

Errata

Title & Document Type: 85082A 50 Ohm Input Module, Op. & Svc. Manual

Manual Part Number: 85082-90007

Revision Date: April 1995

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website: www.tm.agilent.com.

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

This page has been intentionally left blank.

HP 85082A 50 ohm INPUT MODULE

Operating and Service Manual Insert

First Edition

Copyright © HEWLETT-PACKARD LIMITED
SOUTH QUEENSFERRY, WEST LOTHIAN, SCOTLAND EH30 9TG

Operating and Service Manual Insert HP Part 85082-90007

Microfiche Operating and Service Manual Insert HP Part 85082-90001

Printed in U.K. : April 1995



CERTIFICATION

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

WARRANTY

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

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to the Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

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

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

EXCLUSIVE REMEDIES

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

ASSISTANCE

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

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided in this manual.

Contents

SECTION 1 - GENERAL INFORMATION

Introduction	1-1
Specifications	1-1
Anti-static Precautions	1-1
Instruments Covered by Manual	1-2
Description	1-2
Recommended Test Equipment	1-2

SECTION 2 - INSTALLATION

Introduction	2-1
Initial Inspection	2-1
Installing the Module	2-1
Power Requirements	2-1
Operating Environment	2-2
Storage and Shipment	2-2
Environment	2-2
Packaging	2-2

SECTION 3 - OPERATION

Introduction	3-1
--------------	-----

SECTION 4 - PERFORMANCE TESTS

Introduction	4-1
Test Equipment Required	4-1
Test Records	4-2
Calibration Cycle	4-2
Performance Tests	4-2
Warm-up Time	4-3
Isolation Between Channels (Input Crosstalk)	4-4
Reference Channel Lock Level and Channel B Noise Floor	4-6
Phase Accuracy vs Frequency	4-8
Phase Offset Accuracy	4-11
Phase Accuracy vs Level	4-13
Amplitude Accuracy vs Frequency	4-16
Amplitude Accuracy vs Input Level (and rear panel output check)	4-19
Voltage Ratio Accuracy vs Level	4-21
SWR Measurement	4-23
Performance Test Records	4-24

SECTION 5 - ADJUSTMENTS

Introduction	5-1
Warm-up Time	5-1
Safety Considerations	5-1
Equipment Required	5-2

Contents

Post Repair Adjustments	5-2
Related Adjustments	5-2
Adjustable Components	5-3
Set up the SRD Bias, Channel A and B Bias, and the Delay Line Adjustments	5-4
Set up the Symmetry Adjustment for Channels A and B	5-10
Adjustment of the Gain of Channels A and B	5-12
Set up the Module Phase and Impedance	5-14

SECTION 6 - REPLACEABLE PARTS

Introduction	6-1
Abbreviations	6-1
Replaceable Parts List	6-1
Ordering Information	6-2
Direct Mail Order System	6-2

SECTION 7 - MANUAL CHANGES

Introduction	7-1
--------------	-----

SECTION 8 - SERVICE

Introduction	8-1
Anti-Static Precautions	8-1
Recommended Test Equipment	8-1
Troubleshooting	8-2
General Description	8-2
Servicing the Input Module	8-2
Troubleshooting Procedure	8-3

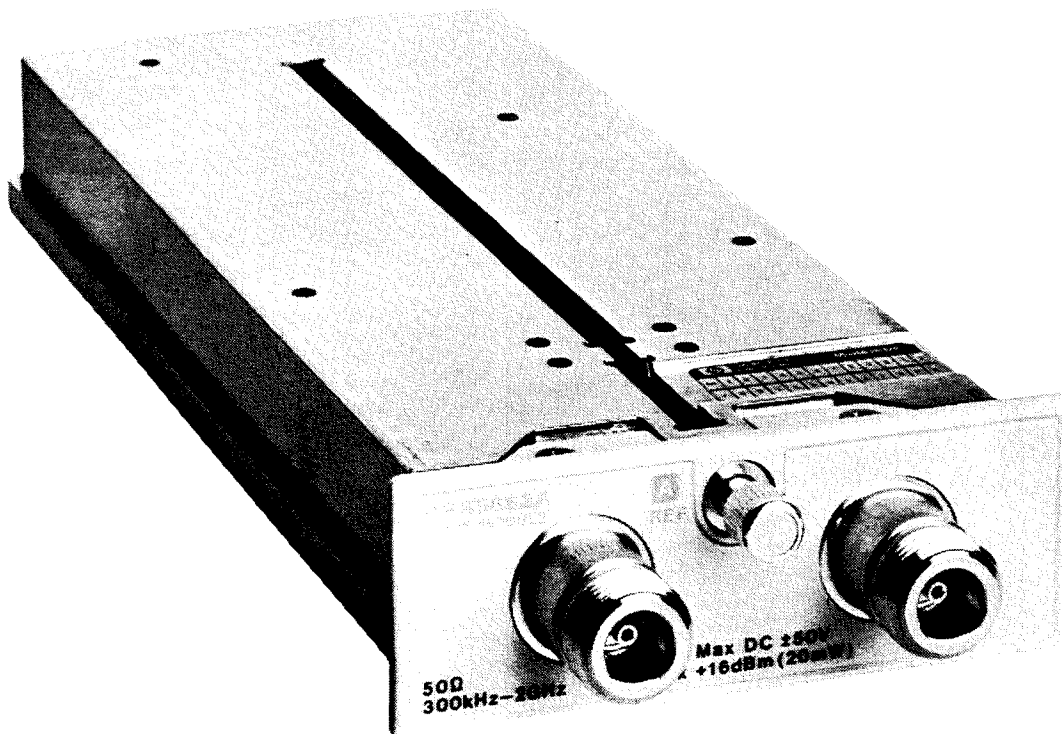


Figure 1-1. The HP 85082A 50 ohm Input Module

General Information

Section 1

1-1 INTRODUCTION

This service manual contains information required to install, test, adjust and service the Hewlett-Packard Model 85082A 50 ohm Input Probe. The HP 85082A 50 ohm Input Probe is shown in Figure 1-1.

On the title page of this manual is a Microfiche Part Number. This number can be used to order 4 x 6 inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual pages.

1-2 SPECIFICATIONS

Instrument specifications are listed in Table 1-2. These specifications are the performance standards or limits against which the instrument is tested. The specifications listed apply when the HP 85082A is installed in either an HP 8508A Vector Voltmeter mainframe, or an HP 70138A MMS Vector Voltmeter Module.

1-3 ANTI-STATIC PRECAUTIONS

The printed circuit board contained in this instrument and the probes have components that are susceptible to damage by electrostatic discharge (ESD). To minimize the risks of damaging or decreasing the reliability of the instrument, the following procedures and cautions should be observed.

Static-free Workstation: All unpackaging and servicing should be carried out at a static-free workstation whenever practical.

De-soldering: When de-soldering components, ensure that the soldering iron is earthed. Always use a metalized solder remover.

Anti-Static Freezer Spray: When attempting to locate a temperature-related fault, use only an approved anti-static freezer spray.

Anti-Static Products: Table 1-1 contains details of anti-static products which are available from Hewlett-Packard.

Table 1-1. Anti-Static Products

Product	HP Part Number
Anti-static workstation kit	9300-0792
Metalized Solder Remover	8690-0227
Wrist-strap	9300-0970

1-4 INSTRUMENTS COVERED BY MANUAL

DATE CODE

The year and week of manufacture are stamped on the circuit board and also on the outer casing of the module. Example: "8-18" would indicate week 18 of 1988. There is no serial number.

SERIES CODE

A four-digit series number is contained on a serial number plate. This number should match the series number on the title page of this manual. An instrument manufactured after the printing of this manual may have a series number that is not listed on the title page. The unlisted series number indicates that the instrument is different from those described in this manual. The manual for this new instrument may be accompanied by a Manual Changes supplement. This supplement contains "change information" that explains how to adapt the manual to the new instrument.

In addition to change information, the supplement may also contain information for correcting errors in the manual. To keep this manual as current and as accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified by the manual print date and part number (both of which appear on the manual title page). Complimentary copies of the supplement are available from Hewlett-Packard. For information concerning a series number that is not listed on the page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

1-5 DESCRIPTION

The Hewlett-Packard Model 85082A 50 ohm Input Probe is a plug-in module for the HP 8508A Vector Voltmeter and the HP 70138A MMS Vector Voltmeter Module. The HP 85082A can measure signals in the frequency range 300kHz to 2GHz and at levels from -47dBm to 13dBm.

1-6 RECOMMENDED TEST EQUIPMENT

Table 1-1 in the HP 8508A Vector Voltmeter manual lists the test equipment required for testing, adjusting and servicing the HP 8508A Vector Voltmeter and the HP 85082A 50ohm Input Probe. Table 1-1 in the HP 70138A MMS Vector Voltmeter Service Manual lists the equipment required for testing and adjusting the HP 70138A MMS Vector Voltmeter and the HP 85082A 50ohm Input Probe. The Critical Specifications column describes the essential requirements for each piece of test equipment. Other equipment can be substituted if it meets or exceeds the critical specifications.

Table 1-2. Specifications

Specifications describe the instrument's warranted performance over the temperature range 0 to 55 deg C unless otherwise stated. Typical values describe typical, but non-warranted, performance. Nominal values are given as a guide to expected performance.

Measurement conditions: All specifications apply to measurements in a 50 ohm system and with frequency autoranging off, unless otherwise stated.

Frequency Range	300kHz-2GHz	
Maximum Input	16dBm, ± 50 Vdc	
Measurement Range		
A and B Channel maximum	Magnitude measurements	3dBm, 300kHz-1MHz, 1GHz-2GHz 13dBm, 1MHz-1GHz
A (Ref) Channel minimum	Phase measurements	3dBm, 300kHz-2GHz -47dBm, 300kHz-3MHz -57dBm, 3MHz-2GHz -87dBm, 300kHz-2GHz
B (Meas) Channel noise floor		
Measurement bandwidth	1kHz (nominal)	
Input Crosstalk	>100dB, 300kHz-500MHz >80dB, 500MHz-1GHz >70dB, 1GHz-2GHz	
Impedance	SWR<1.2, 300kHz-1.5GHz SWR<1.5, 1.5GHz-2GHz	
Magnitude Characteristics		
Resolution:	3 1/2 digits	
Accuracy:	Amplitude accuracy is specified for both ratio and absolute measurements. Each case has two components - accuracy vs level and accuracy vs frequency. Add either the ratio or the absolute uncertainty components from the following graphs, using the information on each graph to decide if the uncertainty applies to the particular measurement.	

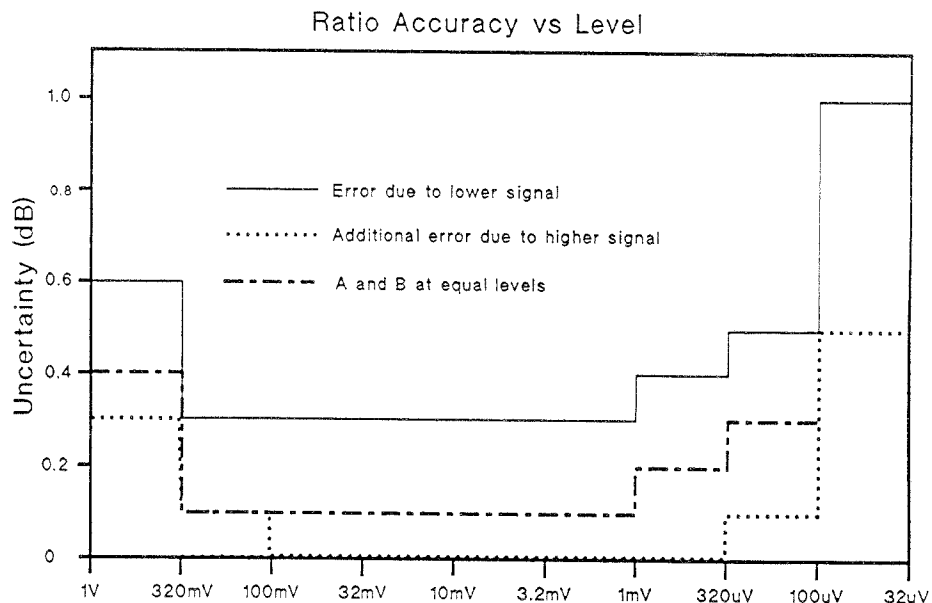
General Information

Ratio Accuracy vs Level (1) (3)

Add this term when making:

Ratio measurements at any single frequency.

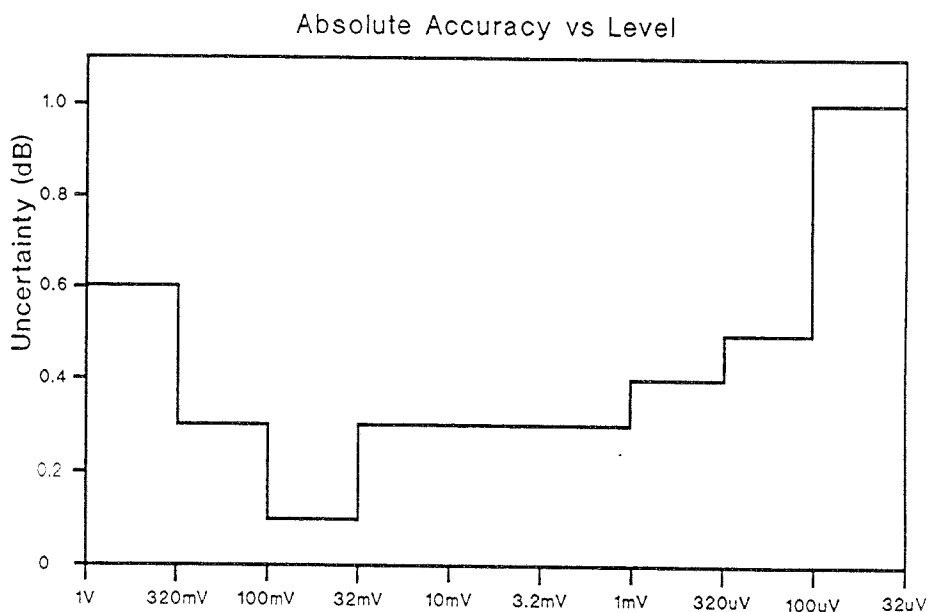
(Accuracy vs level is normally determined by the lower level signal. Noise ($<320\mu\text{V}$) and compression ($>100\text{mV}$) effects cause additional errors.)



Absolute Accuracy vs Level (1) (2) (3)

Add this term when making:

Absolute measurements.

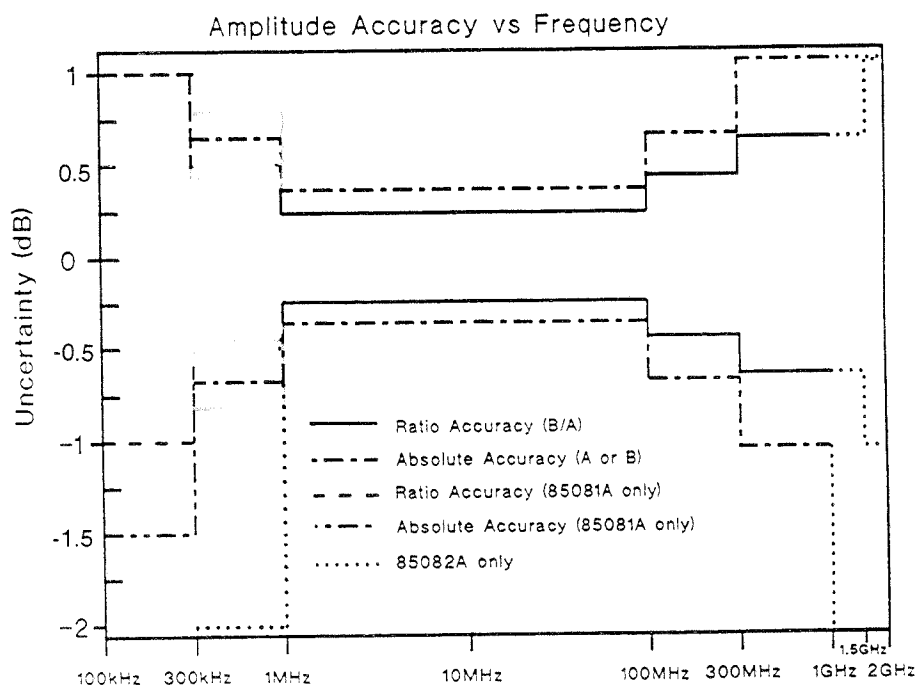


Amplitude Accuracy vs Frequency(1) (4)

(A and B 100mV nominal)

Add this term when making:
 Absolute measurements.
 Ratio measurements over a frequency range.

Ignore this term when making:
 Ratio measurements where the measurement is normalized to a reference at each new frequency.



