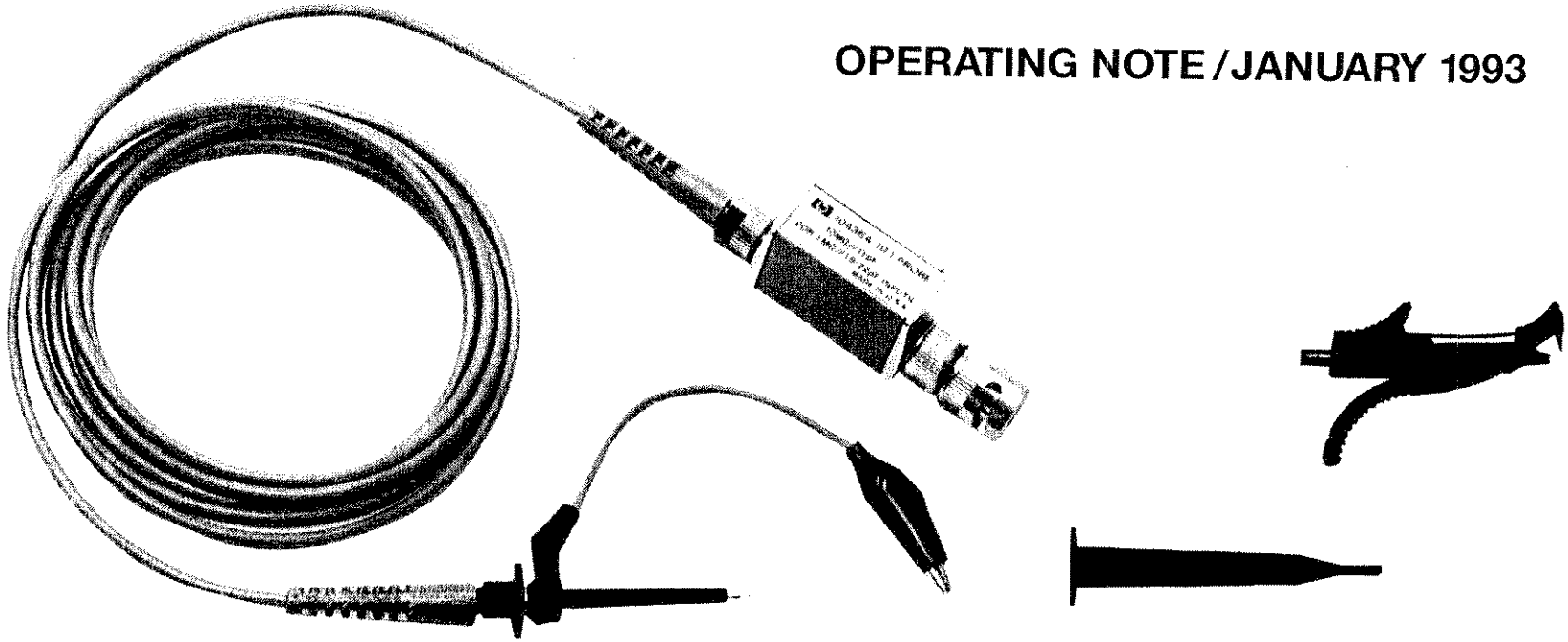
HEWLETT PACKARD

HP 10400A MINIATURE PASSIVE PROBES

__ HP 10430A
__ HP 10431A
__ HP 10432A
__ HP 10433A
__ HP 10434A
__ HP 10435A
__ HP 10436A
__ HP10437A
__ HP10438A
__ HP10439A
__ HP10440A
__ HP10441A
__ HP10442A
__ HP10443A



OPERATING NOTE/JANUARY 1993

Operating Note Part Number 10400-90903
Microfiche Part Number 10400-90803

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.

WARRANTY

This Hewlett-Packard product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. However, warranty service for products installed by HP and certain other products designated by HP will be performed at Buyer's facility at no charge within the HP service travel area. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses.

For products returned to HP for warranty service, Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

P/O CWA584

HP 10400A MINIATURE PASSIVE PROBES

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INTRODUCTION

The HP 10400A Miniature Passive Probe family offers modular construction and improved reliability. Modular construction allows individual replacement of probe tips, cables, and chassis assemblies which reduce probe replacement and repair costs. Improved cable and strain relief design increase reliability.

Hewlett-Packard miniature probes significantly reduce the problem of probing densely populated IC (integrated circuit) components or the characteristically minute conductors on IC boards. These small, lightweight 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. Two accessories that further simplify and improve connection to dual in-line packages are the IC grabber (included accessory) and the IC Test Clip (HP Model 10024A, available accessory).

