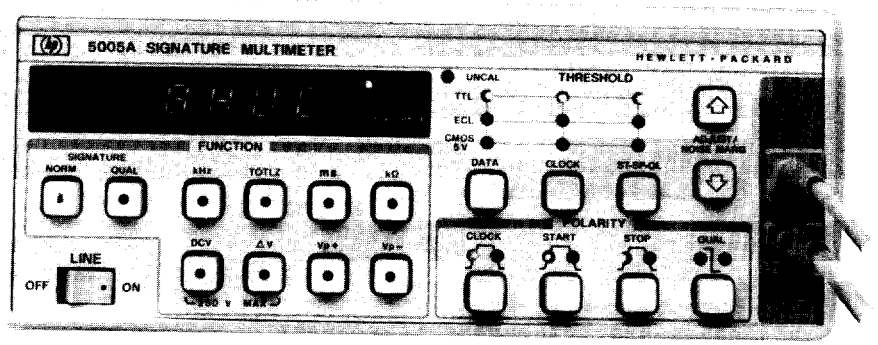
DIGITAL CIRCUIT TESTERS

Signature Multimeter, Combines Counter and Multimeter Functions with Signature Analysis

Model 5005A/B

- Digital and analog measurement capability optimized for digital troubleshooting
- Easy to use single probe measurement of logic signals, voltage, and frequency
- 25 MHz, multiple logic family signature analysis with qualified clocking mode
- Compact and portable (HP 5005A)



HP 5005A Signature Multimeter

Description

Total checkout of a digital system often requires characterizing both digital data activity and analog signal parameters. A typical troubleshooting procedure may specify a digital multimeter for checking power supplies and circuit board integrity (shorts and opens), a universal counter to measure clock frequencies and time intervals between signals, and a means to verify the analog integrity of active digital signals. The HP 5005 Signature Multimeter offers, in a single instrument, a measurement set optimized for these types of digital troubleshooting applications.

Two versions, the HP 5005A for manual applications and the HP 5005B for automatic test system applications, share common performance capabilities. Their feature set includes:

— Field proven Signature Analysis (for multiple logic families).
— Digital multimeter (DC volts, resistance and differential voltage).
— Frequency counter (frequency, totalize, time interval).
— Voltage threshold (upper voltage peak, lower voltage peak).
— Multifunction probe.

Signature Analysis

HP's patented Signature Analysis technique enables the HP 5005 to generate a compressed, four digit "fingerprint" or signature of the digital data stream at a logic node. Any fault associated with a device connected through the node will force a change in the data stream and, consequently, produce an erroneous signature.

Specific features of the HP 5005 Signature Analyzer include:

— Multiple logic family compatibility—preset threshold levels for TTL, CMOS, and ECL or adjustable thresholds (+12.5 V to −12.5 V) assure coverage of a wide variety of logic device types.
— 25 MHz clock frequency—extends Signature Analysis to high speed circuits such as CRT controllers.
— Qualified signature mode—speeds fault isolation in complex products by windowing signature collection to specific modules or devices without requiring major test setup changes. This simplifies the engineering involvement in hardware and software testability and accelerates test procedure preparation.

Digital Multimeter

Certain digital problems result from analog circuit failures: a low power supply voltage, an open or shorted circuit path, a faulty A/D or D/A converter. Each may contribute to a system failure. The HP 5005 contains a 4½ digit dc voltmeter, ohmmeter, and differential voltmeter, each with performance geared toward analog measurements necessary in digital troubleshooting.

The implementation of each multimeter function emphasizes simplicity and convenience. Automatic internal self calibration and autoranging maximize troubleshooting efficiency by eliminating unnecessary interaction with the instrument. Improvements in display interpretation also aid troubleshooting. The ohmmeter, for example, when measuring an open circuit, produces an "OPEN" indication on the display rather than the typical overload display.

Frequency Counter

The counter within the HP 5005 provides totalize and frequency measurements to 50 MHz, and time interval measurements to 100 nanosecond resolution. Intended to extend the digital troubleshooting capabilities of the Signature Analysis (synchronous measurements), the counter functions provide the ability to characterize one-shots and timers through time interval measurement; test interrupt lines, reset lines, and asynchronous communication interfaces (RS-232) through totalize; and verify clock and clock driver circuitry through frequency measurement.

