

OPERATING NOTE/JANUARY 1985

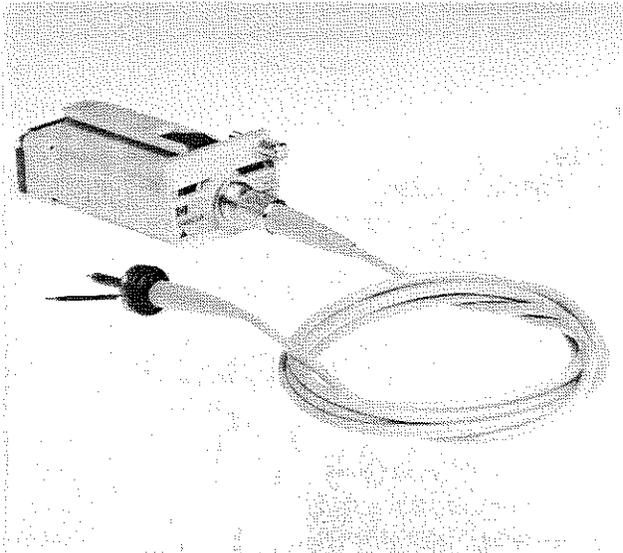


Figure 1. Hewlett-Packard 54001A
Miniature Active Probe

1-1. INTRODUCTION

1-2. The Hewlett-Packard miniature active 1 GHz probe significantly reduces the problem of probing densely populated IC components or the characteristically minute conductors on IC circuit boards. This small, light-weight probe allows 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 (MP6, supplied) and the IC test clip (HP Model 10024A or HP Model 10211A, available accessories).

1-3. 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 MP12 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.

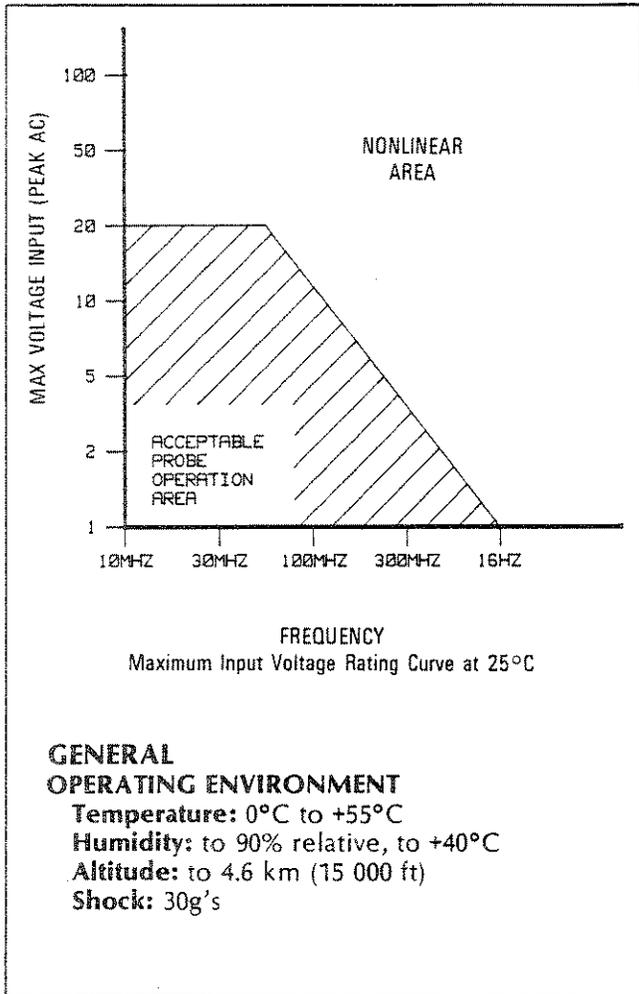
Table 1. Specifications

Probe Model No.	Approximate Overall Length Metres (Ft)	Approximate Propagation Delay	Bandwidth/Risetime	Probe Input C (Approx)
54001A used with	1.5 (5)	7.6 ns	700 MHz/450 ps	2 pF
54100A/D				
54300A				
Input R: 10 kΩ DIVISION RATIO: 10:1 \pm 3%		VOLTAGE RATING VS FREQUENCY Maximum voltage range for linear operation is shown in the voltage vs frequency curve (on page 2). DO NOT exceed the voltage levels for a given frequency as the probe may be permanently damaged.		