DESCRIPTION

The HP 10400A Miniature Passive Probe family consists of fourteen probes and includes: two 1:1 probes for high impedance inputs, eight 10:1 probes, one 100:1 probe for low capacitance loading and large signals, and three probes for oscilloscopes with 50 ohm inputs. HP 10431A and HP 10441A include a probe sensor on the chassis assembly that enables HP 54111D and HP 54112D Digitizing Oscilloscopes to read the probe attenuation factor.

ACCESSORIES SUPPLIED

The following accessories are supplied with each probe of the HP 10400A family:

General Purpose Grabber. One general purpose grabber is supplied with each probe model. The general purpose grabber is attached to the probe tip for use on IC pins and other typical circuit measurements. *HP Part Number 5061-6160.*

Integrated Circuit Grabber. One integrated circuit (IC) grabber is supplied with each probe model. The IC grabber is attached to the probe tip to allow easy and firm grip to an IC without the hazard of shorting adjacent pins on the IC. *HP Part Number 5061-6161.*

Ground Lead. One ground lead with alligator clip is supplied with each probe model. The ground lead has a ferrite bead included in its construction which reduces noise in the measured signal. *HP Part Number 5061-6162.*

Barrel Insulator. One barrel insulator is supplied installed on the tip of each probe model. The barrel insulator prevents possible shorting of probe tip and circuitry. Use barrel insulator with the general purpose grabber for correct fit of grabber.

Accessory Package. One accessory package is supplied with each passive probe. The accessory package contains: four grounding spanners, one barrel insulator, eight colored cable markers, and one adjustment screwdriver.

ACCESSORIES AVAILABLE

The following accessories may be ordered for use with the HP 10400A Miniature Passive Probes:

HP Model 10024A. IC clip provides easy probing and good high-frequency grounding of dual in-line packages and includes four insulated circuit interface pins. Additional circuit interface pins are available in packages of twelve pins. Each pin has a tip on the end so that probes such as those on HP logic analyzers may be connected for fast, functional checks of circuit operation. The HP 10024A is shown in figure 1.

HP Model 10211A. IC clip, same as HP 10024A except for 24-pin integrated circuits.

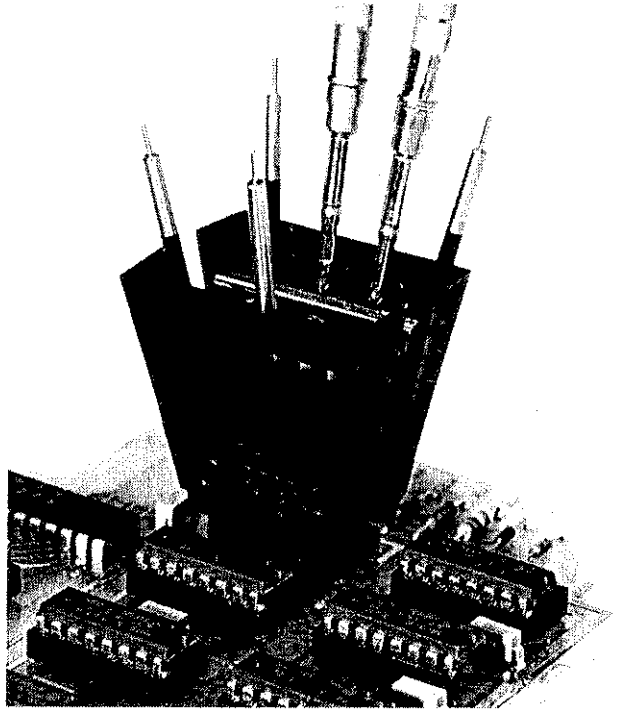


Figure 1. HP 10400A in Use with HP 10024A Test Clip

HP Models 1250-2427 and 1250-2428. PC (printed circuit) Board Miniature Sockets, ideal for breadboard circuit applications where it is desirable to make a reliable circuit connection between the miniature probe tip and a test circuit. (Soldering the probe tip in place is not recommended.) The sockets are also useful in production PC board applications as an oscilloscope test point. The HP 1250-2427 plugs into the socket parallel to the circuit.

CHARACTERISTICS

Operating and general characteristics of the HP 10400A Miniature Passive Probes are listed in table 1.