Phase Characteristics

Display Range: -179.9 to +180.0 degrees

Display Resolution: 0.1 degrees

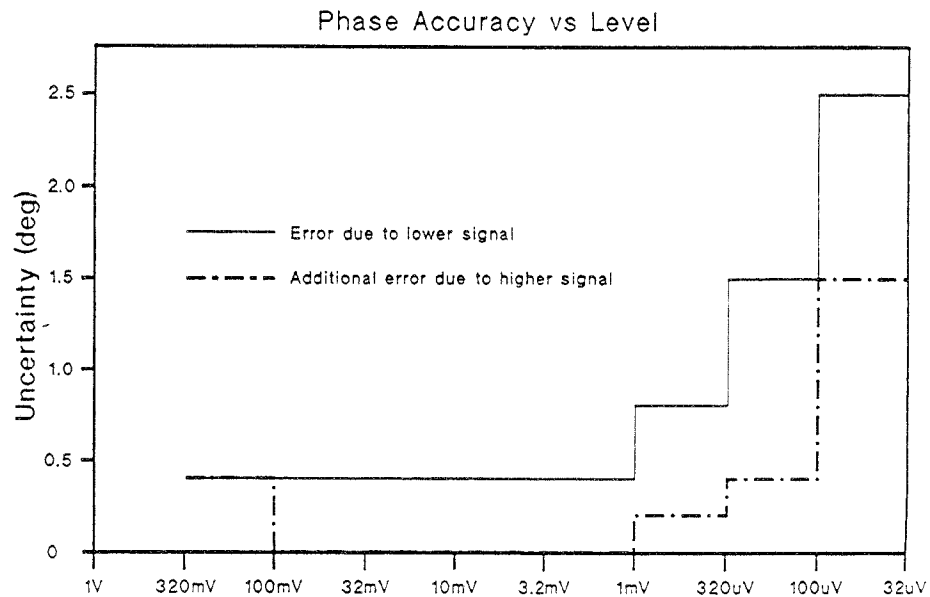
Accuracy: Phase accuracy has two components - phase accuracy vs level and phase accuracy vs frequency. Add the uncertainty components from the following graphs using the information on each graph to decide if the uncertainty applies to the particular measurement.

General Information

Phase Accuracy vs Level (5) (6) (7)

Add this term when making:

Phase measurements at any single frequency.



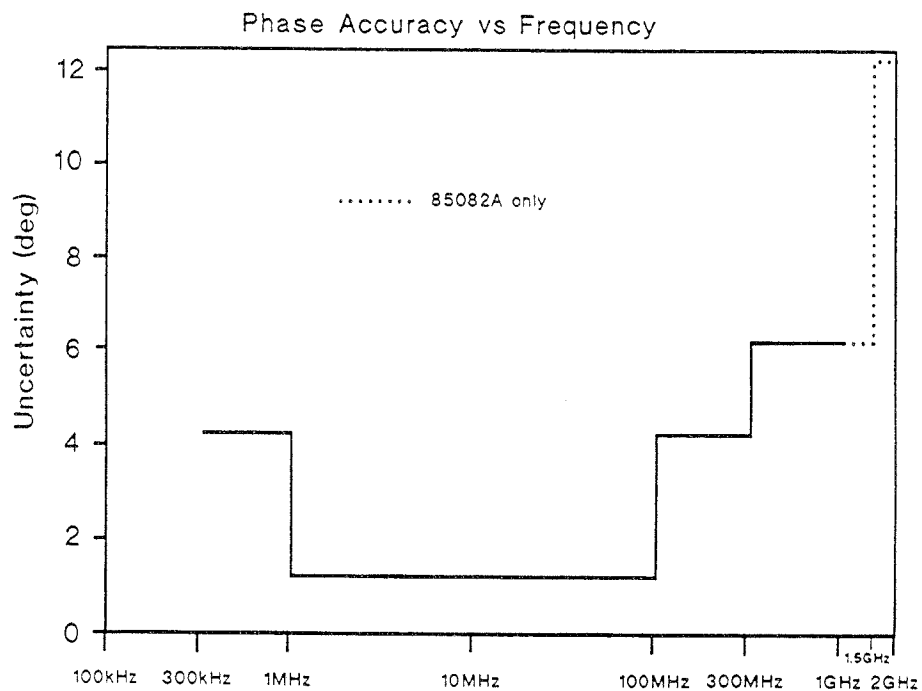
Phase Accuracy vs Frequency (5) (6) (A and B 100mV nominal)

Add this term when making:

Phase measurements over a frequency range.

Ignore this term when making:

Phase measurements where the measurement is normalized to a reference at each new frequency.



Footnotes

- (1) 15 to 30 degrees C. Add ± 0.1 dB per 5 deg C outside this range.
- (2) A minimum input level depends on frequency. See Measurement Range.
- (3) Add ± 0.5 dB for signals above 100mV at frequencies greater than 500MHz.
- (4) A and B absolute value includes ± 0.15 dB source traceability error.
- (5) 15 to 30 degrees C. Add 1 deg per 5 deg C outside this range.
- (6) Add ± 3 deg for signals above 100mV at frequencies greater than 500MHz.
- (7) Add ± 0.4 deg phase non-linearity for measurements other than 0 deg.

General

Search and lock time

Automatic tuning starts from lowest frequency and searches consecutive bands. Total search and lock time depends on the number of bands to be scanned and the lockup time within the selected band.

Process start time:	50ms after lock is lost.
Lockup (within 1 range):	40ms, frequencies up to 3MHz 20ms, frequencies greater than 3MHz
Ranges (MHz):	0.1-0.2, 0.2-0.6, 0.6-1, 1-3, 3-5, 5-8, 8-15, 15-25, 25-50, 50-80, 80-150, 150-250, 250-500, 500-1000, 1000-2000

Rear Panel Outputs:

Normal Operation: Provides an analog representation of the digital display values, including internal instrument correction factors.

OUTPUT 1 corresponds to DISPLAY 1, OUTPUT 2 corresponds to DISPLAY 2.

Range: 0 to ± 1999 display counts.

Sensitivity: 1mV represents 1 display count (nominal).

For readings greater than ± 1999 counts, the rear panel output voltage will remain fixed at ± 2.0 Volts.

Display resolution can be controlled by manual ranging.

Update rate: Approximately 3 readings per second.

Direct Analog Output: Provides continuous direct output from the internal magnitude and phase detectors through 800Hz low-pass filters. No internal correction is applied.

OUTPUT 1 corresponds to linear magnitude (A or B selected by front panel control).

Sensitivity: 1V equals displayed full scale deflection (nominal). Can be controlled by manual ranging.

OUTPUT 2 corresponds to B-A phase.

Sensitivity: 10mV per degree (nominal).

Phase Jitter: < 3 deg rms (typical, A=100mV, B=100uV)

HP-IB Capability

Interface functions:

SH1 AH1 T6 TE0 L4 LE0 SR1 RL1 PP0 DC1 DT1 C0

Transfer Rate:

Normal Operation: Approximately 12 readings per second.

Measurement Conditions: Triggered measurement, default averaging.

Maximum Rate: Approximately 1 reading per 18ms.

Measurement conditions: Continuous output, averaging count 0, system format FP64, display rate off, equal steady state signals at A and B inputs, single output of phase or linear A or B voltage.

General Information

Probe Power Supply

Supplies: +12 and -12 volts and ground

This supply is sufficient to operate 1 HP 85024A High Impedance Probe.

Environment

Temperature: 0 to 55 deg C (operating), -40 to 70 deg C (storage)

Humidity: 0 to 95%, non-condensing

Altitude: 0 to 4500m (operating), 0 to 15000m (storage)

RFI: Conducted and radiated interference is within the requirements of
Messemphaenger-Postverfuegung 526/527/79.

Power: 100, 120, 220 or 240V +5/-10%, 48 to 440 Hz, 40VA

Size: Std: 133mm (5.25in) H x 425.5mm (16.75in) W x 473.3mm (18.65in) D

Weight: Std: 8.1kg (net) 11kg (shipping)

Installation

Section 2

2-1 INTRODUCTION

This section provides installation instructions for the Hewlett-Packard Model 85082A 50 ohm Input Module. This section also includes information about initial inspection and damage claims, preparation for use, packaging, storage and shipment.

2-2 INITIAL INSPECTION

WARNING

IF THERE IS ANY SIGN OF SHIPPING DAMAGE TO THE INSTRUMENT, DO NOT INSTALL IN THE HP 8508A MAINFRAME, OR THE HP 70138A MMS MODULE. RETURN THE INSTRUMENT TO THE NEAREST HEWLETT-PACKARD OFFICE FOR CHECKING.

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The Performance Tests check the complete specification of the instrument.

If the contents of the shipment are incomplete, if there is mechanical damage or defect, or if the instrument performance fails to meet specification, notify the nearest Hewlett-Packard office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping material for the carrier's inspection. The Hewlett-Packard office will arrange for repair or replacement at Hewlett-Packard's option without waiting for a claims settlement, providing that Hewlett-Packard and/or the carrier are notified within 12 days of shipment.

2-3 INSTALLING THE MODULE

The HP 85082A is installed in the opening on the front panel of the HP 8508A Vector Voltmeter or the HP 70138A MMS Vector Voltmeter. The HP 85082A should be carefully slid into the guides and pushed firmly to ensure the connectors are mated. The module should now be locked in place by turning the knob of the locking mechanism clockwise.

2-4 POWER REQUIREMENTS

The HP 85082A derives its power directly from the HP 8508A Vector Voltmeter mainframe or the HP 70138A MMS Vector Voltmeter.

2-5 OPERATING ENVIRONMENT

- Temperature:** The instrument may be operated in temperatures from 0° Centigrade to +50° Centigrade. (Refer to the specifications for limitations.)
- Humidity:** The instrument may be operated with humidity up to 90% up to 40° Centigrade. However, the instrument should also be protected from temperature extremes which may cause condensation within the instrument.
- Altitude:** The instrument may be operated at altitudes up to 4600m (15000ft).

2-6 STORAGE AND SHIPMENT

Environment

The instrument may be stored or shipped in environments within the following limits:

- Temperature:** -40° Centigrade to +75° Centigrade.
Humidity: up to 90% at 65° Centigrade.
Altitude: 15300m (50000ft).

The instrument should also be protected from temperature extremes which may cause condensation within the instrument.

Packaging

- Tagging for Service:** If the instrument is being returned to Hewlett-Packard for service, please complete one of the blue repair tags located at the front of this manual and attach it to the instrument.
- Original Packaging:** Containers and material identical to those used in the factory packing are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, model number and full serial number. Also mark the container "FRAGILE" to ensure careful handling.
- Other Packaging:** The following general instructions should be used for re-packaging with commercially available materials.
- (a) Wrap the instrument in heavy paper or plastic. (If shipping to Hewlett-Packard office or service centre, attach a tag indicating the type of service required, return address, model number and full serial number.)
 - (b) Use a strong shipping container. A double-walled carton of 350-pound test material is adequate.
 - (c) Use a layer of shock absorbing material 70mm to 100mm (3 to 4 inch) thick around all sides of the instrument to provide firm cushioning and prevent movement inside the container. Protect the control panel with cardboard.
 - (d) Securely seal the shipping container.
 - (e) Mark the shipping container "FRAGILE" to ensure careful handling.
 - (f) In any correspondence, refer to the instrument by model number and date code.

Operation

Section 3

3-1 INTRODUCTION

This information is contained in the HP 8508A Vector Voltmeter mainframe and HP 70138A MMS Vector Voltmeter manuals.

Performance Tests

Section 4

4-1 INTRODUCTION

The Performance Test procedures in this section of the manual test the instruments electrical performance using the specifications listed in Table 1-2 of this manual as the performance standard. These specifications apply equally when the HP 85082A is used in either the HP 8508A or the HP 70138A Vector Voltmeter.

In the event of failure, refer to the Troubleshooting information in section 8 of this manual, except where specific reference is made to the Adjustment Procedures in section 5.

Power-on Checks

The Power-on Checks are performed automatically at switch-on. These checks test the operation of the mainframe processor, the functionality of the measurement modes and the presence of the HP 85082A Input Module. The Power-on Checks are part of the self-test routine used for operational verification.

Failure of these tests results in an Error Code number being displayed. Errors relating to the HP 85082A are in the 600 Series.

Performance Tests

The Performance Tests verify that the instrument is operating within the limits of the full specification. It should be noted, however, that the specifications apply to measurements in a 50 ohm system with the autoranging off.

In the event of a performance test failure, the test should be repeated with manual range selection and a check made of Adjustment Procedures and, if necessary, the Troubleshooting section.

4-2 TEST EQUIPMENT REQUIRED

Equipment required for the Performance Tests is listed in Table 1-1 in the HP 8508A or HP 70138A Vector Voltmeter manual. Any equipment which meets or exceeds the critical specifications may be substituted for the recommended model.

4-3 TEST RECORDS

The results of the Performance Tests may be recorded in Tables 4-2 to 4-10. The Test Records list all of the tested specifications and their acceptable limits. The results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting after repair or calibration.

4-4 CALIBRATION CYCLE

This instrument requires periodic verification of performance. Depending upon the use and environmental conditions, the instrument should be checked using the Performance Tests at yearly intervals.

4-5 PERFORMANCE TESTS

The Performance Test procedures provide a complete check of the instrument's electrical performance using the specifications listed in Table 1-2 as the performance standard. Table 4-1 gives a complete list of the Performance Tests. If any of the Performance Tests are out of specification, refer to section 5 of this manual and the appropriate Vector Voltmeter manual. If, after adjustment, the Specifications still cannot be met, refer to section 8 of this manual.

Table 4-1. Performance Tests

Test Title	Paragraph Number
Isolation between Channels (Input Crosstalk)	4-7
Reference Channel Lock Level and Channel B Noise Floor	4-8
Phase Accuracy vs Frequency	4-9
Phase Offset Accuracy	4-10
Phase Accuracy vs Level	4-11
Absolute Accuracy vs Frequency	4-12
Amplitude Accuracy vs Input Level (and rear panel output check)	4-13
Voltage Ratio Accuracy vs Level	4-14
SWR Measurement	4-15

4-6 WARM-UP TIME

The instrument must be switched on for a minimum of 30 minutes before carrying out any tests. Once the instrument's operating temperature has stabilized, perform an automatic internal instrument calibration by selecting [SHIFT] [CAL TEST] on the HP8508A or [Misc] [CAL] on the HP 70138A MMS system.

4-7 ISOLATION BETWEEN CHANNELS (INPUT CROSSTALK)

SPECIFICATIONS:

Input Crosstalk:	1 MHz - 500 MHz	> 100 dB
	500 MHz - 1 GHz	> 80 dB
	1GHz - 2GHz	> 70dB

DESCRIPTION:

Crosstalk is defined as the leakage interference between the instrument input channels. Crosstalk is tested by observing the signal level on a terminated input while applying a signal to the other input.

In this procedure, a maximum level signal of 1Vrms is applied to the Channel A input of the HP 85082A Input Module while the Channel B input is terminated in 50 ohms.

The crosstalk from Channel A to Channel B is indicated by an amplitude ratio measurement in DISPLAY 1.

EQUIPMENT:

Instrument	Critical Specification	Recommended Model
Signal Source	Frequency Range Amplitude	1.0 -2000 MHz 1.0 V rms HP 8642B
50 Ohm Termination N(m)-N(m) Cable		HP 909C HP 11500A

PROCEDURE:

1. Configure the equipment as shown in Figure 4-1.

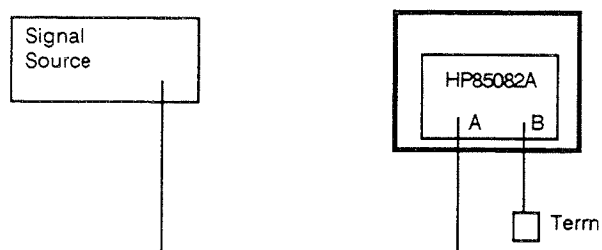


Figure 4-1. Channel Isolation Test Setup

2. Signal source setup:

Frequency: 1.0 MHz
Amplitude: 1.0 V rms

3.	HP 8508A setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B/A MAG] [DISPLAY] dB	[Mag/Ph] [B/A MAG] [Format Functn] [dB]	B/A ratio measurement in dB, in DISPLAY 1.
	[LOCK RANGE] [SHIFT] [VIEW RANGE] "up"/"down" arrow keys to select 1-3MHz	[Lock Range] [1.0-3.0MHz]	Set frequency range.
	[LOCK RANGE]	[Lock Range] [AUTO LOCK]	Unlock frequency range.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration

4. Note the value obtained for the Input Isolation in DISPLAY 1 and record this value in the Performance Test Record (which is located at the end of the Performance Tests section).

5. Repeat this procedure for each frequency noted in the Performance Test Record.

Should the results in any particular frequency range fall outwith the specification limits, the test should be repeated with the instrument locked in the appropriate frequency range. The process for locking the frequency range is shown below.

The instrument can be locked into a particular frequency range as follows:

HP 8508A	HP 70138A
[LOCK RANGE]	[Lock Range] <i>[required frequency range]</i>
[SHIFT] [VIEW RANGE] "up"/"down" keys to select frequency range	
[LOCK RANGE]	[Lock Range] [AUTO LOCK]

Note: The frequency points in the Performance Test Record are a minimum requirement as they have been selected to coincide with the specification needs and ranges of the instrument.

4-8 REFERENCE CHANNEL LOCK LEVEL AND CHANNEL B NOISE FLOOR

SPECIFICATIONS:

Reference Channel Lock Level:	-47dBm, 300kHz - 3.0 MHz. -57dBm, 3.0 MHz - 2.0 GHz.
Channel B Noise Floor:	-87dBm, 300kHz - 2.0GHz.

DESCRIPTION:

In this procedure, Channel B is terminated in 50 ohms and the minimum signal amplitude (appropriate to the frequency), is applied to the reference channel (Channel A). The channel should then be locked onto this signal.

The noise floor is defined with the minimum signal applied to Channel A while Channel B is terminated in 50 ohms.