Operating Note Part No. 54001-90901
Microfiche Part No. 54001-90801



Table 1. Specifications (Cont'd)



these instruments from an external battery will expose the operator to an electrical shock hazard that could be lethal (depending on the electrical energy available).

CAUTION

Power must be removed from the HP 54100A/D Digitizing Oscilloscope or the 54300A Probe Multiplexer when the 54001A is removed or installed as the active probe may be damaged.

1-5. USING THE PROBE WITH THE GRABBER OR THE HOOK TIP. The hook tip (MP1) or the grabber (MP6) can be attached to the probe by installing it over MP12 (see figure 2). The hook tip and the grabber can be rotated on the probe without being removed. The alligator clip (MP2) threads on the lead assembly (MP3) which fits the exposed ground connection on the insulating sleeve (MP12) (see figure 2). Colored wire markers can be installed on the probe cable for identification.

1-6. When using the snap-on ground lead (MP3 or MP4) grip the knurled part of MP12 and unscrew the barrel of the insulating sleeve so that the ground shield on the probe assembly is covered. The spring ground can be used with or without the insulating sleeve being installed. If the insulating sleeve is installed screw the barrel into the probe body as far as possible, this exposes the ground shield on the probe assembly. Install the ground spring by rotating it clockwise on the probe tip (see figure 2).

CAUTION

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

WARNING

This probe was designed for use with the HP Models 54100A/D and the 54300A which have a common terminal at GROUND POTENTIAL (in accordance with OSHA requirements and the National Electric Code). Exposed metallic surfaces of the probe and the 54100A/D and the 54300A MUST BE GROUNDED. Failure to ground the common terminal during certain applications, such as operating

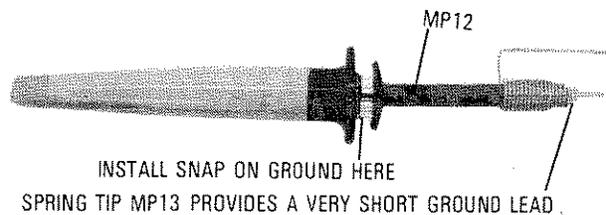


Figure 2. Probe with Ground Spring

1-7. The accessory kit contains two different types of solder in probe sockets, a horizontal socket (MP8) and a vertical socket (MP9) (see figure 9). These sockets are recommended when the shortest ground path possible is necessary when measuring very fast subnanosecond edges, etc. These sockets can be installed either temporarily or permanently in the circuit under test.

1-8. USING THE PROBE WITHOUT THE GRABBER OF THE HOOK TIP. The probe can be used for point-to-point probing by removing the hook tip or the grabber from the probe assembly. The probe can be grounded by using the lead assembly (MP3), ground lead assembly (MP4) mated with ground lead grabber (MP7) spring ground or the spanner tip assembly (MP10) (see figure 9).

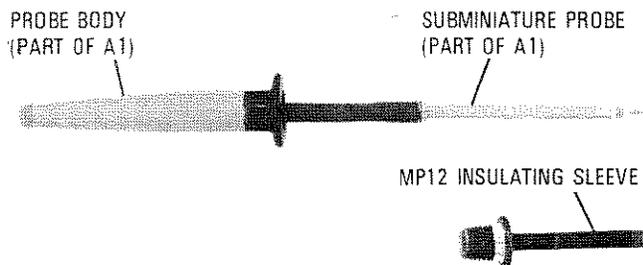


Figure 3. Probe in Subminiature Mode

1-9. SUBMINIATURE MODE OF OPERATION. The size of the probe can be reduced by removing the insulating sleeve (MP12). To accomplish this turn the knurled portion of the insulating sleeve counterclockwise and pull the probe tip out of the sleeve (see figure 3).

