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HEWLETT hp PACKARD

MINIATURE PROBES (10:1 VOLTAGE DIVIDER)

Models
10017A
10018A
10040A
10041A
10042A

OPERATING NOTE/FEBRUARY 1980

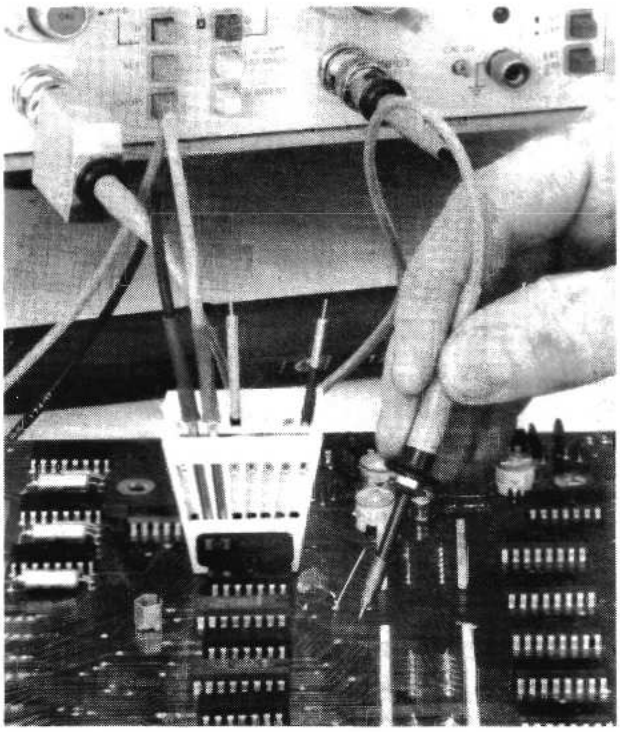


Figure 1. Use of Probe in IC Circuit Testing

1. INTRODUCTION.

2. Hewlett-Packard miniature oscilloscope probes significantly reduce the problem of probing densely populated IC components or the characteristically minute conductors on IC circuit boards (see figure 1). These small, light-weight probes allow measurements that were previously very difficult, while reducing the hazard of shorting. The probe body fits in the hand as comfortably as a pencil, and the needle point tip easily penetrates protective coatings for positive contact. Two accessories that further simplify and improve connection to dual in-line packages are the IC grabber (MP7, supplied) and the IC test clip (HP Model 10024A, available accessory).

3. Length of the probe body is 45 mm (1.78 in.) with an outside diameter of 2.5 mm (0.10 in.). Even with insulating sleeve MP6 installed, the probe body is only 75 mm (2.95 in.) long with an outside diameter of 3.3 mm (0.13 in.). Probe specifications are listed in table 1.

Table 1. Specifications

Probe Model No.	Approximate Overall Length Metres (Ft)	Approximate Propagation Delay	Compensates Scope Input C	Probe Input C (approx)
10017A	1.1 (3.6)	4 ns	9-14 pF	8 pF
10018A	1.9 (6.2)	6.7 ns	9-14 pF	10 pF
10040A	1.1 (3.6)	4 ns	20-30 pF	10 pF
10041A	2.1 (6.9)	8 ns	20-26 pF	12 pF
10042A	3.1 (10.2)	12 ns	20-24 pF	15 pF

INPUT R: 1 megohm

DIVISION RATIO
10:1 ±2% when operated into 1 megohm

VOLTAGE RATING VS FREQUENCY
Maximum power capability of the probe resistive center conductor is shown in the voltage vs frequency curve (on page 2).

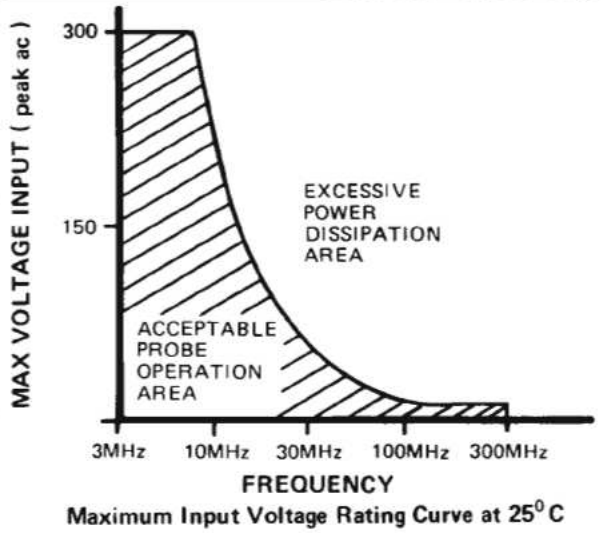
Operating Note Part No. 5955-6270
Microfiche Part No. 5955-6271