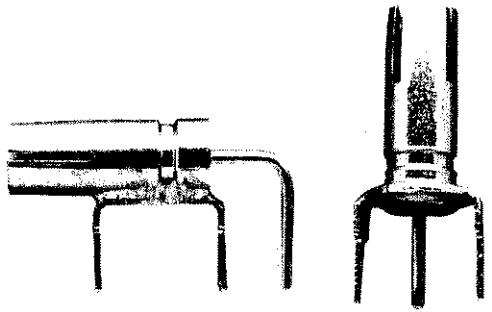
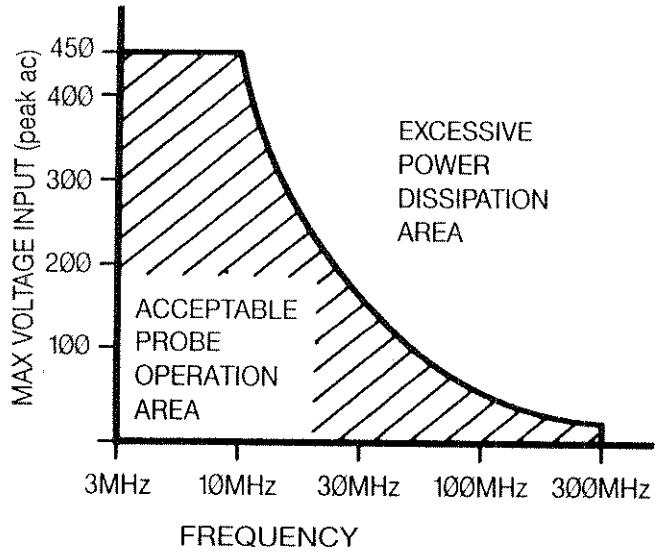


Figure 2. HP Miniature Sockets

Table 1. HP 10400A Probe Family Characteristics



Voltage Versus Frequency Rating Curve (High-Z-Probes)

Approximate Propagation Delay: 5 ns/metre
Maximum Input: 450 Volts (dc + peak ac)
Except - 10437A 5 Volts (dc+ac RMS)
10442A 10 Volts (dc+ac RMS)
10443A 15 Volts (dc+ac RMS)
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 (400 g tip only) 1/2 1/2 sine wave
WEIGHT: 87.9 g (3.1 oz) 1-metre cable with all accessories

Table 1. HP 10400A Probe Family Characteristics (continued)

HP PROBE MODEL	PROBE INPUT C	PROBE INPUT R	DIVISION RATIO	CABLE LENGTH	OSCILLOSCOPE INPUT R
10430A	6.5 pF	1 Megohm	10:1	1 METER	1 Megohm
10431A	6.5 pF	1 Megohm	10:1	1 METER	1 Megohm
10432A	7.5 pF	10 Megohm	10:1	1 METER	1 Megohm
10433A	10 pF	10 Megohm	10:1	2 METER	1 Megohm
10434A	8 pF	10 Megohm	10:1	1 METER	1 Megohm
10435A	7.5 pF	1 Megohm	10:1	1 METER	1 Megohm
10436A	11 pF	10 Megohm	10:1	2 METER	1 Megohm
10437A	NA	50 ohm	1:1	2 METER	50 ohm
10438A	40 pF	NA	1:1	1 METER	NA
10439A	64 pF	NA	1:1	2 METER	NA
10440A	2.5 pF	10 Megohm	100:1	2 METER	1 Megohm
10441A	9 pF	1 Megohm	10:1	2 METER	1 Megohm
10442A	1.2 pF	500 ohm	10:1	2 METER	50 ohm
10443A	1.2 pF	1000 ohm	20:1	2 METER	50 ohm

NA = Not Applicable

SAFETY CONSIDERATIONS

WARNING

These probes are designed for use with oscilloscopes that have a common terminal at GROUND POTENTIAL (in accordance with the Occupational Safety and Health Administration and the National Electric 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, might expose the operator to an electrical shock hazard that could be lethal (depending on voltage and current conditions).

MAINTENANCE AND CLEANING

Maintenance of the probes consists of cleaning, adjustment, and parts replacement. The probes may be cleaned with a soft cloth and a mild detergent diluted with water. Cleaning with alcohol or a harsh detergent may damage the surface of the probe parts. Adjustment procedures and numbers for ordering replaceable parts are included in this operating note.

BANDWIDTH CONSIDERATIONS

The HP 10400A Miniature Probes span three bandwidths. The HP 10430A/31A/41A are designed for use with oscilloscopes having bandwidths of up to 500 MHz. The HP 10432A/33A/35A/40A are designed for oscilloscopes with bandwidths up to 300 MHz, and the HP 10434A/36A are used with oscilloscopes with bandwidths up to 100 MHz.

The dominant probe limitation to system bandwidth is its input capacitance, assuming the high-frequency compensation adjustments have been made. Displayed bandwidth of any measurement system using an oscilloscope and probe is determined by four factors: probe input capacitance, source impedance, source bandwidth and oscilloscope bandwidth.

The system bandwidth when using the 50 ohm probes (10437A/42A/43A) with a 50 ohm test source is generally the bandwidth of the oscilloscope up to 1 GHz approximately.

Table 2 is a list of the HP 10400A probes and the specifications of oscilloscopes that are compatible with the probes.