WARNING

ELECTRICAL SHOCK HAZARD. Before using the probe in the subminiature mode, be sure to read the warning in paragraph 4.

1-10. When you are using the IC Test Clip HP Model 10024A (available accessory), insert the probe in the clip to contact an IC pin (see figure 4). 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 you are using the subminiature probe because it could cause a short circuit if it is dropped in the circuit.

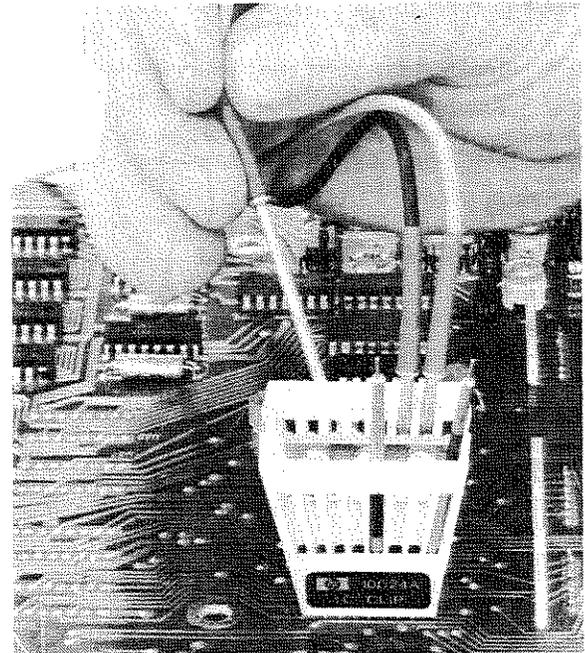


Figure 4. Use of Probe with Model 10024A IC Test Clip

1-11. BANDWIDTH CONSIDERATIONS

1-12. The dominant probe limitation to the system bandwidth is the input capacitance of the system, assuming that the adjustments have been made as described in Section 2, Calibration Procedure. Displayed bandwidth of any measurement system using an oscilloscope depends on:

- a. Probe input capacitance.
- b. Source impedance.
- c. Source bandwidth.

1-13. Each of these factors should be considered separately whenever bandwidth is an important part of the measurement. For more information on probe measurements, refer to Application Note 152, "Probing in Perspective".

1-14. MAINTENANCE

1-15. Maintenance consists of cleaning, adjustment, and probe cable replacement. The probe cable can be removed from the probe pod by following the procedure in paragraph 2-4. The 54001A must be recalibrated if the probe cable assembly is replaced.

Model 54001A

1-16. Other field repairs are not recommended. If a failure should occur, contact your nearest Hewlett-Packard Sales and Service Office for details on the Blue Stripe Exchange Program.

1-17. REPLACEABLE PARTS

1-18. Replaceable parts are shown in figure 9. When ordering a part, address the order to the nearest HP Sales and Service Office. Provide the model number of the probe and a complete description of the part, including the HP Part Number.

1-19. ACCESSORIES AVAILABLE

1-20. The following accessories are available for use with the HP 54001A:

HP 11536A 50-ohm probing Tee. Requires an HP Part No. 54001-23203 probe adapter.

HP 10211A (24 pin) and HP 10024A (16 pin) IC clips.

HP Part No. 54001-23203 probe adapter. The 54001-23203 adapter adapts the HP 54001A mini-probe tip (or other HP mini-probes) to the accessories included with the HP 10020A resistive divider probe kit, and to the 11536A probing Tee.

