

AccessionIndex: TCD-SCSS-T.20160121.006

Accession Date: 21-Jan-2016

Accession By: Peter Canavan

Object name: HP-5022A Logic Probe Kit

Vintage: c.1976

Synopsis: Kit containing HP-545A, HP-546A, HP-547A and HP-548A probes for debugging digital logic. S/N: 001903.

Description:

Hewlett-Packard's HP-5022A Logic Probe Kit consisted of a HP-545A Logic Probe, HP-546A Logic Pulser, HP-547A Current Tracer and HP-548A Logic Clip, all in a leather case. These were useful standalone pencil-like hand-held probes for debugging digital logic, and needed little effort to operate. It's instructive how this was achieved. Firstly, all four probes used custom HP integrated circuits, an advance at that time.

The HP-545A Logic Probe detected logic states using two fast Schottky diode peak detectors and two slower, low-input-current comparators. It assumed active-high logic levels, i.e. voltages above a positive logic threshold were logic 1 and vice-versa, and could be switched to TTL or CMOS logic threshold levels. It had a needle-like probe tip, and an LED diffuser surrounding the probe indicated the logic state through 360 degrees; off for a static logic 0, on for a static logic 1, dim for static voltages between threshold levels, flash at 10Hz for toggling logic levels, or flash for about 50mS for a single pulse. It latched infrequent or single-shot pulses, and an LED/ button lit when that occurred, and was pressed to clear it. The probe required neither configuration nor adjustment, and was compact and light. See Figure 1 below for its specifications.

The HP-546A Logic Pulser generated pulses at TTL or CMOS logic levels using a ROM-based pulse generator that could produce single pulses, pulse bursts, or pulse streams. A normally high-impedance output stage automatically adjusted for the type of logic being stimulated, injecting high-energy, short-duration voltage pulses of the complementary logic state to that of the point of stimulation. A button pressed once injected one pulse, whereas more complex button actions injected 1Hz, 10Hz or 100Hz pulse streams, or programmed for 10-pulse or 100-pulse bursts. Sliding the button forward locked the injection behaviour. An LED/diffuser indicated logic state through 360 degrees, and allowed burst counting. For specifications, see Figure 1.

The HP-547A Current Tracer provided a quick way to debug wired-AND and three-state busses to locate stuck nodes or short circuits. Current transitions near the probe tip were coupled by mutual inductance to induce voltages across a coil at the input of a variable-gain amplifier, with gain adjustable by a sensitivity control. Its output was further amplified and stretched by two cascaded peak detectors to flash a lamp with a diffuser for viewing through 360 degrees. The lamp intensity was proportional to the current transitions near the probe tip, so by moving the tip a skilled observer could employ the intensity to trace directly to the fault. In the absence of current transitions, these could be injected with the HP-546A. See Figure 1 below for its specifications.

HP-548A Logic Clip clipped onto 16 pins of a dual-in-line package (DIP) and displayed the logic states of all pins of the device at once, instead of one pin at a time like the HP-545A Logic Probe. Each side of the DIP used a custom HP integrated circuit with an attached array of eight LEDs. Each pin was fed to a comparator that

directly drove its LED. If an external power source was absent then it automatically found and used the power pins. See Figure 2 below for its specifications.

Many thanks to Peter Canavan, Network Manager, Broadcast Operations, Australian Broadcasting Commission, who donated these items from his personal collection.

Accession Index	Object with Identification
TCD-SCSS-T.20160121.006.001	HP-5022A Logic Probe Kit leather case. S/N: 001903
TCD-SCSS-T.20160121.006.002	HP-545A Logic Probe. S/N:
TCD-SCSS-T.20160121.006.003	HP-546A Logic Pulser. S/N:
TCD-SCSS-T.20160121.006.004	HP-547A Current Tracer. S/N:
TCD-SCSS-T.20160121.006.005	HP-548A Logic Clip. S/N:

References:

1. Hewlett-Packard, *HP-54xA Instruments*, see (last browsed to 3-Feb-2016):
http://www.arcade-museum.com/manuals-test-equipment/hp_54xa.pdf
2. Robert C. Quenelle, *New Logic Probe Troubleshoots Many Logic Families*, HP Journal, pp.9-11, Dec-1976, see (last browsed to 3-Feb-2016):
<http://www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1976-12.pdf>
3. Barry Bronson and Anthony Y. Chan, *A Multifunction, Multifamily Logic Pulser*, HP Journal, pp.12-15, Dec-1976, see (last browsed to 3-Feb-2016):
<http://www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1976-12.pdf>
4. John F. Beckwith, *Current Tracer: A New Way to Find Low-Impedance Logic-Circuit Faults*, HP Journal, pp.2-8, Dec-1976, see (last browsed to 3-Feb-2016):
<http://www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1976-12.pdf>
5. Durward Priebe, *Multifamily Logic Clip Shows All Pin States Simultaneously*, HP Journal, pp.18-20, Dec-1976, see (last browsed to 3-Feb-2016):
<http://www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1976-12.pdf>
6. David E. Gordon, *Probe Family Packaging*, HP Journal, pp.16-17, Dec-1976, see (last browsed to 3-Feb-2016):
<http://www.hpl.hp.com/hpjournal/pdfs/IssuePDFs/1976-12.pdf>

See the extensive set of documents in the related folder in this catalog

DIGITAL CIRCUIT TESTERS

Logic Probe, Logic Pulser, Digital Current Tracer

Models 545A, 546A, 547A

HP 545A TTL/CMOS Logic Probe

The HP 545A Logic Probe contains all the features built into other HP probes, plus switch-selectable, multi-family operation and built-in pulse memory. Employing straightforward one-lamp display the HP 545A operates from 3 to 18 volts in CMOS applications or from 4.5 to 15 Vdc supplies in the TTL mode while maintaining standard TTL thresholds.

The probe's independent, built-in pulse memory and LED display help you capture hard to see, intermittent pulses. Just connect the probe tip to a circuit point, reset the memory, and wait for the probe to catch those hard to find glitches.

The hand-held HP 545A is light, rugged, overload protected, and very fast: 80 MHz in TTL, 40 MHz in CMOS. It also employs handy power supply connectors that enable you to easily hook up to supply voltage almost anywhere in the unit under test.

HP 545A Probe Specifications

Input current: < 15 μ A (source or sink).

Input capacitance: < 15 pF.

Logic thresholds

*TTL: Logic one 2.0 + 0.4, -0.2 V. Logic zero 0.8 + 0.2, -0.4 V.

CMOS: 3-10 Vdc supply

Logic one: 0.7 X V_{supply} \pm 0.5 Vdc.

Logic zero: 0.3 X V_{supply} \pm 0.5 Vdc.

CMOS: >10-18 Vdc supply.

Logic one: 0.7 X V_{supply} \pm 1.0 Vdc.

Logic zero: 0.3 X V_{supply} \pm 1.0 Vdc.

Input minimum pulse width: 10 ns using ground lead (typically 20 ns without ground lead).

Input maximum pulse repetition frequency:

TTL, 80 MHz. CMOS, 40 MHz.

Input overload protection: \pm 120 V continuous (dc to 1 kHz); \pm 250 for 15 seconds (dc to 1 kHz).

Pulse memory: indicates first entry into valid logic level; also indicates return to initial valid level from bad level for pulse > 1 μ s wide.

Power Requirements

TTL: 4.5 to 15 Vdc*.

CMOS: 3 to 18 Vdc.

Maximum current: 70 mA.

Overload protection: \pm 25 Vdc for one minute.

Accessory included: ground clip.

* \pm 5 \pm 10% Vdc power supply; usable to +15 Vdc with slightly increased logic low threshold.

HP 546A Logic Pulser

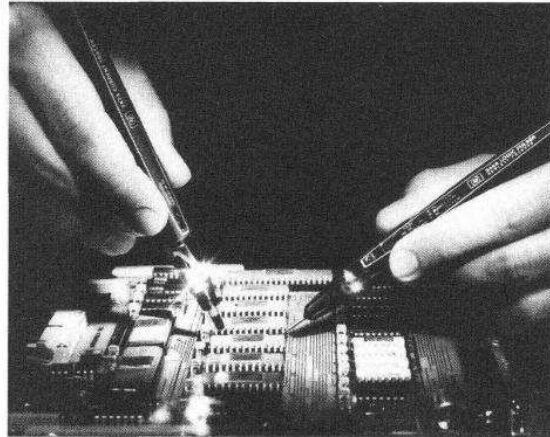
The Logic Pulser solves the problem of how to pulse IC's in digital circuits. Merely touch the Pulser to the circuit under test, press the pulse button and all circuits connected to the node (outputs as well as inputs) are briefly driven to their opposite state. No unsoldering of IC outputs is required. Pulse injection is automatic, high nodes are pulsed low and low nodes, high, each time the button is pressed.