For more information, Call Your Local HP Sales Office or, in U.S., East (201) 265-5000. Midwest (312) 677-0400. South (404) 436-6181 West (213) 877-1282. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, California 94304. In Europe, Post Office Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan, YHP, 1-59-1, Yoyogi, Shibuya-ku, Tokyo, 151.

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Table 1. Specifications (Cont'd)



Maximum Input Voltage Rating Curve at 25° C

GENERAL

OPERATING ENVIRONMENT

Temperature: —25°C to +65°C.
Humidity: to 95% relative, to +40°C.
Altitude: to 4.6 km (15 000 ft).
Shock: 50 g's (400 g's tip only) 1/2 sine wave.

WEIGHT

Net: 45 g (1.5 oz).

4. In general, a probe and its associated oscilloscope attenuators are designed to achieve best overall pulse response fidelity. Therefore, best results are obtained when the probes are used with HP oscilloscopes which have an input resistance of 1 megohm shunted by the capacitance indicated in table 2. These probes, however, may be used with any oscilloscope having an input impedance range and bandwidth as indicated in table 2 with only slight degradation in pulse response fidelity.

NOTE

Low-frequency compensation must be adjusted whenever the probe is first connected to the monitoring oscilloscope. Probe compensation will usually hold over all ranges when used with HP oscilloscopes (see paragraph 15). If input capacitance of the oscilloscope changes as ranges are switched, compensation must be readjusted each time a new range is selected.

5. PROBE OPERATION AND PERSONNEL SAFETY.

WARNING

These probes are designed for use with oscilloscopes that have a common terminal at GROUND POTENTIAL (in accordance with OSHA requirements and the National Electrical Code). Exposed metallic surfaces of the probe and oscilloscope MUST BE GROUNDED. Failure to ground the common terminal during certain applications, such as those requiring the oscilloscope to be powered from an external battery, will expose the operator to an electrical shock hazard that could be lethal (depending on voltage and current conditions).

Table 2. Probe Compatibility

HP OSCILLOSCOPE PLUG-IN		Probe Model No.	Compensates Scope With Input C
Model No.	Bandwidth		
1710B	200 MHz		
1712A	200 MHz		
1715A	200 MHz	10017A	9-14 pF
1720A	275 MHz	or	
1722A/B	275 MHz	10018A	
1725A	275 MHz		
1805A	100 MHz		
1808A	75 MHz		
1809A	100 MHz		
1740A/B	100 MHz	10040A	20-30 pF
1741A		10041A	20-26 pF
1743A		or	
1744A		10042A	20-24 pF
1703A	35 MHz	10040A or	20-30 pF
1707B	75 MHz	10041A	20-26 pF

6. PROBE WITH HOOK TIP OR GRABBER. Hook tip MP1 or grabber MP7 can be attached to the probe by placing it over MP6 and pressing it on (see figure 2). The hook tip or grabber can be rotated on the probe without being removed. Alligator clip MP2 attaches to snap-on ground lead MP3 which fits the exposed ground connection on insulating sleeve MP6. Indicator sleeves snap on the probe cable for identification.