Table 2. System Compatibility

HP PROBE MODEL	OSCILLOSCOPE INPUT C	OSCILLOSCOPE INPUT R	MAXIMUM BANDWIDTH
10430A	6 - 9 pF	1 Megohm	500 MHz
10431A	6 - 9 pF	1 Megohm	500 MHz
10432A	10 - 16 pF	1 Megohm	300 MHz
10433A	10 - 16 pF	1 Megohm	300 MHz
10434A	18 - 22 pF	1 Megohm	100 MHz
10435A	10 - 16 pF	1 Megohm	300 MHz
10436A	18 - 22 pF	1 Megohm	100 MHz
10437A	NA	50 ohm	NA
10438A	NA	NA	NA
10439A	NA	NA	NA
10440A	6 - 14 pF	1 Megohm	300 MHz
10441A	6 - 9 pF	1 Megohm	500 MHz
10442A	NA	50 ohm	NA
10443A	NA	50 ohm	NA

PROBE OPERATION

CAUTION

Do not solder probe tip to any surface. Soldering will damage probe tip.

The probe tip may be used without any accessories for probing in hard-to-get places. The cable strain relief may be snapped out of position and slid back on the cable when using two or more probes in close proximity, as in figure 1. When using the probe in the subminiature mode, care must be taken to avoid shorting components in the circuit where probing.

The insulating barrel (supplied accessory) may be used to cover the tip ground shield to prevent the hazard of shorting when probing within a circuit. The insulating barrel has two positions: the first position covers the ground shield by the probe tip and the second position exposes the ground shield at the probe tip. A grounding spanner may then be added to the probe tip and still make contact with the ground shield.

CAUTION

If using the probe without any accessories, use caution because the probe could cause a short if it is dropped within the circuit.

Probe Tip with Ground

The probe may be used without either supplied grabber for point-to-point probing. Ground the probe by attaching the ground

lead (MP3) or a grounding spanner (both supplied accessories). Either accessory provides reference for a ground point. To avoid possible shorting of other circuitry, use the barrel insulator (supplied accessory) in conjunction with the ground lead or grounding spanner. Figure 3 is the probe in use with the barrel insulator and a grounding spanner.

To install the barrel insulator, press on with the wider end of the insulator to the probe body. Press the grounding spanner on and twist a few times to ensure it is fully mounted. When used with only the insulating barrel and a grounding spanner, the probe is in its subminiature mode of operation and a very short ground lead is obtained.

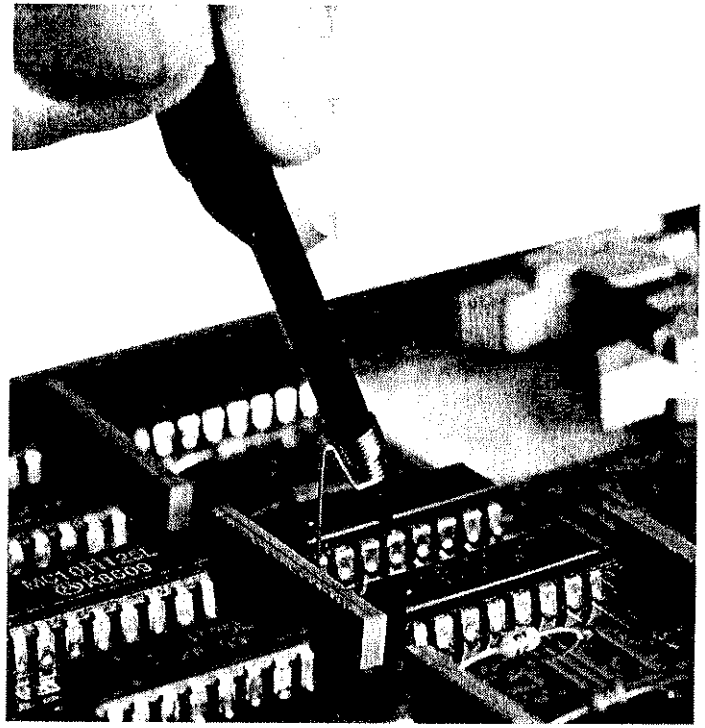


Figure 3. Probe with Insulating Barrel and Grounding Spanner

Probe Tip with General Purpose Grabber

The general purpose grabber (MP1) is used for most typical in-circuit probing and ICs. Attach the ground lead (MP3) to the probe and then the insulating barrel and the general purpose grabber, as in figure 4. Attach the grabber to a probing point by pressing the grabber body towards the probe body, placing hook tip of grabber around probing point, and releasing the grabber body.