Voltage Threshold

Logic level degradation is a common and troublesome malfunction in digital products. Isolating this failure typically requires displaying and interpreting the waveform. The HP 5005's peak voltage measurement mode provides a simple, direct method of measuring logic high and logic low voltage of active digital signals.

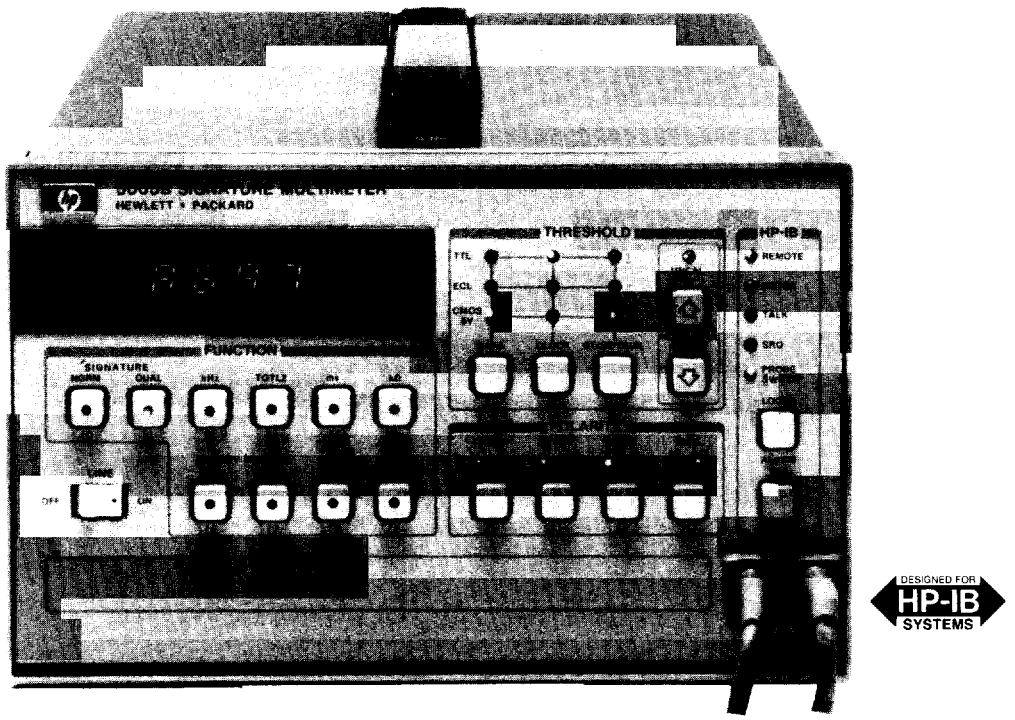
The peak voltage measurement mode allows the HP 5005 to characterize and display either the greatest (positive peak) or lowest (negative peak) voltage measured at the probe. Selection of either positive peak or negative peak mode displays the appropriate measured threshold for comparison against the specifications of the logic family.

DIGITAL CIRCUIT TESTERS

Signature Multimeter, Combines Counter and Multimeter Function with Signature Analysis

Model 5005A/B (cont.)

- Complete HP-IB programmability of every function
- Measurement trigger switch in probe
- Rack and stack enclosure (HP 5005B)
- Programmable audible beeper



HP 5005B Programmable Signature Multimeter

Multifunction Probe

Several measurement functions incorporated into a single instrument can provide optimal troubleshooting efficiency only when each function is easy to use. The operator, when troubleshooting, must be able to measure the analog signal parameters and digital functional characteristics of a node without requiring time consuming and error-prone probe or instrument setup changes. The HP 5005 multifunction probe solves this problem by providing automatic access to the Signature Analyzer, multimeter, and counter functions through a single probe. All signal multiplexing to the appropriate measurement function is accomplished inside the HP 5005.