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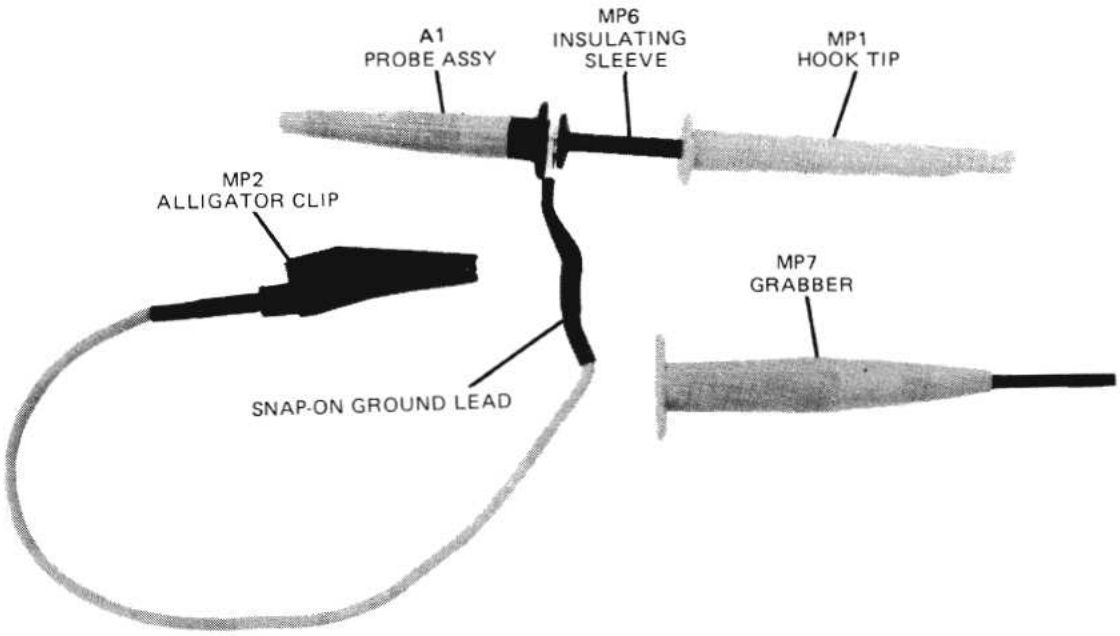


Figure 2. Probe with Hook Tip or Grabber

7. PROBE WITHOUT HOOK TIP OR GRABBER. The probe can be used for point-to-point probing by removing hook tip MP1 or grabber MP7 from probe assembly A1. Ground the probe by attaching snap-on ground lead MP3 or ground spring MP5 (see figure 3).

CAUTION

Verify that the ground spring is fully mounted so that probe tip is well exposed; otherwise, ground spring may short to point being tested.

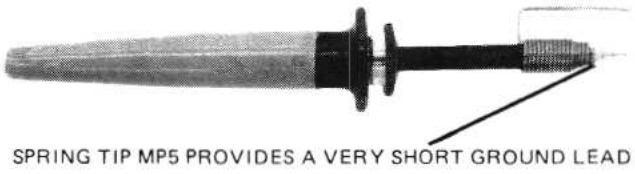


Figure 3. Probe with Ground Spring

8. When using snap-on ground lead MP3, grip the knurled part of MP6 and unscrew the MP6 barrel far enough to cover the ground shield of assembly A1. Ground spring MP5 can be mounted with, or without MP6 installed. If MP6 is installed, screw the MP6 barrel into the probe body as far as possible. This will expose the ground shield of assembly A1. Ground spring MP5 can be installed by twisting it clockwise over MP6.

9. SUBMINIATURE MODE OF OPERATION. Size of the probe can be further reduced by removing MP6 (turn knurled part counterclockwise), and pulling the probe tip out of the probe body (see figure 4).

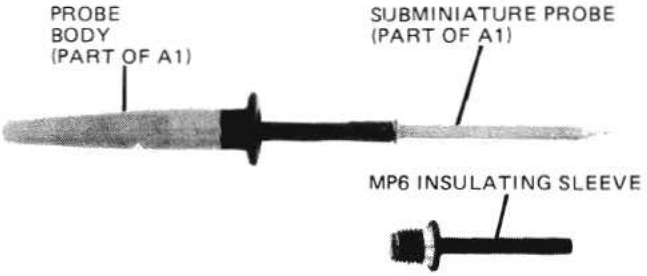


Figure 4. Probe in Subminiature Mode

WARNING

ELECTRICAL SHOCK HAZARD. Before using probe in the subminiature mode of operation, be sure to read the warning given in paragraph 5.

