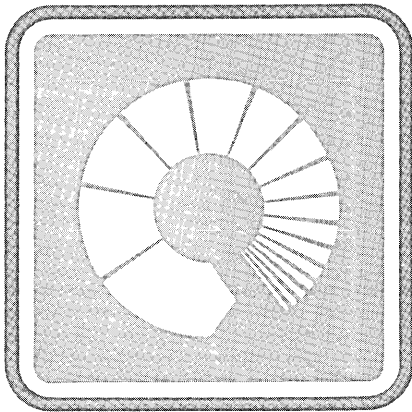


# SITE ENVIRONMENTAL REQUIREMENTS

FOR  
DISC/TAPE DRIVES



HEWLETT  
PACKARD



# **SITE ENVIRONMENTAL REQUIREMENTS**

FOR  
DISC/TAPE DRIVES

Printed: JAN 1982

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HEWLETT-PACKARD COMPANY  
P.O. Box 39, Boise, Idaho 83707, U.S.A.

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# PRINTING HISTORY

New editions incorporate all update material since the previous edition. Updating Supplements, which are issued between editions, contain additional and revised information to be incorporated into the manual by the user. The date on the title page changes only when a new edition is published.

First Printing ..... AUG 1981  
Second Printing ..... JAN 1982

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**FOR U.S.A. ONLY**

The Federal Communications Commission (in 47 CFR 15.805) has specified that the following notice be brought to the attention of the users of this product. This statement applies to all HP Disc/Tape Drives listed in Appendix A.

**FEDERAL COMMUNICATIONS COMMISSION  
RADIO FREQUENCY INTERFERENCE  
STATEMENT**

Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.



# SECTION I

## INTRODUCTION

### GENERAL INFORMATION

This manual provides information regarding the environmental requirements of Hewlett-Packard disc/tape drives. These include operating and non-operating (storage, transport or power down) requirements. Section II provides a generic description of each environmental item. Appendix A contains the specific environmental requirements, operational specifications and operational characteristics for each specific HP disc/tape drive.

Note: This manual applies only to HP disc/tape drives listed in Appendix A.

The environmental requirements cover both the actual physical location of the disc/tape drive and the associated area. While Hewlett-Packard provides consultation on the site environment requirements, the scheduling, planning, preparation and verification of a site environment suitable for installation of a Hewlett-Packard disc/tape drive is the customer's responsibility. Hewlett-Packard Sales and Support Personnel are available during the pre-installation period to assist the customer.

The information in this manual covers only Hewlett-Packard disc/tape drives and accessories. The customer is responsible for meeting the site environmental requirements for the rest of the system components. If the disc/tape drive(s) is to be installed on Hewlett-Packard computer equipment, appropriate site preparation documentation, including environmental requirements, will be provided for each system component.

Environmental requirements are those items required to ensure that HP disc/tape drives meet the published operational characteristics. Each environmental item has a specific measurable parameter or information that affects the operational characteristics of a HP disc/tape drive. Continual operation of the disc/tape drive at the limits of the environmental requirements may result in degradation of disc/tape drive operation. The following items are considered environmental requirements:

- Temperature
- Humidity
- Shock
- Vibration
- Altitude
- Electromagnetic Susceptibility
- Contaminants
- Cooling Requirements
- Tilting

Contaminants (page 2-6) as yet have no measurable parameters except as rated for the disc/tape drive particulate filter. Chemical contaminants that can corrode disc/tape drive components are presently being researched by Hewlett-Packard. Operating a Hewlett-Packard disc/tape drive in an environment known to contain significant amounts of the listed contaminants will lead to disc/tape drive malfunctions requiring extensive servicing. Hewlett-Packard therefore recommends to our customers that HP disc/tape drives not be stored or operated in areas that contain the contaminants listed under corrosive contaminants.



## **CUSTOMER RESPONSIBILITY**

The customer is responsible for furnishing all labor and materials for site preparation, site maintenance, conformance to local codes, and the compatibility of Hewlett-Packard products with local laws, codes and licenses. The customer is solely responsible for establishing and maintaining the site requirements specified at the site planning meeting. Failures resulting from such unspecified environmental or physical phenomena are not covered by warranty or maintenance agreement (examples include, but are not limited to, toxic or corrosive chemicals present in the air).

## **CUSTOMER ENGINEERING SERVICES**

HP offers complete on-site customer engineering maintenance service on a world-wide basis. Charges for this service, quoted as a basic monthly maintenance charge (BMMC), are among the lowest in the industry, contributing to the low overall cost of ownership associated with the purchase of a HP disc/tape drive.

Provisions of the BMMC require compliance with the specifications listed in this site environmental requirements manual. Conditions that are identified as having a detrimental effect on disc/tape drive performance (e.g., corrosive gases, noisy or unstable power source, etc.) must be corrected prior to installation.

For further details, contact your nearest Hewlett-Packard Sales and Support Office.

# SECTION II

## ENVIRONMENTAL REQUIREMENTS

### INTRODUCTION

The quality and reliability features of a product must be developed early in the product design stage and carried through the manufacturing process. Hewlett-Packard seeks to design and build the finest quality and reliability into our products starting at the bread-board design stage.

At each design stage, a randomly selected number of products are put through the environmental test sequence. This random selection of products is referred to as "type testing".

Due to the length of testing time and in some cases the increased stress levels applied to the product, it is not possible to test each and every product manufactured. In addition to the type testing, certain tests are performed on each product as it completes the manufacturing cycle. This testing further ensures that the product sold is as good as the product that was environmentally tested.

### EFFECTS OF CLIMATE

All HP Disc/Tape Drives can operate in an environment suitable for human occupancy as long as moisture will not condense within the environment and room air does not contain chemical contaminants which may degrade disc/tape drive components. Along with the environment in which the disc/tape drive operates, the effects of outside temperature, humidity, altitude and other regional characteristics must be taken into consideration. For instance:

- At higher altitudes, the efficiency of a cooling fan decreases because of reduced air density. Consider keeping the disc/tape drive enclosure at a lower temperature to compensate for the reduced air density at the disc/tape drive air intake vents.
- In locations where extremes of temperature and humidity prevail, consider the effects of such conditions on the disc/tape drive when the main power is shut down. For instance, in northern regions, the effects of winter nighttime temperatures should be considered when the main power is shut off.
- In warm, humid regions, a fungus growth prevention program should be considered.
- In shoreline installations, the disc/tape drive site may require special air conditioners, dehumidifiers, and other items to reduce high humidity and corrosive salt in the air.

Reliability is at its maximum when operated within the optimum temperature and humidity range. See temperature and relative humidity requirements in Appendix A.

### VIBRATION AND SHOCK

Vibration can cause slow degradation of mechanical parts and, when severe, can cause data errors in disc/tape drives; hence it should be avoided or controlled. Also, mechanical connections such as PCA connectors, cable connectors, and processor backplane wiring may be affected. The best preventive measure is to build the site away from vibration-generating sources, such as heavy industrial machinery (stamp mills, etc.). Care in handling the disc/tape drives will also avoid problems resulting from sudden shock. See vibration and shock requirements in Appendix A.

Figures 1 and 2 are the unpackaged operating and nonoperating vibration profiles used to test HP disc/tape drives. The vibration test verifies the disc/tape drive's operational and mechanical integrity.

Figure 3 is the unpackaged operating and nonoperating shock profile used to test HP disc/tape drives. The shock verifies the disc/tape drive operational and mechanical integrity.

## **ALTITUDE**

Altitude must be considered for two conditions: operating and nonoperating. In the operating environment, the lack of adequate air density at extremely high altitudes may be insufficient to allow disc/tape drive heads to fly over the disc surfaces and thereby cause cooling problems or a disc failure. See altitude requirements in Appendix A.

## **ELECTROMAGNETIC SUSCEPTIBILITY**

### **INTRODUCTION**

In order to establish and maintain the correct electromagnetic environment it may be necessary to take unique steps. This may include but not be limited to the following:

- Improved grounding techniques.
- Placing the disc/tape drive in a grounded screen enclosure.
- Placing grounded copper screens on all windows.

### **RADIATED INTERFERENCE SUSCEPTIBILITY**

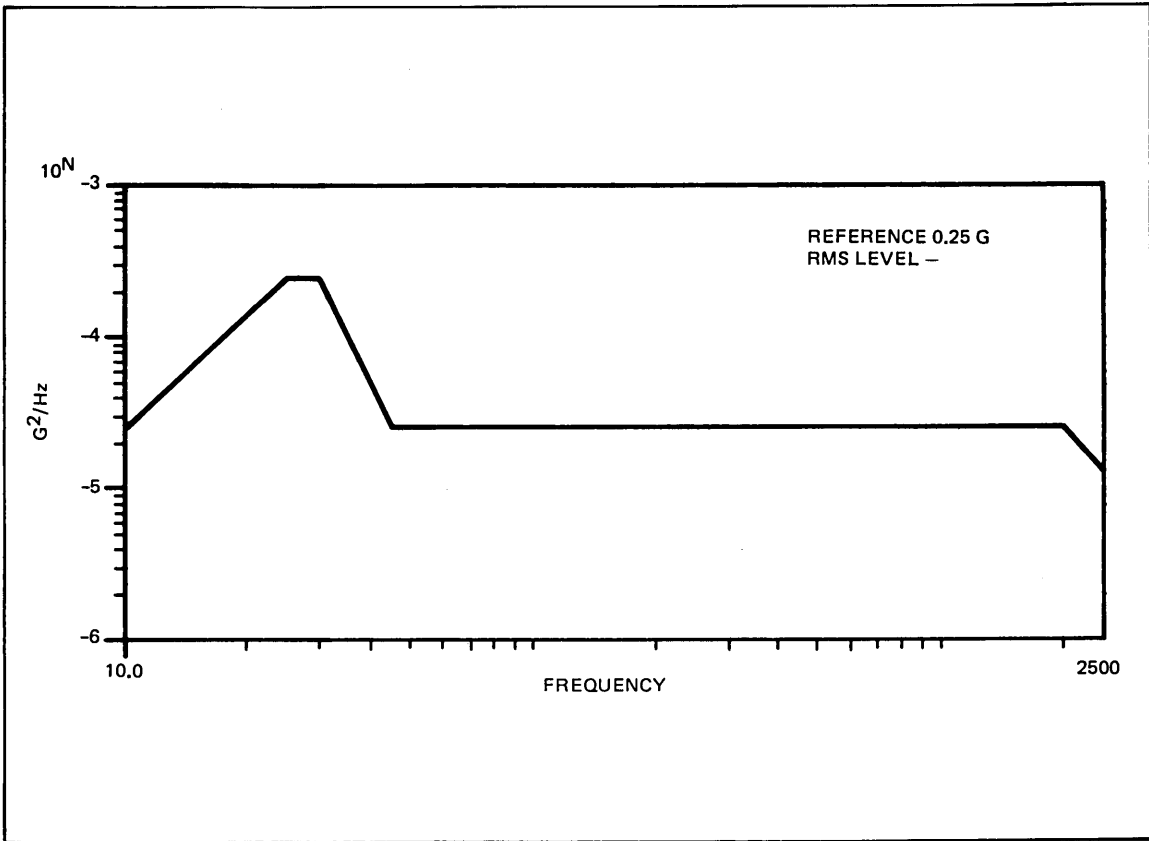
Electronic equipment, including disc/tape drives, may exhibit unacceptable behavior if operation is attempted in environments where electromagnetic fields exist, such as near radio and TV transmitting towers, or near radar installations as found at airports. If radiated electromagnetic fields are suspected, or verified (such as by direct measurement using spectrum analyzers or field strength meters), precautions should be taken to shield the disc/tape drive products from the electromagnetic field.