2-1. 54001A CALIBRATION PROCEDURE

Setup

2-2. Before the 54001A probe can be calibrated a probe extender, HP Part Number 54100-63802 (see figure 5), must be installed in the 54100A/D. To accomplish this:

- a. Insure that the power is removed from the 54100A/D before continuing.
- b. Remove the top cover of the 54100A/D. Be sure to remove the top two feet from the rear of the instrument before removing the top cover.
- c. Disconnect the probe wiring harness and flexible coax from the channel 1 sampling board (A5) and connect the 54100-63802 probe extender in their places. You may want to raise the PC board slightly to facilitate these connections. Insure that the board locks at the front and rear of A5 are released before you attempt to raise the PC board. Make sure the board is resealed before continuing (see figure 6).

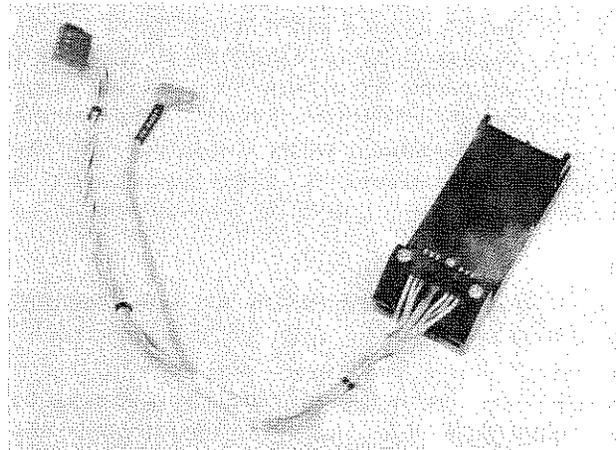


Figure 5. Probe Extender HP Part No. 54100-63802

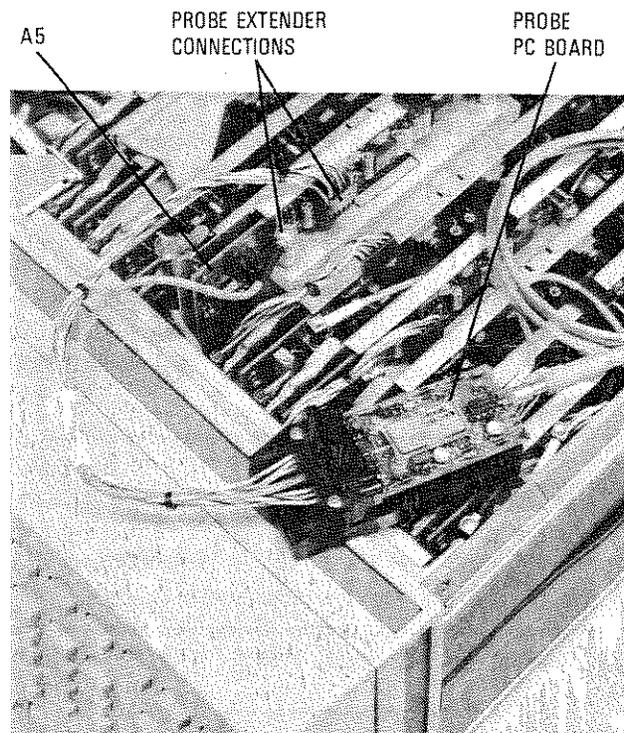


Figure 6. Probe Extender Connections

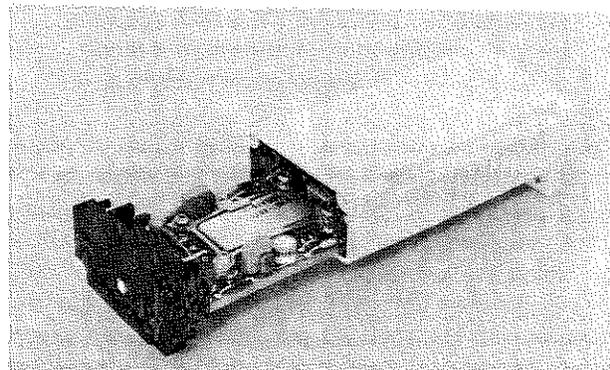


Figure 7. Removal of Probe PC Board

2-3. To calibrate the probe circuitry it must be removed from the pod, To accomplish this remove the two Torx screws from the rear of the pod.