10. When using IC Test Clip HP Model 10024A (available accessory), insert probe in the clip to contact an IC pin (see figure 5). A ground plane is built into the test clip, and the ground path is completed through a ground pin that is inserted in the test clip position corresponding to the ground of the IC under test. The test clip ground plane also contacts the probe ground shield to eliminate the need for additional ground lines.

CAUTION

Be careful when using the subminiature probe because it could cause a short circuit if it is dropped onto the circuit.

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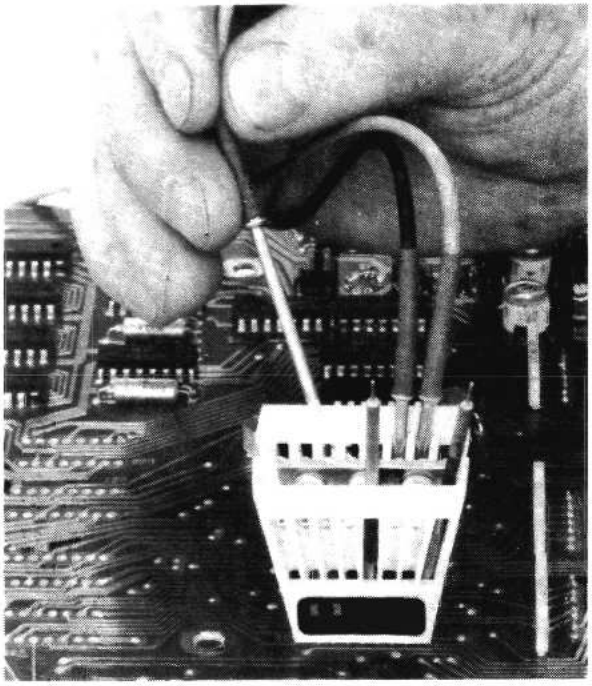


Figure 5. Use of Probe with Model 10024A IC Test Clip

11. BANDWIDTH CONSIDERATIONS.

12. The dominant probe limitation to the system bandwidth is its input capacitance, assuming that the high-frequency compensation adjustments have been made as outlined in paragraph 17. Displayed bandwidth of any measurement system using an oscilloscope and probe is determined by:

a. Probe input capacitance.

b. Source impedance (Z level of circuit being probed).

c. Source bandwidth.

d. Oscilloscope bandwidth.

Thus, each of the above factors should be considered separately whenever bandwidth is an important part of the measurement.

13. ADJUSTMENT PROCEDURE.

14. The probe requires two adjustments: low-frequency and high-frequency compensation. Low-frequency compensation is an operating adjustment. High-frequency compensation is accomplished periodically, according to maintenance schedules.

15. LOW-FREQUENCY COMPENSATION. Hewlett-Packard oscilloscopes have a calibrator (square-wave) output suitable for low-frequency probe compensation. If the monitoring oscilloscope does not have such an output, use a square-wave generator set for approximately 1-kHz output.

16. To accomplish low-frequency compensation, proceed as follows:

a. Connect probe to oscilloscope.

b. Connect probe tip to square-wave source (calibrator or square-wave generator).

c. Adjust oscilloscope for stable display of square wave.

d. Adjust A2A1C1 (through opening in cover A2MP2) for best square wave.

17. HIGH-FREQUENCY COMPENSATION. High-frequency compensation requires an external ≥10-kHz pulse generator (rise time ≤0.5 ns, such as HP 1920A - for 10017A and 10018A; rise time ≤1 ns, such as HP 8082A - for 10040A, 10041A, and 10042A) with the output terminated with a 50-ohm feedthrough (HP Model 10100C) and a probe-tip to BNC adapter (HP Part No. 1250-1454).

18. The purpose of high-frequency compensation in probes is to nullify probe rise time loss other than that added by the probe input capacitance. To accomplish high-frequency compensation, proceed as follows:

a. Using 50-ohm coaxial cable, connect pulse generator directly to channel A (channel B) input connector on oscilloscope. Terminate oscilloscope inputs into 50 ohms.

b. Verify that both channels of oscilloscope meet their published rise time/perturbation specifications.

c. Set both channel inputs of oscilloscope for high-impedance termination.

d. Using 50-ohm feedthrough termination, connect pulse generator to channel A (channel B) input of oscilloscope.

e. Repeat step b.

f. Set oscilloscope input terminations as follows:

Channel A	HI impedance
Channel B	50Ω

g. Connect equipment as shown in figure 6.

