500 MHz to 18 GHz

Specifications

Input
Frequency Range  500 MHz to 18 GHz
Connector    3.5 mm (male)
Nominal Impedance  50 Ω
Coupling ac Input Sensitivity
500 MHz to 2.0 GHz ≤ 50 mVp-p (–22 dBm)
2.0 GHz to 12.4 GHz ≤ 500 mVp-p (–2 dBm)
12.4 GHz to 18 GHz ≤ 1.0 Vp-p (+4 dBm)
Maximum Safe Input 25 Vdc, 4 Vp-p ac (+16 dBm)
Percent Reflection ≤ 5% for 30 ps risetime
Trigger Level 0 V to 2 Vp-p (+10 dBm)
Arming Level 0 V to 2 Vp-p (+10 dBm)
Holdoff 50 µs to 200 µs

Output
Connector 3.5 mm (male)
Nominal Impedance  50 Ω
Coupling ac
Maximum Safe External Voltage ±25 Vdc
Jitter (1 sigma)
≤ 3 % of input signal period
≤ 2.5 ps at 12.4 GHz
≤ 1.7 ps at 18.0 GHz

Operating Characteristics

Output
Signal (into 50 Ω) 200 mV positive pulse 5 ns wide
Delay From Trigger Edge 4 ns (approximate)
Kickout at Signal Input A single, positive pulse, under 300 mV and 900 ps wide at the beginning of the sweep.
Power Input Connector SMB snap-on coaxial
Voltage +15 Vdc ± 5%
Current 150 mA max, 130 mA Typical
Power 2.4 Watts max

Environmental
Temperature, Operating +15 °C to +35 °C
Temperature, Storage – 40 °C to +70 °C
Humidity, Operating 90 % at 35 °C
Humidity, Nonoperating 95 % at 65 °C
Altitude, Operating 4,600 meters
Altitude, Nonoperating 15,300 meters
Vibration, Operating 0.3 g Random 5 to 500 Hz,
10 min/axis
Vibration, Nonoperating 2.41 G (rms) Random
5-500 Hz, 10 min/axis 0.75 G (rms) Sine 5 to 500 Hz,
5 min/resonance Net weight 1.8 kg (4 lb)

The following is a list of standard accessories supplied with the HP 54118A 500-MHz to 18-GHz Trigger. All accessories needed to use the HP 54118A with the HP 54750-series test set test alone are included in the RF accessories kit.

Power Cable
1 each HP 54111 - 61609 Coaxial SMB, 25 cm long

Trigger Output Cable
1 each HP 54118-61607 Semirigid U SMA (male-male) External input cable for connecting the HP 54118A trigger output to the trigger input of the HP 54750 - Series test set.

Trigger Input Cable
1 each HP 54118-61608 8 cm Semirigid L, SMA (male-male)

RF Accessories
1 each HP 11667B dc to 26.5 GHz, 6-dB power divider
1 each HP 33340C opt 006 dc to 26.5 GHz, 6-dB attenuator
1 each HP 54007-61602 3-cm, Semirigid L, SMA (male-male)
1 each HP 54007-61601 6-cm, Semirigid L, SMA (male-male)

Adapters
2 each 3.5 mm (female-female)
HP 5061-5311

Coaxial Shorts
2 each SMA (male) HP 0980-0055
HP 54008A 22-ns Delay Line

- View the Trigger Event

The HP 54008A is a 22-ns delay line whose primary application is to view the trigger event on an HP 54750-series digitizing oscilloscope. The delay line has a frequency range which extends from dc to 20 GHz and has less than 5.70 dB of attenuation at 20 GHz.

Each delay line is shipped from the factory with a VSWR versus frequency plot and an insertion loss versus frequency plot for that particular delay line.

The HP 54750 family of digitizing oscilloscopes are sequential sampling digitizing oscilloscopes and contain about 22 ns of delay between trigger point and the first sampling point. Using the HP 54008, a trigger point can be displayed on the screen of any HP 54750-series oscilloscope.