Automatic polarity pulse output, pulse width, and amplitude make for easy multi-family operation when you use the HP 546A Logic Pulser. But, the real surprise comes when you code in one of its six ROM-programmable output patterns (single pulses; pulse streams of either 1, 10, or 100 Hz; or bursts of 10 or 100 Hz; or bursts of 10 or 100 pulses). This feature allows you to continually pulse a circuit when necessary, or it also provides an easy means to put an exact number of pulses into counters and shift registers. Used with our multi-family IC Troubleshooters, the HP 546A acts as both a voltage and current source in digital troubleshooting applications.

HP 546A Pulser Specifications

Output			Typical Output Voltage	
Family	Output Current	Pulse Width	HIGH	LOW
TTL/DTL	\leq 650 mA	\geq 0.5 μ s	\geq 3 Vdc	\leq 0.8 Vdc
CMOS	\leq 100 mA	\geq 5.0 μ s	$\geq(V_{supply} - 1 \text{ Vdc})$	\leq 0.5 Vdc

Power supply requirements: TTL; 4.5 to 5.5 Vdc at 35 mA, CMOS; 3 to 18 Vdc at 35 mA, protected to \pm 25 Vdc for 1 min.



HP 547A/546A

HP 547A Digital Current Tracer

The HP 547A Current Tracer precisely locates low-impedance faults in digital circuits by locating current sources or sinks. For example, on a bad node the Tracer can verify that the driver is functioning and also show where the problem is by tracing current flow to the source or sink causing the node to be stuck. The Tracer is designed to troubleshoot circuits carrying fast rise-time current pulses. The Tracer senses the magnetic field generated by these signals in the circuit and displays transitions, single pulses, and pulse trains using a simple one-light indicator. Because it is not voltage sensitive, the Tracer operates on all logic families having current pulses exceeding 1 mA, including CMOS, where even lightly loaded outputs can have up to 2 to 3 mA of instantaneous charging current.

To use the Tracer, align the dot on its tip at a reference point, usually the output of a node driver. Set the sensitivity control to indicate the presence of ac current activity. As you probe from point to point or follow traces, the lamp will change intensity; when you find the fault the Tracer will indicate the same brightness found at the reference point.

HP 547A Current Tracer Specifications

Input

Sensitivity: 1 mA to 1 A.

Frequency response: light indicates single-step current transitions; single pulses > 50 ns in width; pulse trains to 10 MHz (typically 20 MHz for current pulses > 10 mA).

Risetime: light indicates current transitions with risetime < 200 ns at 1 mA.

Power Supply Requirements

Voltage: 4.5 to 18 Vdc.

Input current: < 75 mA.

Maximum ripple: \pm 500 mV above 5 Vdc.

Overvoltage protection: \pm 25 Vdc for one minute.

Accessories Available

HP 00545-60104: Tip Kit for HP 546A Pulser, 545A

Probe

HP 10526-60002: Multi-Pin Stimulus Kit

HP 1250-1948 Adapter, Coax Str.

Price

\$65

\$75

\$25

Ordering Information

HP 545A Logic Probe

HP 546A Logic Pulser

HP 547A Digital Current Tracer

Fast-ship product—see page 734.

\$260

\$350

\$630

Figure 1: HP-545A, HP-546A, HP-547A probe specifications

DIGITAL CIRCUIT TESTERS

Logic Clip, Logic Comparator

Models 548A & 10529A



HP 548A

HP 548A Logic Clip

The Logic Clip is an extremely handy service and design tool which clips onto dual-in-line package (DIP) ICs, instantly displaying the states of up to 16 pins. Each of the clip's 16 LEDs independently follows level changes at its associated pin. Lit diodes are logic High, extinguished diodes are Low.