NOTE

The change in rise time on channel B when the probe is inserted in, or removed from, the probe tip to BNC adapter is due to loading by the probe input capacitances.

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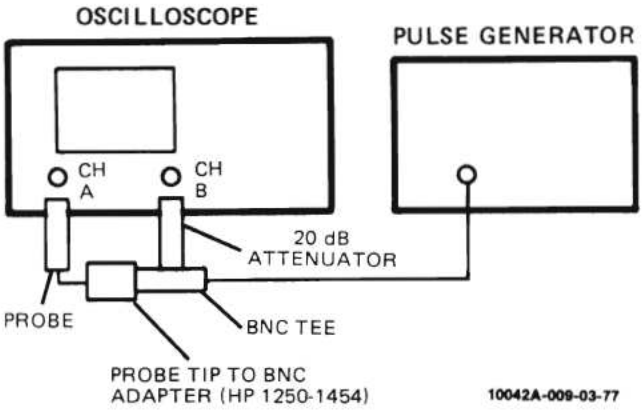


Figure 6. High-frequency Compensation Test Setup

h. Set oscilloscope controls as follows:

VOLTS/DIV (both channels)	6 div display
TRIGGER	COMP
DISPLAY	ALT
TIME/DIV	10 ns

i. Remove probe cover A2MP2 by pressing down on edges and sliding it off.

j. Set A2A1R1 and A2A1R2 fully counterclockwise (see schematics in figure 7).

k. Adjust A2A1R1 and A2A1R2 alternately in small increments until channel A and channel B waveforms are similar.

l. Replace probe cover A2MP2 and note any change in channel A waveform.

m. Remove probe cover A2MP2.

n. Readjust A2A1R1 and A2A1R2 to compensate for probe cover influence.

o. Replace probe cover A2MP2. Waveforms should match.

19. MAINTENANCE.

20. Maintenance consists of cleaning, adjustment, and parts replacement. Disassemble only to the extent necessary to accomplish repairs and parts replacement. Disassembly for parts replacement is as follows:

a. Remove all accessories (MP1 through MP7; MP6 is removed by turning knurled part counterclockwise).

b. Slide cover A2MP2 from compensation assembly A2.

c. Unsolder center conductor of probe cable from board A2A1R4.

d. Unscrew compensation assembly A2 from probe cable. It may be necessary to hold connector nut A1MP1 with a thin, 7/16-inch, open-end wrench.

e. Unsolder lead between board assembly A2A1 and BNC connector A2J1.

f. Remove board assembly A2A1 by removing two nuts and screws.

g. Remove BNC connector A2J1 by turning it counterclockwise with a thin, 7/16-inch, open-end wrench.

h. Reverse procedure for reassembly.