When using an HP 54750-series oscilloscope with the HP 54118A trigger, the delay between the trigger event and the first sample point is increased by about 4 ns. Because the HP 54008A delay line’s electrical timing length is greater than 22 ns long, the HP 54008A will work in this application also.

Specifications

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delay</td>
<td>≥ 22 ns</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>dc to 20 GHz.</td>
</tr>
<tr>
<td>VSWR</td>
<td>≤ 1.45:1</td>
</tr>
<tr>
<td>Insertion Loss</td>
<td>≤ 5.70 dB at 20 GHz</td>
</tr>
</tbody>
</table>

Characteristics

- Risetime: ≤ 40 ps (20% to 70%)
- Overshoot: ≤ 5 mV as displayed with the HP 54754A TDR step generator.

Connectors: SMA (f)

Environmental

- Temperature Operating: + 15 °C to + 35 °C (+ 59 °F to + 95 °F)
- Temperature NonOperating: -40 °C to + 70 °C (– 40 °F to + 158 °F)
- Humidity Operating: Up to 90 % relative humidity at +35 °C (+ 95 °F)
- Humidity Nonoperating: Up to 95 % relative humidity at +65 °C (+ 149 °F)
- Altitude Operating: 4,600 m (15,000 feet)
- Altitude Nonoperating: 15,300 m (50,000 feet)
- Vibration Operating: Random Vibrations 5 to 500 Hz, 10 minutes per axis, approx 0.3 g (RMS)
- Vibrations Nonoperating: Random vibration 5 to 500 Hz, 10 minutes per axis, approx 2.41 g (RMS); and swept sine resonant search, 5 to 500 Hz, 0.75 g (0-peak), 5 minute resonant dwell at 4 resonances per axis.
- Weight: Net Approximately 1.53 kg (3.4 lb)

Dimensions

- Width: 212.60 millimeters (8.37 inches)
- Height: 68.58 millimeters (2.7 inches)
- Depth: 222.25 millimeters (8.75 inches)

Contents of HP 54007A Accessory Kit

<table>
<thead>
<tr>
<th>Item Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 inch Coaxial Cable, APC 3.5 mm (f-f)</td>
<td>HP 8120-4941</td>
</tr>
<tr>
<td>17 inch Coaxial Cable, APC 3.5 mm (m-f)</td>
<td>HP 8120-4942</td>
</tr>
<tr>
<td>Coaxial Short, APC 3.5 mm (f)</td>
<td>HP 1250-2127</td>
</tr>
<tr>
<td>Coaxial Short, APC 3.5 mm (m)</td>
<td>HP 1250-2126</td>
</tr>
<tr>
<td>50 Ω Termination, APC 3.5 mm (m)</td>
<td>HP 909D</td>
</tr>
<tr>
<td>50 Ω Termination, APC 3.5 mm (m-f)</td>
<td>HP 909D opt 011</td>
</tr>
<tr>
<td>7.5 cm Airline, APC 3.5 mm (m-f)</td>
<td>HP 1250-1869</td>
</tr>
<tr>
<td>Power Splitter, APC 3.5 mm (f)</td>
<td>HP 11867B</td>
</tr>
<tr>
<td>2.6 cm, Semi-rigid Coax-“L”, SMA (m-m)</td>
<td>HP 54007-61601</td>
</tr>
<tr>
<td>3 cm, Semi-rigid Coax-“L”, SMA (m-m)</td>
<td>HP 54001-61602</td>
</tr>
<tr>
<td>6dB attenuator, APC 3.5 mm (m-f)</td>
<td>HP 33340C Option 006</td>
</tr>
<tr>
<td>40dB attenuator, APC 3.5 mm (m-f)</td>
<td>HP 33340C Option 040</td>
</tr>
<tr>
<td>Adapter, APC 3.5 mm (m-m)</td>
<td>HP 1250-1748</td>
</tr>
<tr>
<td>Foam Box Liner</td>
<td>HP 54007-29301</td>
</tr>
<tr>
<td>Walnut Box</td>
<td>HP 54007-85501</td>
</tr>
<tr>
<td>54007A Accessory Operating Note</td>
<td>HP 54007-98901</td>
</tr>
</tbody>
</table>