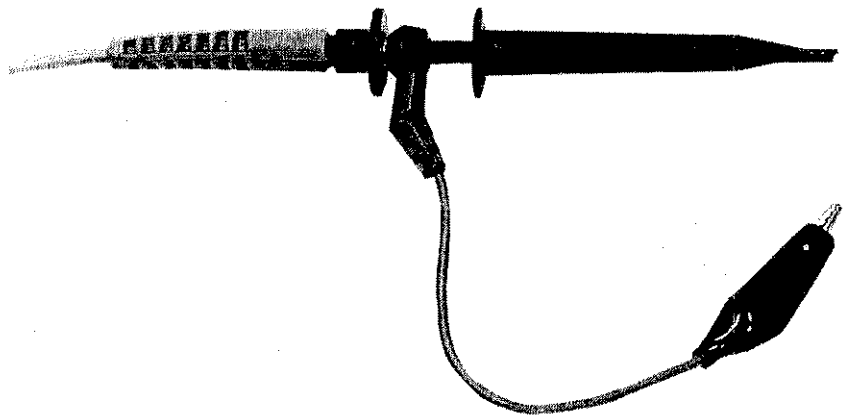


Figure 4. Probe Tip with General Purpose Grabber

Probe Tip with IC Grabber

The IC grabber (MP2) is mounted across an IC to probe a single pin of an IC without hazard of shorting adjacent pins. Install the IC grabber by holding the inner body of the IC grabber and pressing firmly onto probe tip until a positive click is heard. The IC grabber may also be used with the ground lead. The IC grabber is shown across an IC in figure 5.

To attach IC grabber to IC: place forefinger over holder on bottom of IC grabber, place thumb on spring activated outer-body trigger, and press outer body away from inner body of the grabber.

To release IC grabber from IC, use same procedure that attaches the grabber to IC.

To remove IC grabber from probe tip: grasp grabber on inner body (above the spring activated outer body) and firmly pull away from probe tip.

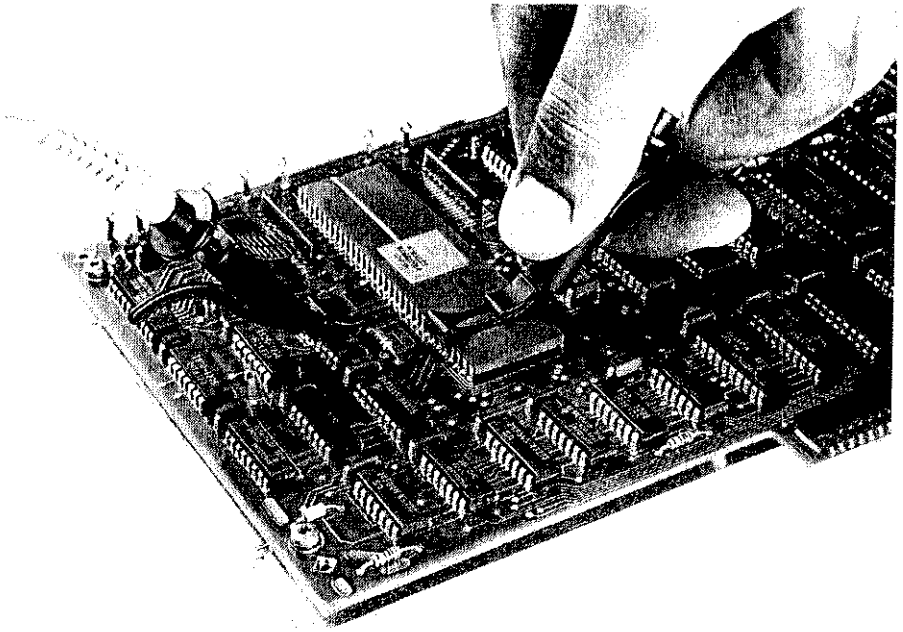


Figure 5. Probe in Use with IC Grabber

COMPENSATION ADJUSTMENTS

The miniature probes require two adjustment procedures: one for low-frequency compensation and one for high-frequency compensation. Low-frequency compensation is an operating adjustment and high-frequency compensation is accomplished periodically, according to maintenance schedules. Low-frequency compensation must be performed before performing high-frequency compensation.

NOTE

Low-frequency compensation is adjusted when the probe is first connected to the oscilloscope. Probe compensation will usually hold over all the ranges when used with a Hewlett-Packard oscilloscope. If the input capacitance of the oscilloscope changes as ranges are switched, compensation must be adjusted each time a new range is selected.

Low-frequency Compensation

Most Hewlett-Packard oscilloscopes have a calibrator (square-wave) output suitable for low-frequency compensation. If your oscilloscope does not have such an output, use a square-wave generator set for an approximate 1-2 kHz output.

To accomplish low-frequency compensation, proceed with the following steps:

1. Connect probe to oscilloscope.

2. Connect probe tip to oscilloscope calibrator output (or square-wave generator).

3. Adjust oscilloscope to display 6 divisions of amplitude.

4. Use adjustment tool (supplied accessory) to adjust C1 (through opening in cover of probe chassis) for the flattest possible pulse top.

High-frequency Compensation

The purpose of high-frequency compensation in probes is to nullify probe rise time loss other than that added by the probe input capacitance.

