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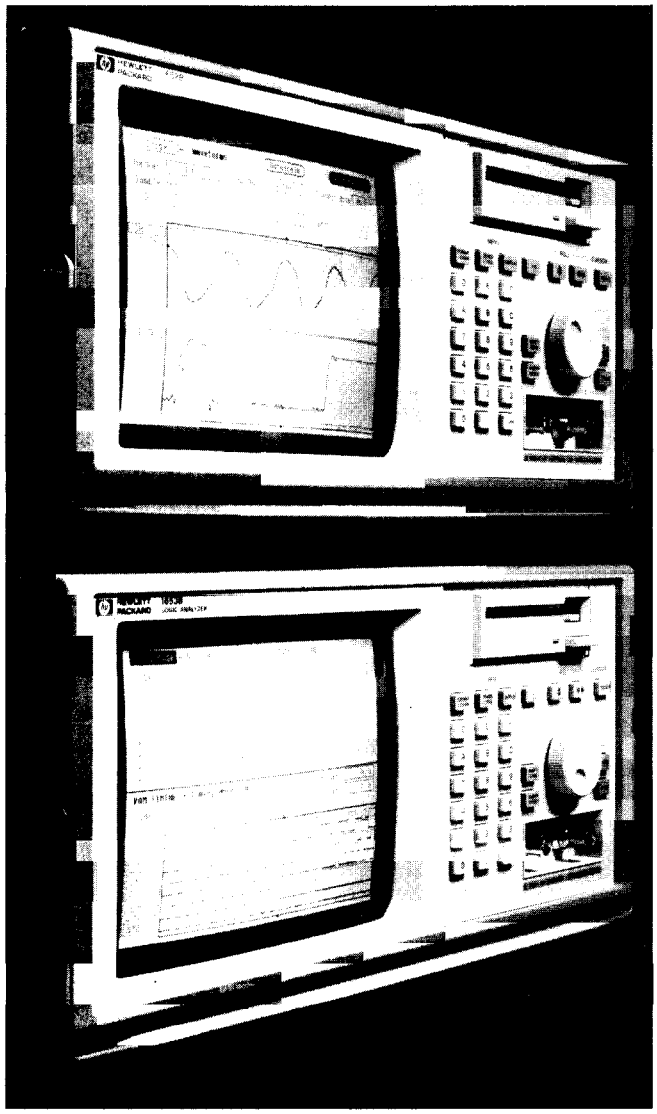
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LOGIC ANALYZERS

Portable Logic Analyzers

HP 1652B, 1653B

- 80 channels of state/timing
- 2 channels of 400 MS/s digitizing oscilloscope
- More measurement power at a lower cost than separate instruments
- See analog events with a general purpose 100 MHz single-shot BW digitizing scope
- Automatic pulse parameter measurements



HP 1652B and HP 1653B

DESIGNED FOR HP-IB SYSTEMS

Logic Analyzers with a Digitizing Oscilloscope

The HP 1652B and HP 1653B logic analyzers have all of the features of the HP 1650B and HP 1651B plus two 400 MSa/s digitizing oscilloscope channels, automatic pulse parameter measurements, and time-correlated state, timing and oscilloscope displays. You can still completely analyze your 8-, 16-, or 32-bit microprocessor while getting better definition on system signals with the 2-channel oscilloscope.

You can characterize critical timing parameters with time interval measurements to better than 1 ns accuracy or examine glitches in your system with the built-in scope to determine if noise or loading is the problem. Or, you can use the scope to enhance your troubleshooting capabilities.

Two Simultaneous 400 MSa/s Analog Channels

Each scope channel is a full-featured, 400 MSa/s, 100 MHz bandwidth oscillosope. Both channels simultaneously capture non-repeating events with a full 2,048 samples per channel. The built-in scope is based on the same technology used in the popular HP 54502A 100 MHz single-shot BW oscilloscope. The scope features include precision voltage and time interval measurements, autoscale, waveform math, auto-calibration, infinite persistence and averaging display modes.

Time-Correlated State, Timing and Oscilloscope Measurements

System debugging becomes easier when you display time-correlated state, timing, and analog displays on the same screen. You can see how hardware and software interact, while getting an accurate view of how your system sees the signal.

Cross-Trigger Measurement Modules

You can use the state analyzer's powerful triggering capabilities to determine when the oscilloscope should trigger.

Glitch triggering on all channels makes the timing analyzer another great tool for triggering the scope. Simply set up the timing analyzer to trigger on a glitch, then trigger the oscilloscope to capture the activity around the glitch. By getting an analog display of the signal, you can determine if the glitch is really a problem.

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Portable Analyzers

The HP 1652B/1653B portable analyzers are ideal for service applications. Their small size and light weight (just 24 lbs) make them easy to carry to test sites. With the built-in scope, you have two complete instruments in one small package.