A 15cm Beadless Airline is available under HP part number 1250-1876

Hewlett-Packard recommends using the following items to properly care for your precision APC 3.5, 2.4-mm and SMA connectors. (See the HP 54007A Operating note for complete details on precision connector care.)

- 5 inch-lbs torque wrench
- 8 inch-lbs torque wrench
- Compressed Air Canister
- Liquid Freon
- Plastic Foam Swabs

HP P/N 8710-1582
HP P/N 8710-1765
HP 92193Y
HP P/N 8500-1914
HP P/N 9300-0468
Using the Proper Attenuator

HP offers two families of ultra-high bandwidth fixed attenuators. The HP 33340C Series are dc to 26.5-GHz attenuators and use 3.5-mm connectors. The HP 33340D Series are dc to 50-GHz attenuators with 2.4-mm connectors. Use the 26.5-GHz attenuator family to attenuate input signals with rise times as fast as 30 ps for minimum time domain distortion. If the signals being analyzed are faster than this, the HP 33340D Series is recommended. When using the HP 33340D Series attenuators, use 2.4-mm to a 3.5-mm connector adapters.

<table>
<thead>
<tr>
<th>HP 54701A 2.5-GHz Active Probe Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (-3 dB)</td>
</tr>
<tr>
<td>Rise Time (calculated from Tr = 0.35/(BW))</td>
</tr>
<tr>
<td>Attenuation Factor</td>
</tr>
<tr>
<td>dc Input Resistance</td>
</tr>
<tr>
<td>dc Gain Accuracy</td>
</tr>
<tr>
<td>Input Capacitance</td>
</tr>
<tr>
<td>Flatness</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Dynamic Range (&lt;1.5% gain compression)</td>
</tr>
<tr>
<td>Offset Adjustment</td>
</tr>
<tr>
<td>RMS Output Noise</td>
</tr>
<tr>
<td>Maximum Input Voltage</td>
</tr>
<tr>
<td>ESD Tolerance (150 Ω/150 pF)</td>
</tr>
</tbody>
</table>

Option 001
Type N (f) to 3.5 mm (f) adaptor
External thread 3.5 mm adaptor to securely connect HP 54701A probe to HP 54750 series plug-ins.
Application Description

ECL signals are normally offset from ground, while high frequency test equipment generally provides 50-Ω termination to ground. Attempting to connect an ECL signal directly to the test equipment could result in either damage to the ECL output or to the test equipment.

The HP 10086A ECL terminator provides an excellent interface between ECL outputs and test and measurement equipment. The terminator offsets and attenuates the signal sufficiently to protect the test equipment, while providing the proper termination voltage between the ECL circuit and the test equipment. The HP 10086A can also be used alone to properly load an ECL output. The ECL terminator is a precision adapter that is dc-coupled to the instrumentation. This allows direct measurement of your ECL signal. Power supply adjustment and capacitive or transformer coupling are no longer necessary with the ECL terminator. In addition, it is no longer necessary to float the instrumentation ground to –2 V, thereby reducing the hazards of power supply shorting and electrical shock or damage to the circuit.

The HP 54006A ECL terminator provides an excellent interface between ECL outputs and test and measurement equipment. The terminator offsets and attenuates the signal sufficiently to protect the test equipment, while providing the proper termination voltage between the ECL circuit and the test equipment. The HP 10086A can also be used alone to properly load an ECL output. The ECL terminator is a precision adapter that is dc-coupled to the instrumentation. This allows direct measurement of your ECL signal. Power supply adjustment and capacitive or transformer coupling are no longer necessary with the ECL terminator. In addition, it is no longer necessary to float the instrumentation ground to –2 V, thereby reducing the hazards of power supply shorting and electrical shock or damage to the circuit.

