HEWLETT *hp* PACKARD

YOUR
X-Y RECORDER

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Model 7015A X-Y Recorder

This booklet is designed to quickly and easily acquaint you with your new Hewlett-Packard X-Y recorder. The complete line of HP X-Y recorders includes many combinations of features and options, which are intended to meet your exact recording requirements. These features and options may or may not all be a part of your recorder. However, this booklet, regardless of the features and options of your unit, contains all the information necessary for you to set up basic recording operations and handle minimum operator maintenance.

Your Hewlett-Packard X-Y recorder has been designed and manufactured to provide you with the best possible performance whether used as a stand-alone instrument or as part of a system. You can assure yourself of this performance by: (1) careful setup and operation, (2) proper periodic maintenance, and (3) using Hewlett-Packard consumables on your recorder.

Model 7045A X-Y Recorder

Model 7046A X-Y Recorder
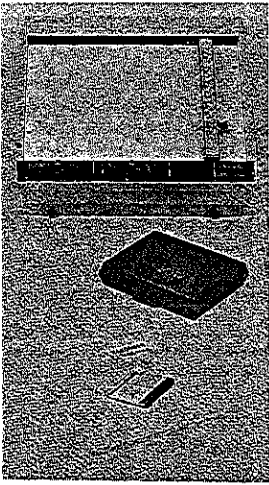
OPERATION

Your X-Y Recorder

Operation of your Hewlett-Packard recorder is easily accomplished with only a minimum setup required. The recorder was shipped from the factory only after being subjected to exhaustive tests and proper calibration, and can be placed into use immediately. If, after operating the recorder for a period of time, you wish to verify that your recorder is operating properly, run the performance tests on Pages 4 through 9. Due to the many models and available options, your recorder may not have the exact control or function specified. The performance test should still be run, with the controls applicable to your system set to provide the expected response.

Disposable pens are supplied as standard equipment and have been designed to provide over 450 meters (1500 feet) of reliable writing. Do not place undue force on the pen tip, as this can distort the tip and produce an unacceptably wide trace. After each use of the recorder, replace the cap over the pen tip to protect it from damage and reduce ink evaporation. European size recording paper, DIN A3 or DIN A4, can be used on certain model recorders. However, since the grid size is larger than standard English or metric recording paper, the pen will not cover the entire grid writing area.

Prior to operating your recorder, review and familiarize yourself with the content of the Operating and Service Manual. Should the recorder at any time fail to provide the expected response, familiarity with the manual will enable you to quickly isolate the fault and make the necessary repair.

SETUP

1. Set the AC SELECTOR on the rear of the recorder to the line voltage of your power source. Verify that the proper fuse has been installed for the voltage selected. Fuse information is marked on the back of your recorder.

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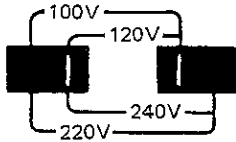
Sample in-line voltage selector switch set to 120V.
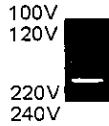
Sample side-by-side voltage selector switch set to 220V.

Paper Positioning

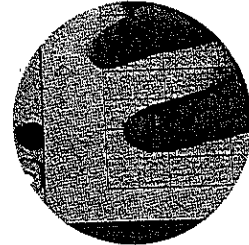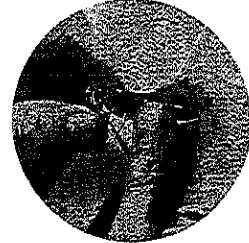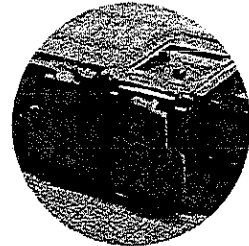2. Remove any dust that may have accumulated on the paper hold-down area with a Kimwipe ® or other industrial, lint-free tissue.

    WARNING: This instrument is equipped with a three-wire power cable for proper earth grounding. Disconnecting the protective earth terminal is likely to make this instrument dangerous.