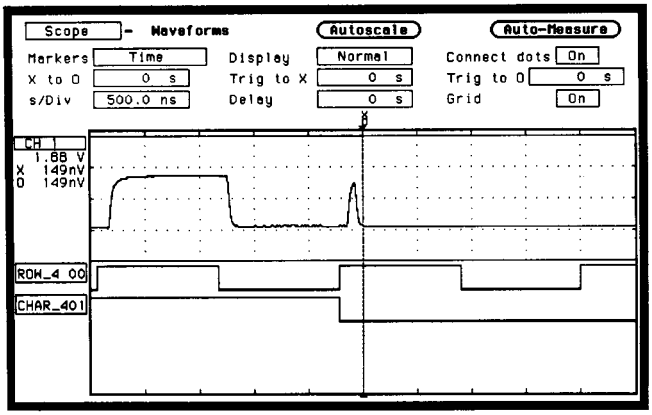
See Pre-trigger Events

2K sample memory per channel lets you view events up to 5μs before the trigger, while maintaining better than 1 ns time interval accuracy.

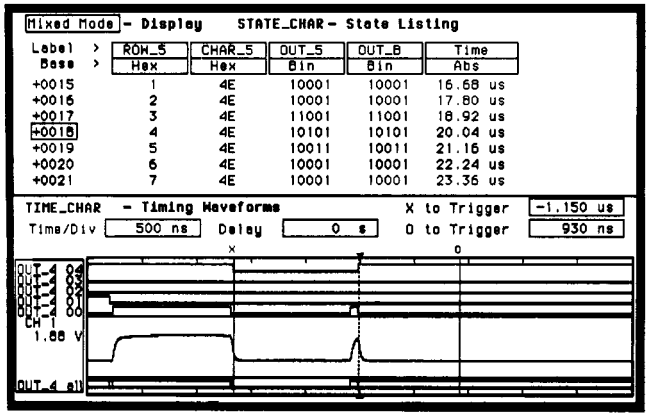
Automatic Pulse Parameter Measurements

Quickly analyze a signal's analog properties without having to count graticules. Choose automatic measurements or time markers to measure voltage and timing relationships. The HP 1652B/1653B automatically measures the following pulse parameters:

+ pulse width	− pulse width
frequency	period
risetime	falltime
peak-peak voltage	overshoot
preshoot	



The HP 1652B and 1653B offer full-featured digitizing oscilloscope performance. Time corrected with 100 MHz timing.



State timing and 100 MHz bandwidth scope all in one portable package.

Automatic Marker Search

Using the automatic marker search, you can examine waveforms for specific patterns that could be the cause of a system crash. Or, use the automatic marker search statistics to reveal setup and hold time violations as you make repeated measurements on the system. After each run, the markers are placed on specified patterns, and statistics are compiled on the mean, minimum, and maximum marker placement times, so you can see how often a specific event occurs.

Hardcopy Output

After using the built-in oscilloscope to find an elusive problem, use either an HP-IB or RS-232 printer to obtain a permanent record. The HP 1652B and 1653B support over 10 printers.

All Other Features of the HP 1650B/1651B

All of the other features of the HP 1650B/1651B logic analyzers are included in the HP 1652B/1653B. These features include 80/32 channels of state and timing analysis, full-featured triggering, built-in disk drives, and support for most popular processors and bus interfaces. Plus, the data and configuration files of the HP 1652B/1653B are compatible with the HP 1650B/1651B/1654B and with the HP 16510B. You can transfer information from one analyzer to another.

	HP 1652B	HP 1653B
Timing	100 MHz all 80 channels	100 MHz all 32 channels
State	35 MHz all 80 channels	25 MHz all 32 channels
Analog	2 - 400 MSa /s 100 Mhz BW Simultaneous acquisition channels	2 - 400 MSa/s 100 MHz BW Simultaneous acquisition channels
Glitch Capture	80 channels	32 channels
Microprocessor support	Most 8-, 16- and 32-bit microprocessors	Most 8-bit microprocessors, busses

See page 282 for specifications.
See page 292 for ordering information.

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LOGIC ANALYZERS
Specifications and Characteristics
HP 1650B, 1651B, 1652B, 1653B, 1654B, 16510B, 16511B

Key State and Timing Specifications and Characteristics

Model	HP 1650B	HP 1651B	HP 1652B	HP 1653B	HP 1654B	HP 16510B	HP 16511B
Channel count	80	32	80	32	64	80	160
Maximum state input Clock rate *	35 MHz	25 MHz	35 MHz	25 MHz	35 MHz	35 MHz	35 MHz
Setup time *	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns
Hold time *	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns	0 ns
Minimum state clock Pulse width *	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns	10 ns
Number of state clocks/qualifiers	5	2	5	2	2	5	5
Memory depth per channel	1024	1024	1024	1024	1024	1024	1024
Sequence levels	8	8	8	8	8	8	8
Trigger width	80 ch	32 ch	80 ch	32 ch	64 ch	80 channels	160 channels
Minimum detectable glitch width * (at threshold)	5 ns	5 ns	5 ns	5 ns	5 ns	5 ns	5 ns
Input R	100 KΩ ±2%	100 KΩ ±2%	100 KΩ ±2%	100 KΩ ±2%	100 KΩ ±2%	100 KΩ ±2%	100 KΩ ±2%
Input C	~8 pF	~8 pF	~8 pF	~8 pF	~8 pF	~8 pF	~8 pF
Lead sets included	YES	YES	YES	YES	YES	YES	YES

* = Specifications

Additional Specifications and Characteristics

Probes

Minimum input voltage swing: 600 mV peak-to-peak[1].