High-frequency compensation requires an external 10 kHz pulse generator with a rise time compatible to the system (oscilloscope and probe). Refer to table 3 for required transition time of pulse generator before preforming high-frequency compensation adjustments. Any pulse generator meeting the given specification may be used for this adjustment.

Table 3. Recommended Test Equipment

HP PROBE MODEL	PULSE GENERATOR TRANSITION TIME	SUGGESTED EQUIPMENT
10430A	≤ 100 ps	TEK 284
10431A	≤ 100 ps	TEK 284
10432A	≤ 0.5 ns	TEK 502
10433A	≤ 0.5 ns	TEK 502
10434A	≤ 1 ns	HP 8082B
10435A	≤ 0.5 ns	TEK 502
10436A	≤ 1 ns	HP 8082B
10437A	NA	NA
10438A	NA	NA
10439A	NA	NA
10440A	≤ 100 ps	TEK 284
10441A	≤ 100 ps	TEK 284
10442A	NA	NA
10443A	NA	NA

NA = Not Applicable

NOTE

Adjust for low-frequency compensation before performing high-frequency compensation or adjustment may not be accurate.

To accomplish high-frequency compensation proceed with the following steps:

1. Using 50-ohm coaxial cable, connect pulse generator directly to channel input connector on oscilloscope. Terminate oscilloscope into 50 ohms.

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

3. Set oscilloscope input terminations for:

   Channel A.....High Impedance
   Channel B.....50-ohms

NOTE

For oscilloscopes with 1 M-ohm impedances only, use a 50-ohm feedthrough termination.

4. Connect equipment as in figure 6.

5. Adjust oscilloscope for highest sensitivity (lowest vertical range).

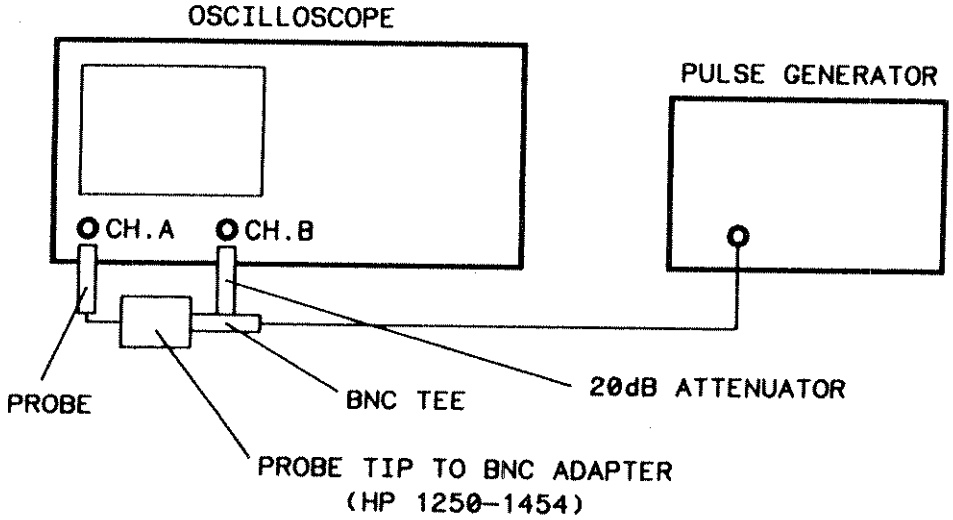


Figure 6. High-frequency Compensation Test Set-up

9. Adjust pulse generator output for oscilloscope display of approximately 6 divisions.

10. Slide off probe chassis assembly cover to expose adjustments. Refer to figure 7 for adjustment locations.

11. Set high-frequency compensation resistor R1 to minimum resistance (completely counterclockwise).

12. Set high-frequency compensation resistor R2 to minimum resistance (completely clockwise).

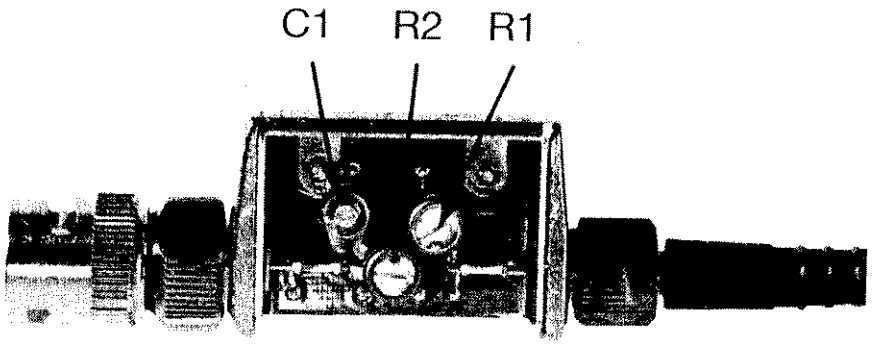


Figure 7. High-frequency Compensation Adjustment Locations

13. Increase resistance by adjusting R1 and R2 alternately in small increments until channel A and channel B waveforms are similar.