3. Install the power cord then turn the power on. Place recording paper on the platen with holes of the 280 X 430 mm (11 X 17-inch) paper on the left and holes of the 216 X 280 mm (8½ X 11-inch) paper on top. Position the paper against the lower left stop and the platen edge X-axis paper guide, then turn on the AUTOGRIP. With firm finger pressure, smooth the paper and check security of the hold down. If the paper is not secure, clean the AUTOGRIP surface as instructed on Page 16. Rough textured, warped, or bent paper will prove unsatisfactory with AUTOGRIP. Store your recording paper on a flat surface, preferably in the box.

Single-Pen Installation

4. On single-pen models, using care not to damage the writing tip, install the disposable pen by pushing into the notched holder and twisting clockwise one-quarter turn. On two-pen models, clip the disposable pens into the provided holder. If you have a two-pen recorder and are recording with only one pen, remove the other pen from the holder. The pen lift raises and lowers both pens together. The unused pen, if not removed, will travel back and forth over a straight line soaking the paper with ink and eventually wearing through the recording paper.

Two-Pen Installation

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PERFORMANCE TESTING
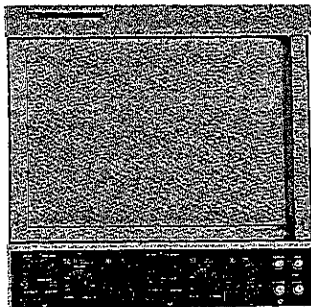
X-Y Pen Movement Check

X-Y MOVEMENT

1. Adjust the X and Y zero controls to set the pen in the lower left (0,0) position. With the pen down, and using either the time base or a ramp input signal with a range setting to provide full axis sweep, run the recorder through the complete X and Y-axis ranges.

2. If the pen trace is unacceptably wide, the pen tip is or has been distorted or is excessively worn. If the trace is weak, the ink supply is depleted. In either case, replace the disposable pen. If the trace varies in width, or skips while moving across the page, the pen lift bar may need adjustment. Refer to the Operation and Service Manual for adjustment procedures.

TIME BASE

1. Using zero controls, set the pen to the zero grid line for the sweep selected.

2. Set the selector switch to the X or Y position, and the SWEEP RATE switch to one of the available sweep speeds.

3. Press the START pushbutton. The pen should lower and sweep across the selected axis at the proper speed.

4. On most models, as soon as the pen stops at the end of the sweep, it will automatically lift and reset to the zero position. On models without automatic reset, as soon as the pen stops at the end of the sweep, press the RESET pushbutton. The pen will then reset to the zero position.

Time Base Check

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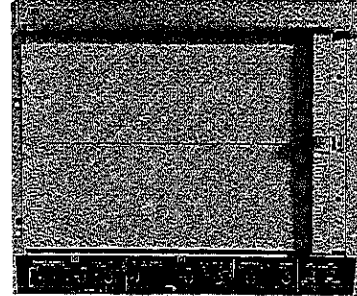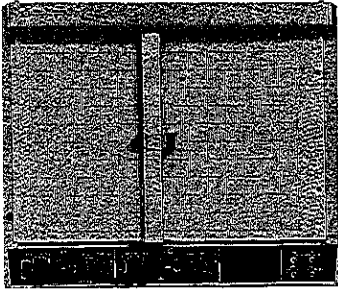
X-Axis Accuracy and Linearity Check

ACCURACY AND LINEARITY

This recorder was calibrated at the factory using precise standards. Due to the dimensional instability of recording paper, at extreme relative humidity ranges the paper can change in size ±1% or more, dependent upon the brand of paper used. This test therefore will not necessarily indicate the precise accuracy the instrument is capable of but should be utilized as a figure of merit. To minimize recording paper dimensional changes, it is recommended that you use only Hewlett-Packard recording paper.

1. Set the recorder SERVO switch to STANDBY. Connect a DC Voltage Standard, such as the HP 740B, which has been set to 0000, to the X-axis inputs of the recorder. Adjust the X and Y zero controls to position the pen at exactly zero on the X axis and approximately 12.5 cm (5 inches) on the Y axis.

2. Set the X-axis RANGE switch to .05 V/cm (.1 V/in.), and the POLARITY switch to +RT, if applicable.

3. Depending upon the horizontal writing area of your recorder, set the DC Voltage Standard to 1.25V (1V) for 25 cm (10-inch) or 1.9V (1.5V) for 38 cm (15-inch) paper, and apply this voltage to the X-input terminals. Set the recorder SERVO switch to ON. The pen will sweep across the paper and stop at 25 cm (10 inches) ±0.050 cm (±0.020 inch) or 38 cm (15 inches) ±0.076 cm (±0.030 inch).