Input threshold accuracy: ±150 mV accuracy over the range −2.0 to 2.0 volts. ±300 mV accuracy over the ranges −9.9 to −2.1 volts and 2.1 to 9.9 volts[1].

Input dynamic range: ±10 volts about the threshold[1].

Minimum input overdrive: 250 mV or 30% of the input amplitude, whichever is greater.

Maximum input voltage: ±40 volts peak.

Threshold setting: threshold levels may be defined for pods 1, 2 and 3 on an individual basis. One threshold can be defined for pods 4 and 5. When using the HP 16511B, each card has independent threshold levels as defined above.

Threshold range: −9.9 to +9.9 volts in 0.1 volt increments.

Channel assignment: each group of 16 channels (a pod) can be assigned to analyzer 1, analyzer 2 or remain unassigned.

State analysis

State clocking

Maximum clock rate with time/event tagging on: 16.67 MHz (60 ns).

Master-slave clocking (mixed/demultiplexed clocking): master clock must follow slave clock by at least 10 ns and precede the next slave clock by at least 50 ns.

Clocks: HP 1650B, 1652B: 5 clocks
HP 1651B, 1653B: 2 clocks
HP 1654B: 4 clocks
Clock edges can be ORed together and operate in single phase, two phase demultiplexing, or two phase mixed mode. Clock edge is selectable as positive, negative, or both edges for each clock.

[1]Specifications.

Clock qualifier: the high or low level of the available clocks can be ANDed with the clock specification. Setup time: 20 ns; hold time: 5 ns.

Pattern recognizers: each recognizer is the AND combination of bit (0, 1, or X) patterns in each label. 8 pattern recognizers are available when one state analyzer is on. 4 are available to each analyzer when two state analyzers are on.

16511B Clock probing: while using the HP 16511B, and when more than 80 channels are assigned to Analyzer 1, each clock probed by pods on the first card must be probed by pods on the second card also.

Range recognizer: recognizes data which is numerically between or on two specified patterns (ANDed combination of zeros and/or ones). The maximum size is 32 bits.

Qualifier: a user-specified term that can be anystate, nostate, a single pattern recognizer, range recognizer, or logical combination of pattern and range recognizers.

Branching: each sequence level has a branching qualifier. When satisfied, the analyzer will restart the sequence or branch to another sequence level. Branching not allowed across sequence that contains the trigger.

Occurrence counter: sequence qualifier can be specified to occur up to 65535 times before advancing to the next level.

Storage qualification: each sequence level has a storage qualifier that specifies the states that are to be stored.

Triggering: user can specify a trigger word qualifier that can occur across any combination of channels, up to 160 (HP 16511B).

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Tagging

State Tagging: Counts the number of qualified states between each stored state. Measurement can be shown relative to the previous state or relative to trigger. Maximum count is 4.4×10^{12}.

Time Tagging: Measures the time between stored states, relative to either the previous state or to the trigger. Maximum time between states is 48 hrs. With tagging on, the acquisition memory depth is halved. Minimum time between states is 60 ns.

Symbols

Pattern symbols: User can define a mnemonic for the specific bit pattern of a label. When data display is SYMBOL, mnemonic is displayed where the bit pattern occurs.

Range symbols: User can define a mnemonic covering a range of values. When data display is SYMBOL, values within the specified range are displayed as mnemonic + offset from base of range.

Number of pattern and range symbols: 100 per analyzer. Symbols can be downloaded over RS-232 or HP-IB.

Timing analysis

Transitional timing mode: sample is stored in acquisition memory only when the data changes. A time tag stored with each sample allows reconstruction of waveform display. Time covered by a full memory acquisition varies with the number of pattern changes in the data.

Sample period: Every 10 ns.

Maximum time covered by data: 5000 seconds.

Minimum time covered by data: 10.24 μs

Glitch capture mode: data sample and glitch information is stored every sample period.

Sample period in glitch mode: 20 ns to 50 ms in a 1-2-5 sequence, dependent on sec/div and delay settings. Sample period displayed when markers are off.

Time covered by data in glitch mode: sample period x 512.

Timing waveform display

Sec/div: 10 ns to 100s; 0.01% resolution.

Hardware delay: 20 ns to 10 ms.

Accumulate: waveform display is not erased between successive acquisitions.

Overlay mode: Multiple channels can be displayed on one waveform display line. Primary use is to view summary of bus activity.

Maximum number of displayed waveforms: 24 lines

Time interval accuracy

Sample period accuracy: 0.01% of sample period.

Channel-to-channel skew: 4 ns typical.

Time interval accuracy: ± (sample period + channel-to-channel skew + 0.01% of time interval reading).