### **CONDUCTED INTERFERENCE SUSCEPTIBILITY**

Radio frequency noise may be introduced into a disc/tape drive through the ac power line as well as through the air as an electric field. Power line conditioners and line filters are very effective in eliminating conducted radio frequency interference (RFI).

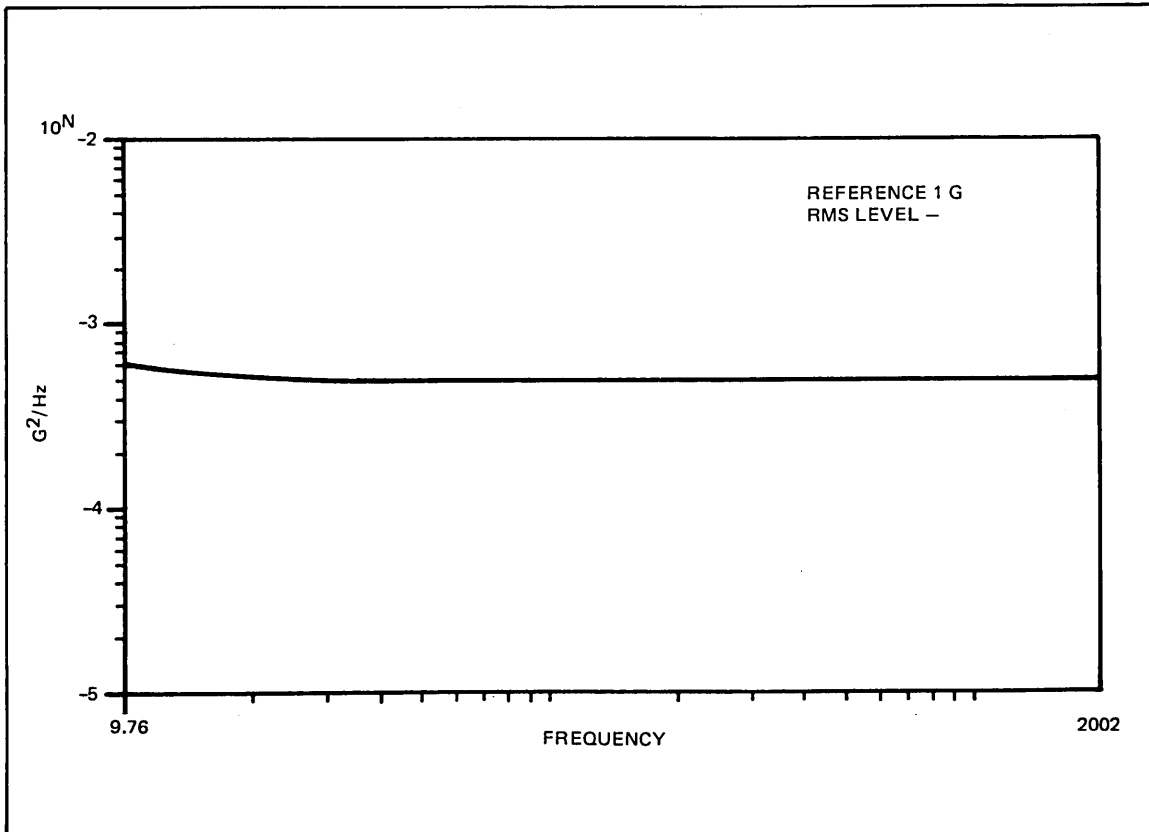
### **ELECTROSTATIC DISCHARGE**

Electrostatic discharge, commonly known as static electricity, may cause alteration of data, improper operation or electronic failure. Carpeting, low humidity, and leather-soled shoes may all contribute to unacceptable electrostatic fields. If static discharges are detected (as when touching door knobs, or metallic objects), humidifiers, anti-static mats and other anti-static procedures should be implemented.



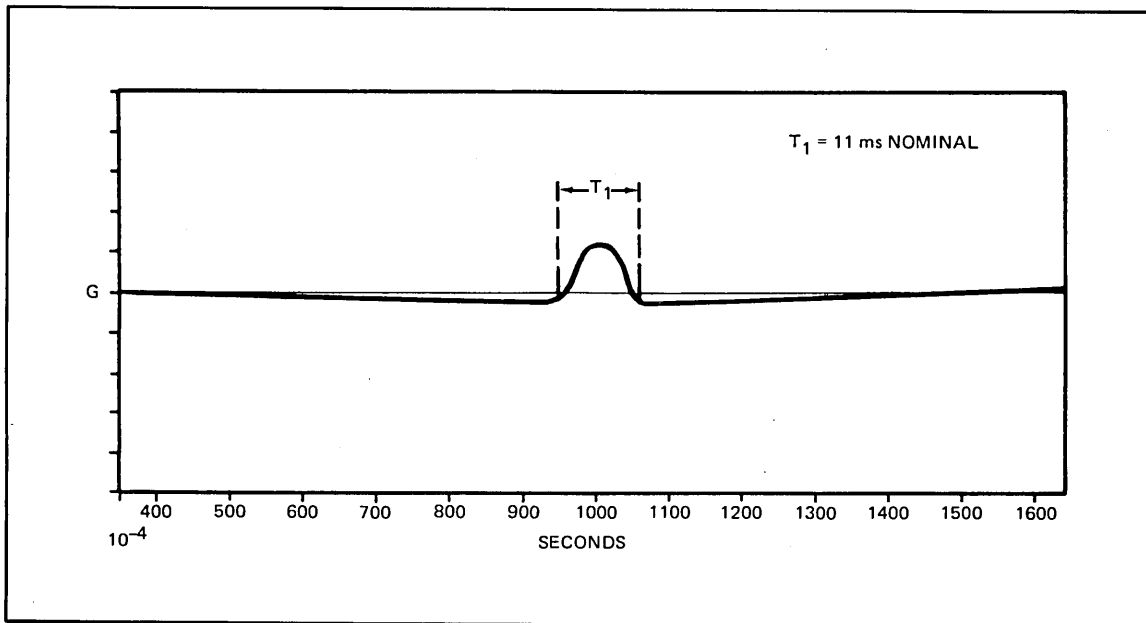
5955-8

Figure 1. Vibration Operating Profile



5955-9

Figure 2. Vibration Nonoperating Profile



5955-10

Figure 3. Shock Operating and Nonoperating Profile

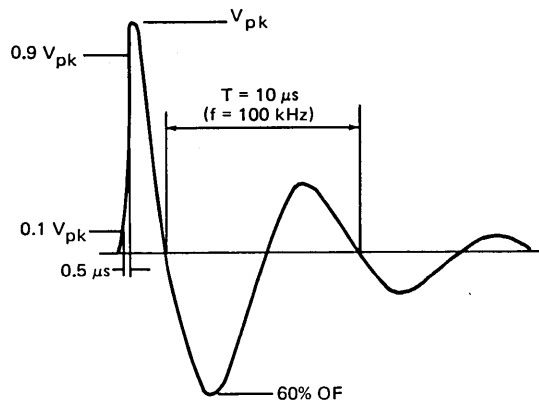
## MAGNETIC SUSCEPTIBILITY

Disc/tape drives, and magnetic media (tapes, floppy discs and removable disc packs), may all exhibit destruction of stored data if exposed to magnetic fields. Keep all magnetic materials away from magnetic media and recording devices.

## POWER LINE IRREGULARITIES

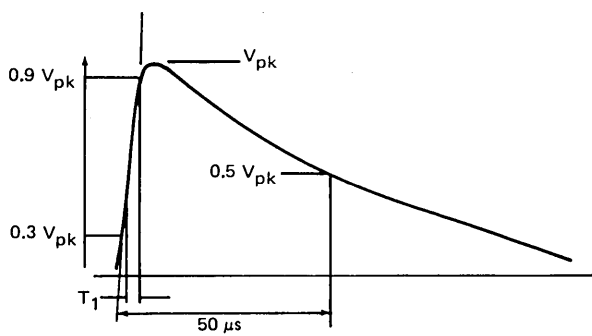
In some geographic areas, available power that is used for the disc/tape drive may experience excessive voltage sags, surges, transients, outages, or other irregularities that are unacceptable for reliable disc/tape drive operation. Therefore, a power quality survey must be conducted. The results of the survey should be analyzed for correct voltage, current, phase, the absence of detrimental power line transients, and conducted interference that can cause a malfunction to occur as a disc/tape drive out-of-specification operation. If any item does not meet HP disc/tape drive requirements, corrective action must be taken to correct the situation. Power line irregularities may be divided into the following categories:

- a. **Line Dropout.** The power distribution network may lose power for short periods of time. HP disc/tape drives recover gracefully from short duration line dropouts. To insure that long duration power line dropout will not affect the constant operation of any electrical device, an uninterruptible power supply (UPS) would be required. Line conditioners and regulators will not help in this situation.
- b. **Over or Under Voltage.** Fluctuations from the nominal line voltage are experienced as the result of equipment being turned on or off both within the immediate vicinity and also over the entire power distribution network. A power failure many miles away may cause voltage fluctuations. In a worst case situation, "brown out", only a UPS will provide uninterrupted power.
- c. **Line Transients.** Just as radio frequency noise may be transmitted over the ac power line, electrical noise may also be evidenced at the ac power outlet. Line transients may result in interrupted operation, blown fuses, or electrical failure. The surge waveforms used to test HP disc/tape drive power line transient response are shown in figure 4. The waveforms are described in the IEEE "Guide on Surge Voltages in AC Circuits up to 600V Final Draft."
- d. **Neutral to Ground Noise.** This is the noise exhibited between the neutral to ground lines.



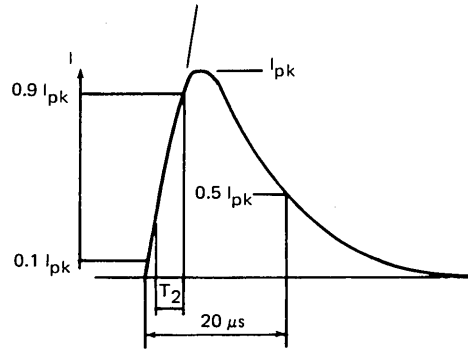
OSCILLATORY WAVE  $0.5 \mu s$  RISE TIME,  $100 \text{ kHz}$  DECAYING AT  $40\%$  FOR EACH SUCCESSIVE PEAK