4. With the pen up, reduce the output of the DC Voltage Standard in 125 mV (100 mV) increments for 25 cm (10-inch) paper or in 190 mV (150 mV) increments for 38 cm (15-inch) paper until reaching zero. Drop the pen at

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each increment and verify that the pen is on each 2.5 cm (1-inch) grid line within 0.076 cm (0.030 inch). If the pen position at the end of the sweep or at any increment exceeds the tolerance, the recorder needs calibration. Refer to the Operating and Service Manual for calibration procedures.

5. Set the recorder SERVO switch to STANDBY. Connect the DC Voltage Standard, which has been set to 0000, to the Y-axis inputs of the recorder. Adjust the X and Y zero controls to position the pen at exactly zero on the Y axis and approximately 12.5 cm (5 inches) on the X axis.

6. Set the Y-axis RANGE switch to .05 V/cm (.1 V/inch) and the POLARITY switch to +UP, if applicable.

Y-Axis Accuracy and Linearity Check

7. Depending upon the vertical writing area of your recorder, set the DC Voltage Standard to 0.9V (0.7V) for 18 cm (7-inch) or 1.25V (1V) for 25 cm (10-inch) paper and apply this voltage to the Y-input terminals. Set the recorder SERVO switch to ON. The pen will sweep up the paper and stop at 18 cm (7 inches) ±0.036 cm (±0.014 inch) or 25 cm (10 inches) ±0.050 cm (±0.020 inch).

8. With the pen up, reduce the output of the DC Voltage Standard in 90 mV (70 mV) increments for 18 cm (7-inch) paper or in 125 mV (100 mV) increments for 25 cm (10-inch) paper until reaching zero. Drop the pen at each increment and verify that the pen is on each 2.5 cm (1-inch) grid line within 0.076 cm (0.030 inch). If the pen position at the end of the sweep or at any increment exceeds the tolerance, the recorder needs calibration. Refer to the Operating and Service Manual for calibration procedures.
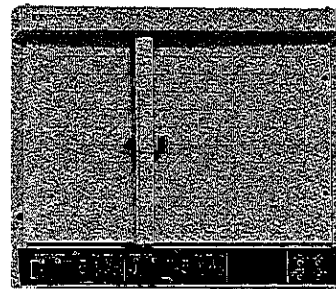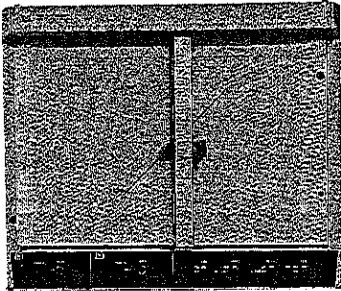
45° Retrace Check

RETRACE

The retrace test is the single best indication of the dynamic performance of your X-Y recorder, excluding calibration. These tests require that the RANGE switches be set to provide an X:Y ratio of 1:1 for 45°, 1:5 for 75°, and 5:1 for 15°. If your recorder does not have the exact setting specified in the step, adjust the controls as necessary to provide the proper X:Y ratio. Perform the retrace test as follows:

1. Set both X and Y-RANGE switches to .05 V/cm (.1 V/in.). Check that the pen is up, then, using a single Function Generator, such as the HP 3310A, supply the following triangular waveform to both X and Y-axis inputs of the recorder:

    0.071 Hz for Models HP 7010A, 7015A, 7035B, 7040A, 7044A
    0.35 Hz for Models HP 7004B, 7034A, 7041A, 7045A, 7046A, 7047A

2. Set the amplitude of the Function Generator and zero position of the recorder so that each axis of the recorder has a total travel of approximately 17.5 cm (7 inches), centered around midscale. Drop the pen, allowing it to draw a single line, then retrace this line once. The width of the line should be no greater than 0.25 mm (0.010 inch) plus the width of a single pen line.