Trigger specification

Asynchronous pattern: Trigger on an asynchronous pattern less than or greater than specified duration. Pattern is the logical AND of specified low, high, or don't care for each assigned channel. If pattern is valid but duration is invalid, there is a 20 ns reset time before looking for patterns again.

Greater than duration: Maximum duration is 40 ns to 10 ms with 10 ns or 0.01% resolution, whichever is greater. Pattern must be valid for at least 20 ns. Accuracy is +20 ns to −0 ns. Trigger occurs at the end of the pattern.

Glitch/Edge Triggering: Trigger on glitch or edge following valid duration of asynchronous pattern and while the pattern is still present. Edge can be specified as rising, falling, or either. Less than duration forces glitch and edge triggering off.

Measurement and display functions

Arming: Each analyzer can be armed by the run key, the other analyzer, the intermodule bus (HP 16500A), or the built-in oscilloscope (HP 1652B/1653B).

Trace mode: Single mode acquires data once per trace specification; repetitive mode repeats single mode acquisitions until stop is pressed or until pattern time interval or compare stop criteria are complete.

Labels: Channels can be grouped together and given a 6-character name. Up to 20 labels in each analyzer can be assigned with up to 32 channels per label.

Activity indicators: provided in the configuration, state format, and timing format menus for monitoring device-under-test activity while setting up the analyzer.

Markers: two markers (X and O) are shown as dashed lines in the display.

Trigger: displayed as a vertical dashed line in the timing waveform, state waveform and X-Y chart displays and as line 0 in the state listing and state compare displays.

Measurement functions

Run: starts acquisition of data in specified trace mode.

Stop: In single trace mode or the first run of a repetitive acquisition, the Stop function halts acquisition and displays the current acquisition data. For subsequent runs in repetitive mode, Stop halts acquisition of data and does not change current display.

Time interval: The X and O markers measure the time interval between events occuring on one or more waveforms or states (only available when time tagging is on).

Delta states: The X and O markers measure the number of tagged states between any two states.

Patterns: The X or O marker can be used to locate the nth occurrence of a specified pattern before or after trigger, or after the beginning of data. The O marker can also find the nth occurrence of a pattern before or after the X marker.

Statistics: X to O marker statistics are calculated for repetitive acquisitions. Patterns must be specified for both markers, and statistics are kept only when both patterns can be found in an acquisition. Statistics are minimum X to O time, maximum X to O time, average X to O time, and ratio of valid runs to total runs.

Compare mode functions: Performs post-processing bit-by-bit comparison of the acquired state data and compare image data.

Compare image: Created by copying a state acquisition into the compare image buffer. Allows editing of any bit in the compare image to a 1, 0 or X. Compare image can also be edited via HP-IB or RS-232.

Compare image boundaries: Each channel (column) in the compare image can be enabled or disabled with bit masks in the compare image. Upper and lower ranges of states (rows) in the compare image can be specified. Any data bits that do not fall within the enabled channels and the specified range are not compared.

Compare Stop measurement: Repetitive acquisitions can be halted when the comparison between the current state acquisition and the current compare image is equal or not equal.

Compare Displays: Compare listing shows the compare image and bit masks; difference listing highlights differences between the current state acquisition and the compare image.

Data entry/display

Display modes: State listing, state waveforms, state chart, state compare listing, compare difference listing, timing waveforms, interleaved time-correlated listing of two state analyzers (time tagging on), time-correlated state listing and timing waveform on the same display; oscilloscope displays (HP 1652B/1653B only): oscilloscope waveform, time-correlated timing with oscilloscope, time-correlated state listing and timing waveform with oscilloscope waveform.

State X-Y chart display: Plots value of a specified label (on y-axis) versus states or another label (on x-axis). Both axes can be scaled.

Markers: Correlated to state listing, state compare, and state waveform displays. Available as pattern, time, or statistics (with time counting) and states (with state counting on).

Accumulate: Chart display is not erased between successive acquisitions.

State waveform display: displays state acquisitions in waveform format.

States/division: 1 to 104 states

Delay: − 1023 to + 1024 states

Accumulate: waveform display is not erased between successive acquisitions.

Overlay mode: Multiple channels can be displayed on one waveform display line. Primary use is to view summary of bus activity.

Maximum number of displayed waveforms: 24.

Markers: Correlated to the state listing, state compare, and X-Y chart displays.

Timing waveform: Pattern readout of timing waveforms at X or O marker.

Bases: Binary, octal, decimal, hexadecimal, ASCII (display only), user-defined symbols

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LOGIC ANALYZERS
Specifications and Characteristics
HP 1652B, 1653B

Key Oscilloscope Specifications and Characteristics

Model(s)	HP 1652B, HP 1653B
Type	2 channel simultaneous acquisition
Bandwidth (–3dB) *	dc to 100 MHz (single shot)
Maximum sample rate	400 MSa/s
Transition time (10% - 90%)	≤ 3.5 ns
A/D	6 bit real-time
A/D resolution	±1.6% of full scale
Waveform record length	2048 points
Time interval measurement accuracy *	±(2% x s/div + .01% x delta t + 500 ps)
dc gain accuracy *	± 3% of full scale
dc offset accuracy *	± (2 mV + 2% of channel offset + 2.5% of full scale)
Voltage measurement accuracy *	Gain accuracy + offset accuracy + ADC resolution
Trigger	Either/both input channels, rising or falling edge(s)
Armed by	run, external BNC low input, or analyzer 1 or 2
Trigger sensitivity *	10% of full screen
Input coupling	dc
Input R	1 MΩ ± 1% or 50 Ω ± 1%
Input C	Approximately 7 pF
Probes included	2 - HP 10430A 10:1, 1 MΩ, 6.5 pF, 1m mini-probes

* = Specifications (valid within ± 10° C of software calibration temperature).