A. RING WAVE ( $0.5 \mu s - 100 \text{ kHz}$ ) OPEN CIRCUIT VOLTAGE



$T_1 \times 1.67 = 1.2 \mu s$

$1.2 \mu s \times 50 \mu s$   
OPEN CIRCUIT VOLTAGE

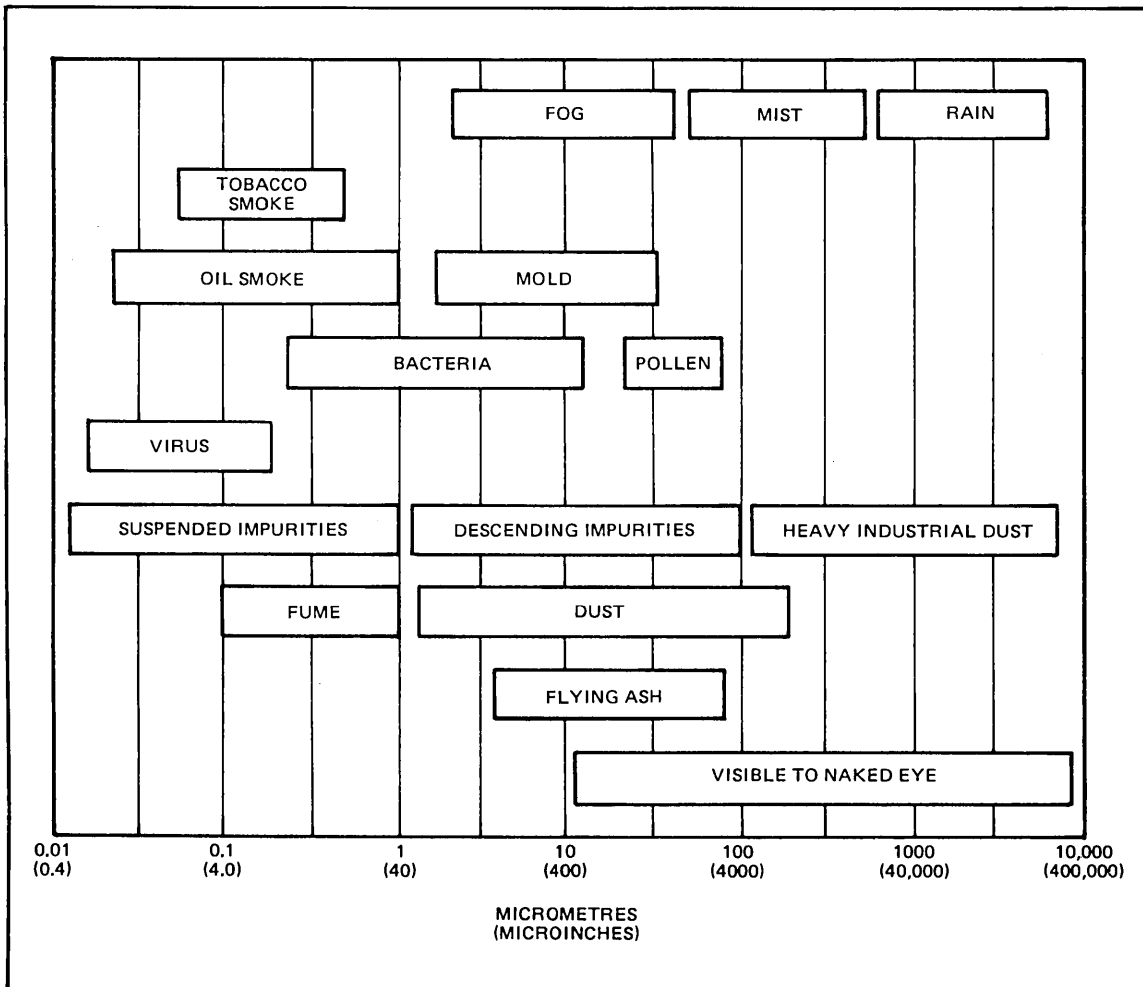


$T_2 \times 1.25 = 1 \mu s$

$1 \mu s \times 20 \mu s$   
DISCHARGE CURRENT

B. UNIDIRECTIONAL WAVES

Figure 4. Surge Voltage Waveforms



5955-12

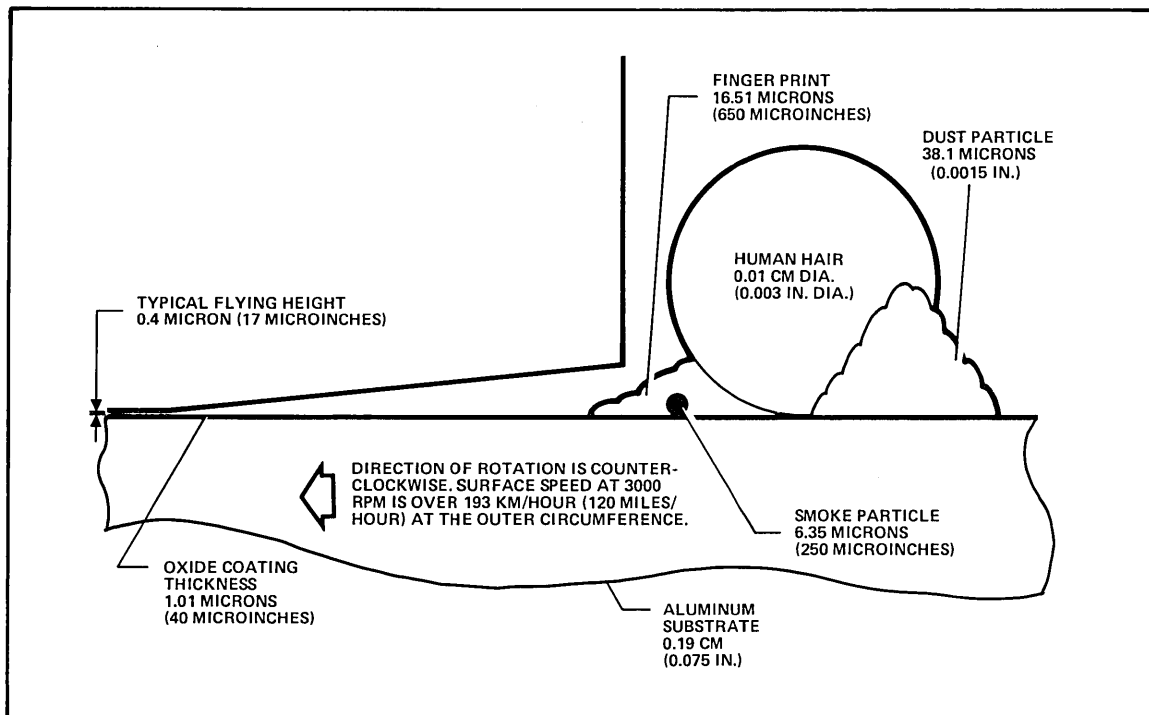
Figure 5. Sizes of Common Air Contaminants

- e. Ground to Ground Noise. This is the noise exhibited between the disc/tape drive ground and earth ground.
- f. Power Line Distortion. This is an undesired change in the original signal waveform that results in an unfaithful representation of the desired waveform. Waveform clipping is one example of this type of distortion. Noise in the form of extraneous signals superimposed on the desired waveform is not defined as distortion.

Power line conditioners may be helpful in regulating and conditioning (removing transients) ac power. Problems associated with power line irregularities are often very difficult to diagnose due to the unpredictable and intermittent nature of the problem.

## CONTAMINANTS

Contaminants consist primarily of particulates or corrosives. Both may be airborne in atmospheric dust as a complex mixture of smokes, mists, fumes, dry granular particles, and fibers. The components of any mixture may consist of soot and smoke, silica, clay, organic materials, and metallic fragments. A sample may also include living organisms such as mold spores and bacteria. These components vary with locality, season of the year, direction and strength of the wind, and proximity of dust sources. Size of the particles also varies with differing conditions. Figure 5 shows size ranges of typically encountered airborne particles and figure 6 shows the relationship between some particles and the gap between the flying heads and oxide coating in a disc/tape drive. Avoid operation in particularly dusty areas, e.g., factory floors, sawmills, etc.



5955-13

Figure 6. Contaminant Sizes Relative to Disc/Head Spacing

## PARTICULATE CONTAMINANTS

Particulate contaminants consist primarily of dust particles which are of various physical compositions. These particles present a clear abrasive hazard to a disc/tape drive if introduced into the operating environment. In some instances, the particles are conductive and can short-circuit wiring in the disc/tape drives when an excessive amount accumulates. Also, film-forming particles and residues cause connector problems.

In environments that contain hydrocarbons, particulate accumulation on the printed circuit assemblies (PCA's) causes an increase in the internal disc/tape drive temperature. Continual accumulations of particulates eventually prevent the disc/tape drive from maintaining the correct amount of cooling on the PCA's. This causes the disc/tape drive to operate beyond the specified temperature range and a malfunction may occur as an out-of-specification operation.

The particulate upper limit is expressed as the arithmetic mean value in micrograms per cubic metre ( $\mu\text{g}/\text{cm}^3$ ) or micrograms per square centimetre per 30 days ( $\mu\text{g}/\text{cm}^2/30$  days). The particulate limits given in Appendix A should be considered a maximum acceptable level and not an ideal operating condition. Operating an HP disc/tape drive at the upper limit may require an increase in the number of times the absolute filter must be changed resulting in an increased basic monthly maintenance charge (BMMC).

## CORROSIVE CONTAMINANTS

Corrosion is a complex form of material deterioration and is generally defined as the destruction of material by chemical or electrochemical reaction with its environment. Some effects of corrosion in disc/tape drives are the destruction of magnetic surfaces on discs and tapes, deterioration of plastics used in the equipment, and general degradation of conformal coatings on printed circuit assemblies (PCA's). Many common problems can be avoided by isolating the disc/tape drive from contaminant-producing machinery. Examples of this type are office copiers, milling machines, and equipment that produce corrosive vapors or particulates. However, in areas where the atmosphere contains large amounts of various corrosive contaminants, more drastic measures



must be taken to ensure clean air in the environment where the disc/tape drive is used. Most environments are corrosive to some degree. Examples are air and moisture; fresh, distilled, or salt water; urban and industrial atmospheres; steam and other gases such as chlorine, ammonia, hydrogen sulfide, sulfur dioxide, and fuel gases; mineral acids such as hydrochloric, sulfuric, and nitric. In general, inorganic materials are more corrosive than organic. For example, corrosion in the petroleum industry is due more to sodium chloride, sulfur, hydrochloric and sulfuric acids, and water than to oil, naphtha, or gasoline.

Modern chemical process industries utilize higher temperatures and pressures, making possible new processes to obtain better yields, greater speeds, or lower costs of production. However, these higher temperatures and pressures unfortunately involve more severe corrosive environments.

Corrosive environments such as that found in steel, acid, and paper manufacturing industries usually preclude the use of filtered ambient air for forced convection cooling. Corrosives generally cannot be filtered out by normal filtration methods, and the techniques that must be used are complex and costly. In these cases, the disc/tape drives must be enclosed in a highly controlled environment.

Although the term "environment" as used here refers only to atmospheric contaminants, there is a strong link between corrosion rates and temperature and humidity conditions. Many corrosion processes (film thickness buildup, etc.) accelerate rapidly at high humidities and temperatures. This means that corrosive environments that possess high temperatures and humidities should be of particular concern. The following are typical corrosive contaminants.

- **Total Hydrocarbons.** Hydrocarbon vapors are known to be corrosive to precious metal contacts used in computer equipment. A typical example is the contacts on PCA's, which employ gold in many instances.
- **Sulfur Dioxide.** Sulfur is generally considered the most corrosive of the common contaminant gases. In combination with water, it forms sulfuric acid mist, an active and rapidly corrosive compound. It is known to produce molecular separation in polymers, and to cause spots on microfilm materials. This acid is found in industrial environments and causes deterioration of disc surfaces.
- **Oxides of Nitrogen.** Oxides of nitrogen cause nitrate-stress cracking in electrical contacts, and the absorbed gases react to form nitric acid on component surfaces. Also, small amounts of nitrogen oxide cause deterioration in polymers.
- **Total Oxidants.** The presence of oxidizing gases in the atmosphere, particularly ozone, is known to be potentially harmful to any organic material. The damaging effects most often encountered are the cross linking of elastomers, the cracking of stressed rubber, and the oxidation of silver.
- **Hydrogen Sulfide.** Hydrogen sulfide is a rapid corrosive agent, particularly to copper and silver. Hydrogen sulfide is a common atmospheric contaminant found near oil fields, sulfur springs, and marshy areas, and occasionally is emitted from industrial or sewage treatment activities.
- **Ammonia.** In sufficient concentrations, ammonia has been found to cause cracking of stressed brass, decrease insulation resistance, and increase loss factor in certain insulators.
- **Halogens.** Halogens are five chemical elements that form salts by direct union with metals. The five halogens are: fluorine, bromine, chlorine, iodine and astatine. Halogens react strongly with metals and hydrogen to form halides. The metal halides are solid water-soluble salts such as table salt (sodium chloride). When hydrogen halides are in a water solution, they form strong acids such as hydrochloric acid. Halogens are both poisonous and corrosive and usually occur in salt deposits and sea water environments. Halogens (and their compounds) are widely used in medicine, photographic films, sanitation processes, disinfectants, insecticides, some textile processes, paints, bleaches and plastics.