EQUIPMENT:

Instrument	Critical Specification		Recommended Model
Signal Source	Frequency Range	0.3 - 2000MHz	HP 8642B
	Amplitude	1mV	
50 Ohm Termination			HP 909C
N(m) - N(m) Cable			HP 11500A

PROCEDURE:

1. Configure the test equipment as in Figure 4-2.

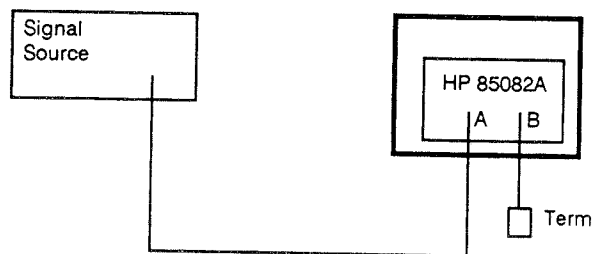


Figure 4-2. Test Setup for Reference Channel Lock Level and Channel B Noise Floor

2. Signal source setup:

Frequency: 300 kHz
Amplitude: -47dBm

3.	HP 8508A setup	HP 70138A setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B]	[Mag/Ph Measure] [DISPLAY 2] [B]	'A' voltage in DISPLAY 1 'B' voltage in DISPLAY 2
	[POWER MEAS]	[Format Functn] [dB]	Display readings in dBm.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration.

4. Disconnect and reconnect Channel A and check that Channel A relocks (indicated by a reading on DISPLAY 1).

5. Note the noise floor readings and enter them in the Performance Test Record (which is located at the end of the Performance Tests section.)

6. Repeat this procedure for each frequency defined in the Performance Test Record. At each point, check that Channel A is locked and note the Channel B noise floor level, as appropriate, at the different points.

Should the results in any particular range fall outwith the specification limits, the test should be repeated with the instrument locked in the appropriate frequency range.

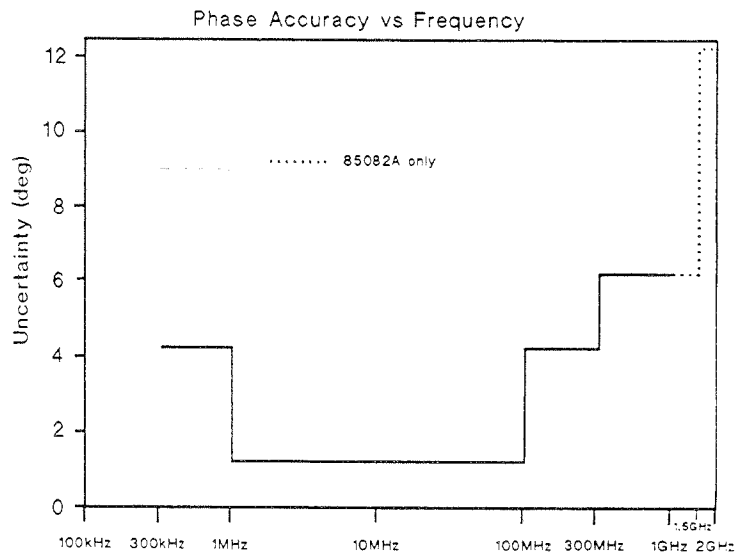
The instrument can be locked into a particular frequency range as follows:

HP 8508A	HP 70138A
[LOCK RANGE]	[Lock Range] [<i>required frequency range</i>]
[SHIFT] [VIEW RANGE] "up"/"down" keys to select frequency range	
[LOCK RANGE]	[Lock Range] [AUTO LOCK]

Note: The frequency points in the Performance Test Record are a minimum requirement as they have been selected to coincide with the Specification needs and frequency ranges of the instrument.

4-9 PHASE ACCURACY vs FREQUENCY

SPECIFICATIONS:



DESCRIPTION:

In this test, the Phase Uncertainty is tested through the frequency range of the instrument, from 300kHz to 2GHz, at a reference level of 100mV and zero phase difference between the channel inputs.

The test looks at the phase difference in the phase tracking of the two channels.

EQUIPMENT:

Instrument	Critical Specification		Recommended Model
Signal Source	Frequency Range	0.3 - 2000MHz	HP 8642B
	Amplitude	200 mV	
Power Divider			HP 11636A
50 Ohm Termination			HP 909C
Phase Matched Cables			HP 11851B

PROCEDURE:

1. Configure the equipment as shown in Figure 4-3, connecting the probe divider outputs to the HP 85082A inputs with the phase matched cables.

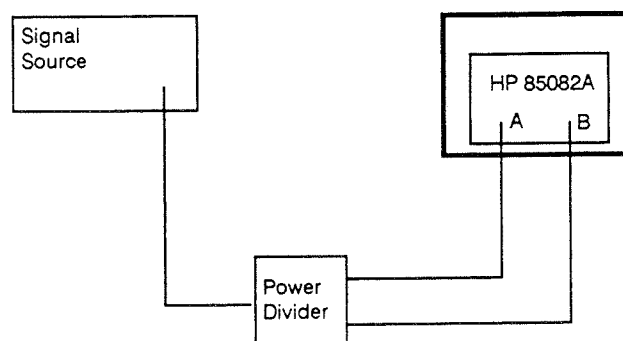


Figure 4-3. Phase Accuracy vs Frequency Test Setup

2. Signal source setup:

Frequency: 1.0 MHz
 Amplitude: 200mV (to produce a nominal output level of 100mV at the output of the power divider).

3:	HP 8508A setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B-A PHASE]	[Mag/Ph Measure] [DISPLAY 2] [B-A PHASE]	'A' voltage in DISPLAY 1 Phase in DISPLAY 2
	[LOCK RANGE] [SHIFT] [VIEW RANGE] "up"/"down" keys to select 1-3MHz	[Lock Range] [1.0-3.0MHz]	Set frequency range.
	[LOCK RANGE]	[Lock Range] [AUTO LOCK]	Unlock frequency range.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration

4. With the source output level maintained, at 200mV, vary the frequency in the sequence shown in the Performance Test Record and record the phase reading at each step. The Performance Test Record is located at the end of the Performance Test section.

Performance Tests

NOTE: For this measurement, it is critical that the differences in electrical path lengths and phase tracking of the power divider are removed from the measurement to minimize phase measurement errors. For any frequency point that may be outwith the specification limits, this source of error should be balanced out by using manual frequency range selection in conjunction with the following notes.

- a) Repeat the measurement as previously detailed and make a note of the phase lag or lead.
- b) Press [LOCK RANGE] on the HP 8508A, or [Lock Range] [AUTO LOCK] on the HP 70138A, to ensure that the instrument stays on the same range for both measurements.
- c) Interchange the two cables at the input of the HP 85082A, without disturbing the rest of the test setup.
- d) Make a note of this new value of phase lag or lead.
- e) These two measurements should be summed and the result divided by two. This result is the phase error due to the HP 85082A. The rest is due to phase unbalance.
- e) Repeat this process for any frequency noted as being out of specification.

4-10 PHASE OFFSET ACCURACY

SPECIFICATIONS:

Non-linearity of phase from 0 degrees is ± 0.4 degrees.

DESCRIPTION:

In this test, the channels are set up for a nominal level of 100mV, at a frequency of 1.0MHz. The phase between the two channels is then varied.

EQUIPMENT:

Instrument	Critical Specification	Recommended Model
Signal Source	Dual Channel Synthesizer	HP 3326A
	Frequency Range	dc-13 MHz
	Amplitude	100mV
Phase Matched Cables		HP 11850B
Adaptor N(f) to BNC (m) (2)		HP 1250-0077

PROCEDURE:

1. Configure the equipment as shown in Figure 4-4.

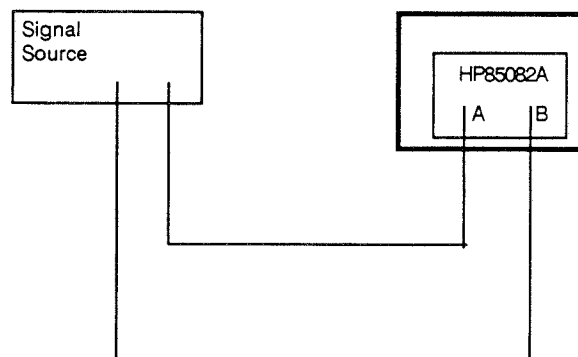


Figure 4-4. Phase Offset Accuracy Setup

Performance Tests

2. Signal source Setup:

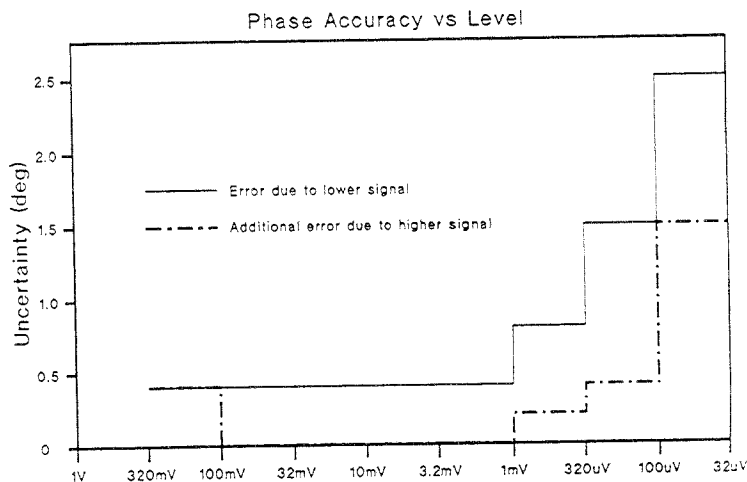
Frequency: 1.0 MHz on both channels.
 Amplitude: 100mV rms on both Channels.
 Phase Offset: Zero.

3.	HP 8508A Setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B-A PHASE]	[Mag/Ph Measure] [DISPLAY 2] [B-A PHASE]	Amplitude in DISPLAY 1 Phase in DISPLAY 2
	[LOCK RANGE] [SHIFT] [VIEW RANGE] "up"/"down" arrow keys to select 1-3MHz	[Lock Range] [1.0-3.0MHz]	Set frequency range.
	[LOCK RANGE]	[Lock Range] [AUTO LOCK]	Unlock frequency range.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration
	[SHIFT] [SAVE REF]	[Ref] [SAVE REF]	Normalize system

4. With the frequency and level unchanged, vary the signal source phase offset between the channels as defined in the Performance Test Record and note the instrument reading at each step. The Performance Test Record is located at the end of the Performance Test section.

4-11 PHASE ACCURACY vs LEVEL

SPECIFICATIONS:



DESCRIPTION:

This test is a measure of the instrument’s ability to measure phase as the signal level is varied. This is a function of the IF performance. This test can be repeated for other frequencies as required.

EQUIPMENT:

Instrument	Critical Specification		Recommended Model
Signal Source	Frequency Range	0.3 - 13MHz	HP 3326A
	Amplitude	19dBm	
Power Divider	dc - 4 GHz		HP 11636A
	Ins Loss	6 dB	
	O/P Tracking	< = 0.4 dB	
	Phase Tracking	2deg or better	
Attenuator (2)	0-110 dB in 10 dB steps		HP 8496A/G Opt 890*
Attenuator Driver	Required for HP 8496G		HP 11713A**
Phase Matched Cables			HP 11851B

*Calibration required.

NOTE: The construction of the HP 8496 attenuator series is such that the change in electrical length (phase response) as attenuator sections are switched in and out is substantially less than the HP 85082A specifications. This may not be the case if different attenuators are substituted.

** Required if HP 8496G programmable attenuator is used.

PROCEDURE:

1. Configure the Test Equipment as shown in Figure 4-5.

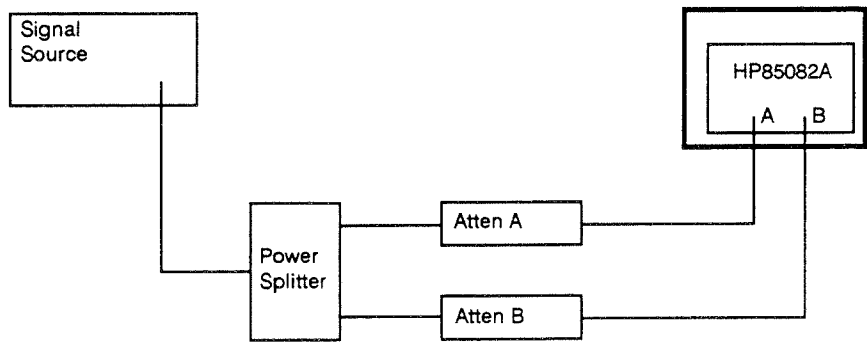


Figure 4-5. Phase Accuracy vs Level Test Setup

2. Set both attenuators to 20 dB.

3. Signal source setup:

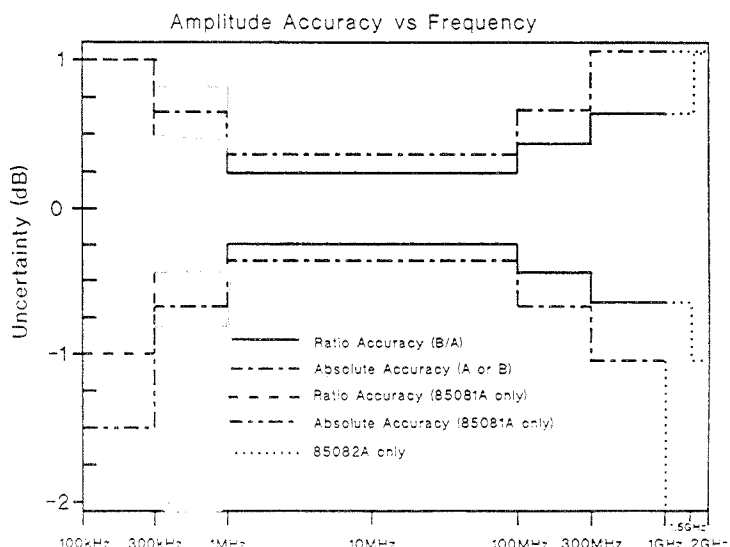
Frequency: 1 MHz
Amplitude: +19dBm

4.	HP 8508A setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B-A PHASE]	[Mag/Ph Measure] [DISPLAY 2] [B-A PHASE]	Amplitude in DISPLAY 1 Phase in DISPLAY 2
	[LOCK RANGE] [SHIFT] [VIEW RANGE] "up"/"down" arrow keys to select 1-3MHz	[Lock Range] [1.0-3.0MHz]	Select frequency range
	[LOCK RANGE]	[Lock Range] [AUTO LOCK]	Unlock frequency range.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration
	[SHIFT] [SAVE REF]	[Ref] [SAVE REF]	Normalize system

5. Note the Phase reading in DISPLAY 2 and record this in the Performance Test Table which is located at the end of the Performance Tests section.
6. Repeat this process for the attenuator settings defined in the Performance Test Record and note the phase reading at each step.

4-12 AMPLITUDE ACCURACY vs FREQUENCY

SPECIFICATION:



DESCRIPTION:

The voltage amplitude accuracy is measured with the channel input level set to $-7.00\text{dBm} \pm 0.1\text{dBm}$ at each frequency point being checked.

The signal level is checked with the power meter. Care must be taken to ensure that the power meter calibration factor is corrected for the frequency being used.

To allow measurement of Channel B, a power splitter is used to divide the signal and provide a lock reference to Channel A.

EQUIPMENT:

Instrument	Critical Specification		Recommended Model
Signal source	Frequency Range	300kHz to 2GHz	HP 8642B
	Amplitude	200mV	
Power Divider			HP 11636A
Phase Matched Cables			HP 11851B
RF Power Meter	Accuracy	$\pm 0.02\text{dB}$	HP 436A/HP 438A
	Power Ref	50MHz 1.00mW	
	NBS Traceable.		
Power Sensor			HP 8482A
Adaptor N(f)-N(f)			HP 1250-1472

PROCEDURE:

1. Configure the equipment as shown in Figure 4-6 step (a), with the power meter connected to port 2 of the power splitter and Channel B of the HP 85082A connected to port 3 of the power splitter.

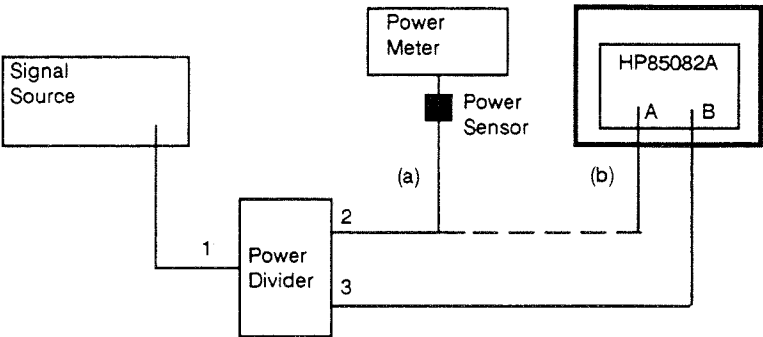


Figure 4-6. Voltage Accuracy Equipment Setup

2. Signal source setup:

FREQUENCY: 1.0 MHz.
AMPLITUDE: -1 dBm. To produce a power meter reading of -7.0 dBm, ± 0.1 dB.

3. Record the power meter reading in the Performance Tests Results table at the rear of this section.
4. Reconfigure the equipment as shown in Figure 4-6 step (b), with Channel A of the HP 85082A connected to port 2 of the power splitter.