3. Repeat the retrace at an angle of 75° with the X-RANGE switch set to .5 V/cm (.5 V/in.), Y-RANGE switch set to .1 V/cm (.1 V/in.), and Function Generator set to 0.071 Hz triangular wave. Repeat the retrace at an angle of 15° with the X-RANGE switch set to .1 V/cm (.1 V/in.), Y-RANGE switch set to .5 V/cm (.5 V/in.), and Function Generator set to 0.05 Hz triangular wave. The 75° and 15° retrace line widths should be no greater than 0.38 mm (0.015 in.) plus the width of a single pen line.

4. Check the retrace lines just drawn. If there are any irregularities or evidence of jumpy recording, clean the wipers and slidewire as instructed on Pages 14 and 15. After cleaning and any necessary lubrication of the wipers and slidewire, rerun the retrace tests to be sure the trace is smooth. If the retrace width is greater than the amount specified, check the mechanical freedom and X-axis amplifier gain as instructed in the Operating and Service Manual.

PREVENTIVE MAINTENANCE

You can maintain your Hewlett-Packard recorder at peak performance by a program of proper care. The Operating and Service Manual supplied with your recorder contains detailed maintenance procedures. The condensed information presented here is intended to help you establish a preventive maintenance program for your recorder.

WARNING: Disconnect the recorder from the power source prior to performing any maintenance. Inspection, cleaning, and wiper and slidewire cleaning should be performed only by qualified service personnel.

PERIODIC MAINTENANCE

Periodic maintenance, as scheduled, is recommended to assure trouble-free operation of your recorder. This schedule assumes that the recorder is operating under normal use and environmental conditions. More frequent use, or operation in areas of high air contamination, will require shorter maintenance intervals.

Recommended Maintenance Equipment

Description	HP Part Number
Slidewire Cleaner	5080-3605
Slidewire Lubricant	5080-3635
Silicone Grease	6040-0363
Instrument Oil	6040-0220
Isopropyl Alcohol	8500-0559
Kimwipes® (Kimberly Clark)	9300-0001
Cleanser	9310-0515
Mild Liquid Soap	– –

Recommended Maintenance Schedule

Description of Maintenance	Interval
General Inspection	90 Days
Wiper and Slidewire Cleaning	90 Days
General Cleaning	6 Months
Calibration	6 Months
General Lubrication	12 Months
Autogrip Table Cleaning	As Required

GENERAL INSPECTION

Access for inspection requires removal of the Autogrip table, rear hood, and bottom cover. Refer to the Operating and Service Manual for removal procedures. After removing these items, inspect for the following:

- Both X and Y drive gears should be in proper adjustment with minimum backlash and should be free of worn or damaged teeth.

- Servo motors should be securely mounted.

- Slide the Y-axis pen carriage through several excursions, listening for scrapes, grinding noises, etc., while feeling for any binding in the movement. Repeat this procedure for the X-axis arm.

- Check all cables for evidence of fraying or rubbing.

- Check for evidence of overheated components, loose connections, cracked circuit boards, or other defects.

- Check for worn wipers, or wipers that do not have proper contact with the slidewire.

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GENERAL CLEANING

WARNING: When cleaning, apply water using only a Kimwipe® or equivalent. Do not allow water to run onto electrical components and circuits or through openings in the enclosure as it may cause a potential electrical hazard.

EXTERNAL. Clean with mild liquid soap and warm water, then wipe dry.

INTERNAL. Access for internal cleaning requires removal of the Autogrip table, rear hood, and bottom cover. Refer to the Operating and Service Manual for removal procedures. Clean accessible internal areas with mild liquid soap and warm water then wipe dry. Do not use soap and water on gears, bearings, or similar parts.

GEARS. Clean all gears with slidewire cleaner (HP 5080-3605). After cleaning, lubricate all gears as instructed on Page 13.