## **COOLING REQUIREMENTS**

A fan, internal to the disc/tape drive, provides adequate ventilation when the disc/tape drive is operated in the appropriate environment. To obtain maximum efficiency, allow the required clearances between the front and rear of the disc/tape drive. Air conditioning may be required to maintain the correct temperature. Install required air conditioning before installation of a HP disc/tape drive. See temperature and cooling requirements in Appendix A.

## **TILTING**

Tilting the disc/tape drive more than the specified angle will result in longer seek times or no seek at all. These seek times will be outside of the specified seek time. See tilting requirements in Appendix A.



**APPENDIX A**

**HEWLETT-PACKARD**

**DISC/TAPE DRIVE REQUIREMENTS**



Table A-1. HP 7908 Disc/Tape Drive Specifications

## OPERATING SPECIFICATIONS

### DISC DRIVE

#### Seek Time

Track to Track:	5 ms
Average random:	41.6 ms
Full stroke (typical over (380 cylinders):	70 ms

#### Rotation

Speed:	3600 rpm ( $\pm 3\%$ )
Average rotational latency:	8.33 ms

#### Data Transfer Rate

Average:	System dependent (537.6 kbytes/s maximum)
Maximum Burst:	1 Mbyte/s

### TAPE DRIVE

#### Speed

Read/write/verify speed:	152.4 cm/s (60 in./s)
Search speed:	228.6 cm/s (90 in./s)

#### Data Transfer Rate

Average Transfer Rate:	
Over internal data path:	35.0 kbytes/s
Over HP-IB:	System dependent (35 kbytes/s maximum)
Burst Transfer Rate:	
Over HP-IB:	1 Mbyte/s maximum

## OPERATING CHARACTERISTICS

### DISC DRIVE DATA CAPACITY

	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8	1			
Word	16	2	1		
Sector	2,048	256	128	1	
Track	71,680	8,960	4,480	35†	1
Head	26,521,600	3,315,200	1,675,600	12,950	370‡
Drive	132,608,000	16,576,000	8,288,000	64,750	1,850

†Total number of sectors per track is 36, one of which is utilized as a spare.

‡There are 380 tracks per surface. Six tracks are used as spares for defective tracks and four are used for maintenance tracks.

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Table A-1. HP 7908 Disc/Tape Drive Specifications (continued)

**TAPE DRIVE DATA CAPACITY (HP 88140S, 150 ft)**

	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track	8,372,224	1,046,528	523,264	1,022	
Cartridge	133,955,584	16,744,448	8,372,224	16,352*	16

\* Total number of blocks per 150 ft. cartridge is 16,624, 32 of which are utilized as spares and 240 of which are used as maintenance blocks.

**TAPE DRIVE DATA CAPACITY (HP 88140L, 600 ft)**

	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track	33,488,896	4,186,112	2,093,056	4,088	
Cartridge	535,822,336	66,977,792	33,488,896	65,408**	16

\*\* Total number of blocks per 600 ft. cartridge is 65,776, 128 of which are utilized as spares and 240 of which are used as maintenance blocks.

**Heat Dissipation**

400 Watts (1364 Btu/hr)

**Electromagnetic Emissions**

Radiated and conducted interference:

- HP 7908P — For U.S.A., designed to meet FCC Docket 20780 for Class A computing devices.
- HP 7908P — For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.
- HP 7908R — The rackmount version is intended for installation in an overall product that will affect the emissions characteristics. It is recommended that end-use products be tested for RFI emissions.

Magnetic nonoperating:

< 2 milligauss at 7 ft on all surfaces

Magnetic operating:

< 10 gauss at any surface

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Table A-1. HP 7908 Disc/Tape Drive Specifications (continued)

**Acoustic Emissions**

Sound Pressure Level per ISO standard 3744

HP 7908P — 53 dBa

HP 7908R — 59 dBa

**Safety**

- HP 7908P/R — CSA certified to CSA 22.2 No. 143 and No. 154.
- HP 7908P/R — Meets all applicable safety standards of IEC 380 and IEC 435.
- HP 7908P — UL listed to UL 114 and UL 478.
- HP 7908R — UL recognized to UL 114 and UL 478.

**Power Characteristics**

Voltage: 88 to 127V (includes 100, 110, and 120V)  
 180 to 255V (includes 208, 220, and 240V)

Frequency: 47.5 to 66 Hz

Phase: Single

Line Dropout: No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line.

Power: 400 watts

**Physical Characteristics**

	HP 7908R	HP 7908P
Height:	177 mm (7 in.)	720 mm (28.4 in.)
Width:	482 mm (19 in.)	354 mm (13.9 in.)
Depth:	689 mm (27.1 in.)	740 mm (29.1 in.)
Weight		
Net:	37.0 kg (81.6 lb)	72.5 kg (160 lb)
Shipping:	58.9 kg (130 lb)	104 kg (230 lb)

**ENVIRONMENTAL REQUIREMENTS**

Note: The environmental specifications listed herein apply when this device is not connected to a Hewlett-Packard (HP) system. When this device is connected with HP systems, the more stringent environmental specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

**Temperature**

Operating: 10°C (50°F) to 40°C (104°F)

Non-operating: -40°C (-40°F) to 60°C (140°F)

Maximum Rate of Change: Not to exceed 10°C/hr (18°F)

**Relative Humidity**

Operating: 20% to 90%, noncondensing with a maximum of 0.015 pound of water per pound of dry air. For example, this is equivalent to a maximum of 80% humidity at 24°C (75°F), a maximum of 50% humidity at 32°C (90°F), or a maximum of 30% humidity at 40°C (104°F).

Nonoperating: 10% to 90% noncondensing

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Table A-1. HP 7908 Disc/Tape Drive Specifications (continued)

<b>Vibration</b>	
Operating:	0.1 g rms in direction of actuator 0.25 g rms in any other direction
Nonoperating:	1 g rms in any direction
<b>Shock</b>	
Operating:	Will withstand 11 ms, half-wave sine shock with a peak amplitude of 2 g's.
Nonoperating (Storage and Transit):	Will withstand 11 ms, half-wave sine shock with a peak amplitude of 20 g's.
<b>Altitude</b>	
Operating:	100 m below sea level to 4 574 m (330 ft below sea level to 15,000 ft)
Non-operating:	300 m below sea level to 15 000 m (1,000 ft below sea level to 50,000 ft)
<b>Electromagnetic Susceptibility Operating Range</b>	
Radiated:	HP 7908R < 3V/m 14 kHz to 1 GHz HP 7908P < 1V/m 14 kHz to 1 GHz
Conducted:	< 3V rms 30 Hz to 50 kHz < 1V p-p 50 kHz to 400 MHz
Electrostatic Discharge:	≤ 12.5 kV
Magnetic:	< 5 gauss 47.5 to 198 Hz < 100 picotesla 30 Hz to 30 kHz
Power line transients*	
Oscillatory wave (100 kHz ringing wave):	< 1.5 kV
Unidirectional wave (one 30 μs wide pulse; one 80 μs wide pulse):	< 1.0 kv
*Per IEEE Standard P587.1/F	
<b>Power Requirements</b>	
Voltage:	88 to 127V (includes 100, 110, and 120V) 180 to 255V (includes 208, 220, and 240V)
Frequency:	47.5 to 66 Hz
Phase:	Single
Current:	7 amperes maximum at 120 Vac, 60 Hz
<b>Cooling Requirements</b>	
Allow 76.2 mm (3 in.) front and behind HP 7908 for adequate air flow.	
<b>Tilt</b>	
< 30 degrees maximum along axis of voice coil.	
<i>Hewlett-Packard, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs, and models without notice.</i>	

Table A-2. HP 7911 and HP 7912 Disc/Tape Drives Specifications

## OPERATING SPECIFICATIONS

### DISC DRIVE

#### Seek Time

Track to track:	5 ms
Average random:	26.7 ms
Full stroke (typical over 582 tracks):	50 ms

#### Rotation

Speed:	3600 rpm ( $\pm 15\%$ )
Average rotational latency:	8.3 ms

#### Data Transfer Rate

Average:	System dependent (983 kbytes/s maximum)
Burst:	1.0 Mbyte/s maximum

### TAPE DRIVE

#### Speed

Read/write:	152.4 cm/s (60 in./s)
Search:	228.6 cm/s (90 in./s)

#### Data Transfer Rate

Average Transfer Rate:	
Over internal data path:	35.0 kbytes/s
Over HP-IB:	System dependent (35 kbytes/s maximum)
Burst Transfer Rate:	
Over HP-IB:	1 Mbyte/s maximum

## OPERATING CHARACTERISTICS

### DISC DRIVE DATA CAPACITY

Data Capacity	Data Bits Per	Data Bytes Per	Sectors Per	Tracks Per
Byte	8	1		
Word	16	2		
Sector	2,048	256	1	
Track	131,072	16,384	64†	1
Head	74,973,184	9,376,148	36,608	572‡
HP 7911†	224,919,552	28,114,944	109,824	1,716
HP 7912‡	524,812,228	65,601,536	256,256	4,004

†Total number of tracks per head is 582; eight are used as spares for defective track allocation and two are used for maintenance tracks. Total number of sectors per track is 65, with one used as a spare.

‡The HP 7911 and HP 7912 utilize two heads per surface.

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Table A-2. HP 7911 and HP 7912 Disc/Tape Drives Specifications (continued)

**TAPE DRIVE DATA CAPACITY (HP 88140S, 150 ft)**

	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track	8,372,224	1,046,528	523,264	1,022	
Cartridge	133,955,584	16,744,448	8,372,224	16,352*	16

\* Total number of blocks per 150 ft. cartridge is 16,624, 32 of which are utilized as spares and 240 of which are used as maintenance blocks.

**TAPE DRIVE DATA CAPACITY (HP 88140L, 600 ft)**

	Data Bits Per	Data Bytes Per	Data Words Per	Sectors Per	Tracks Per
Byte	8				
Word	16	2			
Block	8,192	1,024	512		
Track	33,488,896	4,186,112	2,093,056	4,088	
Cartridge	535,822,336	66,977,792	33,488,896	65,408**	16

\*\* Total number of blocks per 600 ft. cartridge is 65,776, 128 of which are utilized as spares and 240 of which are used as maintenance blocks.

**Heat Dissipation**

700 Watts (2389 Btu/hr) maximum

**Electromagnetic Emissions**

Radiated and conducted interference:

- HP 7911/HP 7912 P/R — For U.S.A., designed to meet FCC Docket 20780 for Class A computing devices.
- HP 7911/HP 7912 P/R — For Europe, designed to meet VDE 0871 for Level A computing devices. FTZ licensed on some HP systems. Refer to your local sales representative for more information.
- HP 7911/HP 7912 R — The rackmount version is intended for installation in an overall product that will affect the emissions characteristics. It is recommended that end-use products be tested for RFI emissions.

Magnetic nonoperating:

< 2 milligauss at 7 ft on all surfaces

Magnetic operating:

< 5 gauss at any surface

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Table A-2. HP 7911 and HP 7912 Disc/Tape Drives Specifications (continued)

**Acoustic Emissions**

Sound Pressure Level per ISO standard 3744

HP 7911P and HP 7912P — 55 dBa

HP 7911R and HP 7912R — nonspecified due to variety of rackmount configurations

**Safety**

- HP 7911/HP 7912 P/R — CSA certified to CSA 22.2 No. 143 and No. 154.
- HP 7911/HP 7912 P/R — Meet all applicable safety standards of IEC 380 and IEC 435.
- HP 7911/HP 7912 P — UL listed to UL 114 and UL 478.
- HP 7911/HP 7912 R — UL recognized to UL 114 and UL 478.