HP 8508A setup	HP 70138A setup	Function
[PRESET]	[I-P]	Instrument preset
[B]	[Mag/Ph Measure] [DISPLAY 2] [B]	'A' voltage in DISPLAY 1. 'B' voltage in DISPLAY 2.
[POWER MEAS] [DISPLAY] dB	[Format Functn] [dB]	dBm display
[LOCK RANGE] [SHIFT] [VIEW RANGE] "up"/"down" arrow keys to select 1-3MHz	[Lock Range] [1.0-3.0MHz]	Set frequency range.
[SHIFT] [CAL]	[Misc] [CAL]	Self calibration

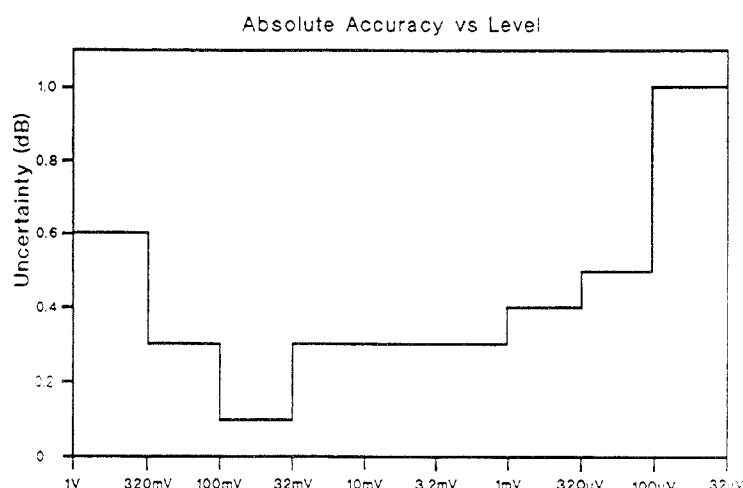
Performance Tests

6. Record the DISPLAY 1 reading in the Performance Tests Results table.
7. Interchange the connections at the Channel A and B inputs of the HP 85082A and record the value of the reading in DISPLAY 2 in the Performance Tests Results table.
8. Repeat the entire test for each frequency point required.

NOTE: Ensure that you set the power meter calibration factors to the value appropriate to the frequency being used.

4-13 AMPLITUDE ACCURACY vs INPUT LEVEL (and rear panel output check)

SPECIFICATIONS:



DESCRIPTION:

The amplitude accuracy is tested by applying known signal levels and comparing these with the results displayed by the Vector Voltmeter.

Rear panel output signals are checked for a nominal sensitivity of 1mV per display count.

EQUIPMENT:

Instrument	Critical Specification	Recommended Model
Signal Source	Dual Channel (+13dBm per channel)	HP 3326A
Attenuator (2)	0 to 110dB in 10dB steps	HP 8496A/G Opt890*
Attenuator Driver	Required for HP 8496G	HP 11713A **
Phase Matched Cables		HP 11851B
Adaptor N(m)-BNC(m)		HP 1250-0082
Power Meter	Accuracy ± 0.02 dB Ref Output 50MHz, 0.0dBm Traceable to NBS	HP 436A/HP 438A
Power Sensor		HP 8482A
DVM		HP 3456A

* Calibration data required.

** Required if HP 8496G programmable attenuator is used.

PROCEDURE:

1. Configure the equipment as shown in Figure 4-7.

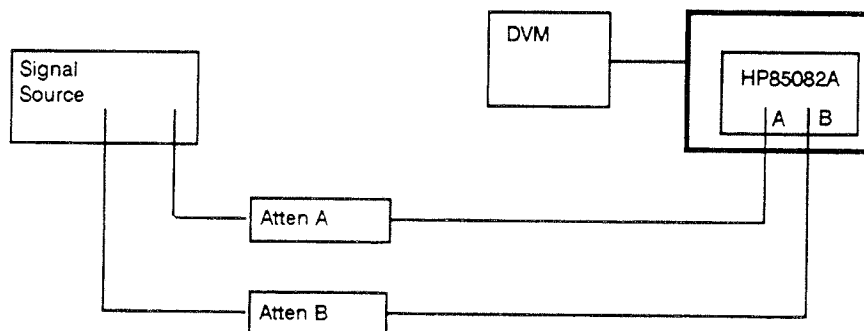


Figure 4-7. Amplitude Accuracy vs Input Level (and rear panel output check) Test Setup

2. Set both attenuators to 20dB.

3. Set both channels of the signal source as follows:

Frequency:	10MHz
Amplitude:	+13dBm

4. Measure the signal source output level with the power meter to verify an output level of +13dBm $\pm$ 0.1dBm on each channel. Adjust the source output level as necessary to achieve this result.

5.	HP 8508A setup	HP 70138A setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B] [POWER MEAS] [DISPLAY] dB	[Mag/Ph Measure] [Format Functn] [dB]	Set up for dBm in both displays.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration

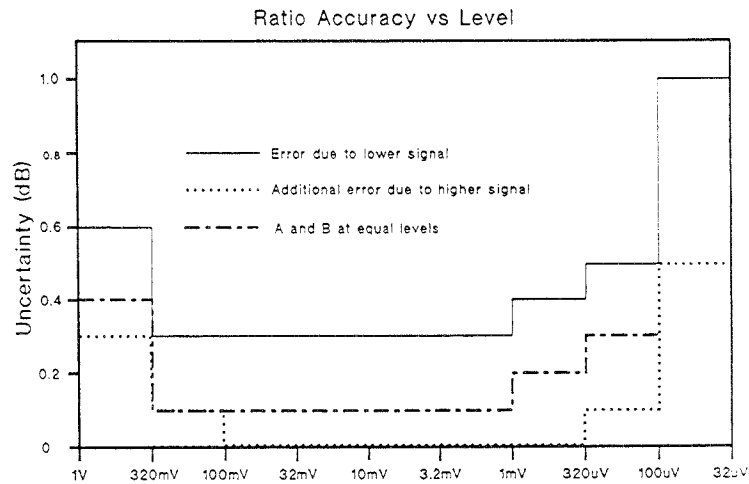
6. Vary the attenuator settings as shown in the Performance Test Table and note the channel readings at each step. Check that these are within the permitted tolerance.

Note the value of the appropriate rear panel output. This has a nominal sensitivity of 1mV per display count.

7. Repeat step 6 for Channel B.

4-14 VOLTAGE RATIO ACCURACY vs LEVEL

SPECIFICATIONS:



DESCRIPTION:

The voltage ratio accuracy is tested by applying known signal levels and comparing these with the results displayed by the Vector Voltmeter.

EQUIPMENT:

Instrument	Critical Specification	Recommended Model
Signal Source	Dual Channel (+13dBm per channel)	HP 3326A
Attenuator (2)	0 to 110dB in 10dB steps	HP 8496A/G Opt890*
Attenuator Driver	Required for HP 8496G	HP 11713A **
Phase Matched Cables		HP 11851B
Adaptor N(m)-BNC(m)		HP 1250-0082
Power Meter	Accuracy $\pm 0.02\text{dB}$ Ref Output 50MHz, 0.0dBm Traceable to NBS	HP 436A/HP 438A
Power Sensor		HP 8482A
DVM		HP 3456A

* Calibration data required.

** Required if HP 8496G programmable attenuator is used.

PROCEDURE:

1. Configure the equipment as shown in Figure 4-8.

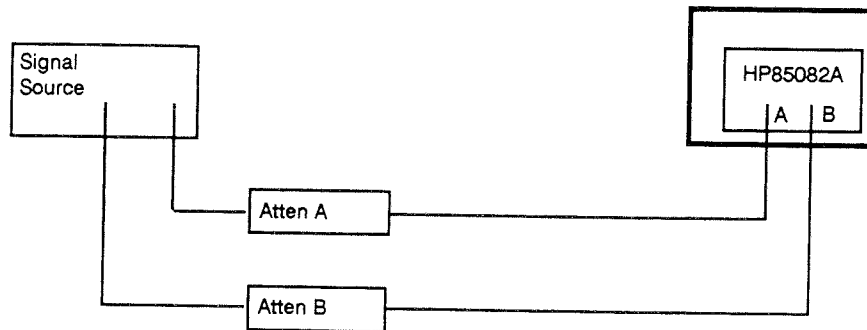


Figure 4-8. Voltage Ratio Accuracy vs Level Test Setup

2. Set both attenuators to 20dB.
3. Set both channels of the signal source as follows:

Frequency:	1.0MHz
Amplitude:	+ 13dBm

4. Measure the signal source output level with the power meter to verify an output level of + 13dBm $\pm$ 0.1dBm. Adjust the level as necessary to achieve this result.

5.	HP 8508A setup	HP 70138A setup	Function
	[PRESET]	[I-P]	Instrument preset
	[B/A MAG] [DISPLAY] dB	[Mag/Ph Measure] [B/A MAG] [Format Functn] [dB]	B/A ratio measurement, in dB, in DISPLAY 1.
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Self calibration

6. Enter the corrected attenuator figures in the Performance Test Record (which is contained at the end of the Performance Tests section).
7. Vary the attenuator settings as shown in the Performance Test Table and note the channel readings at each step.
8. Calculate the actual errors and check for compliance with the instrument specification.

4-15 SWR MEASUREMENT

SPECIFICATIONS:

SWR <1.2	300kHz to 1.5GHz	(Return loss = -21dB)
SWR <1.9	1.5GHz to 2.0GHz	(Return loss = -14dB)

DESCRIPTION:

The SWR of each input is measured over the operating frequency range of 300kHz to 2GHz.

EQUIPMENT:

Instrument	Critical Specification	Recommended Model
Network Analyzer		HP 8753A
S Parameter Test Set		HP 85046A
Cables (N)m-(N)m (2)		HP 11500A

PROCEDURE:

1. Connect the equipment as shown in Figure 4-9.

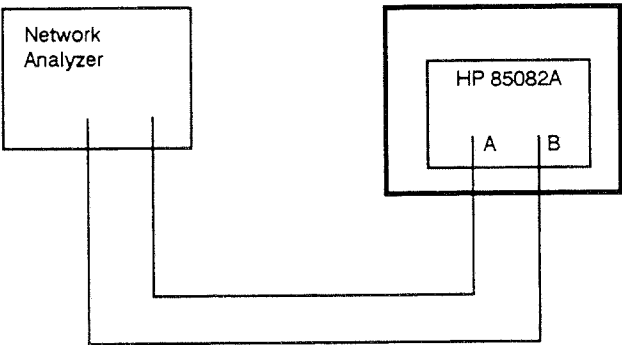


Figure 4-9. SWR Measurement Setup

2. Set up the Network Analyzer for SWR measurement.
3. Measure the SWR over the frequency range 300kHz to 2GHz and record the results in the Performance Test Record (which is contained at the end of the Performance Tests section).

Table 4-2. Performance Test Record (1 of 9)

Paragraph 4-7

ISOLATION BETWEEN CHANNELS (INPUT CROSSTALK)			
Frequency Range (MHz)	Frequency (MHz)	Isolation (dB in A)	Specification
1.0-3.0	1.0	_____	> -100 dB
3.0-5.0	4.0	_____	> -100 dB
5.0-8.0	6.5	_____	> -100 dB
8.0-15.0	11.5	_____	> -100 dB
15.0-25.0	20.0	_____	> -100 dB
25.0-50.0	35.0	_____	> -100 dB
50.0-80.0	65.0	_____	> -100 dB
80.0-150.0	100.0	_____	> -100 dB
150.0-250.0	200.0	_____	> -100 dB
250.0-500.0	400.0	_____	> -100 dB
500.0-1000.0	750.0	_____	> -80 dB
500.0-1000.0	1000.0	_____	> -80 dB
1000.0-2000.0	1200.0	_____	> -70 dB
1000.0-2000.0	1500.0	_____	> -70 dB
1000.0-2000.0	2000.0	_____	> -70 dB

Table 4-3. Performance Test Record (2 of 9)

Paragraph 4-8

REFERENCE CHANNEL LOCK LEVEL AND CHANNEL B NOISE FLOOR					
Frequency Range (MHz)	Frequency (MHz)	Channel A Input Level (dBm)	Lock OK?	Noise Floor Measured	Noise Floor Maximum
0.2-0.6	0.3	-47.0	—	—	-87 dBm
0.6-1.0	0.8	-47.0	—	—	-87 dBm
1.0-3.0	1.0	-47.0	—	—	-87 dBm
3.0-5.0	4.0	-57.0	—	—	-87 dBm
5.0-8.0	6.5	-57.0	—	—	-87 dBm
8.0-15.0	11.5	-57.0	—	—	-87 dBm
15.0-25.0	20.0	-57.0	—	—	-87 dBm
25.0-50.0	35.0	-57.0	—	—	-87 dBm
50.0-80.0	50.0	-57.0	—	—	-87 dBm
50.0-80.0	65.0	-57.0	—	—	-87 dBm
80.0-150.0	115.0	-57.0	—	—	-87 dBm
150.0-250.0	200.0	-57.0	—	—	-87 dBm
250.0-500.0	400.0	-57.0	—	—	-87 dBm
500.0-1000.0	750.0	-57.0	—	—	-87 dBm
500.0-1000.0	1000.0	-57.0	—	—	-87 dBm
1000.0-2000.0	1200.0	-57.0	—	—	-87 dBm
1000.0-2000.0	1500.0	-57.0	—	—	-87 dBm
1000.0-2000.0	2000.0	-57.0	—	—	-87 dBm

Table 4-4. Performance Test Record (3 of 9)

Paragraph 4-9

PHASE ACCURACY vs FREQUENCY at Reference Level			
Frequency Range (MHz)	Frequency (MHz)	Phase Reading (DISPLAY 2)	Tolerance
0.2-0.6	0.3	_____	± 4.2 Deg
0.6-1.0	0.8	_____	± 4.2 Deg
1.0-3.0	1.0	_____	± 1.2 Deg
3.0-5.0	4.0	_____	± 1.2 Deg
5.0-8.0	6.5	_____	± 1.2 Deg
8.0-15.0	11.5	_____	± 1.2 Deg
15.0-25.0	20.0	_____	± 1.2 Deg
25.0-50.0	35.0	_____	± 1.2 Deg
50.0-80.0	50.0	_____	± 1.2 Deg
50.0-80.0	65.0	_____	± 1.2 Deg
80.0-150.0	115.0	_____	± 4.2 Deg
150.0-250.0	200.0	_____	± 4.2 Deg
250.0-500.0	400.0	_____	± 6.2 Deg
500.0-1000.0	750.0	_____	± 6.2 Deg
500.0-1000.0	1000.0	_____	± 6.2 Deg
1000.0-2000.0	1200.0	_____	± 6.2 Deg
1000.0-2000.0	1500.0	_____	± 6.2 Deg
1000.0-2000.0	2000.0	_____	± 12.2 Deg

Table 4-5. Performance Test Record (4 of 9)

Paragraph 4-10

PHASE OFFSET ACCURACY			
Signal Source Phase Offset (Deg)	Vector Voltmeter Phase Reading (DISPLAY 2)	Display Error	Tolerance (Degrees)
+ 180	_____	_____	± 0.4
+ 150	_____	_____	± 0.4
+ 120	_____	_____	± 0.4
+ 90	_____	_____	± 0.4
+ 30	_____	_____	± 0.4
000	_____	_____	± 0.00
- 30	_____	_____	± 0.4
- 90	_____	_____	± 0.4
- 120	_____	_____	± 0.4
- 150	_____	_____	± 0.4
- 180	_____	_____	± 0.4

Table 4-6. Performance Test Record (5 of 9)

Paragraph 4-11

PHASE ACCURACY vs SIGNAL LEVEL					
Attenuator A Setting	Attenuator B Setting	Channel A Input Level	Channel B Input Level	Phase Reading	Tolerance (Degrees)
20 dB	20 dB	100mV	100mV	_____	0
20 dB	10 dB	100mV	320mV	_____	±0.4
20 dB	30 dB	100mV	32mV	_____	±0.4
20 dB	40 dB	100mV	10mV	_____	±0.4
20 dB	50 dB	100mV	3.2mV	_____	±0.4
20 dB	60 dB	100mV	1.0mV	_____	±0.4
20 dB	70 dB	100mV	320uV	_____	±0.8
10dB	20dB	320mV	100mV	_____	±0.4
30dB	20dB	32mV	100mV	_____	±0.4
40dB	20dB	10mV	100mV	_____	±0.4
50dB	20dB	3.2mV	100mV	_____	±0.4
60dB	20dB	1.0mV	100mV	_____	±0.4
70dB	20dB	320uV	100mV	_____	±0.8

Table 4-7. Performance Test Record (6 of 9)

Paragraph 4-12

AMPLITUDE ACCURACY vs FREQUENCY						
Frequency (MHz)	Power Meter Reading (M) (dBm)	Display Reading		Errors		Limits
		1	2	Channel A (M-1)	Channel B (M-2)	
0.300	_____	_____	_____	_____	_____	± 0.65
1.000	_____	_____	_____	_____	_____	± 0.35
10.000	_____	_____	_____	_____	_____	± 0.35
50.000	_____	_____	_____	_____	_____	± 0.35
100.000	_____	_____	_____	_____	_____	± 0.35
300.000	_____	_____	_____	_____	_____	± 0.65
700.000	_____	_____	_____	_____	_____	± 1.0
1000.000	_____	_____	_____	_____	_____	± 1.0
1500.000	_____	_____	_____	_____	_____	+ 1.20
		_____	_____	_____	_____	-2.00
2000.00	_____	_____	_____	_____	_____	+ 1.20
		_____	_____	_____	_____	-2.0

Table 4-8. Performance Test Record (7 of 9)

Paragraph 4-13

AMPLITUDE ACCURACY - CHANNEL A (Source Output +13dBm, ± 0.1 dBm)						
Attenuator A Setting	Attenuator 'A' Cal Data (A)*	Channel A Input Level (L) = (13-A)	Display 1 Reading (D)	Measurement Error (E) = (L-D)	Limits	Rear Panel Output 1
20dB	_____	_____	_____	_____	± 0.0	_____
10dB	_____	_____	_____	_____	± 0.3	_____
0dB	_____	_____	_____	_____	± 0.6	_____
30dB	_____	_____	_____	_____	± 0.1	_____
40dB	_____	_____	_____	_____	± 0.3	_____
50dB	_____	_____	_____	_____	± 0.3	_____
60dB	_____	_____	_____	_____	± 0.3	_____
70dB	_____	_____	_____	_____	± 0.4	_____

* Data from Calibration Certificate.