This efficient probing scheme becomes particularly important in automatic applications. The HP 5005B takes advantage of the several functions available in the multifunction probe. A switch, located on the side of the probe, allows the operator to trigger automatic measurement. The instrument controller can then characterize both the analog parameters and functional digital operation of a circuit node while the operator probes the same point. This greater automatic measurement efficiency translates into increased troubleshooting productivity.

HP-IB Programmability

Complete programmability makes the HP 5005B an ideal choice for automatic digital testing and troubleshooting. Every HP 5005B measurement and control function can be programmed through the HP-IB interface. This flexibility allows the automatic test system designer full access to the many measurement functions in the instrument.

Simplified programming enhances the automatic testing and troubleshooting productivity improvements inherent in the HP 5005B. Straightforward commands and data output formats aid in accelerating test program development. A measurement trigger switch located in the probe allows direct operator communication to the controller. Audible feedback, supplied by the beeper in the HP 5005B, can then indicate the completion of the measurement cycle. This closed-loop communication (controller-to-operator) aids in improving troubleshooting efficiency.

Portability

The HP 5005A offers a compact portable solution for manual troubleshooting of digitally based products. Its compact package, complete measurement capabilities, and multifunction probe make it invaluable as a bench or field service tool. This complete measurement set, combined into a single instrument, insures your always having the necessary troubleshooting capabilities in hand.

The identical feature set between the HP 5005A and HP 5005B also simplifies going from automatic to manual troubleshooting procedures. Consistent front panel function key arrangements and performance specifications allow direct translation of test or troubleshooting procedures. Your investment in an automatic procedure provides an additional return when expanding into a manual troubleshooting environment.

HP 5005A/B Specifications

Signature

Display: 4 digits. Characters 0-9, ACFHPU.
Fault detection accuracy: 100% probability of detecting single-bit errors: 99.998% probability of detecting multiple-bit errors.
Minimum gate length: 1 clock cycle (1 data bit) between START and STOP.
Maximum gate length: no limit.
Minimum timing between gates: 1 clock cycle between STOP and START.
Data Probe Timing
Setup time: 10 ns (data to be valid at least 10 ns before selected clock edge.)
Hold time: 0 ns (data to be held until occurrence of selected clock edge.)
START, STOP, QUAL Timing
Setup time: 20 ns (signals to be valid at least 20 ns before selected clock edge.)
Hold time: 0 ns (signals to be held until occurrence of selected clock edge.)
CLOCK Timing
Maximum clock frequency: 25 MHz.
Minimum pulse width: 15 ns in high or low state.
Qualify mode: allows data clock qualification by an external signal.
DATA probe input impedance ≃50 kΩ to the average value of "0" and "1" threshold settings (±6 V max); 15 pF.
START, STOP, CLOCK, QUAL input impedance ≃100 kΩ; 15 pF.
Front panel indicators: flashing GATE light indicates detection of valid START, STOP, CLOCK conditions. Flashing UNSTABLE light indicates a difference between 2 successive signatures, and possible intermittent faults.

Frequency

Display: 5 digits.
Ranges: 100 kHz, 1 MHz, 10 MHz, 50 MHz, autoranged.
Resolution: 1 LSD (1 Hz on 100 kHz range).
Accuracy: ±0.01% of reading ±1 count.
Minimum pulse width ≃10 ns in high or low state.
Gate time ≃1 s, fixed.
Input impedance ≃50 kΩ to the average value of "0" and "1" threshold settings (±6 V max); 15 pF.

Totalizing

Display: 5 digits.
Range: 0-99,999 counts.
Resolution: 1 count.
Maximum input frequency ≃50 MHz, with a minimum pulse width of 10 ns, and minimum pulse separation of 10 ns.
Minimum START/STOP pulse width ≃20 ns.
DATA input impedance ≃50 kΩ to the average value of "0" and "1" threshold settings (+6 V max); 15 pF.
START, STOP input impedance ≃100 kΩ; 15 pF.

Time Interval

Display: 5 digits.
Ranges: 10 ms, 100 ms, 1 s, 10 s, 100 s, autoranged.
Resolution: 1 count (100 ns on 10 ms range).
Accuracy ±0.01% of reading ±2 counts.
Minimum START/STOP pulse width ≈20 ns.