Y-AXIS SLIDER ROD. Clean Y-axis slider rod with slidewire cleaner. After cleaning, lubricate the Y-axis slider rod as instructed on Page 13.
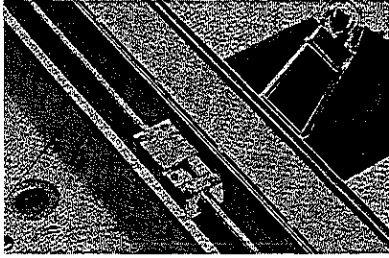
X-AXIS SLIDER ROD. Clean X-axis slider rod with a clean, dry, lint-free cloth. If your recorder is either Model HP 7010A or HP 7015A, lubricate the X-axis slider rod as instructed on Page 13. All other models do not require X-axis slider rod lubrication.
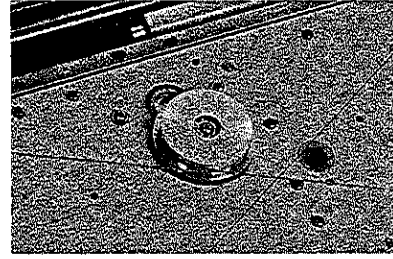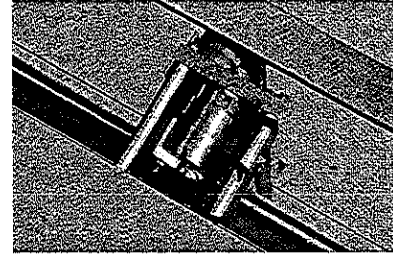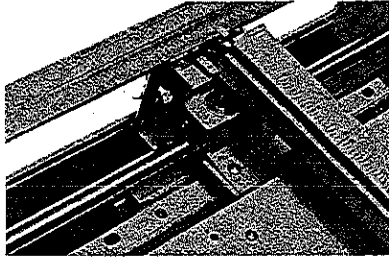

X-Axis Drive Gear

Y-Axis Drive Gear

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Y-Axis Slider Rod

X-Axis Slider Rod

GENERAL LUBRICATION

Certain components of the recorder require lubrication after each cleaning. No lubrication is needed for the ball bearings. Perform necessary lubrication as follows:

GEARS: Lubricate gears with light grade silicone grease (HP 6040-0363).

Y-AXIS SLIDER ROD. Lubricate Y-axis slider rod with instrument oil (HP 6040-0220). Lubricate guide under Y-axis slider rod with light grade silicone grease (HP 6040-0363).

X-AXIS SLIDER ROD. Recorder Models HP 7010A and HP 7015A are the ONLY units requiring lubrication of the X-axis slider rod. Lubricate with instrument oil (HP 6040-0220).
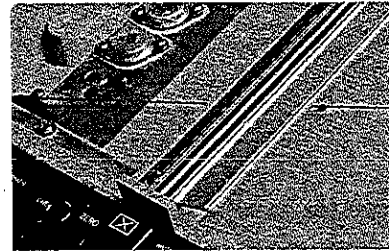
WIPER AND SLIDEWIRE CLEANING

Keeping the wiper and slidewire or balance potentiometer clean are one of the most important items in caring for your recorder. If the wiper is worn, dirty, or does not make proper contact with the slidewire, irregular or jumpy recordings may result. Refer to the Operating and Service Manual for access to the wipers and slidewires. Clean the wiper and slidewire as follows:

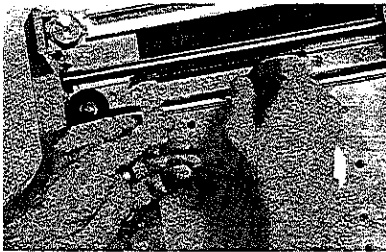
Cleaning X-Axis Wiper and Slidewire

1. Spray entire potentiometer and wiper with slidewire cleaner (HP 5080-3605), then rapidly move the pen carriage through several complete excursions. Be sure cleaner does not get on bearings or gears as they would then need lubrication.
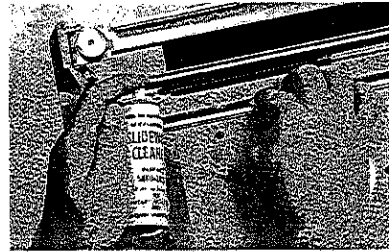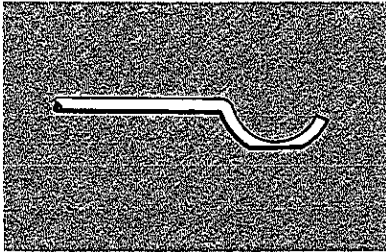

Y-Axis Wiper and Slidewire

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Lubricating X-Axis Wiper and Slidewire

Worn Wiper

2. Saturate a Kimwipe® or cotton swab with slidewire cleaner and rub the slidewire and return strip along the entire length. Repeat until there is no stain or discoloration on the tissue or swab.