AMPLITUDE ACCURACY - CHANNEL B (Source Output +13dBm, ± 0.1 dBm)						
Attenuator B Setting	Attenuator 'B' Cal Data (B)*	Channel B Input Level (L) = (13-B)	Display 2 Reading (D)	Measurement Error (E) = (L-D)	Limits	Rear Panel Output 2
20dB	_____	_____	_____	_____	± 0.0	_____
10dB	_____	_____	_____	_____	± 0.3	_____
0dB	_____	_____	_____	_____	± 0.6	_____
30dB	_____	_____	_____	_____	± 0.1	_____
40dB	_____	_____	_____	_____	± 0.3	_____
50dB	_____	_____	_____	_____	± 0.3	_____
60dB	_____	_____	_____	_____	± 0.3	_____
70dB	_____	_____	_____	_____	± 0.4	_____
80dB	_____	_____	_____	_____	± 0.5	_____
90dB	_____	_____	_____	_____	± 1.0	_____

* Data from Calibration Certificate.

Table 4-9. Performance Test Record (8 of 9)

Paragraph 4-14

VOLTAGE RATIO ACCURACY vs LEVEL (for Level A = Level B up to 300MHz)								
Nominal I/P Level	Atten A Setting (dB)	Atten B Setting (dB)	Atten A Actual * A	Atten B Actual * B	(B-A) Actual (R)	Display Reading (D)	Error (D-R)	Spec (dB)
100mV	20	20	_____	_____	_____	_____	_____	±0.1
320mV	10	10	_____	_____	_____	_____	_____	±0.1
1000mV	0	0	_____	_____	_____	_____	_____	±0.6
32mV	30	30	_____	_____	_____	_____	_____	±0.1
10mV	40	40	_____	_____	_____	_____	_____	±0.1
3.2mV	50	50	_____	_____	_____	_____	_____	±0.1
1.0mV	60	60	_____	_____	_____	_____	_____	±0.1
320uV	70	70	_____	_____	_____	_____	_____	±0.2

* Data from Calibration Certificate.

B/A RATIO ACCURACY vs LEVEL (where A and B vary)								
Nominal I/P Level A B	Atten A Setting (dB)	Atten B Setting (dB)	Atten A Actual * A	Atten B Actual * B	(B-A) Actual (R)	Display Reading (D)	Error (D-R)	Spec (dB)
100mV	100mV	20	20	_____	_____	_____	_____	±0.1
100mV	32mV	20	30	_____	_____	_____	_____	±0.3
100mV	10mV	20	40	_____	_____	_____	_____	±0.3
100mV	3.2mV	20	50	_____	_____	_____	_____	±0.3
100mV	1.0mV	20	60	_____	_____	_____	_____	±0.3
100mV	320uV	20	70	_____	_____	_____	_____	±0.4
100mV	100uV	20	80	_____	_____	_____	_____	±0.5
100mV	32uV	20	90	_____	_____	_____	_____	±1.0
100mV	320mV	20	10	_____	_____	_____	_____	±0.6
100mV	1000mV	20	0	_____	_____	_____	_____	±0.6

* Data from Calibration Certificate.

Table 4-10. Performance Test Record (9 of 9)

Paragraph 4-15

SWR MEASUREMENT		
Frequency Range	Measured SWR	Specification
300kHz - 1.5GHz	_____	< 1.2
1.5GHz - 2.0GHz	_____	< 1.5

Adjustments

Section 5

5-1 INTRODUCTION

This section describes the adjustment procedures required to enable the HP 8508A Vector Voltmeter mainframe or the HP 70138A MMS Vector Voltmeter module with the HP 85082A 50 ohm Input Module to meet the specifications listed in Table 1-2 of this manual. Adjustments should only be made after determining that the instrument is out of calibration or if a repair has been carried out.

5-2 WARM-UP TIME

The HP 8508A or HP 70138A Vector Voltmeter with HP 85082A must be switched on for a minimum of 30 minutes before carrying out any adjustments. This allows the instrument to reach a stable operating temperature.

5-3 SAFETY CONSIDERATIONS

WARNING

PROCEDURES DESCRIBED IN THIS SECTION ARE PERFORMED WITH THE MAINFRAME PROTECTIVE COVERS REMOVED AND POWER SUPPLIED TO THE INSTRUMENT. SERVICING SHOULD ONLY BE PERFORMED BY TRAINED PERSONNEL WHO ARE AWARE OF THE HAZARDS INVOLVED.

Anti-Static Precautions

The printed circuit board contained in this instrument has components and devices which are susceptible to damage by electrostatic discharge (ESD). To minimize the risks of damaging or decreasing the reliability of the instrument, the following procedures and cautions should be observed when servicing the instrument.

Static-free Workstation

All servicing should be carried out at a static-free workstation whenever practical.

De-soldering

When de-soldering components, ensure that the soldering iron is grounded. Always use a metalized solder remover.

Adjustments

Anti-Static Freezer Spray

When attempting to locate a temperature related fault, use only an approved anti-static freezer spray.

Anti-Static Products

Table 5-1 contains details of anti-static products which are available from Hewlett-Packard.

Table 5-1. Anti-Static Products

Product	HP Part Number
Anti-static workstation kit	9300-0792
Metalized Solder Remover	8690-0227
Wrist-strap and cord	9300-0970

5-4 EQUIPMENT REQUIRED

All adjustment procedures contain a list of required test equipment. The test equipment is also identified by callouts in the test setup diagrams, where included. If substitutions must be made for the specified test equipment, refer to the Recommended Test Equipment table in the HP 8508A Vector Voltmeter mainframe manual or the HP 70138A MMS Vector Voltmeter module manual for the minimum specifications. It is important that the test equipment meet the critical specifications listed in the table if the Vector Voltmeter and the 50 ohm Input Module are to meet their performance requirements.

Note: Use a non-metalic tool whenever possible (HP Part Number 8830-0024).

When performing the adjustments to an HP 85082A which is contained in an HP 70138A MMS Vector Voltmeter, a module extender (HP Part Number 08508-60032) is required. Access to the delay adjustment can then be made from the underside of the HP 85082A.

5-5 POST REPAIR ADJUSTMENTS

In the event of a module repair, it will be necessary to carry out all the adjustments as listed in Table 5-2.

5-6 RELATED ADJUSTMENTS

Several of the HP 85082A adjustments are interdependent and isolated adjustments should not be attempted. Because of their interactive nature, the adjustments for SRD Bias, Channel Bias, and Delay should be checked at least twice.

5-7 ADJUSTABLE COMPONENTS

Table 5-2 lists all adjustable components in the HP 85082A 50 ohm Input Module.

Table 5-2. Adjustable Components

Reference Designator	Adjustment Name	Adjustment Paragraph
A6R32	SRD Bias	5-8
A6R15/R115	Channel A and B Bias	5-8
A6DD 01	Delay Line	5-8
A6R10/R110	Channel A and B Symmetry	5-9
A6R3/R103	Channel A and B Gain	5-10
A6R38	LF Phase	5-11

5- 8 Set up the SRD Bias, Channel A and B Bias, and the Delay Line Adjustments

DESCRIPTION

The bias level of the SRD is adjusted for a maximum reading in the UHF amplitude response. The Channel Bias is set for optimum flatness of the high frequency amplitude, and the Delay Line is adjusted to compensate for the differences in electrical length within the HP 85082A.

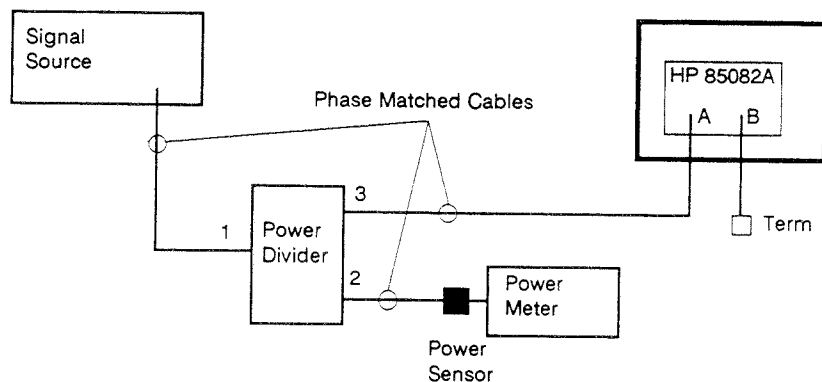


Figure 5-1. SRD Bias Adjust Setup

EQUIPMENT

Instrument	Recommended Model
Signal Source	HP 8642B
Power Divider	HP 11636A
Power Meter	HP 436A/437A/438A
Power Sensor	HP 8482A
Phase Matched Cables	HP 11851B
50ohm Termination	HP 909C
Adaptor N(f)-N(f)	HP 1250-0777

PROCEDURE

This procedure is in three interdependent parts. Perform all three parts in sequence at least twice to ensure correct adjustment.

A. SRD Bias Adjustment

1. Configure the equipment as shown in Figure 5-1.
2. Switch on the equipment and allow to warm up for 30 minutes.
3. On the signal generator:

Frequency	390kHz
Level	-1.0dBm. Adjust for a power meter reading of -7.0dBm $\pm$ 0.1dBm.

4.

HP 8508A Setup [PRESET]	HP 70138A Setup [I-P]	Function: DISPLAY 1 reads Channel A.
----------------------------	----------------------------	---

5. Adjust A6R32 to obtain a maximum reading on DISPLAY 1.

NOTE: Adjustment of A6R32 changes the calibration settings for the entire HP 85082A.

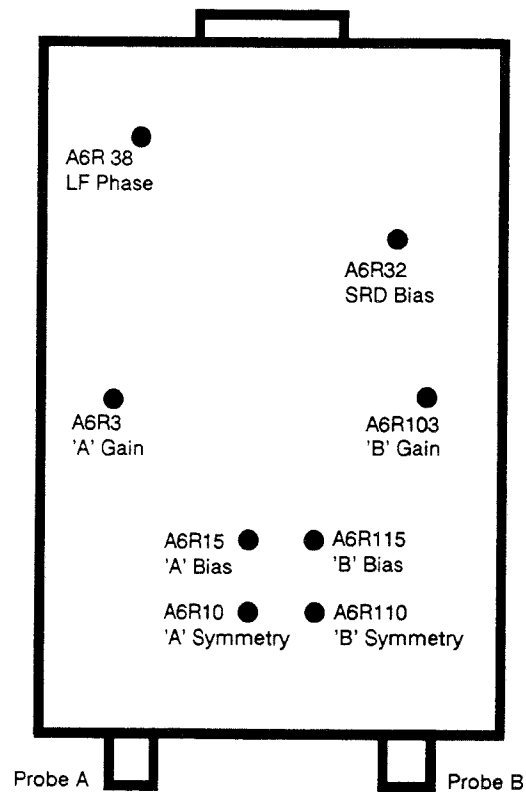


Figure 5-2. Input Module Adjustment Locations

B. Channels A and B Bias Adjustment (Amplitude vs Frequency)

DESCRIPTION

The bias level is adjusted for optimum flatness of the high frequency amplitude.

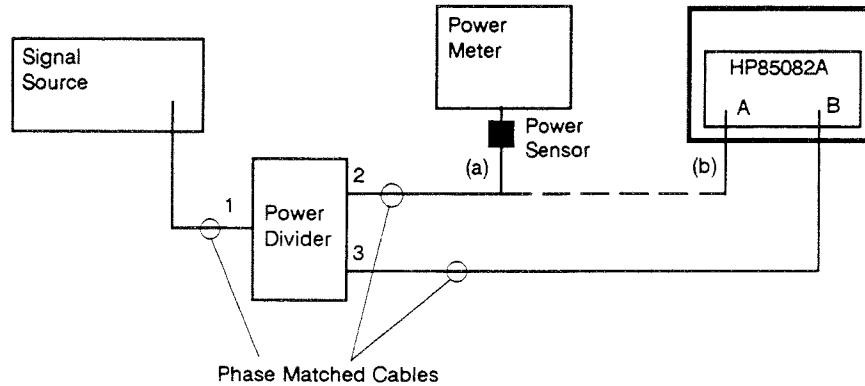


Figure 5-3 . Bias Adjustment Setup

PROCEDURE

1. Configure the equipment as shown in Figure 5-3 step (a). Connect the power meter to port 2 of the power divider and Channel B of the HP 85082A to port 3, using the phase matched cables.

2. On the signal generator:

Frequency	50MHz
Level	-1.0dBm. Adjust for a power meter reading of -7.0dBm $\pm$ 0.1dBm.

3. Normalize the power meter reading. The power meter should now read "0".

4. Reconfigure the equipment as shown in Figure 5-3 step (b). Connecting Channel A of the HP 85082A to port 2 of the power divider and Channel B of the HP 85082A to port 3, using the phase matched cables.

5.	HP 8508A Setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Preset status
	[B]	[Mag/Ph Measure]	
	[POWER MEAS]	[DISPLAY 2] [B]	
	[DISPLAY] dB	[Format Functn] [dB]	
	[SHIFT] [SAVE REF]	[Ref] [SAVE REF]	Normalize displays

6. Reconfigure the equipment as in Figure 5-3 step (a).

7. Readjust the signal generator as follows, and change the power meter calibration factor to accommodate the change of frequency.

Frequency	1.5GHz
Output level	Adjust for a power meter reading of "0".

8. Reconfigure the equipment as shown in Figure 5-3 step (b).

9. Adjust A6R15 (Channel A Bias adjustment) for a reading of 0.6dB in DISPLAY 1.

The process is now repeated for the Channel B adjustment.

10. Reconfigure the equipment as shown in Figure 5-3 step (a).

11. Readjust the signal generator as follows, and change the power meter calibration factor to accommodate the change of frequency.

Frequency	50MHz
Output level	Adjust for a power meter reading of "0".

12. Reconfigure the equipment as shown in Figure 5-3 step (b).

13.	HP 8508A Setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Preset status
	[B]	[Mag/Ph Measure]	
	[POWER MEAS]	[DISPLAY 2] [B]	
	[DISPLAY] dB	[Format Functn] [dB]	
	[SHIFT] [SAVE REF]	[Ref] [SAVE REF]	Normalize Displays

14. Reconfigure the equipment as shown in Figure 5-3 step (a).

15. Readjust the signal generator as follows, and change the power meter calibration factor to accommodate the change of frequency.

Frequency	1.5GHz
Output level	Adjust for a power meter reading of "0".

16. Reconfigure the equipment as shown in Figure 5-3 step (b).

17. Adjust A6R115 (Channel B Bias adjustment) for a reading of 0.6dB in DISPLAY 2.

18. Cancel the normalization of the power meter.

C. DELAY LINE Adjustment (Phase vs Frequency)

DESCRIPTION

This adjustment compensates for the differences in electrical length of the probes and cables.

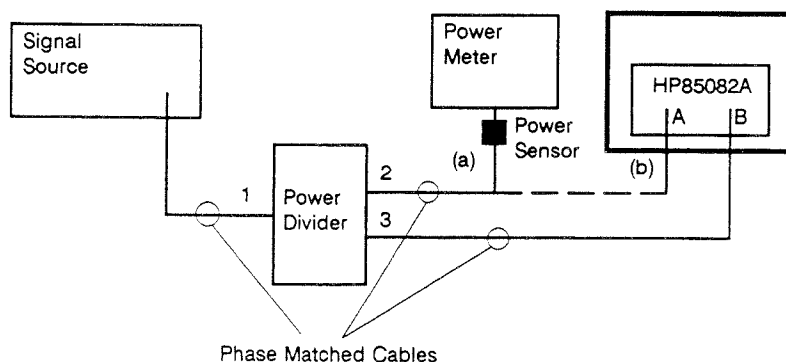


Figure 5-4. Delay Line Adjust Setup

PROCEDURE

1. Configure the equipment as shown in Figure 5-4 step (a). Connect the power meter to port 2 of the power divider and Channel B of the HP 85082A to port 3, using the phase matched cables.
2. On the signal generator:

Frequency	50 MHz
Output level	-1.0dBm

3. Adjust the signal generator output level to produce a power meter reading of $-7.00\text{dBm} \pm 0.1\text{dBm}$.
4. Normalize the power meter reading which should now read "0".
5. Reconfigure the equipment as shown in Figure 5-4 step (b). Connecting Channel A of the HP 85082A to port 2 of the power divider and Channel B of the HP 85082A to port 3, using the phase matched cables.

6.	HP 8508A Setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Preset Status
	[B-A PHASE]	[Mag/Ph Measure] [DISPLAY 2] [B-A PHASE]	DISPLAY 1 - Magnitude DISPLAY 2 - Phase
	[SHIFT] [CAL TEST]	[Misc] [CAL]	Instrument Calibration
	[SHIFT] [SAVE REF]	[Ref] [SAVE REF]	Normalizes Instrument

7. Reconfigure the equipment as shown in Figure 5-4 step (a).

8. Readjust the signal generator as follows and change the power meter calibration factor to accommodate the change of frequency.

Frequency	1.5GHz
Signal level	Adjust for a power meter reading of "0".

9. Disconnect the power meter and reconfigure the equipment as shown in Figure 5-4 step (b).

10. Note the phase reading in DISPLAY 2. If this is within the range ± 2.0 deg, it will not be necessary to make any delay adjustment. However, if the reading is greater than ± 2.0 deg, then continue with the procedure.