The HP 54006A is shipped with a dc Blocking Capacitor (HP 11742A) which can be used to remove a dc offset from a signal. The HP 54006A also contains an SMA (m) to BNC (m) adapter (HP 1250-2015). The two different tips included with each HP 54006A can be distinguished by their length. The 20:1 probe tip is longer than the 10:1 tip by about 0.2 inches.

The tips of the HP 54006A are replaceable. Kits of each tip can be obtained from HP under the following part numbers:

- HP 54006-68701 Pack of 4, 450 Ω resistors probe tips for 10:1 probing and an extra sleeve.
- HP 54006-68702 Pack of 4, 950 Ω resistors probe tips for 20:1 probing and an extra sleeve.
The HP 11898A module extender can be used with plug-in modules compatible with the HP 83480A and 54750A mainframes. The extender allows the plug-in to be placed up to 1.5 meters away from the mainframe. This allows users to make measurements on devices where the test device cannot be physically located close to the instrument mainframe. Examples include testing of very high-frequency electrical circuits where lengths of electrical cabling can degrade signal performance or for measurements where isolation from the mainframe is required to reduce vibration of the test device.

HP 11898A specifications and characteristics:
There are no specifications for the HP 11898A extender module. Performance is characterized in terms of how it will affect operation of the mainframe and plug-in.

Operating temperature range: 15°C to 35°C
Warm-up time: 2 Hours
Time Base Delay: Minimum delay will be increased from a 22ns minimum to typically 40 ns when triggering at the remote module, 30 ns when triggering at the mainframe.
Trigger Sensitivity: Trigger sensitivity will be reduced by 4 dB at 2.5 GHz

Static Protection Unit from Picosecond ATE Inc.
The Picosecond ATE Inc. Static Protection Unit model 1202 offers static damage protection for TDR measurements. A foot switch or TTL signal allows connection of the device under test after static charge is removed. Risetime is <40 ps. In North America, contact Stu McNaughton at Picosecond ATE Inc. (503) 641-3295.

PicoSecond Pulse Labs 4015C
15-ps, 9 V External TDR or TDT Source
The PicoSecond Pulse Labs model 4015C pulse generator extends the TDR/TDT performance of the HP 54750 series oscilloscopes. The pulse generator produces a 15-ps fall time with an amplitude of 9 V, which can be triggered by any HP 54750 series TDR step generator. The HP 11667C power splitter is not included. Contact Dr. Jim Andrews at PSPL, P.O. Box 44, Boulder, CO 80306; (303) 443-1249.
Ordering Information

Step Attenuators
- HP 8494B opt. 002 Manual Step Attenu, 0-11 dB 1 dB steps SMA(f)
- HP 8495B opt. 002 Manual Step Attenu, 0-70 dB 10 dB steps SMA(f)
- HP 33320H programmable Step Attenu, 0-11 dB 1 dB steps SMA(f)
- HP 33321H programmable Step Attenu, 0-70 dB 10 dB steps SMA(f)

Connector Care
- HP 8710-1582 5 in-lbs Torque Wrench
- HP 8710-1765 8 in-lbs Torque Wrench
- HP 5061-5311 Connector Saver

Power Splitter/Directonal Coupler
- HP 11667B Power Divider
- HP 773D Directional Coupler

Preamp
- HP 8447F Preamp - Power Amp (BNC)