**Physical Characteristics**

	<b>Rackmount</b>	<b>Stand-alone</b>
Height:	311 mm (12.25 in.)	720 mm (28.4 in.)
Front Panel Width:	482 mm (19.0 in.)	N/A
Width (behind front panel):	451 mm (17.75 in.)	354 mm (14.0 in.)
Depth (behind front panel):	705 mm (27.8 in.)	740 mm (29.1 in.)
Depth (overall):	752 mm (29.6 in.)	N/A
Net Weight:	67.2 kg (148 lb)	85.4 kg (188 lb)
Shipping Weight:	89.9 kg (198 lb)	117.1 kg (258 lb)

**Power Characteristics**

Voltage:	88 to 127V (includes 100 and 120V) 198 to 255V (includes 220 and 240V)
Frequency:	47.5 to 66 Hz
Phase:	Single
Line Dropout:	No effect on performance; no operator intervention required for dropout equal to or less than one-half cycle of the ac line.
Power:	700 watts

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Table A-2. HP 7911 and HP 7912 Disc/Tape Drives Specifications (continued)

## ENVIRONMENTAL REQUIREMENTS

Note: The environmental specifications listed herein apply when this device is not connected to a Hewlett-Packard (HP) system. When this device is connected with HP systems, the more stringent environmental specifications listed for any single HP device within the HP system are applicable and supersede these specifications.

### Temperature

Operating: +10°C to +40°C (50°F to 104°F). The rate of change shall not exceed 10°C (18°F) per hour.

Nonoperating: -40°C to +60°C (-40°F to 140°F). The rate of change shall not exceed 10°C (18°F) per hour.

### Relative Humidity

Operating: 20% to 80% noncondensing with a maximum of 0.015 pound of water per pound of dry air. For example, this is equivalent to a maximum of 80% humidity at 24°C (75°F), a maximum of 50% humidity at 32°C (90°F), or a maximum of 30% humidity at 40°C (104°F).

Nonoperating: 10% to 90% noncondensing with maximum wet bulb temperature not to exceed 26.5°C (80°F).

### Vibration

Operating: 0.25 g rms in any direction

Nonoperating: 1 g rms in any direction

### Shock

Operating: Will withstand 11 ms, half-wave sine shock with a peak amplitude of 2 g's.

### Altitude

Operating: 300 m (1,000 ft) below sea level to 4 600 m (15,000 ft)

Nonoperating: 300 m (1,000 ft) below sea level to 15 000 m (50,000 ft)

*Hewlett-Packard, in a continuing effort to offer excellent products at a fair value, reserves the right to change specifications, designs, and models without notice.*

Table A-2. HP 7911 and HP 7912 Disc/Tape Drives Specifications (continued)

**Electromagnetic Susceptibility Operating Range**

Radiated:	≤ 3V/m, 14 kHz to 1 GHz
Conducted:	≤ 3V rms, 30 Hz to 50 kHz ≤ 1V peak-to-peak, 50 kHz to 400 MHz
Electrostatic Discharge:	≤ 12.5 kV
Magnetic:	< 5 gauss, 47.5 to 198 Hz < 100 picotesla, 30 Hz to 30 kHz
Power line transients*	
Oscillatory wave (100 kHz ringing wave):	< 1.5 kV
Unidirectional wave (one 30 μs wide pulse; one 80 μs wide pulse):	< 1.0 kV
*Per IEEE Standard P587.1/F	

**Power Requirements**

Voltage:	88 to 127V (includes 100 and 120V) 198 to 255V (includes 220 and 240V)
Frequency:	47.5 to 66 Hz
Phase:	Single
Current:	8 amperes maximum at 120 Vac, 60 Hz

**Systems Configurations**

- Total cable length is limited to 1 metre per equivalent HP-IB load.
- Each HP 7911 or HP 7912 places one equivalent load on each of the HP-IB lines.
- In addition to the external HP-IB cable provided, each HP 7911 and HP 7912 has an internal 1-metre HP-IB cable that must be considered when configuring the disc drive with a system.
- Consult the appropriate system configuration guide for specific configurations.

**Tilt**

Can be operated in any position.

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# SALES & SUPPORT OFFICES

Arranged alphabetically by country



## Product Line Sales/Support Key

**Key Product Line**  
**A** Analytical  
**CM** Components  
**C** Computer Systems Sales only  
**CH** Computer Systems Hardware Sales & Services  
**CS** Computer Systems Software Sales & Services  
**E** Electronic Instruments & Measurement Systems  
**M** Medical Products  
**MP** Medical Products Primary SRO  
**MS** Medical Products Secondary SRO  
**P** Personal Computing Products  
\* Sales only for specific product line  
\*\* Support only for specific product line

**IMPORTANT:** These symbols designate general product line capability. They do not insure sales or support availability for all products within a line, at all locations. Contact your local sales office for information regarding locations where HP support is available for specific products.

*HP distributors are printed in italics.*

### ANGOLA

*Telectra*  
*Empresa Técnica de Equipamentos Eléctricos, S.A.R.L.*  
*R. Barbosa Rodrigues, 41-I DT.*  
*Caixa Postal 6487*  
**LUANDA**  
*Tel: 35515,35516*  
*E,M,P*

### ARGENTINA

Hewlett-Packard Argentina S.A.  
Avenida Santa Fe 2035  
Martínez 1640 **BUENOS AIRES**  
Tel: 798-5735, 792-1293  
Tel: 122443 AR CIGY  
Cable: HEWPACKARG  
A,E,CH,CS,P

*Biotron S.A.C.I.y.M*  
*Av Paseo Colon 221, 9 Piso*  
*1399 BUENOS AIRES*  
*Tel: 30-4846, 30-1851, 30-8384*  
*Telex: 17595 BIONVAR*  
*M*

*Fate S.A. I.C.I./Electronica*  
*Venezuela 1326*  
*1095 BUENOS AIRES*  
*Tel: 379026, 379027*  
*Telex: 18137, 22754 ALVAR AR*  
*P*

### AUSTRALIA

**Adelaide, South Australia Office**  
Hewlett-Packard Australia Pty.Ltd.  
153 Greenhill Road  
**PARKSIDE, S.A. 5063**  
Tel: 272-5911  
Tel: 82536  
Cable: HEWPARD Adelaide  
A\*,CH,CM,,E,MS,P

**Brisbane, Queensland Office**  
Hewlett-Packard Australia Pty.Ltd.  
5th Floor  
Teachers Union Building  
495-499 Boundary Street  
**SPRING HILL, Queensland 4000**  
Tel: 229-1544  
Tel: 42133  
Cable: HEWPARD Brisbane  
A,CH,CM,,E,MS,P

**Canberra, Australia Capital Territory Office**  
Hewlett-Packard Australia Pty.Ltd.  
121 Wollongong Street  
**FYSHWICK, A.C.T. 2609**  
Tel: 80 4244 Telex: 62650  
Cable: HEWPARD Canberra  
A\*CH,CM,E,MS,P

### Melbourne, Victoria Office

Hewlett-Packard Australia Pty.Ltd.  
31-41 Joseph Street  
**BLACKBURN, Victoria 3130**  
Tel: 89-6351  
Tel: 31-024  
Cable: HEWPARD Melbourne  
A,CH,CM,CS,E,MS,P

### Perth, Western Australia Office

Hewlett-Packard Australia Pty.Ltd.  
141 Stirling Highway  
**NEDLANDS, W.A. 6009**  
(effective 28 Sept. 1981:  
261 Stirling Highway  
**CLAREMONT, W.A. 6010**)  
Tel: 386-5455  
Tel: 93859  
Cable: HEWPARD Perth  
A,CH,CM,,E,MS,P

### Sydney, New South Wales Office

Hewlett-Packard Australia Pty.Ltd.  
17-23 Talavera Road  
P.O. Box 308  
**NORTH RYDE, N.S.W. 2113**  
Tel: 887-1611  
Tel: 21561  
Cable: HEWPARD Sydney  
A,CH,CM,CS,E,MS,P

### AUSTRIA

Hewlett-Packard Ges.m.b.h.  
Grottenhofstrasse 94  
Verkaufsburo Graz  
A-8052 **GRAZ**  
Tel: 21-5-66  
Tel: 32375  
CH,CM,E\*

Hewlett-Packard Ges.m.b.h.  
Wehlstrasse 29  
P.O. Box 7  
A-1205 **VIENNA**  
Tel: (222) 35-16-210  
Tel: 135823/135066  
A,CH,CM,CS,E,MS,P

### BAHRAIN

*Green Salon*  
*P.O. Box 557*  
**BAHRAIN**  
*Tel: 25503-250950*  
*Telex: 84419*  
*P*

*Wael Pharmacy*  
*P.O. Box 648*  
**BAHRAIN**  
*Tel: 256123*  
*Telex: 8550 WAEL GJ*  
*M*

### BELGIUM

Hewlett-Packard Belgium S.A./N.V.  
Blvd de la Woluwe, 100  
Woluwedal  
B-1200 **BRUSSELS**  
Tel: (02) 762-32-00  
Tel: 23-494 paloben bru  
A,CH,CM,CS,E,MP,P

### BRAZIL

Hewlett-Packard do Brasil I.e.C.  
Ltda.  
Alameda Rio Negro, 750  
**ALPHAVILLE 06400 Barueri SP**  
Tel: 421-1311  
Tel: 011 33872  
Cable: HEWPACK Sao Paulo  
A,CH,CM,CS,E,MS  
Hewlett-Packard do Brasil I.e.C.  
Ltda.  
Avenida Epitacio Pessoa, 4664  
22471 **RIO DE JANEIRO-RJ**  
Tel: 286-0237  
Tel: 021-21905 HPBR-BR  
Cable: HEWPACK Rio de Janeiro  
A,CH,CM,E,MS,P\*

### CANADA

**Alberta**  
Hewlett-Packard (Canada) Ltd.  
210, 7220 Fisher Street S.E.  
**CALGARY, Alberta T2H 2H8**  
Tel: (403) 253-2713  
A,CH,CM,E\*,MS,P\*

Hewlett-Packard (Canada) Ltd.  
11620A-168th Street  
**EDMONTON, Alberta T5M 3P9**  
Tel: (403) 452-3670  
A,CH,CM,CS,E,MS,P\*

### British Columbia

Hewlett-Packard (Canada) Ltd.  
10691 Shellbridge Way  
**RICHMOND, British Columbia V6X 2W7**  
Tel: (604) 270-2277  
Tel: 610-922-5059  
A,CH,CM,CS,E\*,MS,P\*

### Manitoba

Hewlett-Packard (Canada) Ltd.  
380-550 Century Street  
**WINNIPEG, Manitoba R3H 0Y1**  
Tel: (204) 786-6701  
A,CH,CM,E,MS,P\*

### New Brunswick

Hewlett-Packard (Canada) Ltd.  
190 Wilbur Street  
**MONCTON, New Brunswick E2B 2V0**  
Tel: (506) 386-1677  
Tel: 01931470  
CH\*\*

### Nova Scotia

Hewlett-Packard (Canada) Ltd.  
P.O. Box 931  
900 Windmill Road  
**DARTMOUTH, Nova Scotia B2Y 3Z6**  
Tel: (902) 469-7820  
Tel: 01931470  
CH,CM,CS,E\*,MS,P\*

### Ontario

Hewlett-Packard (Canada) Ltd.  
552 Newbold Street  
**LONDON, Ontario N6E 2S5**  
Tel: (519) 686-9181  
Tel: 610-352-1201  
A,CH,CM,E\*,MS,P\*