NOTE: Twists in the probe cables or loose cable connections could affect this reading.

11. The delay adjuster should be set to give a reading of 0 in DISPLAY 2.

The delay adjustment is on the underside of the HP 85082A and access to this is dependent upon the mainframe being used.

HP 8508A: In this case, the bottom cover should be removed from the HP 8508A Vector Voltmeter mainframe and the instrument turned onto its right side. With the HP 85082A Input Module installed in the HP 8508A, the delay adjustment can be accessed through a hole in the bottom panel of the HP 8508A.

In some early instruments, this hole may not have been provided. However, information is given in Section 7 of the HP 8508A Service Manual as to how this hole can be added.

The alternative process is to extend the HP 85082A Input Module from the HP 8508A Vector Voltmeter mainframe using a module extender (HP Part Number 08508-60032). Access to this adjustment can then be made from the underside of the HP 85082A.

HP 70138A: In this case, the HP 85082A Input Module should be used with the module extender (HP Part Number 08508-60032). Access to the delay adjustment can then be made from the underside of the HP 85082A.

12. Interchange the connections at the input of the HP 85082A and note the phase reading obtained in DISPLAY 2.

13. The delay adjuster should now be adjusted for a reading equivalent to half the value obtained in step 12.

14. Cancel the normalization of the power meter.

NOTE: After completing this adjustment, repeat the SRD Bias, Channel Bias, and Delay adjustments at least once more until the results are stable. When the results are stable, you can continue with the other adjustment procedures.

5-9 Set up the SYMMETRY Adjustment for Channels A and B

DESCRIPTION

Minimizes the residual signal at the sampler inputs.

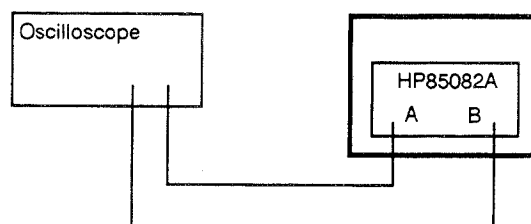


Figure 5- 5. Symmetry Adjust Setup

EQUIPMENT

Instrument	Recommended Model
Oscilloscope 275MHz	HP 54100D
Phase Matched Cables	HP 11851B
Adaptors N(f)-BNC(m)	HP 1250-0077

PROCEDURE

1. Configure the equipment as shown in Figure 5-5.
2. Switch on the equipment and allow to warm up for 30 minutes.
3. On the oscilloscope:

Display	Alt
Sweep Speed	1us/div
Sensitivity	10uV/div
Input Coupling	50ohm
Triggering	As required.

4.	HP 8508A Setup:	HP 70138A Setup:	Function:
	[PRESET]	[I-P]	Instrument Preset
	[LOCK RANGE] [SHIFT] [VIEW RANGE] 'up'/'down' arrow keys to select 1000-2000MHz	[Lock Range] [1-2GHz]	Select 1-2 GHz frequency range

5. Adjust A6R10 (Channel A Symmetry) and A6R110 (Channel B Symmetry) in turn so that the sampler pulses displayed on the oscilloscope traces are symmetrical about the baseline.

The pulse leakage display is typically spikes in the order of 10mV in amplitude and they should be symmetrical about the baseline.

NOTE: If this result cannot be achieved, sampler damage is indicated.

6. Cancel the [LOCK RANGE] or [AUTO LOCK] as appropriate.

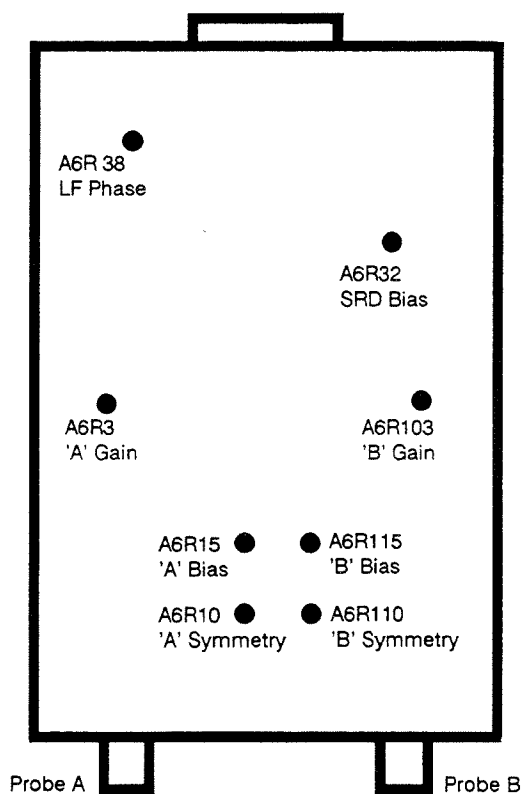


Figure 5-6. Input Module Adjustment Locations

5-10 Adjustment of the Gain of Channels A and B

DESCRIPTION

These adjustments set up the overall absolute gain of the HP 85082A Input Module. Note that this adjustment changes the gain at all frequencies.

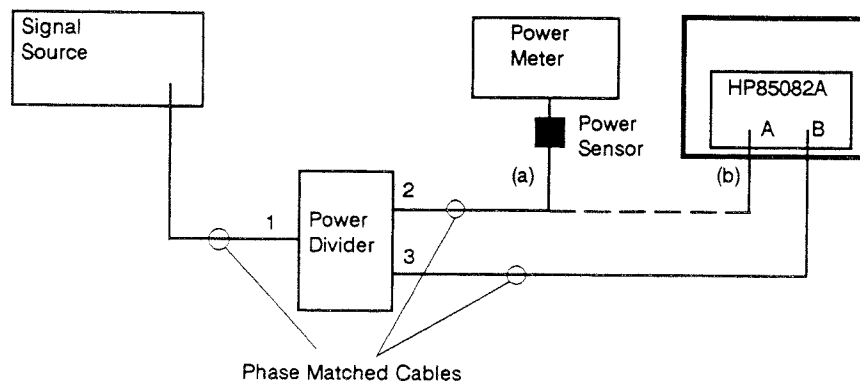


Figure 5-7. Channel Gain Setup

EQUIPMENT

Instrument	Recommended Model
Signal Source	HP 8642A
Power Divider	HP 11636A
Power Meter	HP 436A/437A/438A
Power Sensor	HP 8482A
Phase Matched Cables	HP 11851B
Adaptor N(f)-N(f)	HP 1250-0777

PROCEDURE

1. Configure the equipment as shown in Figure 5-7 step (a), using the phase matched cables to connect the power divider to the signal source, power meter, and HP 85082A.

2. Switch on the equipment and allow to warm up for 30 minutes.

3. On the signal generator:

Frequency	50 MHz
Level	-1.0 dBm

4. Adjust the signal generator output as necessary for a power meter reading of $-7.0\text{dBm} \pm 0.1\text{dBm}$. Record the value of the power meter reading.

5. Interchange the cable connections so that port 2 of the power divider is connected to Channel A of the HP 85082A and port 3 is connected to the power meter. Record the value of the power meter reading.

6. Reconfigure the equipment as in Figure 5-7 step (b).

7.	HP 8508A Setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Instrument preset
	[POWER MEAS] [DISPLAY] dB	[Mag/Ph Measure] [DISPLAY 2] [B] [Format Functn] [dB]	dBm magnitude in both displays
	[SHIFT] [CAL/TEST]	[Misc] [CAL]	Instrument calibration

8. Adjust A6R3 (Channel A Gain) until the reading in DISPLAY 1 is the same as the power meter reading obtained in step 4.

9. Adjust A6R103 (Channel B Gain) until the reading in DISPLAY 2 is the same as the power meter reading obtained in step 5.

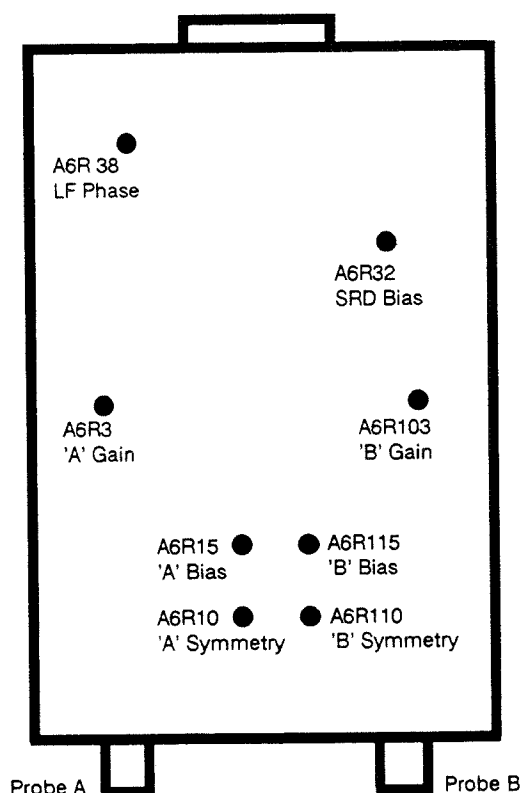


Figure 5-8. Input Module Adjustment Locations

5-11 Set up the Module Phase and Impedance

DESCRIPTION

This adjustment is controlled by an internal test routine which will affect the phase readings at all frequencies.

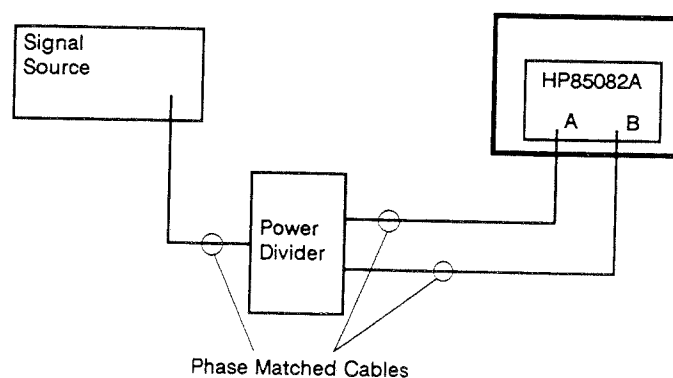


Figure 5-9. LF Phase Adjust Setup

EQUIPMENT

Instrument	Recommended Model
Signal Source	HP 8642B
Power Divider	HP 11636A
Phase Matched Cables	HP 11851B

PROCEDURE

1. Configure the equipment as shown in Figure 5-9.
2. Switch on the equipment and allow to warm up for 30 minutes.
3. On the signal generator

Frequency	50 MHz
Level	200mV

4.	HP 8508A Setup	HP 70138A Setup	Function
	[PRESET]	[I-P]	Instrument preset
	[SHIFT] [POWER MEAS]	[MISC] [7] [0] [1] [3] [8] [MISC] [SELF TEST MENU]	Instrument into self-test setup mode.
	'up'/'down' keys for test "6"	'up'/'down' keys for test "6"	Setup code for test 6.
	[HOLD VALUE] check that indicator is on	[Misc] [TEST ON]	Runs test.

5. **HP 8508A:** DISPLAY 1 should show the characters 50 (this is the identification for the HP 85082A 50ohm Input Module). If other characters are displayed, adjust A6R38 until the display shows the characters 50 in DISPLAY 1.

HP 70138A: At the right hand of the MMS screen, the lower display should show the characters 50 (this is the identification for the HP 85082A 50ohm Input Module). If other characters are displayed, adjust A6R38 until the characters 50 appears.

6. **HP 8508A:** Adjust A6R38 for a reading of 0.0 in DISPLAY 2, and 50 in DISPLAY 1. Select [HOLD VALUE] to cancel the test.

HP 70138A: Adjust A6R38 for a reading of 0.0 in the upper display at the right-hand side of the MMS screen, and a reading of 50 in the lower display. Select [Misc] [TEST OFF].

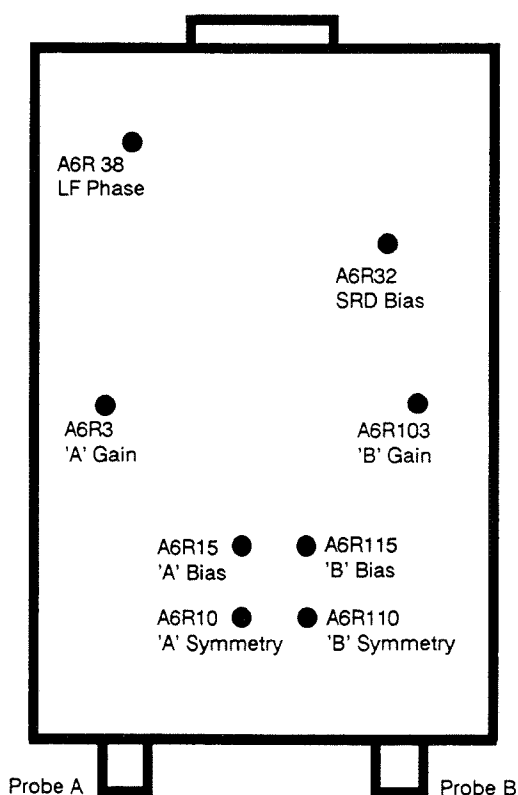


Figure 5-10. Input Module Adjustment Locations

Adjustments

Replaceable Parts

Section 6

6-1 INTRODUCTION

This section contains information for ordering parts. Table 6-2 lists the abbreviations used in the parts list and throughout the manual. Table 6-3 lists all replaceable parts in reference designator order and Table 6-4 lists the names and addresses that correspond to the manufacturer's code number used in the parts list.

6-2 ABBREVIATIONS

Table 6-2 lists all the abbreviations used in the parts lists and throughout the manual. In some cases, two forms of an abbreviation are given, one in all capital letters and the other in partial or no capital letters. This is because the abbreviations used in the parts list are always all capitals; however, in other parts of the manual, abbreviations are used in partial or no capital letters.

6-3 REPLACEABLE PARTS LIST

Table 6-3 is organized as follows:

- (a) Electrical assemblies and their components in alpha-numeric order followed by reference designation.
- (b) Chassis-mounted parts in alpha-numeric order by reference designation.
- (c) Miscellaneous parts.

The information given for each part consists of the following:

- (a) The Hewlett-Packard part number.
- (b) Part number check digit (CD).
- (c) The total quantity (QTY) in the instrument.
- (d) The description of the part.
- (e) A typical manufacturer of the part (in a five-digit code).
- (f) The manufacturer's part number for that part.

The total quantity for each part is given only once - at the first appearance of the part in the list.

6-4 ORDERING INFORMATION

To order a part listed in the replaceable parts list table, quote the Hewlett-Packard part number (with the check digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the Replaceable Parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

6-5 DIRECT MAIL ORDER SYSTEM

Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

- (a) Direct ordering and shipment from the HP Parts Centre in Roseville, California.
- (b) No maximum or minimum order value on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).
- (c) Prepaid transportation (there is a small handling charge for each order).
- (d) No invoices - to provide these advantages, a cheque or money order must accompany each order.

Mail order forms and specific ordering information are available through your local HP office. Addresses and phone numbers are located at the back of this manual.