The Logic Clips's real value is in its ease of use. It has no controls to set, needs no power connections, and requires practically no explanation as to how it is used. The clip has its own gating logic for locating ground and V_{CC} pins and its buffered inputs reduce circuit loading.

The Logic Clip is much easier to use than either an oscilloscope or a voltmeter when you are interested in whether a circuit is in the high or low state, rather than its actual voltage. The Clip, in effect, is 16 binary voltmeters, and the user does not have to shift his eyes away from his circuit to make the readings.

The intuitive relationship of the input to the output—lighted diode corresponding a high logic state—greatly simplifies the troubleshooting procedure. The user is free to concentrate his attention on his circuits, rather than on measurement techniques. Also, timing relationships become especially apparent when clock rates can be slowed to about 1 pulse per second.

When used in conjunction with the Logic Pulser, the Logic Clip offers unparalleled analysis capability for troubleshooting sequential Logic Devices used to inject pulses between gates allowing it to supply signals to the IC under test absolutely independent of gates connected to the IC. All outputs may then be observed simultaneously on the Logic Clip. Deviations from expected results are immediately apparent as the Pulser steps the IC through its truth table.

HP 548A Multi-Family Logic Clip

Fully automatic and protected to 30 Vdc, and employing bright individual LEDs in its display, the HP 548A brings multi-family operation to the HP line of IC Troubleshooters. The Clip can be externally powered, if desired, using a simple power connector.

HP 548A Specifications

Input threshold: $(>0.4 \pm 0.06 \times \text{Supply Voltage}) = \text{Logic High}$.

Input impedance: 1 CMOS load per input.

Input protection: 30 Vdc for 1 minute.

Supply voltage: 4-18 Vdc across any two pins.

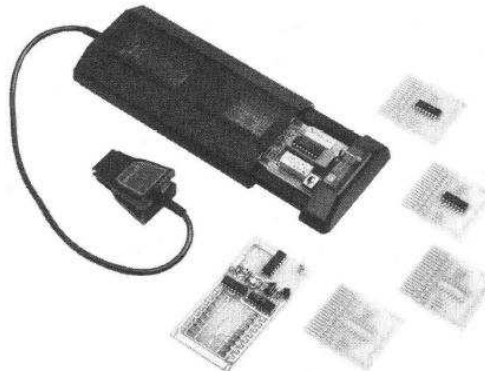
Auxiliary supply input: 4.5 to 20 Vdc applied via connector. Supply must be >1.5 Vdc more positive than any pin of IC under test.

Supply current: <55 mA.

HP 548A Logic Clip

☎ Fast-ship product—see page 734.

\$320 ☎



HP 10529A

HP 10529A Logic Comparator

The HP 10529A Logic Comparator clips onto powered TTL or DTL ICs and detects functional failures by comparing the in-circuit test IC with a known good reference IC inserted in the Comparator. Outputs of the particular IC to be tested are selected via 16 miniature switches which tell the Comparator which pins of the reference IC are inputs and which are outputs. Any logic state difference between the test IC and reference IC is identified to the specific pin(s) on 14- or 16-pin dual in-line packages on the Comparator's display. A lighted LED corresponds to a logic difference. Intermittent errors as short as 300 nanoseconds (using the socket board) are detected, and the error indication on the Comparator's display is stretched for a visual indication. A failure on an input pin, such as an internal short, will appear as a failure on the IC driving the failed IC; thus a failure indication actually pinpoints a malfunctioning node. A test board is supplied to exercise all of the circuitry, test leads, and display elements to verify proper operation.

HP 10541A: twenty additional blank reference boards; identical to the 10 boards provided with the Logic Comparator.

HP 10541B: twenty preprogrammed reference boards. The 10541B includes the following ICs: 7400, 7402, 7404, 7408, 7410, 7420, 7430, 7440, 7451, 7454, 7473, 7474, 7475, 7476, 7483, 7486, 7490, 7493, 74121, 9601.

HP 10529A Specifications

Input threshold: 1.4 V nominal (1.8 V nominal with socket board), TTL or DTL compatible.