Extending Your Oscilloscope’s Channel Count
- HP 3498A Switch/Control Unit
- HP 44476A Microwave Switch Module incl. 3 HP 33311B switches
- HP 33311B 2x1 18 GHz Switch, 50 ohms on unswitched inputs
- HP 34531R Rack Mount Faceplate for HP 34531B switches
- HP 6269B 40V, 50A Power Supply
- HP 44471A 10 Channel General Purpose Relay Module
- HP 44476B Microwave Switch Module
- HP 34531B 6x1 18 GHz Switch, 50 ohms on unswitched inputs

Options
- 0B1 Extra manual set
- 1CM Rack mount kit w/o handles
- 1CP Rack mount kit w/ handles

Accessories
- HP 54006A 6 GHz divider probe
- HP 54008A 22 ns delay line
- HP 54118A 500 MHz to 18 GHz trigger
- HP 10086A ECL terminator
- HP 54007A Accessories Kit
- HP 54121-68701 Mini accessories kit

Miscellaneous Connection Devices
- HP 1250-1864 APC 3.5 (m-m) adapter
- HP 1250-1747 APC 7 to APC 3.5(f) adapter
- HP 1250-1468 APC 7 to SMA (f) adapter
- HP 1250-1748 APC 3.5(m) to APC 3.5 (m) adapter
- HP 1250-1744 N-type (m) to APC 3.5 (f) adapter
- HP 1250-1250 N-type to SMA (f) adapter
- HP 1250-1158 SMA (f-f) adapter
- HP 1250-1159 SMA (m-m) adapter
- HP 1250-1857 SMB (f) to BNC (m) adapter
- HP 1250-0808 BNC (f) to BNC (f) adapter
- HP 10933A 48 inch BNC male cable
- HP 1250-2277 BNC (f) to dual banana jack
- HP 1250-1236 Panel mount SMB (f) to BNC (f)
- HP 1250-1876 15 cm leadless Airline
- HP 11901A APC 3.5(m) to 2.4(m) Adapter
- HP 11901D APC 3.5(m) to 2.4(f) Adapter
- HP 11901C APC 3.5(f) to 2.4(m) Adapter
- HP 11901B APC 3.5(f) to 2.4(f) Adapter
- HP 909D APC 3.5(f) Precision 50Ω Termination

Miscellaneous 2.4 mm Accessories
- HP 84904L 40 GHz Programmable Step Attain., 0-11 dB in 10 dB steps, 2.4 mm (f)
- HP 84906L 40 GHz Programmable Step Attain., 0-70 dB in 10 dB steps, 2.4 mm (f)
- HP 84907L 40 GHz Programmable Step Attain., 0-70 dB in 10 dB steps, 2.4 mm (f)
- HP 11867C 50 GHz power splitter
- Gore GD501501-012 40 GHz Cable (SMA connectors)*
- Gore GD0A0J0A-J-012 GHz cable (2.4mm connectors)*
- See HP publications #11900-90033 and #5953-2346 for additional 2.4-mm accessories
- * Contact W.L. Gore and Associates Inc.

Fixed Attenuators
- HP 33340C opt 003 3 dB fixed attenuator (APC 3.5)
- HP 33340C opt 006 6 dB fixed attenuator (APC 3.5)
- HP 33340C opt 010 10 dB fixed attenuator (APC 3.5)
- HP 33340C opt 020 20 dB fixed attenuator (APC 3.5)
- HP 33340C opt 030 30 dB fixed attenuator (APC 3.5)
- HP 33340C opt 040 40 dB fixed attenuator (APC 3.5)
- HP 33340D opt 003 3 db 50 GHz fixed attenuator (2.4mm)
- HP 33340D opt 006 6 db 50 GHz fixed attenuator (2.4mm)
- HP 33340D opt 010 10 db 50 GHz fixed attenuator (2.4mm)
- HP 33340D opt 020 20 db 50 GHz fixed attenuator (2.4mm)
- HP 33340D opt 030 30 db 50 GHz fixed attenuator (2.4mm)
- HP 33340D opt 040 40 db 50 GHz fixed attenuator (2.4mm)
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