Table 6-1. Reference Designations

REFERENCE DESIGNATIONS			
A	assembly	E	miscellaneous electrical part
AT	attenuator; isolator; termination	F	fuse
B	fan; motor	FL	filter
BT	battery	H	hardware
C	capacitor	HY	circulator
CP	coupler	J	electrical connector (stationary portion); jack
CR	diode; diode thyristor; varactor	K	relay
DC	directional coupler	L	coil; inductor
DL	delay line	M	meter
DS	annunciator; signaling device (audible or visual); lamp; LED	MP	miscellaneous mechanical part
		P	electrical connector (movable portion); plug
		Q	transistor; SCR; triode thyristor; FET
		R	resistor
		RT	thermistor
		S	switch
		T	transformer
		TB	terminal board
		TC	thermocouple
		TP	test point
		U	integrated circuit; microcircuit
		V	electron tube
		VR	voltage regulator; breakdown diode
		W	cable; transmission path; wire
		X	socket
		Y	crystal unit (piezo-electric or quartz)
		Z	tuned cavity; tuned circuit

Table 6-2. Abbreviations (1 of 2)

ABBREVIATIONS			
A	ampere	COEF	coefficient
ac	alternating current	COM	common
ACCESS	accessory	COMP	composition
ADJ	adjustment	COMPL	complete
A/D	analog-to-digital	CONN	connector
AF	audio frequency	CP	cadmium plate
AFC	automatic frequency control	CRT	cathode-ray tube
AGC	automatic gain control	CTL	complementary transistor logic
AL	aluminum	CW	continuous wave
ALC	automatic level control	cw	clockwise
AM	amplitude modulation	cm	centimeter
AMPL	amplifier	D/A	digital-to-analog
APC	automatic phase control	dB	decibel
ASSY	assembly	dBm	decibel referred to 1 mW
AUX	auxiliary	dc	direct current
avg	average	deg	degree (temperature interval or difference)
AWG	American wire gauge	...°	degree (plane angle)
BAL	balance	°C	degree Celsius (centigrade)
BCD	binary coded decimal	°F	degree Fahrenheit
BD	board	°K	degree Kelvin
BECE	beryllium copper	DEPC	deposited carbon
BFO	beat frequency oscillator	DET	detector
BH	binder head	diam	diameter
BKDN	breakdown	DIA	diameter (used in parts list)
BP	bandpass	DIFF AMPL	differential amplifier
BPF	bandpass filter	div	division
BRS	brass	DPDT	double-pole, double-throw
BWO	backward-wave oscillator	DR	drive
CAL	calibrate	DSB	double sideband
ccw	counter-clockwise	DTL	diode transistor logic
CER	ceramic	DVM	digital voltmeter
CHAN	channel	ECL	emitter coupled logic
cm	centimeter	EMF	electromotive force
CMO	cabinet mount only		
COAX	coaxial		
		EDP	electronic data processing
		ELECT	electrolytic
		ENCAP	encapsulated
		EXT	external
		F	farad
		FET	field-effect transistor
		F/F	flip-flop
		FH	flat head
		FIL H	fillister head
		FM	frequency modulation
		FP	front panel
		FREQ	frequency
		FXD	fixed
		g	gram
		GE	germanium
		GHz	gigahertz
		GL	glass
		GRD	ground(ed)
		H	henry
		h	hour
		HET	heterodyne
		HEX	hexagonal
		HD	head
		HDW	hardware
		HF	high frequency
		HG	mercury
		HI	high
		HP	Hewlett-Packard
		HPF	high pass filter
		HR	hour (used in parts list)
		HV	high voltage
		Hz	Hertz
		IC	integrated circuit
		ID	inside diameter
		IF	intermediate frequency
		IMPG	impregnated
		in	incandescent
		INCL	include(s)
		INP	input
		INS	insulation
		INT	internal
		kg	kilogram
		kHz	kilohertz
		k	kilohm
		kV	kilovolt
		lb	pound
		LC	inductance-capacitance
		LED	light-emitting diode
		LF	low frequency
		LG	long
		LH	left hand
		LIM	limit
		LIN	linear taper (used in parts list)
		LK WASH	lock washer
		LO	low; local oscillator
		LOG	logarithmic taper (used in parts list)
		log	logarithm(ic)
		LPF	low pass filter
		LV	low voltage
		m	meter (distance)
		mA	milliampere
		MAX	maximum
		M	megohm
		MEG	meg (10 ⁶) (used in parts list)
		MET FLM	metal film
		MET OX	metallic oxide
		MF	medium frequency; microfarad (used in parts list)
		MFR	manufacturer
		mg	milligram
		MHz	megahertz
		mH	millihenry
		mho	mho
		min	minute (time)
			minute (plane angle)
		MINAT	miniature
		mm	millimeter

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6-2. Abbreviations (2 of 2)

MOD mo dulator	OD outside diameter	PWV peak working voltage	TD time delay
MOM momentary	OH oval head	RC resistance-capacitance	TERM terminal
MOS metal-oxide semiconductor	OP AMPL operational amplifier	RECT rectifier	TFT thin-film transistor
ms millisecond	OPT option	REF reference	TGL toggle
MTG mounting	OSC oscillator	REG regulated	THD thread
MTR meter (indicating device)	OX oxide	REPL replaceable	THRU through
mV millivolt	oz ounce	RF radio frequency	TI titanium
mVac millivolt, ac	Ω ohm	RFI radio frequency interference	TOL tolerance
mVdc millivolt, dc	P peak (used in parts list)	RH round head; right hand	TRIM trimmer
mVpk millivolt, peak	PAM pulse-amplitude modulation	RLC resistance-inductance-capacitance	TSTR transistor
mVp-p millivolt, peak-to-peak	PC printed circuit	RMO rack mount only	TTL transistor-transistor logic
mVrms millivolt, rms	PCM pulse-code modulation; pulse-count modulation	rms root-mean-square	TV television
mW milliwatt	PDM pulse-duration modulation	RND round	TVI television interference
MUX multiplex	pF picofarad	ROM read-only memory	TWT traveling wave tube
MY mylar	PH BRZ phosphor bronze	R&P rack and panel	U micro (10^{-6}) (used in parts list)
μ A microampere	PHL Phillips	RWV reverse working voltage	UF microfarad (used in parts list)
μ F microfarad	PIN positive-intrinsic-negative	S scattering parameter	UHF ultrahigh frequency
μ H microhenry	PIV peak inverse voltage	s second (time)	UNDEF undefined
μ mho micromho	pk peak	S-B second (plane angle)	UNREG unregulated
μ s microsecond	PL phase lock	S-B slow-blow (fuse) (used in parts list)	V volt
μ V microvolt	PLO phase lock oscillator	SCR silicon controlled rectifier; screw	VA voltampere
μ Vac microvolt, ac	PM phase modulation	SE selenium	Vac volts, ac
μ Vdc microvolt, dc	PNP positive-negative-positive	SECT sections	VAR variable
μ Vpk microvolt, peak	P/O part of	SEMICON semiconductor	VCO voltage-controlled oscillator
μ Vp-p microvolt, peak-to-peak	POLY polystyrene	SHF superhigh frequency	Vdc volts, dc
μ Vrms microvolt, rms	PORC porcelain	SI silicon	VDCW volts, dc, working (used in parts list)
μ W microwatt	POS positive; position(s) (used in parts list)	SIL silver	V(F) volts, filtered
NC no connection	POSN position	SL slide	VFO variable-frequency oscillator
N/C normally closed	POT potentiometer	SNR signal-to-noise ratio	VHF very-high frequency
NE neon	p-p peak-to-peak	SPDT single-pole, double-throw	Vpk volts, peak
NEG negative	PP peak-to-peak (used in parts list)	SPG spring	Vp-p volts, peak-to-peak
nF nanofarad	PPM pulse-position modulation	SR split ring	Vrms volts, rms
NI PL nickel plate	PREAMPL preamplifier	SPST single-pole, single-throw	VSWR voltage standing wave ratio
N/O normally open	PRF pulse-repetition frequency	SS Service Sheet	VTO voltage-tune oscillator
NOM nominal	PRR pulse repetition rate	SSB single sideband	VTVM vacuum-tube voltmeter
NORM normal	PT point	SST stainless steel	V(X) volts, switched
NPN negative-positive-negative	PTM pulse-time modulation	STL steel	W watt
NPO negative-positive zero (zero temperature coefficient)	PWM pulse-width modulation	SQ square	W/ with
NRFR not recommended for field replacement		SWR standing-wave ratio	WIV working inverse voltage
NSR not separately replaceable		SYNC synchronize	WW wirewound
ns nanosecond		T timed (slow-blow fuse)	W/O without
nW nanowatt		TA tantalum	YIG yttrium-iron-garnet
OBD order by description		TC temperature compensating	Z ₀ characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^9
M	mega	10^6
k	kilo	10^3
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code
	85082-69100	7	1	Rebuilt 50 ohm Input Module	
	85081-20105	9 5	1	Rod, Module Locking	
	85081-20107	1	1	Knob, Module Locking	
	0510-0070	7	2	Retainer, Crsnt.Ext	
				Ring Retaining	
	85082-00001	3	1	Label - Horizontal (HP 8508A System)	
	85082-00005	7	1	Label - Vertical (HP 70138A System)	

Replaceable Parts

Mfr Code	Manufacturer Name	Address	Zip Code
08792	PAPST-MOTOPEN KG	SCHWAPZVALD GM	7742
09188	VTM A/S	GLOSTRUP DK	2080
09027	SCHUPTER AG	LUZERN SW	CH-60
50167	FUJITSU MICROELECTRONICS INC	SANTA CLARA CA US	95054
54013	HITACHI AMERICA LTD	SUNNYVALE CA US	94086
00779	AMP INC	HARRISBURG PA US	17111
01121	ALLEN-BRADLEY CO INC	EL PASO TX US	79935
01295	TEXAS INSTRUMENTS INC	DALLAS TX US	75265
02111	SPECTROL ELECTRONICS CORP	CITY OF IND CA	91745
03508	GE CO SEMICONDUCTOR PROD DEPT	AUBURN NY US	13201
03888	K D I PYROFILM CORP	WHIPPANY NJ	07981
04713	MOTOROLA INC SEMI-COND PROD	PHOENIX AZ US	85008
07263	FAIRCHILD CORP	MOUNTAIN VIEW CA US	94042
07933	PAYTHEON CO SEMICONDUCTOR DIV HQ	MOUNTAIN VIEW CA	94040
09353	C & K COMPONENTS INC	NEWTON MA US	02158
10582	CTS CORP ASHEVILLE DIV	SKYLAND NC US	28776
10899	EASTERN AIP DEVICES INC	GREAT NECK NY	11021
11236	CTS CORP BERNE DIV	BERNE IN US	46711
14433	ITT SEMICONDUCTORS DIV	TUSTIN CA US	92680
14936	GENERAL INSTRUMENT CORP (DIODE)	HICKSVILLE NY US	11802
15818	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW CA	94043
17856	SILICONIX INC	SANTA CLARA CA	95054
18324	SIGNETICS CORP	SUNNYVALE CA US	94086
19701	MEPCO/CENTRALAB INC	WEST PALM BEACH FL US	33407
20627	POHM CORP	IRVINE CA US	92716
24355	ANALOG DEVICES INC	NORWOOD MA US	02062
24546	CORNING ELECTRONICS	SANTA CLARA CA US	95050
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA US	95052
27167	CORNING GLASS WORKS (WILMINGTON)	WILMINGTON NC	28401
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
31585	PCA CORP SOLID STATE DIV	SOMERVILLE NJ	
31680	BEMAN MFG INC	ETTERS PA	17319
32293	INTERSIL INC	CUPERTINO CA CA	95014
34649	INTEL CORP	SANTA CLARA CA US	95054
51642	CENTRE ENGINEERING INC	STATE COLLEGE PA	16801
56283	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71468	ITT CORP CANNON ELECTRIC DIV	SANTA ANA CA US	92702
72136	ELECTRO MOTIVE CORP	FLORENCE SC	06226
73893	J F D ELECTRONICS CORP	BROOKLYN NY	11219
75042	TRW INC PHILADELPHIA DIV	PHILADELPHIA PA	19108
90171	UNITRODE CORP	LEXINGTON MA US	02173
90283	WORKSAFE INC	NEW YORK NY	10001
91637	DALE ELECTRONICS INC	EL PASO TX US	79936

Manual Changes

Section 7

7-1 INTRODUCTION

This section normally contains information for adapting this manual to instruments for which the content does not directly apply. Since this manual does directly apply to instruments having the series code listed on the title page, no change information is given here. Refer to INSTRUMENTS COVERED BY MANUAL in Section 1 for additional important information about date code and series code coverage.

Service

Section 8

8-1 INTRODUCTION

The HP 85082A is not repairable to component level. Should a unit prove to be defective, it should be replaced with a rebuilt assembly (exchange unit) obtainable through your local HP Service Office.

8-2 ANTI-STATIC PRECAUTIONS

The printed circuit board of this instrument is susceptible to damage by electrostatic discharge (ESD). To minimize the risks of damaging or decreasing the reliability of the instrument, the following procedures and cautions should be observed when servicing the instrument.

Static-free Workstation

All servicing should be carried out at a static-free workstation.

De-soldering

When desoldering, ensure that the soldering iron is earthed. Always use a metalized solder remover.

Anti-static freezer spray

When attempting to locate a temperature related fault, use only an approved anti-static freezer spray.

Anti-static Products

Table 8-1 contains details of anti-static products which are available from Hewlett-Packard.

Table 8-1. Anti-Static Products

Product	HP Part No.
Anti-static workstation kit	9300-0792
Metalized Solder Remover	8690-0227
Wrist-strap and cord	9300-0970

8-3 RECOMMENDED TEST EQUIPMENT

Equipment required to troubleshoot the HP 85082A is listed in Table 1-2. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

8-4 TROUBLESHOOTING

GENERAL DESCRIPTION

The HP 85082A is a two-channel RF to IF convertor plug-in module with a 50ohm input impedance, that operates in the 300kHz to 2GHz frequency range. The module reconstructs two RF signals (having the same fundamental frequency) into two IF signals at a frequency of 20kHz. These re-constructed signals have the same amplitude and phase relationships of the original RF signal.

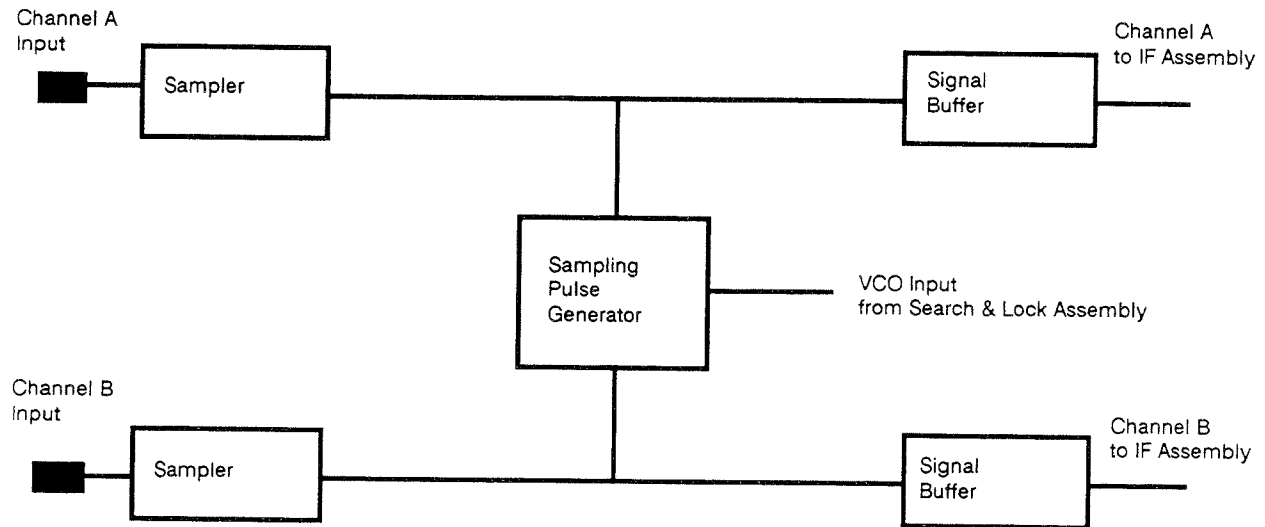


Figure 8-1. Simplified Block Diagram

The Input Module forms a dual-channel sampling system. The main elements of which are a Pulse Generator, two Sampling Bridges and two Signal Buffers.

SERVICING THE INPUT MODULE

The Input Module must be installed in either an HP 8508A mainframe or an HP 70138A MMS Vector Voltmeter before it can be tested. Should the Self Test process detect a failure in the Input Module, an appropriate Error Code in the 600 Series will be shown in DISPLAY 2 of the instrument.

TROUBLESHOOTING PROCEDURE

An HP 85082A failure will be indicated in one of two ways. Either the HP 8508A or the MMS System will display an error code in the 600 Series, or no digits will be shown in the displays.

1. Check that the HP 85082A is properly installed in the HP 8508A Vector Voltmeter mainframe or the HP 70138A MMS Vector Voltmeter Module.
2. Cycle the instrument power.
3. If a 600 Series error code persists, the HP 85082A should be replaced with a rebuilt (exchange) unit.
4. If no digits are shown on the displays, the HP 85082A adjustments should be checked with the procedures given in Section 5 of this manual.
5. If the HP 85082A adjustments are completed successfully, then this indicates that the problem is in either the HP 8508A Vector Voltmeter mainframe, or the HP 70138A MMS Vector Voltmeter module.

Failure of the HP 85082A adjustments indicates that the HP 85082A should be replaced.

The replacement module is already calibrated and no adjustments should be necessary when this is installed.

SALES & SUPPORT OFFICES

Arranged alphabetically by country

1



Product Line Sales/Support Key

Key Product Line

A Analytical

CM Components

C Computer Systems

E Electronic Instruments & Measurement Systems

M Medical Products

P Personal Computation 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.

HEADQUARTERS OFFICES

If there is no sales office listed for your area, contact one of these headquarters offices.

NORTH/CENTRAL AFRICA

Hewlett-Packard S.A.
7, rue du Bois-du-Lan
CH-1217 MEYRIN 1, Switzerland
Tel: (022) 83 12 12
Telex: 27835 hmea
Cable: HEWPACKSA Geneve

ASIA

Hewlett-Packard Asia Ltd.
47/F, 26 Harbour Rd.,
Wanchai, HONG KONG
G.P.O. Box 863, Hong Kong
Tel: 5-8330833
Telex: 76793 HPA HX
Cable: HPASIAL TD

CANADA

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Telex: 069-8644

EASTERN EUROPE

Hewlett-Packard Ges.m.b.h.
Liebigasse 1
P.O.Box 72
A-1222 VIENNA, Austria
Tel: (222) 2500-0
Telex: 1 3 4425 HEPA A

NORTHERN EUROPE

Hewlett-Packard S.A.
V. D. Hooplaan 241
P.O.Box 999
NL-1183 AG AMSTELVEEN
The Netherlands
Tel: 20 547999
Telex: 18 919 hpner

SOUTH EAST EUROPE

Hewlett-Packard S.A.
World Trade Center
110 Avenue Louis Casai
1215 Cointrin, GENEVA, Switzerland
Tel: (022) 98 96 51
Telex: 27225 hpser

MEDITERRANEAN AND MIDDLE EAST

Hewlett-Packard S.A.
Mediterranean and Middle East
Operations
Atrina Centre
32 Kifissias Ave.
Paradissos-Amarousion, ATHENS
Greece
Tel: 682 88 11
Telex: 21-6588 HPAT GR
Cable: HEWPACKSA Athens

UNITED KINGDOM

Hewlett-Packard Ltd.
Nine Mile Ride
Easthampstead, WOKINGHAM
Berkshire, RG11 3LL
Tel: 0344 773100
Telex: 848805

EASTERN USA

Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370

MIDWESTERN USA

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

SOUTHERN USA

Hewlett-Packard Co.
2000 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500

WESTERN USA

Hewlett-Packard Co.
5161 Lankershim Blvd.
NORTH HOLLYWOOD, CA 91601
Tel: (818) 505-5600

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

ALGERIA

Bureau de Liaison
Hewlett-Packard Alger
Villa des Lions
9, Hai Galloul
DZ-BORDJ EL BAHRI
Tel: 76 03 36
Telex: 51260 dliondz

ANGOLA

Telectra Angola LDA
Empresa Técnica de Equipamentos
Rua Barbosa Rodrigues, 41-1 DT.
Caixa Postal 6487
LUANDA
Tel: 35515,35516
Telex: 3134
E,P

ARGENTINA

Hewlett-Packard Argentina S.A.
Montaneses 2140/50
1428 BUENOS AIRES
Tel: 781-4059/69
Cable: HEWPACKARG
A,C,E,P
Biotron S.A.C.I.M.E.I.
Av. Paso Colon 221, Piso 9
1399 BUENOS AIRES
Tel: 541-333-490,
541-322-587
Telex: 17595 BIONAR
M

Laboratorio Rodriguez
Corswant S.R.L.