3. X-Y recorders, Models HP 7004B, 7034A, and 7035B, contain slidewires which require lubrication after each cleaning. Lubricate sparingly with slidewire lubricant (HP 5080-3635) being careful to keep lubricant away from drive cables. Do not use slidewire lubricant on any other model recorders.

4. Inspect the wiper for proper contact with slidewire and any evidence of excessive wear. Align or replace the wiper as necessary.

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AUTOGRIP TABLE CLEANING

Dust and other contaminants on the Autogrip surface will lower the paper holding capability. Although recording ink will not affect Autogrip performance, it may be desirable to remove ink stains as well. NO STRONG CHEMICALS, SILICONE-BASED CLEANERS, OR HARSH ABRASIVE CLEANERS SHOULD BE USED ON THE AUTOGRIP TABLE.

WARNING: Scratches or punctures in the table surface may expose high voltage conductors. Instruments damaged in this manner should NOT BE OPERATED. Apply water using only a Kimwipe® or equivalent, being careful to not allow water to stand on the Autogrip surface or run through openings in the enclosure as it may cause a potential electrical hazard.

Cleaning moderate contamination can be accomplished as follows:

1. Prepare a mixture of 50% isopropyl alcohol and 50% water by volume.

2. Apply the alcohol/water mixture to the table using a Kimwipe®. Immediately wipe any moisture from the surface. Never let any liquid stand on Autogrip surface as the surface may become permanently damaged.

If the surface cannot be easily cleaned with the alcohol/water mixture, cleaning can be accomplished as follows.

1. Select a clean, lint-free cloth that will not scratch the Autogrip surface.

2. Dampen the cloth with warm water or alcohol and apply a light amount of cleanser (HP 9310-0515). A commercial cleanser such as Ajax®, Comet®, or Vim may be used.

3. Wipe the table surface until it is clean, then rinse the cloth and wipe any remaining cleanser from the table. Immediately wipe any moisture from the surface.

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HEWLETT-PACKARD CONSUMABLES

Hewlett-Packard X-Y recording papers and pens are manufactured to rigid specifications. Hewlett-Packard graph papers are cut at a 45° angle across the grain and are printed under controlled conditions at 50% relative humidity. These factors help to minimize paper size changes when recording within the normal humidity ranges. The margins are carefully controlled for width and parallelism so that sheet after sheet can be quickly and accurately registered in the recorder. A wide variety of standard, semi-logarithmic, logarithmic, and special formats, as well as coated papers for slow-speed recording, are available to satisfy all of your recording requirements. Permanent, crisp, continuous traces are produced with Hewlett-Packard pens. For a complete listing of Hewlett-Packard consumables, see the Recorder Consumables Catalog, available from your local Hewlett-Packard Sales and Service Office.
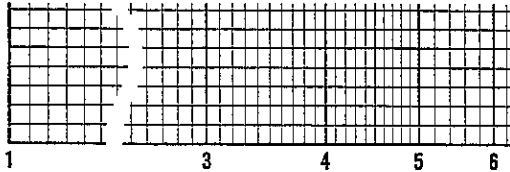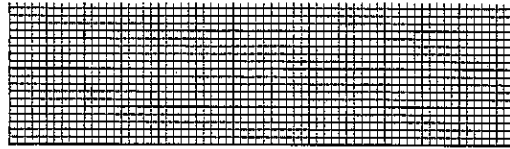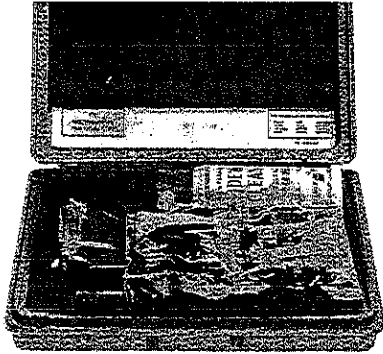
HEWLETT-PACKARD SALES AND SERVICE

For further information regarding Hewlett-Packard products, call your local Hewlett-Packard Sales and Service Office listed in the Operating and Service Manual.

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