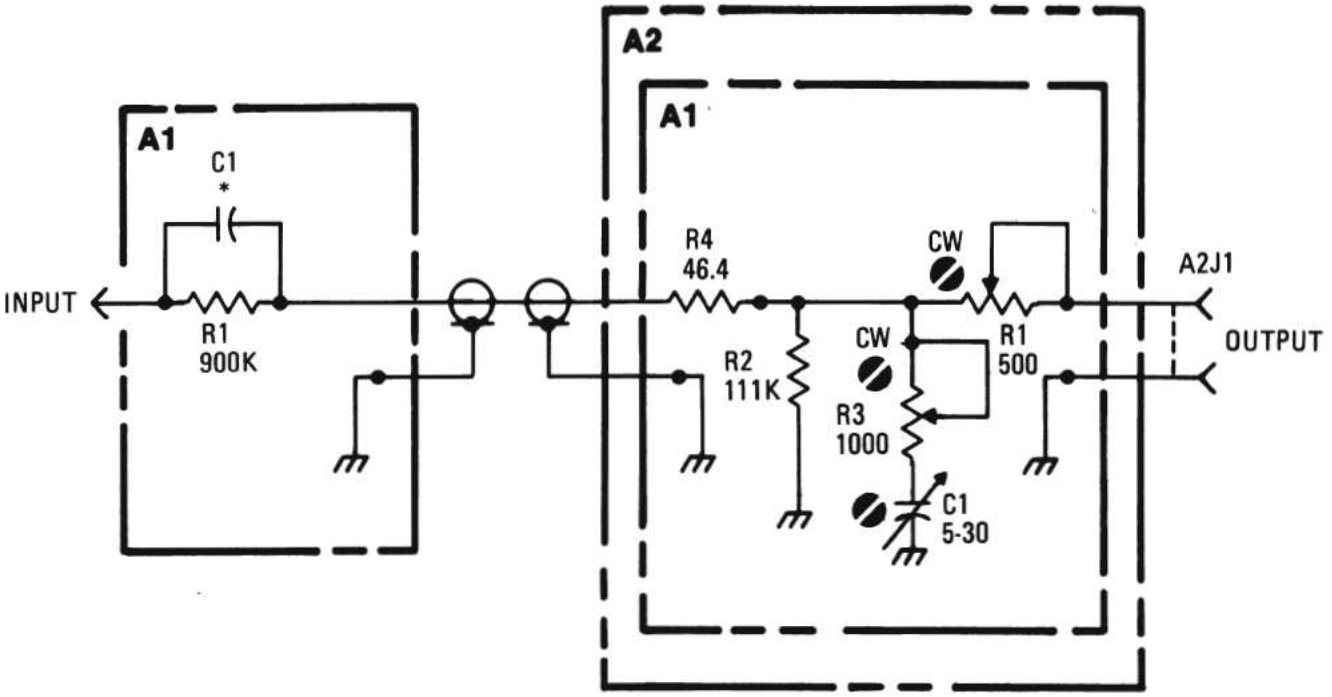
21. REPLACEABLE PARTS.

22. Replaceable parts are shown in figure 8. When ordering a part, address the order to the nearest HP Sales/Service Office. Provide model number of the probe and a complete description of the part, including HP Part Number.

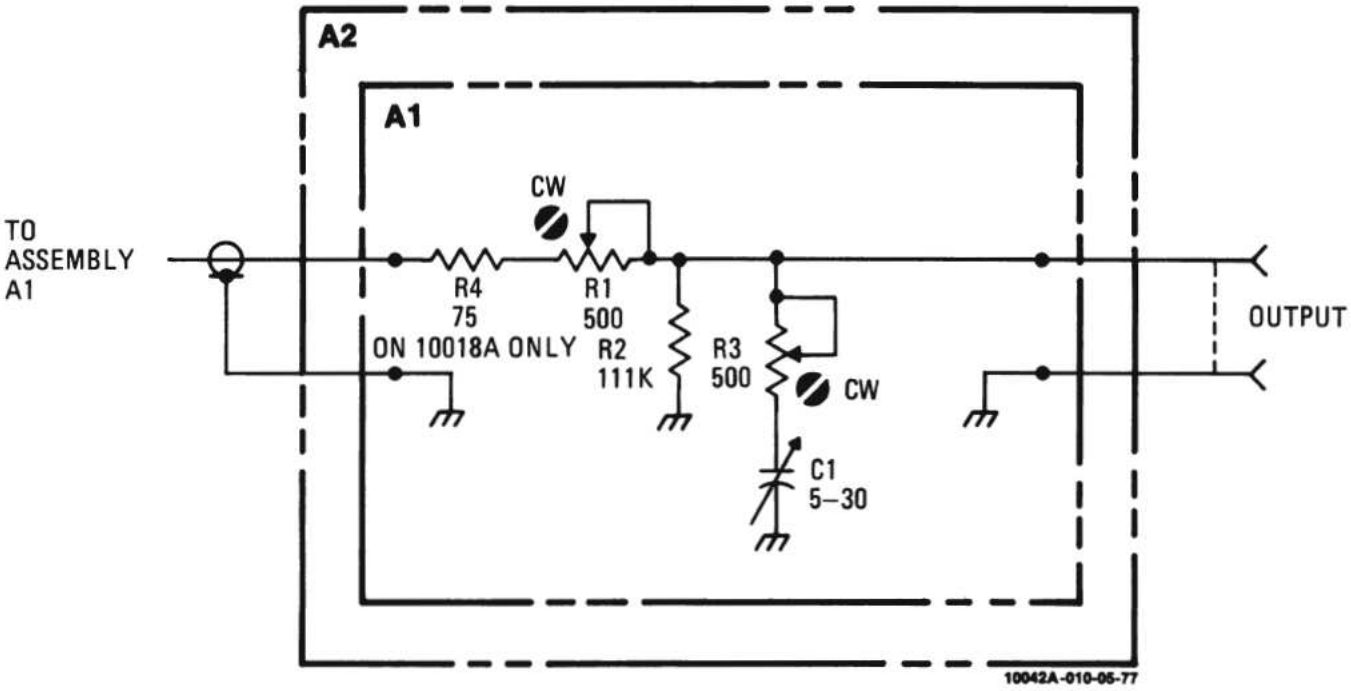
23. ACCESSORIES AVAILABLE. The following accessories are available for use with these probes:

Probe Tip to BNC Adapter - HP Part No. 1250-1454.
IC Test Clip - HP Model 10024A.

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Schematic - Model 10042A

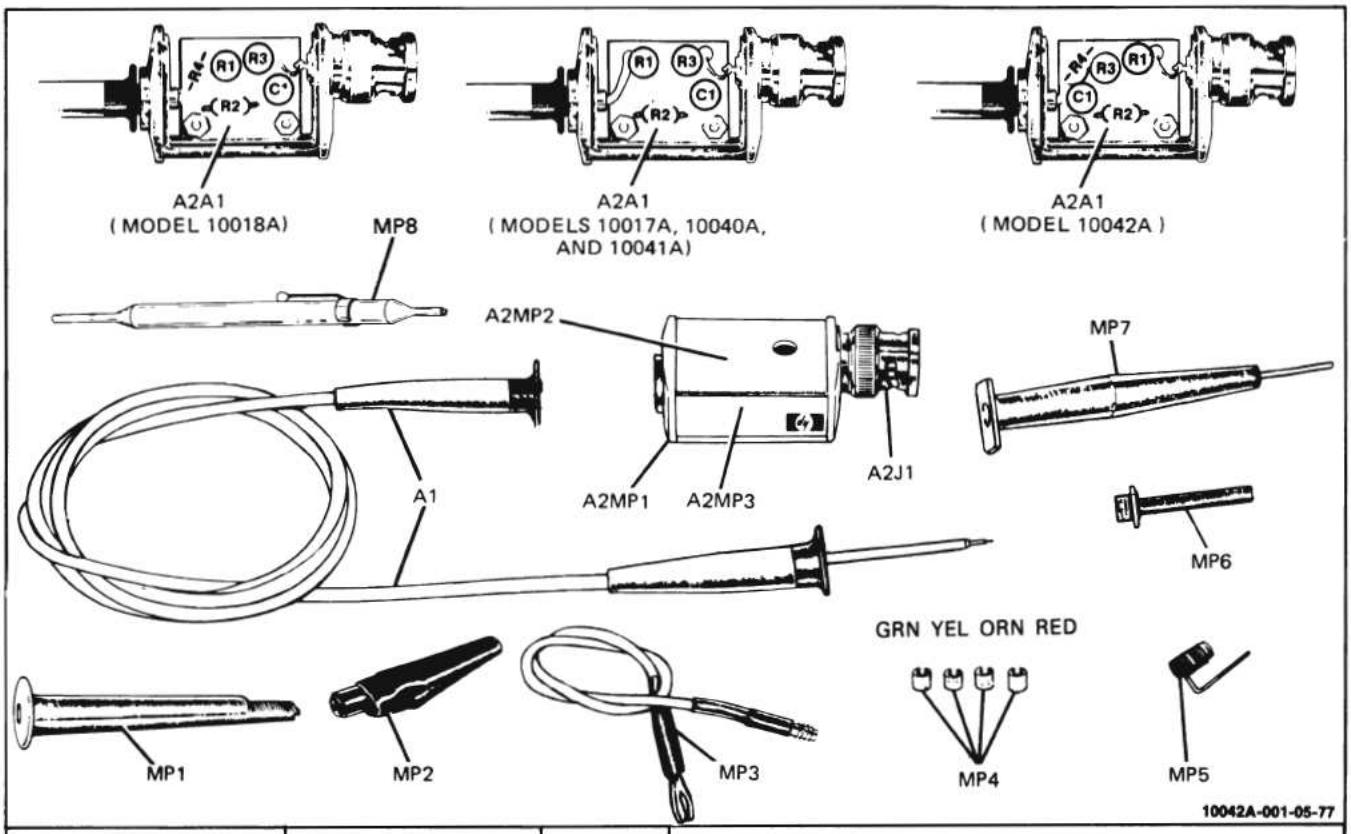


Schematic - Models 10017A, 10018A, 10040A, 10041A

Model	A1C1*
10017A	6 pF
10018A	9 pF
10040A	8 pF
10041A	11 pF
10042A	14 pF

Figure 7. Schematics

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Reference Designation	HP Part No.	Qty	Description
A1	10017-60001	1	ASSY, ATTENUATOR-CABLE (MODEL 10017A)
A1	10018-60001	1	ASSY, ATTENUATOR-CABLE (MODEL 10018A)
A1	10040-60001	1	ASSY, ATTENUATOR-CABLE (MODEL 10040A)
A1	10041-60001	1	ASSY, ATTENUATOR-CABLE (MODEL 10041A)
A1	10042-60001	1	ASSY, ATTENUATOR-CABLE (MODEL 10042A)
		1	
A2	10017-62102	1	ASSY, COMPENSATION (MODEL 10017A)
A2	10018-62101	1	ASSY, COMPENSATION (MODEL 10018A)
A2	10040-62101	1	ASSY, COMPENSATION (MODEL 10040A)
A2	10041-62101	1	ASSY, COMPENSATION (MODEL 10041A)
A2	10042-62101	1	ASSY, COMPENSATION (MODEL 10042A)
A2J1	1250-1233	1	CONNECTOR, BNC
A2A1	10017-66501	1	ASSY, PC BOARD (MODELS 10017A, 10040A, 10041A)
A2A1	10017-66501	1	ASSY, PC BOARD (MODEL 10018A)
A2A1	10042-66501	1	ASSY, PC BOARD (MODEL 10042A)
A2A1C1	0121-0491	1	C:VAR CER 5-30 PF
A2A1R1	2100-1788	1	R:VAR METFLM 500 OHM 1/2W
A2A1R2	0698-6430	1	R:FXD METFLM 111K OHM 1/8W