14. Replace probe chassis cover.

TROUBLESHOOTING

Probe Tip Failure

Excessive force on the probe tip assembly may result in a bent or broken tip. A slight bend may be carefully straightened with pliers. If the bend is extreme, the probe tip will probably have an open circuit and should be replaced. Suspect probe tips may be checked with an ohmmeter or by substitution with a known good probe.

Probe Cable Failure

A bent or pinched cable may have inner and/or outer conductive changes that may affect bandwidth and pulse response characteristics. Extreme stress in the cable may cause center conductor failure.

In either case, replacement of the cable is necessary.

Probe Chassis Failure

Chassis failure is uncommon and is usually the result of mechanical abuse. Replace chassis assembly if failure occurs.

DISASSEMBLY/ASSEMBLY PROCEDURES

Disconnect chassis assembly (A1A1) from cable assembly (A1A3) by unscrewing the knurled nut. Use a 10 mm open-end or an adjustable open-end wrench to loosen the nut.

Disconnect probe tip assembly (A1A2) from cable assembly (A1A3) with the following procedure:

1. Remove all accessories from probe tip.

2. Grasp probe body tightly and pull tip away from probe body. No tools should be required unless the probe has been physically damaged.

CAUTION

Use of tools (pliers, etc.) may damage circuitry located in the probe tip. Do not use tools to remove probe tip unless tip has been damaged and cannot be removed easily or it is going to be discarded.

NOTE

Six to eight pounds of force is required to disconnect and connect the probe tip and probe cable. To increase grip on probe tip barrel, wind a rubber band around the barrel several times to provide a non-slip grip.

3. Connect probe tip assembly to cable assembly by grasping probe cable tightly and push tip onto cable end until a positive click is heard and tip barrel is bottomed out against shoulder on cable interconnect.

CAUTION

Do not use tools (pliers, etc.) to install probe tip. Tools may damage circuitry located in the probe tip. Use rubber band as indicated in previous note.

REPLACEABLE PARTS

All HP 10400A replaceable parts are shown in figure 8 and listed in table 4 of this operating note. 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.

To order additional probes, orders may be placed with the Hewlett-Packard Direct Marketing Division at the following address:

Hewlett-Packard
HP Direct, Test and Measurement
5301 Stevens Creek Blvd.
MS51LSC
Santa Clara, CA 95052-8059 USA

To order by telephone, call one of these toll free numbers:

800-452-4844

or, in California:

408-246-4300

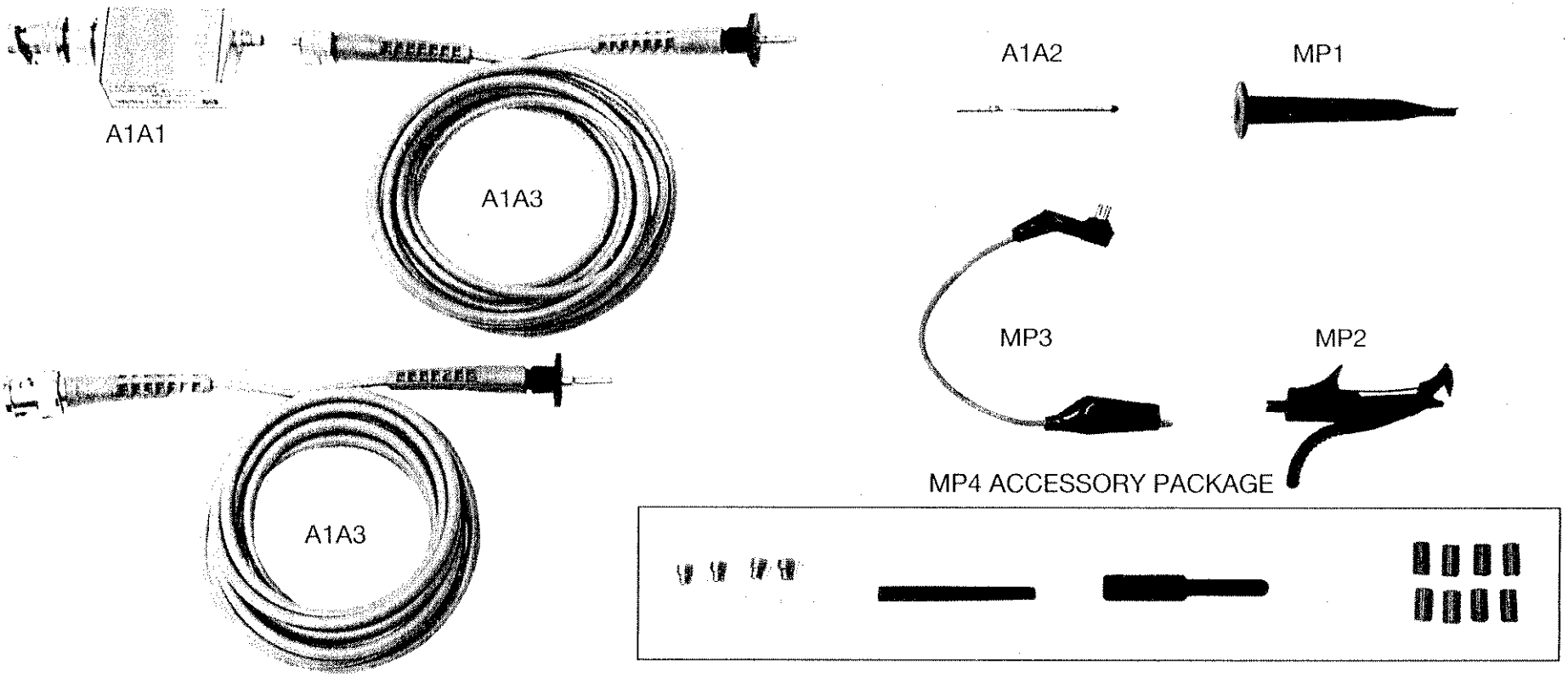


Figure 8. HP 10400A Replaceable Parts

Table 4. Replaceable Parts

DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1A1	10430-60101	CHASSIS ASSEMBLY - HP 10430A
A1A1	10431-60101	CHASSIS ASSEMBLY - HP 10431A (INCLUDES PROBE SENSOR PIN)
A1A1	10432-60101	CHASSIS ASSEMBLY - HP 10432A
A1A1	10433-60101	CHASSIS ASSEMBLY - HP 10433A
A1A1	10434-60101	CHASSIS ASSEMBLY - HP 10434A
A1A1	10435-60101	CHASSIS ASSEMBLY - HP 10435A
A1A1	10436-60101	CHASSIS ASSEMBLY - HP 10436A
A1A1	10438-60101	CHASSIS ASSEMBLY - HP 10438A
A1A1	10439-60101	CHASSIS ASSEMBLY - HP 10439A
A1A1	10440-60101	CHASSIS ASSEMBLY - HP 10440A
A1A1	10441-60101	CHASSIS ASSEMBLY - HP 10441A (INCLUDES PROBE SENSOR PIN)

Table 4. Replaceable Parts (continued)

DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1A2	5061-6145	TIP ASSEMBLY - HP 10430A/31A - WHITE
A1A2	5061-6151	TIP ASSEMBLY - HP 10432A - RED
A1A2	5061-6146	TIP ASSEMBLY - HP 10433A - BLUE
A1A2	5061-6150	TIP ASSEMBLY - HP 10434A - BROWN
A1A2	5061-6147	TIP ASSEMBLY - HP 10435A - GREEN
A1A2	5061-6152	TIP ASSEMBLY - HP 10436A - ORANGE
A1A2	5061-6149	TIP ASSEMBLY - HP 10437A/38A/39A - BLACK
A1A2	5061-6148	TIP ASSEMBLY - HP 10440A - YELLOW
A1A2	5061-6153	TIP ASSEMBLY - HP 10441A - PURPLE
A1A2	5062-7387	TIP ASSEMBLY - HP 10442A - GRAY
A1A2	5062-7388	TIP ASSEMBLY - HP 10443A - TAN
A1A3	5061-6139	CABLE ASSEMBLY - 1 METRE - HIGH Z-HP 10430A/ 31A/32A/34A/35A/38A
A1A3	5061-6140	CABLE ASSEMBLY - 2 METRE - HIGH Z-HP 10433A/ 36A/37A/39A/40A/41A

Table 4. Replaceable Parts (continued)

DESIGNATOR	HP PART NUMBER	DESCRIPTION
A1A3	5061-6142	CABLE ASSEMBLY - 50 OHM - 2 METRE - HP 10437A
A1A3	5062-7393	CABLE ASSEMBLY - 50 OHM - 2 METRE - HP 10442A
A1A3	5062-7394	CABLE ASSEMBLY - 50 OHM - 2 METRE - HP 10443A
		ACCESSORIES
MP1	5061-6160	GENERAL PURPOSE GRABBER/HOOK TIP
MP2	5061-6161	INTEGRATED CIRCUIT GRABBER
MP3	5061-6162	GROUND LEAD
MP4	5061-6163	ACCESSORY PACKAGE - 4 GROUNDING SPANNERS, 1 PROBE BARREL INSULATOR*, 1 ADJUSTMENT TOOL, AND 8 COLORED WIRE MARKERS

*Probe is shipped with one probe barrel insulator attached to probe tip.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OR MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

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