Hewlett-Packard (Canada) Ltd.  
6877 Goreway Drive  
**MISSISSAUGA, Ontario L4V 1M8**  
Tel: (416) 678-9430  
Tel: 610-492-4246  
A,CH,CM,CS,E,MP,P

Hewlett-Packard (Canada) Ltd.  
2670 Queensview Dr.  
**OTTAWA, Ontario K2B 8K1**  
Tel: (613) 820-6483  
Tel: 610-563-1636  
A,CH,CM,CS,E\*,MS,P\*

### Quebec

Hewlett-Packard (Canada) Ltd.  
17500 South Service Road  
Trans-Canada Highway  
**KIRKLAND, Quebec H9J 2M5**  
Tel: (514) 697-4232  
Tel: 05821521  
A,CH,CM,CS,E,MP,P\*  
Hewlett-Packard (Canada) Ltd.  
Les Galeries du Vallon  
2323 Boulevard du Versant Nord  
**STE. FOY, Quebec G1N 4C2**  
Tel: (418) 687-4570  
CH

### CHILE

*Jorge Calcagni y Cia. Ltda.*  
*Arturo Burihle 065*  
*Casilla 16475*  
**SANTIAGO 9**  
*Tel: 222-0222*  
*Telex: Public Booth 0001*  
*A,CM,E,M*  
*Olympia (Chile) Ltd.*  
*Rodrico de Araya 1045*  
*Casilla 256-V*  
**SANTIAGO 21**  
*Tel: 225-5044*  
*Telex: 40565 OLYMP CL*  
*C,P*

### CHINA, People's Republic of

*CEIEC Inc.*  
*44 Beiwai Rd.*  
*BEIJING, China*  
*Telex: 22475 CEIEC CN*  
*A,CH,CM,CS,E,P*

### COLOMBIA

*Instrumentación*  
*H. A. Langebaek & Kier S.A.*  
*Apartado Aéreo 6287*  
**BOGOTÁ 1, D.E.**  
*Carrera 7 No. 48-75*  
**BOGOTÁ, 2 D.E.**  
*Tel: 287-8877*  
*Telex: 44400*  
*Cable: AARIS Bogota*  
*A,CM,E,M,P*

### COSTA RICA

*Científica Costarricense S.A.*  
*Avenida 2, Calle 5*  
*San Pedro de Montes de Oca*  
*Apartado 10159*  
**SAN JOSÉ**  
*Tel: 24-38-20, 24-08-19*  
*Telex: 2367 GALGUR*  
*CM,E,M*

### CYPRUS

*Telexa Ltd.*  
*P.O. Box 4809*  
*14C Stassinou Avenue*  
**NICOSIA**  
*Tel: 62698*  
*Telex: 2894 Levidoc*  
*E,M,P*

### CZECHOSLOVAKIA

*Hewlett-Packard*  
*Obchodní Zastupitelství v CSSR*  
*Post. schránka 27*  
**CS-118 01 PRAHA 011**  
*Tel: 66-296*  
*Telex: 121353 IHC*

### DENMARK

Hewlett-Packard A/S  
Dalavej 52  
**DK-3460 BIRKEROD**  
Tel: (02) 81-66-40  
Tel: 37409 hpas dk  
A,CH,CM,CS,E,MS,P  
Hewlett-Packard A/S  
Navervej 1  
**DK-8600 SILKEBOERG**  
Tel: (06) 82-71-66  
Tel: 37409 hpas dk  
CH,CM,E

### ECUADOR

*CYEDE Cia. Ltda.*  
*Avenida Eloy Alfaro 1749*  
*Casilla 6423 CCI*  
**QUITO**  
*Tel: 450-975, 243-052*  
*Telex: 2548 CYEDE ED*  
*A,CM,E,P*  
*Hospitalar S.A.*  
*Robles 625*  
*Casilla 3590*  
**QUITO**  
*Tel: 545-250, 545-122*  
*Telex: 2485 HOSPTEL ED*  
*Cable: HOSPITALAR-Quito*  
*M*

### EGYPT

*International Engineering Associates*  
*24 Hussein Hegazi Street*  
*Kasr-el-Aini*  
**CAIRO**  
*Tel: 23-829*  
*Telex: 93830*  
*CH,CS,E,M*  
*Informatic For Systems*  
*22 Talaat Harb Street*  
**CAIRO**  
*Tel: 759006*  
*Telex: 93938 FRANK UN*  
*CH,CS,P*  
*Egyptian International Office*  
*for Foreign Trade*  
*P.O.Box 2558*  
**CAIRO**  
*Tel: 984935*  
*Telex: 93337 EGPOR*  
*P*

### EL SALVADOR

*IPESA de El Salvador S.A.*  
*Boulevard de los Heroes 1148*  
**SAN SALVADOR**  
*Tel: 252787, 259621*  
*Telex: Public Booth 20107*  
*A,CH,CM,CS,E,P*

### FINLAND

Hewlett-Packard Oy  
Revontulente 7  
**SF-02100 ESPOO 10**  
Tel: (90) 455-0211  
Tel: 121563 hewpa sf  
A,CH,CM,CS,E,MS,P





# SALES & SUPPORT OFFICES

Arranged alphabetically by country

## FRANCE

Hewlett-Packard France  
Le Ligoures  
Bureau de Vente de Aix-en-Provence  
Place Romée de Villeneuve  
F-13090 AIX-EN-PROVENCE  
Tel: (42) 59-41-02  
Telex: 410770F  
A,CH,CM,E,MS,P\*

Hewlett-Packard France  
Boite Postale No. 503  
F-25026 BESANCON  
28 Rue de la Republique  
F-25000 BESANCON  
Tel: (81) 83-16-22  
CH,M

Hewlett-Packard France  
Bureau de Vente de Lyon  
Chemin des Mouilles  
Boite Postale No. 162  
F-69130 ECULLY Cédex  
Tel: (78) 33-81-25  
Telex: 310617F  
A,CH,CM,CS,E,MP

Hewlett-Packard France  
Immeuble France Evry  
Tour Lorraine  
Boulevard de France  
F-91035 EVRY Cédex  
Tel: (60) 77-96-60  
Telex: 692315F  
CM,E

Hewlett-Packard France  
5th Avenue Raymond Chanas  
F-38320 EYBENS  
Tel: (76) 25-81-41  
Telex: 980124 HP GRENOB EYBE  
CH,CM

Hewlett-Packard France  
Bâtiment Ampère  
Rue de la Commune de Paris  
Boite Postale 300  
F-93153 LE BLANC MESNIL  
Tel: (01) 865-44-52  
Telex: 211032F  
CH,CM,CS,E,MS

Hewlett-Packard France  
Le Montesquieu  
Avenue du President JF Kennedy  
F-33700 MERIGNAC  
Tel: (56) 34-00-84  
Telex: 550105F  
CH,CM,E,MS

Hewlett-Packard France  
32 Rue Lothaire  
F-57000 METZ  
Tel: (87) 65-53-50  
CH,CM

Hewlett-Packard France  
3 Rue Julien Videment  
F-44200 NANTES  
Tel: (40) 48-09-44  
CH\*\*

Hewlett-Packard France  
Zone Industrielle de Courtaboeuf  
Avenue des Tropiques F-91947 Les  
Ullis Cédex ORSAY  
Tel: (1) 907-78-25  
Telex: 600048F  
A,CH,CM,CS,E,MP,P

Hewlett-Packard France  
Paris Porte-Maillot 13, 15 25  
Boulevard De L'Amiral Bruix  
F-75782 PARIS Cédex 16  
Tel: (01) 502-12-20  
Telex: 613663F  
CH,CM,MS,P

Hewlett-Packard France  
2 Allée de la Bourgonette  
F-35100 RENNES  
Tel: (99) 51-42-44  
Telex: 740912F  
CH,CM,E,MS,P\*

Hewlett-Packard France  
98 Avenue de Bretagne  
F-76100 ROUEN  
Tel: (35) 63-57-66 CH\*,CS

Hewlett-Packard France  
4 Rue Thomas Mann  
Boite Postale 56  
F-67200 STRASBOURG  
Tel: (88) 28-56-46  
Telex: 890141F  
CH,CM,E,MS,P\*

Hewlett-Packard France  
20 Chemin de la Cèpière  
F-31081 TOULOUSE Cédex  
Tel: (61) 40-11-12  
Telex: 531639F  
A,CH,CM,CS,E,P\*

Hewlett-Packard France  
Bureau de Vente de Lille  
Immeuble Péricentre  
Rue Van Gogh  
F-59650 VILLENEUVE D'ASO  
Tel: (20) 91-41-25  
Telex: 160124F  
CH,CM,E,MS,P\*

## GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH  
Technisches Büro Berlin  
Keilstrasse 2-4  
D-1000 BERLIN 30  
Tel: (030) 24-90-86  
Telex: 018 3405 hpbm d  
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Hewlett-Packard GmbH  
Technisches Büro Böblingen  
Herrenberger Strasse 110  
D-7030 BÖBLINGEN  
Tel: (07031) 667-1  
Telex: 07265739 bbn or 07265743  
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Hewlett-Packard GmbH  
Technisches Büro Düsseldorf  
Emanuel-Leulze-Strasse 1  
D-4000 DUSSELDORF  
Tel: (0211) 5971-1  
Telex: 085/86 533 hpdd d  
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Hewlett-Packard GmbH  
Vertriebszentrale Frankfurt  
Berner Strasse 117  
Postfach 560 140  
D-6000 FRANKFURT 56  
Tel: (0611) 50-04-1  
Telex: 04 13249 hpffm d  
A,CH,CM,CS,E,MP,P

Hewlett-Packard GmbH  
Technisches Büro Hamburg  
Kapsladtring 5  
D-2000 HAMBURG 60  
Tel: (040) 63804-1  
Telex: 21 63 032 hpqh d  
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Hewlett-Packard GmbH  
Technisches Büro Hannover  
Am Grossmarkt 6  
D-3000 HANNOVER 91  
Tel: (0511) 46-60-01  
Telex: 092 3259  
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Hewlett-Packard GmbH  
Technisches Büro Mannheim  
Rosslauer Weg 2-4  
D-6800 MANNHEIM  
Tel: (621) 70050  
Telex: 0462105  
A,C,E

Hewlett-Packard GmbH  
Technisches Büro Neu Ulm  
Messerschmittstrasse 7  
D-7910 NEU ULM  
Tel: 0731-70241  
Telex: 712816 HP ULM-D  
A,C,E\*

Hewlett-Packard GmbH  
Technisches Büro Nürnberg  
Neumeyerstrasse 90  
D-8500 NÜRNBERG  
Tel: (0911) 56-30-83  
Telex: 0623 860  
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Hewlett-Packard GmbH  
Technisches Büro München  
Eschenstrasse 5  
D-8021 TAUFKIRCHEN  
Tel: (089) 6117-1  
Telex: 0524985  
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## GREAT BRITAIN

Hewlett-Packard Ltd.  
Trafalgar House  
Navigation Road  
ALTRINCHAM  
Cheshire WA14 1NU  
Tel: (061) 928-6422  
Telex: 0668068  
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Hewlett-Packard Ltd.  
Oakfield House, Oakfield Grove  
Clifton

BRISTOL BS8 2BN  
Tel: 36806  
Telex: 444302  
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Hewlett-Packard Ltd.  
14 Wesley Street  
CASTLEFORD  
Yorkshire WF10 1AE  
Tel: (0977) 550016  
Telex: 5557355  
CH

Hewlett-Packard Ltd.  
Fourier House  
257-263 High Street  
LONDON COLNEY  
Herts., AL2 1HA  
Tel: (0727) 24400  
Telex: 1-8952716  
CH,CS,E