Supplemental Characteristics

Vertical (at BNC)

Vertical sensitivity range: 15 mV/div to 10 V/div (1:1 probe)

Vertical sensitivity resolution: Adjustable 2 digit resolution

dc offset range: ± 2.0 V for ≤ 50 mV/div
(1:1 probe) ± 10 V for 100 mV/div and 200 mV/div
± 50 V for 500 mV/div and 1 V/div
± 125 V for ≥ 2 V/div
± 5 V max if input impedance at 50 ohm.

dc offset resolution: 200 μV for ≤ 50 mV/div
(1:1 probe) 1 mV for 100 mV/div and 200 mV/div
5 mV for 500 mV/div and 1 V/div
25 mV for ≥ 2 V/div
or 4 digits of resolution, which ever is greater.

Probe factors: Any integer ratio from 1:1 to 1000:1.

Maximum safe input voltage: 1 MΩ: ± 250 V [dc + peak ac (<10kHz)]; 50 Ω: 5 V rms.

Channel isolation: 40 dB: dc to 50 MHz; 30 dB: 50 MHz to 100 MHz (with channels at equal sensitivity).

Horizontal

Timebase range: 5 ns/div to 5 s/div

Timebase resolution: for t < 10 ns/div, 100 ps resolution; for t ≥ 10 ns/div, adjustable with 3-digit resolution

Delay Pretrigger Range:

Time/division Setting	Available Delay
5 ns - 500 ns	2.5 μs
500 ns - 5s	5 x (s/div)
5 ns - 50 μs/div	10,000 x (s/div)

Triggering

Trigger level range: dc offset ± 6 divisions

Trigger level resolution: 400 μV for ≤ 50 mV/div (1:1 probe)
2 mV for 100 mV/div and 200 mV/div
10 mV for 500 mV/div and 1 V/div
50 mV for ≥ 2 V/div

Trigger mode descriptions

Immediate: Triggers immediately after arming condition is met.

Edge: Triggers on rising or falling edge from channel 1 or 2.

Auto Trigger: Self triggers if no trigger condition is found within approximately 1 second after arming.

Trigger Out: Arms Analyzer 1 or 2 or triggers the rear panel BNC.

Waveform display

Display formats: 1 to 8 scope waveforms displayed.

Display resolution: 500 points horizontal, 240 points vertical.

Display modes

Single: new acquisition replaces old.

Accumulate: new acquisition displayed in addition to previous acquisitions until screen is erased.

Average: New acquisitions are averaged with old acquisitions and displayed. Maximum number of averages 256.

Overlay: Channel 1 and Channel 2 can be overlayed in the same area.

Connect-the-dots: Sampled data values connected by straight lines.

Waveform reconstruction: A reconstruction filter fills in missing data points for timebase ≤ 100 ns/div.

Waveform math: Display capability of A–B and A+B functions.

Mixed mode: Scope plus logic analyzer displays on same screen.

Measurement aids

Time markers: Two vertical markers labeled X and O. Voltage levels displayed for each marker. Time interval measurements can be made between any two events.

Automatic search: Searches for a specified absolute or percentage voltage level at a positive or negative edge, count adjustable from 1 to 1024.

Auto Search Statistics: Mean, maximum, and minimum values for elapsed time from X to O markers for multiple runs. Number of valid runs and total number of runs displayed.

Trigger level marker: Horizontal trigger level marker displayed in Trace/Trigger menu only.

Automatic measurements: Automatic measurement of: + pulse width, – pulse width, frequency, period, risetime, falltime, V p-p, preshoot, overshoot.

Grid: Selectable (on/off).

Setup aids

Autoscale: Auto scales the vertical and horizontal ranges, offset, and trigger levels to best display input signals. Requires amplitude above 10 mV peak, and frequency between 50 Hz and 100 MHz.

Preset: Scales the vertical range, offset, and trigger level to best display TTL and ECL waveforms.

Calibration: vertical, trigger, channel 1 to channel 2 deskewing, delay, and all defaults.

Probe compensation source: External BNC supplies square wave approx. –400 mV to –900 mV at approximately 1.25 KHz.

Interactive measurements

Acquisition: Analog, timing, and state can occur simultaneously or in series.

Mixed displays: Timing channels and analog channels can be displayed on the same screen. State listings with time tags, timing channels and analog channels can be displayed on the same screen.

Time correlation: All modules are time correlated.