2-4. Remove the probe cable assembly from the pod by loosening the two set screws at the front of the pod and unscrewing the cable connector from the pod (see figure 7).

2-5. Reconnect the cable connector to the PC board as shown in figure 6.

2-6. Connect the PC board to the probe extender. This allows the adjustment points to be exposed (see figure 6).

2-7. To connect the probe tip to the pulse source use this procedure:

- a. Remove the black insulating sleeve from the probe tip and install HP 54051A Probe Adapter in its place.
- b. Press the probe tip with adapter in the HP 11536A Probing Tee.
- c. Install a 50-ohm terminator on type N female end of the probing tee.
- d. Install a BNC to type N adapter to the male type N end of the tee.
- e. Connect the probing tee directly to the output of the pulser, Tektronix Model Number PG 506 or equivalent. Do not use a cable between the pulse generator and the probing tee as the skin effect losses of the cable might lead to incorrect setting of the high frequency component.

2-8. Calibration

- a. Insure that the pulse generator is turned off.
- b. On the 54100A/D, set the vertical sensitivity on channel 1 to 100 mV/div. Insure that the oscilloscope is in the Auto Sweep mode. Adjust R2, probe offset adjustment, on the probe PC board so that the trace coincides with horizontal line on the graticule. (Use the axis graticule.) See figure 8.
- c. Set the 54100A/D as follows:
Channel 1 on, volts/div=100mV, offset=-300mV.
Timebase - sec/div=10ms, delay=0, trg'd sweep.
Trigger - trigger mode=edge, source=chan 1, level=-300mV, slope=pos.
Display - display mode=averaged, averages=4, split screen off, graticule=frame.
Delta V - Vmarkers=chan 1