Hewlett-Packard Ltd  
Tradax House, St. Mary's Walk  
MAIDENHEAD  
Berkshire, SL6 1ST  
Tel: (0628) 39151  
CH,CS,E,P

Hewlett-Packard Ltd.  
308/314 Kings Road  
READING, Berkshire  
Tel: 61022  
Telex: 84-80-68  
CM,P

Hewlett-Packard Ltd.  
Quadrangle  
106-118 Station Road  
REDHILL, Surrey  
Tel: (0737) 68655  
Telex: 947234 CH,CS,E

Hewlett-Packard Ltd.  
Westminster House  
190 Stratford Road  
SHIRLEY, Solihull  
West Midlands B90 3BJ  
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Telex: 339105  
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WINKERSH, Wokingham  
Berkshire RG11 5AR  
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8 Omirou Street  
ATHENS 133  
Tel: 32-30-303, 32-37-371  
Telex: 21 59 62 RKAR GR  
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PLAISIO S.A.  
G. Gerardos  
24 Stourara Street  
ATHENS  
Tel: 36-11-160  
Telex: 21 9492  
P

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IPESA  
Avenida Reforma 3-48  
GUATEMALA 9  
Tel: 316627, 314786  
Telex: 4192 TELETRU GU  
A,CH,CM,CS,E,M,P

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Hewlett-Packard Hong Kong, Ltd.  
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5th Floor, SUN HUNG Kai Centre  
30 Harbour Road  
HONG KONG  
Tel: 5-8323211  
Telex: 66678 HEWPA HX  
Cable: HP ASIA LTD Hong Kong  
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Schmidt & Co. (Hong Kong) Ltd.  
Wing On Centre, 28th Floor  
Connaught Road, C.  
HONG KONG  
Tel: 5-455644  
Telex: 74766 SCHMX HX  
A,M

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Elding Trading Company Inc.  
Halnarnvöli-Tryggvagötu  
P.O. Box 895  
IS-REYKJAVIK  
Tel: 1-58-20, 1-63-03  
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Cable: BLUESTAR  
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Prabhadevi  
BOMBAY 400 025  
Tel: 422-3101  
Telex: 011-3751  
Cable: BLUESTAR  
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Blue Star Ltd.  
Sahas  
414/2 Vir Savarkar Marg  
Prabhadevi  
BOMBAY 400 025  
Tel: (021) 7458800  
Telex: 011-4093  
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Alkapuri, BORODA, 390 005  
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Blue Star Ltd.  
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CALCUTTA 700 001  
Tel: 12-01-31  
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Blue Star Ltd.  
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MADRAS 600 034  
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Telex: 041-379  
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91 Nehru Place  
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PUNE 411 011  
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Maruthankuzhi  
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Telex: 46748 BERSAL IA  
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P

BERCA Indonesia P.T.  
Wisma Antara Bldg., 17th floor  
JAKARTA  
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BERCA Indonesia P.T.  
P.O. Box 174/SBY.  
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SURABAYA  
Tel: 68172  
Telex: 31146 BERSAL SB  
Cable: BERSAL-SURABAYA  
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Telex: 2455 HEPAIRAQ IK  
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Lower Mount Street  
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Telex: 30439  
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*Kilmore Road*  
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Telex: 30439  
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*Electronics Engineering Division*  
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Tel: 3-338973  
Telex: 33569 Molil IL  
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Telex: 511630  
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Via Principe Nicola 43G/C  
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Telex: 970291 C,P  
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Telex: 334632  
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I-16156 GENOVA PEGLI  
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Via Turazza 14  
I-35100 PADOVA  
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Tel: (011) 682245, 659308  
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CH,CM,E

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Inoue Building  
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Tel: (0462) 24-0451  
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Yokogawa-Hewlett-Packard Ltd.  
Sannomiya-Daichi Seimei-Bldg. 5F  
69 Kyo-machi Chuo-ku  
KOBE 650  
Tel: (078) 392-4791  
C,E  
Yokogawa-Hewlett-Packard Ltd.  
Kumagaya Asahi Yasoji Bldg 4F  
3-4 Chome Tsukuba  
KUMAGAYA, Saitama 360  
Tel: (0485) 24-6563  
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Yokogawa-Hewlett-Packard Ltd.  
Mito Mitsui Building  
1-4-73, San-no-maru  
MITO, Ibaragi 310  
Tel: (0292) 25-7470  
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Sumitomo Seimei Nagoya Bldg.  
11-2 Shimo-sasajima-cho  
Nakamura-ku

NAGOYA, Aichi 450  
Tel: (052) 571-5171  
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Yokogawa-Hewlett-Packard Ltd.  
Chuo Bldg., 4th Floor  
5-4-20 Nishinakajima, 5-chome  
Yodogawa-ku  
OSAKA, 532  
Tel: (06) 304-6021  
Telex: YHPOSA 523-3624  
A,CH,CM,CS,E,MP,P\*

Yokogawa-Hewlett-Packard Ltd.  
3-29-21 Takaido-Higashi 3-chome  
Suginami-ku  
TOKYO 168  
Tel: (03) 331-6111  
Telex: 232-2024 YHPTOK  
A,CH,CM,CS,E,MP,P\*  
Yokogawa-Hewlett-Packard Ltd.  
3-30-4 Tsuruya-cho  
Kanagawa-ku,  
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Tel: (045) 312-1252  
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*Mouasher Cousins Company*  
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Telex: 21456 SABCO JO  
CH,E,M,P

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*ADCOM Ltd., Inc.*  
*City House, Wabera Street*  
P.O. Box 30635  
**NAIROBI**  
Tel: 331955  
Telex: 22639  
E,M

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*Industrial Products Div.*  
76-561 Yeoksam-Dong  
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P.O. Box 270 Safat  
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Telex: 2247 Malin  
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P.O. Box 165, 167  
**BEIRUT**  
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B-1200 BRUSSELS  
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Hewlett-Packard Sales (Malaysia)  
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Suite 2.21/2.22  
Bangunan Angkasa Raya  
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**KUALA LUMPUR**  
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Telex: MA31011  
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Lot 319, Satok Road  
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C.V.  
Avenida Periferico Sur No. 6501  
Tépepan, Xochimilco  
**MEXICO CITY 23, D.F.**  
Tel: (905) 676-4600  
Telex: 017-74-507  
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C.V.  
Rio Volga 600  
Colonia del Valle  
**MONTERREY, N.L.**  
Tel: 78-42-93, 78-42-40, 78-42-41  
Telex: 038-410  
CH

**MOROCCO**

*Dolbeau*  
81 rue Karatchi  
**CASABLANCA**  
Tel: 3041-82, 3068-38  
Telex: 23051, 22822  
E  
*Gerep*  
2 rue d'Agadir  
Boite Postale 156  
**CASABLANCA**  
Tel: 272093, 272095  
Telex: 23 739  
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**NETHERLANDS**

Hewlett-Packard Nederland B.V.  
Van Heuven Goedhartlaan 121  
NL 1181KK AMSTELVEEN  
P.O. Box 667  
NL1080 AR AMSTELVEEN  
Tel: (20) 47-20-21  
Telex: 13 216  
A,CH,CM,CS,E,MP,P  
Hewlett-Packard Nederland B.V.  
Bongerd 2  
NL 2906VK CAPPELLE, A/D IJssel  
P.O. Box 41  
NL2900 AA CAPELLE, IJssel  
Tel: (10) 51-64-44  
Telex: 21261 HEPAC NL  
A,CH,CM,CS

Koning en Hartman Electrotechniek  
B.V.  
Koperwerf 30  
2544 En den Haag  
The NETHERLANDS  
Tel: 070-210101  
Telex: 31528  
CM

**NEW ZEALAND**

Hewlett-Packard (N.Z.) Ltd.  
169 Manukau Road  
P.O. Box 26-189  
Epsom, AUCKLAND  
Tel: 687-159  
Cable: HEWPACK Auckland  
CH,CM,E,P\*  
Hewlett-Packard (N.Z.) Ltd.  
4-12 Cruickshank Street  
Kilbirnie, WELLINGTON 3  
P.O. Box 9443  
Courtenay Place, WELLINGTON  
Tel: 877-199  
Cable: HEWPACK Wellington  
CH,CM,E,P  
*Northrop Instruments & Systems Ltd.*  
369 Khyber Pass Road  
P.O. Box 8602  
**AUCKLAND**  
Tel: 794-091  
Telex: 60605  
A,M

*Northrop Instruments & Systems Ltd.*

110 Mandeville St.  
P.O. Box 8388  
**CHRISTCHURCH**  
Tel: 486-928  
Telex: 4203  
A,M

*Northrop Instruments & Systems Ltd.*

Sturdee House  
85-87 Ghuznee Street  
P.O. Box 2406  
**WELLINGTON**  
Tel: 850-091  
Telex: NZ 3380  
A,M

**NORTHERN IRELAND**

*Cardiac Services Company*  
95A Finaghy Road South  
**BELFAST BT 10 OBY**  
Tel: (0232) 625-566  
Telex: 747626  
M

**NORWAY**

Hewlett-Packard Norge A/S  
Folke Bernadottesvei 50  
P.O. Box 3558  
N-5033 FYLLINGSDALEN (BERGEN)  
Tel: (05) 16-55-40  
Telex: 16621 hpnas n  
CH,CM,E

Hewlett-Packard Norge A/S  
Oesterdalen 18  
P.O. Box 34  
N-1345 OESTERVAAS  
Tel: (02) 17-11-80  
Telex: 16621 hpnas n  
A\*,CH,CM,E,MS,P

**OMAN**

*Khimji Ramdas*  
P.O. Box 19  
**MUSCAT**  
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Telex: 3289 BROKER MB MUSCAT  
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**PAKISTAN**

*Mushko & Company Ltd.*  
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Sector G-6/4  
**ISLAMABAD**  
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Cable: FEMUS Rawalpindi  
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*Oosman Chambers*  
*Abdullah Haroon Road*  
**KARACHI 0302**  
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Telex: 2894 MUSKO PK  
Cable: COOPERATOR Karachi  
A,E,M,P\*

**PANAMA**

*Electrónico Balboa, S.A.*  
Calle Samuel Lewis  
Apartado 4929  
Panama 5  
Edificio "Alfa" No. 2  
**CIUDAD DE PANAMA**  
Tel: 64-2700  
Telex: 0383 ELECTRON PG  
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Arranged alphabetically by country

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Telex: 379 8626, 386 8722  
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Clá Electro Médica S.A.  
Los Flamencos 145, San Isidro  
Casilla 1030  
LIMA 1

Tel: 41-4325, 41-3703  
Telex: Pub. Booth 25306  
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## PHILIPPINES

The Online Advanced Systems  
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Rico House, Amorsolo Cor. Herrera  
Street  
Legaspi Village, Makati  
P.O. Box 1510  
Metro MANILA  
Tel: 85-35-81, 85-34-91, 85-32-21  
Telex: 3274 ONLINE  
A,CH,CS,E,M

Electronic Specialists and  
Proponents Inc.  
690-B Epifanio de los Santos  
Avenue  
Cubao, QUEZON CITY  
P.O. Box 2649 Manila  
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MACKAY BOOTH  
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Ul Slawki 2, 6P  
PL00-950 WARSZAWA  
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Telex: 812453 hepa pl

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SOQUIMICA  
Av. da Liberdade 220-2  
P-1298 LISBOA Codex  
Tel: 56 21 81, 56 21 82  
Telex: 13316

Telectra-Empresa Técnica de  
Equipamentos Eléctricos S.a.r.l.  
Rua Rodrigo da Fonseca 103  
P.O. Box 2531

P-LISBON 1  
Tel: (19) 68-60-72  
Telex: 12598  
CH,CS,E,P

Mundinter  
Intercambio Mundial de Comercio  
S.a.r.l.  
P.O. Box 2761  
Avenida Antonio Augusto de Aguiar  
138  
P-LISBON  
Tel: (19) 53-21-31, 53-21-37  
Telex: 16691 munter p  
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## PUERTO RICO