Time interval accuracy

Between modules: Equals the sum of channel to channel time interval accuracies of each machine used for a measurement.

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LOGIC ANALYZERS
General Characteristics
HP 1650B, 1651B, 1652B, 1653B, 1654B, 16500A

Characteristics

Disk Drives/Files

Built-in disk drives file types: system software, configuration (contains instrument configuration, data, pointer to inverse assembler file), inverse assembler, auto-configuration.

Autoload designation: a pre-defined configuration file can be loaded at powerup.

Disk operations: store, load, copy, duplicate disk, pack disk, rename, purge, format Disk.

Programmability/IO Ports

Instrument settings and operating modes can be remotely programmed for ALL logic analyzer models with either RS-232C or HP-IB (IEEE-488). Both ports are standard on all analyzers. Either port can be used for hardcopy output.

Hard-copy Output

Printers supported: HP ThinkJet, HP QuietJet, HP LaserJet series, HP PaintJet, HP DeskJet, Epson and Epson-compatible (e.g., Epson RX-80, RX-100, MX-80, MX-100) printers via RS-232C or HP-IB.

HP-IB interface functions: SH1, AH1, T5, TE0, L3, LE0, SR1, RL1, PP1, DC1, DT1, C0 and E2.

RS-232C configurations

Protocols: XON/XOFF, ENQ/ACK, none, data

Bits: 8

Stop Bits: 1, 1½, 2

Parity: none, odd, even

Baud Rates: 110, 300, 600, 1200, 4800, 9600, 19200.

Input/output Rear-panel BNCs

Input BNC: Labeled port-in (HP 16500A) or external trigger input (HP 1650B/1651B/1652B/1653B/1654B). Input signal must drive two LS TTL loads.

Output BNC: Labeled Port-out (HP 16500A) or External Trigger Output (HP 1650B/1651B/1652B/1653B/1654B). Output signal is active high, TTL output level, high > 2 V into 50 ohms, < 0.4 V into 50 ohms.

Auxilary power available through cables: The HP 1650B/1651B 1652B/1653B/1654B/16510B provide power through the state/timing cables. Each cable is capable of providing 2/3 amp @ 5 V, to a maximum of 2 amp @ 5 V per analyzer or card. The HP 16500A logic analysis mainframe can provide 16.3 amp - current draw of installed cards @ 5 V. The primary use of the auxilary power is as a source for preprocessors.

Current draw per card: 3.0 amp per HP 16510B, 1.3 amp per HP 16515A, 1.4 amp per HP 16516A, .7 amp per HP 16520A, .8 amp per HP 16521A, .4 amp per HP 16530A, 1.1 amp per HP 16531A.

HP 16500A InterModule Bus (IMB)

Run control: Analog, timing, state, and pattern generation can be armed by group run. Modules can run concurrently or be armed in series. Each module can arm one or more modules.

Mixed display modes: Any timing or oscilloscope waveform displays can be mixed. State listings can be included with waveforms in the state/timing Mixed Mode display.

Acquiring data for mixed displays: To obtain a mixed display, multiple modules must be armed through the IMB. To include a state listing(s) in mixed mode display, state time tagging must be on.

Time interval accuracy between modules: Equals the sum of the channel-to-channel time interval accuracies of each module used in the measurement, for a deskewed measurement.

Operating Environment

Temperature: Instrument, 0° to 50°C (+32° to 122°F). Disk media, 10° to 40°C (+50° to 104°F). Probes and cables, 0° to 65°C (+32° to 149°F).

Humidity: Instrument, up to 95% relative humidity at +40°C (+104°F). Disk media, 8% to 80% relative humidity.

Altitude: to 4600 m (15 000 ft)

Vibration-operating: random vibration 5-500 Hz, 10 minutes per axis, ~ 0.3 g (rms)

Vibration-non-operating: random vibration 5-500 Hz, 10 minutes per axis, ~ 2.41 g (rms); and swept sine resonant search, 5-500 Hz, 0.75 g (0-peak), 5 minute resonant dwell @ 4 resonances per axis.

Weight

HP 1650B/1651B/1654B: net, 10.0kg (22lb); shipping 18.2kg (40lb).

HP 1652B/1653B: net, 11.0kg (24lb); shipping 19.0kg (42lb) shipping

HP 16500A (max): net, 18.1kg (40lb) + (.7kg (1.6lb) * number of cards); shipping 25.9kg (57lb) + (3.6kg (8lb) * number of cards)

Power

HP 1650B/1651B/1652B/1653B/1654B: 115V/230 V, 48-66 Hz, 200 W max

HP 16500A: 115V/230 V, 48-66 Hz, 475 W max

Size

HP 1650B/1651B/1652B/1653B/1654B: 194.3H x 425.4W x 355.6mmD (7.65" x 16.62" x 14.0") including rear feet, excluding bottom feet

HP 16500A: 222.2H x 425.7W x 548.6mmD (8.75" x 16.76" x 21.6"), including rear feet, excluding bottom feet

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LOGIC ANALYZERS
Ordering Information