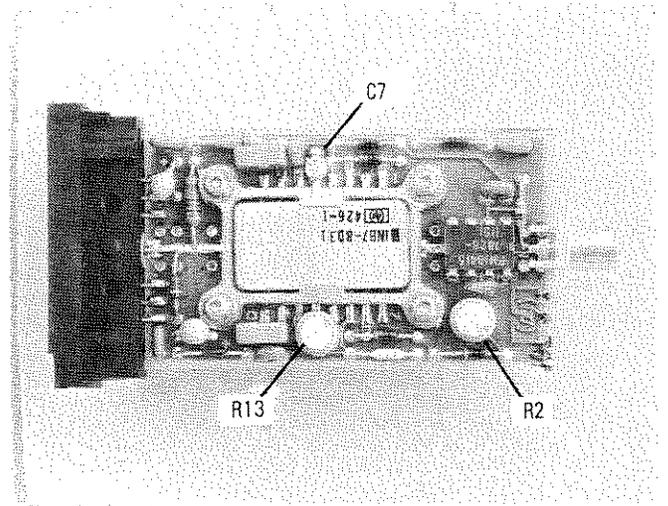


Figure 8. Probe PC Board

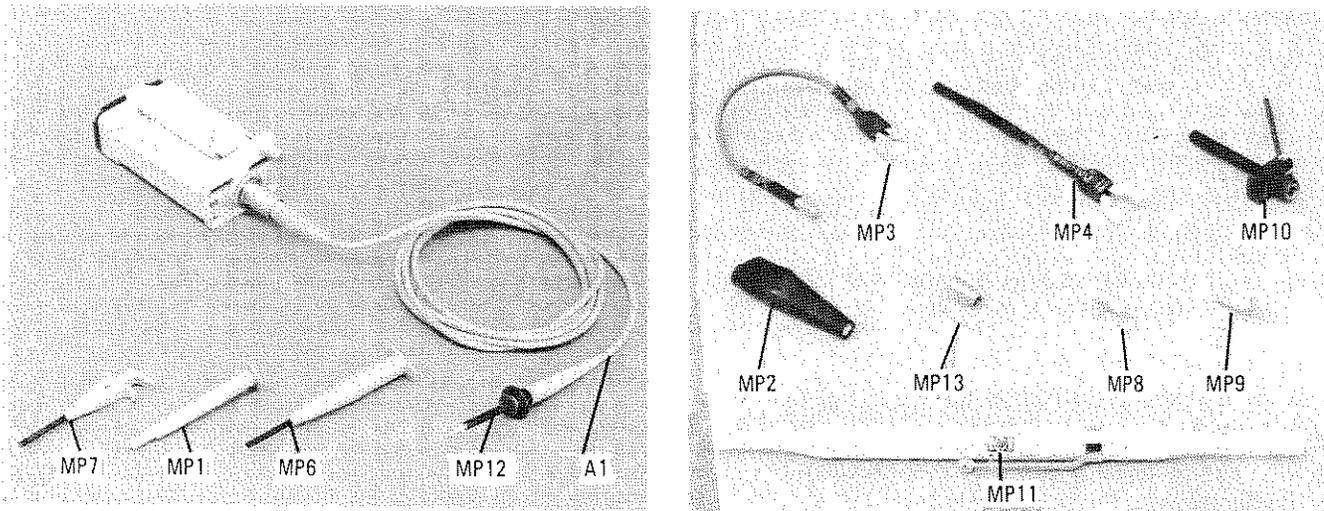
- d. Energize the pulse generator and set the output for a 600mV square wave with a 100 ms pulse period.
- e. Adjust R13 (see figure 8) on the probe PC board for the flattest pulse top possible.
- f. Change the sweep speed of the 54100A/D to 5 ns/div. and adjust the pulse generator for a pulse period of approximately 10 μ s.
- g. Adjust C7 (see figure 8) using a 0.025 in. (0.27mm) square shaft adjustment tool for the flattest overall pulse response. See Equipment Required List.

NOTE

It is sometimes helpful to repeat step 2-7 at this point to minimize the possibility of power-up offset drift errors.

EQUIPMENT REQUIRED

Oscilloscope	1 GHz bandwidth	HP 54100A/D
Probing tee	50 ohm type N	HP 11536A
Probe adapter		HP 54001-23203
Terminator	50 ohm type N	HP 908A
Adapter	BNC to type N (male) (female)	HP 1250-0077
Alignment tool	blade type	HP 8710-1300
Alignment tool	0.025" square	8710-1515 and Johanson #4932
Probe extender		HP 54100-63802
Flat pulser	<2% perturbations to 100ms period	Tektronix PG506



Replaceable Parts

Reference Designator	HP Part Number	C D	Qty	Description
A1	54001-61601	5	1	Probe Cable 1.5M
MP14	0510-0958	0	1	Push On Retaining Ring
MP15	2190-0068	5	1	Knurled Nut
Accessories				
MP1	10017-67602	4	1	Retractable Hook Tip
MP2	5061-1258	7	1	Alligator Clip
MP3	54001-63201	5	1	Lead Assembly
MP4	54001-63202	6	1	Ground Lead Assembly
MP5	5040-1484	9	2	Wire Marker - Green
MP5	5040-1485	0	2	Wire Marker - Yellow
MP5	5040-1486	1	2	Wire Marker - Orange
MP5	5040-1487	2	2	Wire Marker - Red
MP6	10017-69501	6	1	Grabber
MP7	10230-62101	7	1	Grabber (Ground)
MP8*	1250-1737	4	4	Horizontal Test Point
MP9+	1250-1918	3	4	Vertical Test Point
MP10	54001-67602	8	1	Spanner Tip Assembly
MP11	8710-1300	0	1	Alignment Tool
MP12	10017-62302	1	1	Insulating Sleeve
MP13	1460-1476	3	1	Spring Ground
* E. F. Johnson Part No. 129-701-301 + E. F. Johnson Part No. 129-701-201				

Figure 9. Replaceable Parts and Included Accessories

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.

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.

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 OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

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.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

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