Test IC loading: outputs driving Test C inputs are loaded by 5 low-power TTL loads plus input of Reference C. Test C outputs are loaded by 2 low-power TTL loads.

Input protection: voltages <-1 V α >7 V must be current limited to 10 mA.

Supply voltage: 5 V $\pm 5\%$, at 300 mA.

Supply protection: supply voltage must be limited to 7 V.

Maximum current consumption: 300 mA.

Sensitivity

Error sensitivity: 200 ns with reference board or 300 ns with socket board. Errors greater than this are detected and stretched to at least 0.1 second.

Delayed variation immunity: 50 ns. Errors shorter than this value are considered spurious and ignored.

Frequency range: maximum operational frequency varies with duty cycle. An error existing for a full clock cycle will be detected if the cycle rate is less than 3 MHz.

Accessories included: 1 test board; 10 blank reference boards; 1 programmable socket board; 1 carrying case.

Accessories Available

HP 10541A: Twenty Blank Reference Boards

HP 10541B: Twenty Pre-programmed Boards

Price

\$140 ☎

\$440 ☎

HP 10529A Logic Comparator

☎ Fast-ship product—see page 734.

\$1100 ☎

Figure 2: HP-548A probe specifications



*Figure 3: HP-5022A Kit in its leather case front view, unopened
S/N: 001903*



Figure 4: HP-545A Logic Probe front view, with cover on probe tip

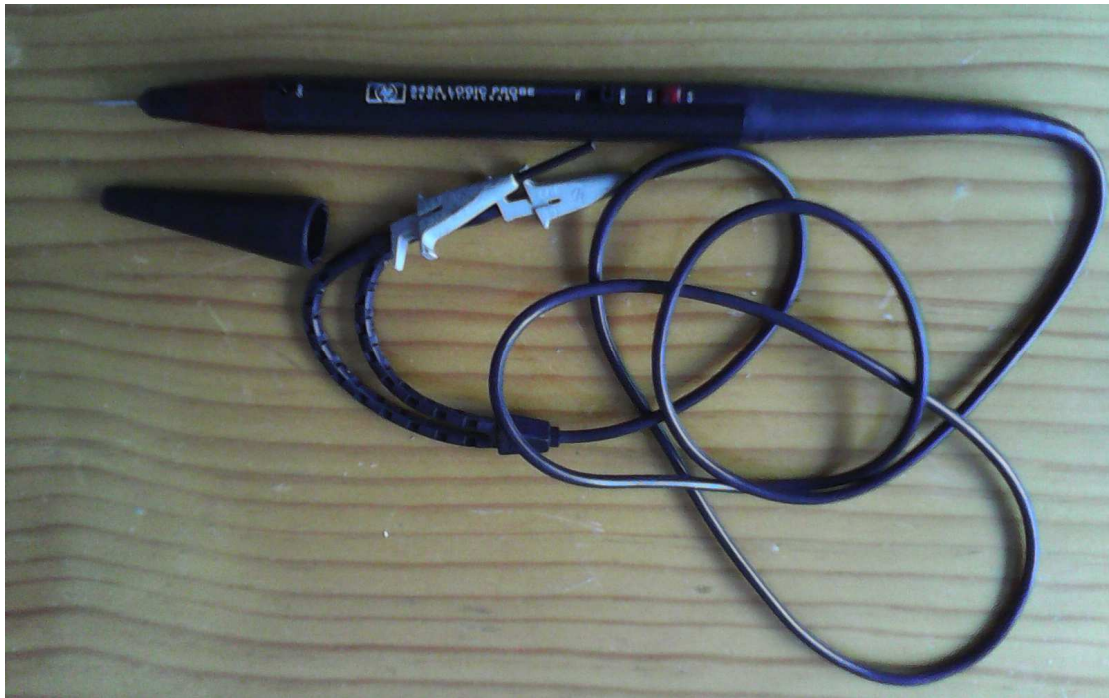


Figure 5: HP-545A Logic Probe front view, with probe tip cover removed



Figure 6: HP-546A Logic Pulser front view



Figure 7: HP-547A Current Tracer front view



Figure 8: HP-548A Logic Clip front three-quarter view



Figure 9: HP-548A Logic Clip top view showing LEDs