Portable Logic Analyzers
HP 1650B 80-channel logic analyzer
Opt 908 Rackmount tray
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 1651B 32-Channel logic analyzer
Opt 908 Rackmount tray
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 1652B 80-channel logic analyzer with oscilloscope
Opt 908 Rackmount tray
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 1653B 32-Channel logic analyzer with oscilloscope
Opt 908 Rackmount tray
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 1654B 64-channel logic analyzer
Opt 908 Rackmount tray
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723

Modular Logic Analyzers
HP 16500A Logic analysis system mainframe
Opt 908 Rackmount kit (8 3/4" EIA rackmount)
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 16501A Logic analysis system expansion frame
Opt 908 Rackmount kit (8¾" EIA rackmount
Opt W30 Extended repair service. See page 723
HP 16510B 80-channel 35 MHz state/100 MHz timing
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 16511B 160-channel logic analyzer 35 MHz state/100 MHz timing conversion kit (2 HP 16510Bs needed)
HP 16515A 16-channel 1 GHz timing master card
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 16516A 16-channel 1 GHz timing expansion card
Opt W30 Extended repair service. See page 723
HP 16520A 12-channel 50 Mbit/s pattern generation card
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 16521A Pattern generator expansion card
Opt W30 Extended repair service. See page 723
HP 16530A 400 MSa/s oscilloscope timebase card
Opt 910 Extra operating and programming manual
Opt W30 Extended repair service. See page 723
HP 16531A 2-channel 400 Msa/s scope acquisition card
Opt W30 Extended repair service. See page 723
HP 16540A 16-channel 100 MHz state master card
Opt 910 Extra operating and programming manual
Opt W30 Extended Repair Service. See page 723
Opt W32 Calibration service. See page 723.
HP 16541A 48-channel 100 MHz state expansion card
Opt W30 Extended repair service. See page 723
Opt W32 Extended calibration service

Upgrade Kits
HP 10449A Software Upgrade Kit for HP 1650A/51A
HP 16510-68703 Software Upgrade Kit for HP 16510A
HP 10448A 35 MHz State Upgrade Kit for HP 16510A
HP 10349B Scope Upgrade Kit for HP 1650B or HP 1651B
HP 16500-68704 CPU Upgrade Kit for HP 16500A Mainframe
HP 16500-68703 Current Operating Software Version (16500A)
HP 01650-68703 Current Operation Software Version (1652B/53B)
HP 01652-68703 Current Operation Software Version (1652B/53B)
Price for upgrade kits DOES NOT include installation.

Accessory Software
HP 10390A System Performance Analysis Software
Opt 001 for the HP 1650A and HP 1650B
Opt 002 for the HP 1651A and HP 1651B
Opt 003 for the HP 16540A/41A
HP 10391B Inverse Assembler Development Package
HP 10392A State-to-Pattern Generator Link

Probe Interface
HP 10269C General-purpose probe interface (required with many microprocessor support packages, see Microprocessor and Interface Support page 262).

Microprocessor Interfaces
HP E2417A AMD 29000 (PGA) preprocessor
HP 10335G Hitachi 6301/6303 (DIP) preprocesor
HP 10336G Hitachi 64180 (DIP) preprocessor
HP 10336H Hitachi 64180 (PLCC) preprocessor
HP E2415A Intel MCS-51 (DIP) preprocessor
HP E2416A Intel MCS-96 (PGA) preprocessor
HP 10304B Intel 8085 (DIP) preprocessor
HP 10305B Intel 8086/88 (DIP) preprocessor
HP 10306G Intel 80186/88 (PGA) preprocessor
HP E2409A Intel 80286 (PLCC/PGA) preprocessor
HP 10314D Intel 80386 (PGA) preprocessor
HP E2403A Intel 80486 (PGA) universal interface
HP E2411A Intel 80486 (PGA) preprocessor
HP E2405A Intel 80860 (PGA) universal interface
HP 10311B Motorola 68000/10 (DIP) preprocessor
HP 10311G Motorola 68000/10 (PGA) preprocessor
HP E2426A Motorola 68020 (PGA) preprocessor
HP 10315G Motorola 68HC11 (DIP) preprocessor
HP 10315H Motorola 68HC11 (PLCC) Preprocessor
HP E2413A Motorola 68332 EVS Logic Analysis Support
HP E2414A Motorola 68302 ADS Logic Analysis Support
HP E2406A Motorola 68030 50MHhz (PGA) Preprocessor

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HP E2420A Motorola 68040 Preprocessor
HP E2400A Motorola 88200 (PGA) Preprocessor
HP E2404A Motorola 88100 (PGA) Preprocessor
HP E2418A Texas Instruments TMS320C25 Preprocessor
HP 10300B Zilog Z80 (DIP) Preprocessor

Bus and Interface Preprocessors

HP 10342B HP-IB, RS-232C and RS-449 buses
HP 10342G HP-IB bus
HP 10341B MIL-STD 1553A/B bus
HP 10343B SCSI bus
HP 10344A A-size VME bus
HP E1323A B-size VME; B- & C-Size VXIbus