Hewlett-Packard Puerto Rico  
P.O. Box 4407  
CAROLINA, Puerto Rico 00630  
Calle 272 Edificio 203  
Urb. Country Club  
RIO PIEDRAS, Puerto Rico 00924  
Tel: (809) 762-7255  
Telex: 345 0514  
A,CH,CS

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Tel: 22170  
Telex: 4439 NASSER  
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Computearabia  
P.O. Box 2570  
DOHA

Tel: 329515  
Telex: 4806 CHPARB  
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Hewlett-Packard Reprezentanta  
Boulevard Nicolae Balcescu 16  
BUCURESTI  
Tel: 130725  
Telex: 10440

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AL-KHOBAR  
Tel: 44-678, 44-813  
Telex: 670136  
Cable: ELECTA AL-KHOBAR  
CH,CS,E,M,P

Modern Electronic Establishment  
P.O. Box 1228, Baghdadiyah Street  
JEDDAH  
Tel: 27-798  
Telex: 401035  
Cable: ELECTA JEDDAH  
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Modern Electronic Establishment  
P.O. Box 2728  
RIYADH  
Tel: 62-596, 66-232  
Telex: 202049  
CH,CS,E,M,P

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Royal Bank Buildings  
Swan Street  
BRECHIN, Angus, Scotland  
Tel: 3101, 3102  
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Hewlett-Packard Ltd.  
SOUTH QUEENSFERRY  
West Lothian, EH30 9GT  
GB-Scotland  
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Telex: 72682  
A,CH,CM,CS,E,M

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SINGAPORE, 9115  
6th Floor, Inchcape House  
450-452 Alexandra Road  
SINGAPORE 0511  
Tel: 631788  
Telex: HPSGSO RS 34209  
Cable: HEWPACK, Singapore  
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Pinelands  
CAPE PROVINCE 7450  
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Telex: 57-0006  
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Hewlett-Packard South Africa (Pty.)  
Ltd.  
P.O. Box 37099  
Overport  
DURBAN 4067  
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Hewlett-Packard South Africa (Pty.)  
Ltd.  
P.O. Box 33345  
Glenstantia 0010 TRANSVAAL  
1st Floor East  
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Centre  
Constania Park  
PRETORIA  
Tel: 01298-1126  
Telex: 32163  
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Ltd.  
Private Bag Wendywood  
SANDTON 2144  
Tel: 802-5111, 802-5125  
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Tel: (3) 322-24-51, 321-73-54  
Telex: 52603 hpbpe  
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Hewlett-Packard Española S.A.  
c/San Vicente S/N  
Edificio Albia II, 7 B  
E-BILBAO 1  
Tel: (944) 423-8306, 423-8206  
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Calle Jerez 3  
E-MADRID 16  
Tel: 458-2600  
Telex: 23515 hpe  
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Colonia Mirasierra  
E-MADRID 34  
Tel: 734-8061, 734-1162  
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Telex: 72933  
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Bahnhöherweg 44  
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CH-1219 LE LIGNON-Geneva  
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Telex: 27333 hpag ch  
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Tel: (57) 50-111  
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Telex: 11215 ITIKAL  
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Taichung Office  
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10th Floor, Room 5

TAICHUNG  
Tel: (042) 289274

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Taiwan Office  
5th Floor  
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Telex: 42155

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Hewlett-Packard Co.  
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 BIRMINGHAM, AL 35226  
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 TUCSON, AZ 85702  
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 Tel: (714) 870-1000  
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Hewlett-Packard Co.  
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 Tel: (213) 970-7500  
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Hewlett-Packard Co.  
 3939 Lankershim Blvd.  
 NORTH HOLLYWOOD, CA 91604  
 Tel: (213) 877-1282  
 Regional Headquarters

Hewlett-Packard Co.  
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 PALO ALTO, CA 94304  
 Tel: (415) 857-8000  
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 Suite 4, Building 1  
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 2000 South Park Place  
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 P.O. Box 816  
 AUGUSTA, GA 30907  
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 WARNER ROBINS, GA 31098  
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 WICHITA, KA 67207  
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Hewlett-Packard Co.  
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 Tel: (504) 443-6201  
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Hewlett-Packard Co.  
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 HANOVER, MD 21076  
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 2 Choke Cherry Road  
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 Tel: (314) 878-0200  
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**Ohio**

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3070 Directors Row  
MEMPHIS, TN 38131  
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Suite C-110  
4171 North Mesa  
EL PASO, TX 79902  
Tel: (915) 533-3555  
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FORT WORTH, TX 76106  
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HOUSTON, TX 77036  
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3309 67th Street  
Suite 24  
LUBBOCK, TX 79413  
Tel: (806) 799-4472  
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P.O. Box 1270  
930 E. Campbell Rd.  
RICHARDSON, TX 75081  
Tel: (214) 231-6101  
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2914 Hungary Spring Road  
RICHMOND, VA 23228  
Tel: (804) 285-3431  
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ROANOKE, VA 24015  
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VIRGINIA BEACH, VA 23455  
Tel: (804) 460-2471  
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Hewlett-Packard Co.  
15815 S.E. 37th Street  
BELLEVUE, WA 98006  
Tel: (206) 643-4000  
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Hewlett-Packard Co.  
Suite A  
708 North Argonne Road  
SPOKANE, WA 99206  
Tel: (509) 922-7000  
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Hewlett-Packard Co.  
4604 MacCorkle Ave., S.E.  
CHARLESTON, WV 25304  
Tel: (304) 925-0492  
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MOSCOW 101000 Tel: 294-2024  
Telex: 7825 HEWPACK SU

## VENEZUELA

Hewlett-Packard de Venezuela C.A.  
Apartado 50933  
3A Transversal Los Ruices Norte  
Edificio Segre  
CARACAS 1071  
Tel: 239-4133  
Telex: 25146 HEWPACK  
A,CH,CS,E,MS,P

## YUGOSLAVIA

*Iskra-Commerce-Representation of*  
*Hewlett-Packard*  
*Sava Centar Delegacija 30*  
*Milenija Popovica 9*  
**11170 BEOGRAD**  
Tel: 638-762  
Telex: 12042, 12322 YU SAV CEN  
*Iskra-Commerce-Representation of*  
*Hewlett-Packard*  
*Koprska 46*  
**61000 LJUBLJANA**  
Tel: 321674, 315879  
Telex:

## ZAIRE

*Computer & Industrial Engineering*  
*25 Avenue de la Justice*  
*B.P. 10-976*  
*Kinshasha I/Zaire*  
**GOMBE**  
Tel: 32063  
Telex: 21-457 SGEKIN ZR  
CH,CS

## ZIMBABWE

*Field Technical Sales*  
*45 Kelvin Road, North*  
*P.B. 3458*  
**SALISBURY**  
Tel: 705 231  
Telex: 4-122 RH  
C,E,M,P

## FOR COUNTRIES AND AREAS NOT LISTED:

### CANADA

**Ontario**  
Hewlett-Packard (Canada) Ltd.  
6877 Goreway Drive  
MISSISSAUGA, Ontario L4V 1M8  
Tel: (416) 678-9430  
Telex: 610-492-4246

### EASTERN USA

**Maryland**  
Hewlett-Packard Co.  
4 Choke Cherry Road  
Rockville, MD 20850  
Tel: (301) 258-2000

### MIDWESTERN USA

**Illinois**  
Hewlett-Packard Co.  
5201 Tollview Drive  
ROLLING MEADOWS, IL 60008  
Tel: (312) 255-9800

### SOUTHERN USA

**Georgia**  
Hewlett-Packard Co.  
P.O. Box 105005  
450 Interstate N. Parkway  
ATLANTA, GA 30339  
Tel: (404) 955-1500

### WESTERN USA

**California**  
Hewlett-Packard Co.  
3939 Lankersim Blvd.  
LOS ANGELES, CA 91604  
Tel: (213) 877-1282

### EUROPEAN AREAS NOT LISTED, CONTACT

**SWITZERLAND**  
Hewlett-Packard S.A.  
7 Rue du Bois-du-Lan  
CH-1217 MEYRIN 2, Switzerland  
Tel: (022) 83-81-11  
Telex: 27835 hpse  
Cable: HEWPACKSA Geneve

### EAST EUROPEAN AREAS NOT LISTED, CONTACT

**AUSTRIA**  
Hewlett-Packard Ges.m.b.H.  
Wehlstrasse 29  
P.O. Box 7  
A-1205 VIENNA  
Tel: (222) 35-16-210  
Telex: 135823/135066

### MEDITERRANEAN AND MIDDLE EAST AREAS NOT LISTED, CONTACT

**GREECE**  
Hewlett-Packard S.A.  
Mediterranean & Middle East  
Operations  
32 Kifissias Ave.  
Atrina Center  
PARADISOS, Amarcoussion  
Tel: 808-1741-4  
Telex: 21-6588 HPAT GR  
Cable: HEWPACKSA Athens

### INTERNATIONAL AREAS NOT LISTED, CONTACT

**OTHER AREAS**  
Hewlett-Packard Co.  
Intercontinental Headquarters  
3495 Deer Creek Road  
PALO ALTO, CA 94304  
Tel: (415) 857-1501  
Telex: 034-8300  
Cable: HEWPACK

## FOR COUNTRIES AND AREAS NOT LISTED, CONTACT:

### AFRICA

### NORTHERN AND CENTRAL AFRICA

**SWITZERLAND**  
Hewlett-Packard S.A.  
7 Rue du Bois-du-Lan  
CH-1217 MEYRIN 2, Switzerland  
Tel: (022) 98-96-51  
Telex: 27835 hpse  
Cable: HEWPACKSA Geneve

### ASIA

**HONG KONG**  
Hewlett-Packard Asia Ltd.  
6th Floor, Sun Hung Kai Center  
30 Harbor Rd.  
G.P.O. Box 795  
**HONG KONG**  
Tel: 5-832 3211  
Telex: 66678 HEWPA HX  
Cable: HP ASIA LTD Hong Kong

### EUROPE

### EASTERN EUROPE

**AUSTRIA**  
Hewlett-Packard Ges.m.b.H.  
Wehlstrasse 29  
P.O.Box 7  
A-1205 VIENNA  
Tel: (222) 35-16-210  
Telex: 135823/135066

### NORTHERN EUROPE

**THE NETHERLANDS**  
Hewlett-Packard S.A.  
Uilenstede 475  
NL-1183 AG AMSTELVEEN, The Netherlands  
P.O.Box 999  
NL-1180 AZ AMSTELVEEN, The Netherlands  
Tel: 20 437771

### SOUTH EASTERN EUROPE

**SWITZERLAND**  
Hewlett-Packard S.A.  
7 Rue du Bois-du-Lan  
CH-1217 MEYRIN 2, Switzerland  
Tel: (022) 98-96-51  
Telex: 27835 hpse  
Cable: HEWPACKSA Geneve  
(Offices in the World Trade Center)

### MEDITERRANEAN AND MIDDLE EAST

**GREECE**  
Hewlett-Packard S.A.  
Mediterranean and Middle East  
Operations  
Atrina Centre  
32 Kifissias Ave.  
Amaroussion, ATHENS, Greece  
Tel: 808-0359 808-0429  
Telex: 21-6588  
Cable: HEWPACKSA Athens

### OTHER INTERNATIONAL AREAS

Hewlett-Packard Co.  
Intercontinental Headquarters  
3495 Deer Creek Road  
PALO ALTO, CA 94304  
Tel: (415) 857-1501  
Telex: 034-8300  
Cable: HEWPACK  
August 1981 5952-6900