START, STOP input impedance ≃100 kΩ; 15 pF.

Resistance

Display: 4 or 5 digits, depending on range.
Ranges: 30 kΩ, 300 kΩ, 1 MΩ, 3 MΩ, 10 MΩ, autoranged.
Accuracy: (at 15°C–30°C).

RANGE	FULL SCALE	ACCURACY	DISPLAY RESOLUTION
30 kΩ	29.999 kΩ	±1% of reading ±2 Ω	1 Ω
300 kΩ	299.99 kΩ	±1% of reading	10 Ω
1 MΩ	999.9 kΩ	±1% of reading	100 Ω
3 MΩ	2999. kΩ	±10% or reading	1 kΩ
10 MΩ	10000. kΩ	±10% of reading	10 kΩ

Input impedance ≃20 kΩ to ±2 V

DC Voltage

Display: 4½ digits.
Ranges: ±25 V, ±250 V, autoranged; referenced to earth ground.
Accuracy: (at 15°C–30°C).

RANGE	ACCURACY	RESOLUTION
25 V	±0.1% of reading ±2 mV	1 mV
250 V (<100 V)	±0.25% of reading ±20 mV	10 mV
250 V (≥100 V)	±0.25% of reading ±20 mV	100 mV

Input impedance ≃10 MΩ.

Differential Voltage

Reading: reads input voltage present at the probe and displays difference between it and voltage at the time ΔV key was depressed.
Specifications: same as for DCV, above. Voltage range is determined by larger of 2 compared voltages.

Peak Voltage

Display: 3½ digits.
Range: 0–±12 Vp.
Resolution: 50 mV.
Accuracy: ±2% of reading ±5% of p-p signal ±100 mV.
Minimum peak duration ≃10 ns.
Maximum time between peaks ≃50 ms.
Input impedance ≃100 kΩ; 15 pF.

Signature Analyzer Logic Thresholds

Preset thresholds: TTL, ECL, CMOS.

Adjustable thresholds: each preset threshold can be adjusted.
Range: ±12.5 V, in 50 mV steps.
Accuracy: ±2% of setting, ±.2 V
Logic threshold circuitry is operative during NORM, QUAL, kHz, TOTLZ and ms measurements.

General

Data probe tip: acts as high-speed logic probe in the NORM, QUAL, kHz and TOTLZ modes. Lamp indicates high, low, bad-level and pulsing states.
Minimum detected pulse width is 10 ns.
Data Probe Protection
Continuous Overload
DCV, ΔV, kΩ modes only: ±250 V ac/dc.
All other modes: ±150 V ac/dc, 20 V rms at input frequencies >2 MHz.
Intermittent overload: ±250 V ac/dc, up to 1 min, for all modes.
Timing Pod Protection
Continuous overload: ±100 V ac/dc, 20 V rms at input frequencies >2 MHz.
Intermittent overload: ±140 V ac/dc, up to 1 min.
Auxiliary power supply: three rear-panel connectors supply 5 V at 0.7A total for accessories (HP 5005A only)
Operating temperature: 0°C to +55°C.
Power: selectable 100 V, 120 V, 220 V or 240 V ac line (+5%–10%), HP 5005A–48-440 Hz, 35 VA maximum.
HP 5005B–48-66 Hz, 35 VA maximum.
Weight: HP 5005A–Net: 3.5 kg (8.0 lb.) Shipping: 10 kg (22.5 lb.).
HP 5005B–Net: 5.5 kg (12.0 lb.) Shipping: 8.7 kg (19 lb.).
Size: HP 5005A–90 mm H x 215 mm W x 410 mm D (3½" x 8½" x 16"), excluding handle.
HP 5005B–133 mm H x 212 mm W x 432 mm D (5¼" x 8⅜" x 17"), excluding handle.

Ordering Information

	Price
HP 5005A Signature Multimeter	$2,900
Option 910 Additional manual	$35
HP 5005B Signature Multimeter	$4,000
Option 910 Additional Manual	$40