User-Definable Interface Products

HP 10320C User-definable interface
HP 10321A Microprocessor interface parts kit
HP 10322A 40-pin DIP interface cable
HP 10323A 48-pin DIP interface cable
HP 10324A 64-pin DIP interface cable
HP 10391B Inverse assembler development package

Miscellaneous Accesories

HP E2421A Pomona 5514 SOIC Clip Kit
HP E2422A Pomona 5515 QUAD clip kit

Printers and Accessories

HP 3630A PaintJet color graphics printer
  Opt 001 with RS-232C/V.24 interface
  Opt 002 with HP-IB interface
HP 2225A ThinkJet printer with HP-IB interface
HP 2225D ThinkJet printer with RS-232C/V.24 interface
HP 92261A ThinkJet print cartridges
HP 92261N paper (2500 Sheets, for ThinkJet, DeskJet)
HP 92261S Mini-printer stand
HP 2276A DeskJet printer, Centronics/Rs-232C/v.24 Interface
HP 10833A HP-IB cable, 1m
13242-60010 RS-232C cable, 3m

Oscilloscope Accessories

HP 10503A BNC-to-BNC cable, 1.2m
HP 10240B BNC-to-BNC blocking capacitor
HP 10211A IC probe clip
HP 10024A 16-pin IC test clip

Oscilloscope Probes

HP 10020A 1:1-100, 50-5000 Ω, < 1 pF resistive divider probe set, 1.2m
HP 10430A 10:1, 1 MΩ, 6.5 Pf mini-probe, 1m
HP 10433A 10:1, 10 MΩ, 10 pF mini-probe, 2m
HP 10435A 10:1, 1 MΩ, 7.5 pF mini-probe, 1m
HP 10437A 1:1, 50 Ω, mini-probe, 2m
HP 10438A 1:1, 1 MΩ, 40 pF mini-probe, 1m
HP 10439A 1:1, 1 MΩ, 64 pF mini-probe, 2m
HP 10440A 100:1, 10 MΩ, 2.5 pF mini-probe, 2m

State and Timing Analyzer Replacement Probes and Lead Sets

HP 01650-61607 16-channel woven probe cable for 1650B, 1651B, 1652B and 1653B
HP 16510-61601 16-channel woven probe cable for HP 16510B
HP 16510-61602 16-channel woven probe cable for HP 16510B
HP 5959-9333 5 probe leads for HP 1650 B series
HP 5959-9334 5 short ground leads for HP 1650B, 1651B, 1652B, 1653B and 16510B
HP 5959-9335 5 long ground leads for HP 1650B, 1651B, 1652B, 1653B and 16510B
HP 01650-61608 16-channel probe lead set for HP 1650B/1651B/1652B/1653B/16510B
HP 01650-63203 termination adaptor for HP 1650B/1651B/1652B/1653B/16510B
HP 1810-1278 9-channel IC termination adaptor
HP 1251-8106 2 x 10, 0.1″ center header (similar to 3-M[1] p/n 3592-6002)
HP 5090-4356 Surface-mount grabbers (package of 20)
HP 5959-0288 Throughhole grabbers (package of 20)
HP 16515-61604 1-channel coax probe cable for HP 16515A/16516A
HP 16515-69502 8 1-channel lead set for HP 16515A/16516A
HP 16515-68703 grounding kit for HP 16515A/16516A
HP 16515-68705 Probe pins for HP 16515A/16516A
HP 16515-63202 1 GHz Timing Termination Adaptor

Pattern Generator Accessories; Replacement Probes and Lead Sets

HP 10392A state-to-pattern generator link
HP 16520-61601 Input qualifier probe cable
HP 16520-69501 Input qualifier probe kit
HP 16520-61602 8-channel data probe cable
HP 16520-61603 Clock/strobe probe cable
HP 10347A Pattern generator probe lead set
HP 10345A 8-channel ECL differential driver pod
HP 10346A 8-channel TTL tristate buffer pod
HP 10348A 8-channel CMOS tristate buffer pod
HP 5959-0288 grabbers (package of 20)

Other Accessories for the HP 1650B/1651B/1652B/1653B

HP 1180A Testmobile for HP 1650B/1651B/1652B/1653B
HP 92199B Power strip
HP 1540-1066 Soft carrying case for HP 1650B/1651B/1652B/1653B
HP 92192A Blank double-sided 3.5″ diskette (box of 10)
HP 5061-6175 Rackmount kit for HP 1650B/1651B/1652B/1653B
HP 1494-0015 Rackmount slide tray for HP 1650B/1651B/1652B/1653B
HP 9211-2645 Transit Case HP 1650B/1652B/1652B/1653B
HP 5061-6183 Front Cover for HP 1650B/1651B/1652B/1653B

Other Accessories for the HP 16500A

HP 92192A Blank double-sided 3.5″ diskettes (box of 10)
HP 1008A Testmobile for the HP 16500A
  Option 006 Power strip and cabinet
HP 46060A HP Mouse
HP M1309A Trackball
HP 5061-9679 Rackmount kit for HP 16500A
HP 9211-2658 Transit case for HP 16500A

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