A2A1R3	2100-1788	1	R:VAR METFLM 500 OHM 1/2W (MODEL 10017A, 10018A, 10040A, 10041A)
A2A1R3	2100-1986	1	R:VAR METFLM 1K OHM 1/2W (MODEL 10042A)
A2A1R4	0698-7209	1	R:FXD METFLM 75 OHM 2% 1/2W (MODEL 10018A)
A2A1R4	0698-7204	1	R:FXD METFLM 46.4 OHM 1% 1/8W (MODEL 10042A)
A2MP1	10014-20102	1	CHASSIS
A2MP2	10014-24102	1	COVER (MODELS 10017A, 10018A, 10040A, 10041A)
A2MP2	10016-24101	1	COVER (MODEL 10042A)
			ACCESSORIES
MP1	10017-67602	1	RETRACTABLE HOOK TIP
MP2	5061-1258	1	ALLIGATOR CLIP
MP3	10006-61301	1	SNAP-ON GROUND LEAD
MP4	5041-1484	1	WIRE MARKER, GRN
MP4	5041-1485	1	WIRE MARKER, YEL
MP4	5041-1486	1	WIRE MARKER, ORN
MP4	5041-1487	1	WIRE MARKER, RED
MP5	1460-1476	1	GROUND SPRING
MP6	10017-62302	1	INSULATING SLEEVE
MP7	10017-69501	1	GRABBER
MP8	8710-1300	1	ALIGNMENT TOOL

Figure 8. Replaceable Parts

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SAFETY

This product has been designed and tested according to International Safety Requirements. To ensure safe operation and to keep the product safe, the information, cautions, and warnings in this manual must be heeded. Refer to Section I and the Safety Summary for general safety considerations applicable to this product.

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

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