Misiones, 1156 - 1876
Bernal, Oeste
BUENOS AIRES
Tel: 252-3958, 252-4991
A
Argentina Esanco S.R.L.
A/ASCO 2328
1416 BUENOS AIRES
Tel: 541-58-1981, 541-59-2767
Telex: c/o 9400 HPARGENTINA
A

AUSTRALIA

Adelaide, South Australia Office

Hewlett-Packard Australia Ltd.
153 Greenhill Road
PARKSIDE, S.A. 5063
Tel: 272-5911
Telex: 82536
Cable: HEWPARD Adelaide
A*,C,CM,E,P

Brisbane, Queensland Office

Hewlett-Packard Australia Ltd.
10 Payne Road
THE GAP, Queensland 4061
Tel: 30-4133
Telex: 42133
Cable: HEWPARD Brisbane
A,C,CM,E,M,P

Canberra, Australia

Capital Territory Office

Hewlett-Packard Australia Ltd.
Thynne Street, Fern Hill Park
BRUCE, A.C.T. 2617
P.O. Box 257,
JAMISON, A.C.T. 2614
Tel: 51 6999
Telex: 62650
Cable: HEWPARD Canberra
C,CM,E,P

Melbourne, Victoria Office

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
P.O. Box 221
BLACKBURN, Victoria 3130
Tel: 895-2895
Telex: 31-024
Cable: HEWPARD Melbourne
A,C,CM,E,M,P

Perth, Western Australia Office

Hewlett-Packard Australia Ltd.
261 Stirling Highway
CLAREMONT, W.A. 6010
Tel: 383-2188
Telex: 93859
Cable: HEWPARD Perth
C,CM,E,P

Sydney, New South Wales Office

Hewlett-Packard Australia Ltd.
17-23 Talavera Road
P.O. Box 308
NORTH RYDE, N.S.W. 2113
Tel: 888-4444
Telex: 21561
Cable: HEWPARD Sydney
A,C,CM,E,M,P

AUSTRIA

Hewlett-Packard Ges.m.b.h.
Verkaufsbuero Graz
Grottenhofstrasse 94
A-8052 GRAZ
Tel: (0316) 28-30-66
Telex: 312375
C,E

Hewlett-Packard Ges.m.b.h.
Liebigasse 1
P.O. Box 72
A-1222 VIENNA
Tel: (0222) 2500-0
Telex: 134425 HEPA A
A,C,CM,E,M,P

BAHRAIN

Green Salon
P.O. Box 557
MANAMA
Tel: 255503-250950
Telex: 84419
P

Wael Pharmacy
P.O. Box 648
MANAMA
Tel: 256123
Telex: 8550 WAEL BN
E,M



SALES & SUPPORT OFFICES

Arranged alphabetically by country

BAHRAIN (Cont'd)

Zayani Computer Systems
218 Shaik Mubarak Building
Government Avenue
P.O. Box 5918
MANAMA
Tel: 276278
Telex: 9015 plans bn
P

BELGIUM

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

BERMUDA

Applied Computer Technologies
Atlantic House Building
Par-La-Ville Road
HAMILTON 5
Tel: 295-1816
Telex: 380 3589/ACT BA
P

BOLIVIA

Arrellano Ltda
Av. 20 de Octubre #2125
Casilla 1383
LA PAZ
Tel: 368541
M

BRAZIL

Hewlett-Packard do Brasil
I.e.C. Ltda.
Alameda Rio Negro, 750
ALPHAVILLE
06400 Barueri SP
Tel: (011) 421.1311
Telex: (011) 33872 HPBR-BR
Cable: HEWPACK Sao Paulo
A,C,CM,E,M,P
Hewlett-Packard do Brasil
I.e.C. Ltda.
Praia de Botafogo 228
6° Andar-conj 614
Edificio Argentina - Ala A
22250 **RIO DE JANEIRO**, RJ
Tel: (021) 552-6422
Telex: 21905 HPBR-BR
Cable: HEWPACK Rio de Janeiro
A,C,CM,E,P*
Convex/Van Den
Rua Jose Bonifacio
458 Todos Os Santos
CEP 20771
RIO DE JANEIRO, RJ
Tel: 591-0197
Telex: 33487 EGLB BR
A
ANAMED I.C.E.I. Ltda.
Rua Bage, 103
04012 **SAO PAULO**, SP
Tel: (011) 572-6537
Telex: 24720 HPBR-BR
M
Datatronix Electronica Ltda.
Av. Pacaembu 746-C11
SAO PAULO, SP
Tel: (118) 260111
CM

BRUNEI

Komputer Wisman Sdn Bhd
Room 1
3rd Floor, Tumasek Plaza
Jalan Tutong
BANDAR SERI BEGAWAN
Tel: 23918,25603
C,E,P

CAMEROON

Beriac
B. P. 23
DOUALA
Tel: 420153
Telex: 5351
C,P

CANADA

Alberta

Hewlett-Packard (Canada) Ltd.
3030 3rd Avenue N.E.
CALGARY, Alberta T2A 6T7
Tel: (403) 235-3100
A,C,CM,E*,M,P*
Hewlett-Packard (Canada) Ltd.
11120-178th Street
EDMONTON, Alberta T5S 1P2
Tel: (403) 486-6666
A,C,CM,E,M,P

British Columbia

Hewlett-Packard (Canada) Ltd.
10691 Shellbridge Way
RICHMOND,
British Columbia V6X 2W8
Tel: (604) 270-2277
Telex: 610-922-5059
A,C,CM,E*,M,P*
Hewlett-Packard (Canada) Ltd.
121 - 3350 Douglas Street
VICTORIA, British Columbia V8Z 3L1
Tel: (604) 381-6616
C

Manitoba

Hewlett-Packard (Canada) Ltd.
1825 Inkster Blvd.
WINNIPEG, Manitoba R2X 1R3
Tel: (204) 694-2777
A,C,CM,E,M,P*

New Brunswick

Hewlett-Packard (Canada) Ltd.
814 Main Street
MONCTON, New Brunswick E1C 1E6
Tel: (506) 855-2841
C

Nova Scotia

Hewlett-Packard (Canada) Ltd.
Suite 111
900 Windmill Road
DARTMOUTH, Nova Scotia B3B 1P7
Tel: (902) 469-7820
C,CM,E*,M,P*

Ontario

Hewlett-Packard (Canada) Ltd.
3325 N. Service Rd., Unit W03
BURLINGTON, Ontario L7N 3G2
Tel: (416) 335-8644
C,M*

Hewlett-Packard (Canada) Ltd.
496 Days Road
KINGSTON, Ontario K7M 5R4
Tel: (613) 384-2088
C

Hewlett-Packard (Canada) Ltd.
552 Newbold Street
LONDON, Ontario N6E 2S5
Tel: (519) 686-9181
A,C,CM,E*,M,P*

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Telex: 069-8644
A,C,CM,E,M,P

Hewlett-Packard (Canada) Ltd.
2670 Queensview Dr.
OTTAWA, Ontario K2B 8K1
Tel: (613) 820-6483
A,C,CM,E*,M,P*

Hewlett-Packard (Canada) Ltd.
The Oaks Plaza, Unit #9
2140 Regent Street
SUDBURY, Ontario, P3E 5S8
Tel: (705) 522-0202
C

Hewlett-Packard (Canada) Ltd.
3790 Victoria Park Ave.
WILLOWDALE, Ontario M2H 3H7
Tel: (416) 499-2550
C,E

Quebec

Hewlett-Packard (Canada) Ltd.
17500 Trans Canada Highway
South Service Road
KIRKLAND, Quebec H9J 2X8
Tel: (514) 697-4232
Telex: 058-21521
A,C,CM,E,M,P*
Hewlett-Packard (Canada) Ltd.
1150 rue Claire Fontaine
QUEBEC CITY, Quebec G1R 5G4
Tel: (418) 648-0726
C
Hewlett-Packard (Canada) Ltd.
130 Robin Crescent
SASKATOON, Saskatchewan S7L 6M7
Tel: (306) 242-3702
C

CHILE

ASC Ltda.
Austria 2041
SANTIAGO
Tel: 223-5946, 223-6148
Telex: 340192 ASC CK
C,P
Jorge Calcagni y Cia
Av. Italia 634 Santiago
Casilla 16475
SANTIAGO 9
Tel: 222-0222
Telex: 440283 JCycl CZ
CM,E,M
Metrolab S.A.
Monjitas 454 of. 206
SANTIAGO
Tel: 395752, 398296
Telex: 340866 METLAB CK
A

Olympia (Chile) Ltda.
Av. Rodrigo de Araya 1045
Casilla 256-V
SANTIAGO 21
Tel: 225-5044
Telex: 340892 OLYMP
Cable: Olympiachile Santiagochile
C,P

CHINA, People's Republic of

China Hewlett-Packard Co., Ltd.
47/F China Resources Bldg.
26 Harbour Road
HONG KONG
Tel: 5-8330833
Telex: 76793 HPA HX
Cable: HP ASIA LTD
A*,M*
China Hewlett-Packard Co., Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory Main
Bldg.
Shuang Yu Shou, Bei San Huan Road
Hai Dian District
BEIJING
Tel: 28-0567
Telex: 22601 CTSHP CN
Cable: 1920 Beijing
A,C,CM,E,M,P
China Hewlett-Packard Co., Ltd.
CHP Shanghai Branch
23/F Shanghai Union Building
100 Yan An dong Lu
SHANG-HAI
Tel: 265550
Telex: 33571 CHPSB CN
Cable: 3416 Shanghai
A,C,CM,E,M,P
COLOMBIA
Instrumentación
H. A. Langebaek & Kier S.A.
Carrera 4A No. 52A-26
Apartado Aereo 6287
BOGOTA 1, D.E.
Tel: 212-1466
Telex: 44400 INST CO
Cable: AARIS Bogota
CM,E,M
Nefromedicas Ltda.
Calle 123 No. 9B-31
Apartado Aereo 100-958
BOGOTA D.E., 10
Tel: 213-5267, 213-1615
Telex: 43415 HEGAS CO
A
Compumundo
Avenida 15 # 107-80
BOGOTA D.E.
Tel: 214-4458
Telex: 45466 SUMA CO
P
Carvajal, S.A.
Calle 29 Norte No. 6A-40
Apartado Aereo 46
CALI
Tel: 368-1111
Telex: 55650
C,E,P



CONGO

Seric-Congo

B. P. 2105

BRAZZAVILLE

Tel: 815034

Telex: 5262

COSTA RICA

Cientifica 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 CR

CM,E,M

O. Fischel R. Y. Cia. S.A.

Apartados 434-10174

SAN JOSE

Tel: 23-72-44

Telex: 2379

Cable: OFIR

A

CYPRUS

Telerexa Ltd.

P.O. Box 1152

7 A Afroditis Avenue

NICOSIA

Tel: 45 628, 62 698

Telex: 2894 LEVIDO CY

E,M,P

DENMARK

Hewlett-Packard A/S

Kongevejen 25

DK-3460 BIRKERØD

Tel: (02) 81-66-40

Telex: 37409 hpas dk

A,C,CM,E,M,P

Hewlett-Packard A/S

Rolighedsvej 32

DK-8240 RISSKOV, Aarhus

Tel: (06) 17-60-00

Telex: 37409 hpas dk

C,E

DOMINICAN REPUBLIC

Microprog S.A.

Juan Tomás Mejía y Cotes No. 60

Arroyo Hondo

SANTO DOMINGO

Tel: 565-6268

Telex: 4510 ARENTA DR (RCA)

P

ECUADOR

CYEDE Cia. Ltda.

Avenida Eloy Alfaro 1749

y Belgica

Casilla 6423 CCI

QUITO

Tel: 245-0975, 243-052

Telex: 22548 CYEDE ED

E,P

Medtronics

Valladolid 524 Madrid

P.O. 9171, QUITO

Tel: 2-238-951

Telex: 2298 ECUAME ED

A

Hospitalar S.A.

Robles 625

Casilla 3590

QUITO

Tel: 545-250, 545-122

Telex: 2485 HOSPTL ED

Cable: HOSPITALAR-Quito

M

Ecuador Overseas Agencies C.A.

Calle 9 de Octubre #818

P.O. Box 1296, Guayaquil

QUITO

Tel: 306022

Telex: 3361 PBCGYE ED

M

EGYPT

Sakro Enterprises

P.O. Box 259

ALEXANDRIA

Tel: 802908, 808020, 805302

Telex: 54333

C

International Engineering Associates

24 Hussein Hegazi Street

Kasr-el-Aini

CAIRO

Tel: 23829, 21641

Telex: 93830 IEA UN

Cable: INTEGASSO

E

Sakro Enterprises

70 Mossadak Street

Dokki, Giza

CAIRO

Tel: 706 440, 701 087

Telex: 9337

C

S.S.C. Medical

40 Gezerat El Arab Street

Mohandessin

CAIRO

Tel: 803844, 805998, 810263

Telex: 20503 SSC UN

M*

EL SALVADOR

IPESA de El Salvador S.A.

29 Avenida Norte 1223

SAN SALVADOR

Tel: 26-6858, 26-6868

Telex: 301 20539 IPESA SAL

A,C,CM,E,P

ETHIOPIA

Seric-Ethiopia

P.O. Box 2764

ADDIS ABABA

Tel: 185114

Telex: 21150

C,P

FINLAND

Hewlett-Packard Oy

Piispankalliontie 17

02200 ESPOO

Tel: 00358-0-88721

Telex: 121563 HEWPA SF

C,CM,P

FRANCE

Hewlett-Packard France

Z.I. Mercure B

Rue Berthelot

13763 Les Milles Cedex

AIX-EN-PROVENCE

Tel: (42) 59-41-02

Telex: 410770F

A,C,E,M

Hewlett-Packard France

64, Rue Marchand Saillant

61000 ALENCON

Tel: (33) 29 04 42

C**

Hewlett-Packard France

Batiment Levitan

2585, route de Grasse

Bretelle Autoroute

06600 ANTIBES

Tel: (93) 74-59-19

C

Hewlett-Packard France

28 Rue de la République

Boite Postale 503

25026 BESANCON

Tel: (81) 83-16-22

Telex: 361157

C,E*

Hewlett-Packard France

13 Place Napoléon III

29000 BREST

Tel: (98) 41-87-90

E

Hewlett-Packard France

Chemin des Mouilles

Boite Postale 162

69131 ECULLY Cedex (Lyon)

Tel: (78) 133-81-25

Telex: 310617F

A,C,E,M,P*

Hewlett-Packard France

Parc d'activités du Bois Briard

Avenue du Lac

91040 EVRY Cedex

Tel: (60) 77-83-83

Telex: 692315F

C

Hewlett-Packard France

5, avenue Raymond Chanas

38320 EYBENS (Grenoble)

Tel: (76) 62-57-98

Telex: 980124 HP GRENOB EYBE

C

Hewlett-Packard France

Rue Fernand. Forest

Z.A. Kergaradec

29239 GOUESNOU

Tel: (98) 41-87-90

Hewlett-Packard France

Parc Club des Tanneries

Batiment B4

4, Rue de la Faisanderie

67380 LINCOLSHEIM

(Strasbourg)

Tel: (88) 76-15-00

Telex: 890141F

C,E*,M*,P*

Hewlett-Packard France

Centre d'affaires Paris-Nord

Bâtiment Ampère

Rue de la Commune de Paris

Boite Postale 300

93153 LE BLANC-MESNIL

Tel: (1) 865-44-52

Telex: 211032F

C,E,M

Hewlett-Packard France

Parc d'activités Cadéra

Quartier Jean-Mermoz

Avenue du Président JF Kennedy

33700 MÉRIGNAC (Bordeaux)

Tel: (56) 34-00-84

Telex: 550105F

C,E,M

Hewlett-Packard France

3, Rue Graham Bell

BP 5149

57074 METZ Cedex

Tel: (87) 36-13-31

Telex: 860602F

C,E

Hewlett-Packard France

Miniparc-ZIRST

Chemin du Vieux Chêne

38240 MEYLAN (Grenoble)

Tel: (76) 90-38-40

C

Hewlett-Packard France

Bat.A l'Erable

Bureau vert du Bois Briand

44085 NANTES Cedex

Tel: (40) 50-32-22

Telex: 711085F

A,C,E,CM*,P

Hewlett-Packard France

125, Rue du Faubourg Bannier

45000 ORLÉANS

Tel: (38) 62-20-31

E,P*

Hewlett-Packard France

Zone Industrielle de Courtaboeuf

Avenue des Tropiques

91947 LES ULIS Cedex (Orsay)

Tel: (69) 07-78-25

Telex: 600048F

A,C,CM,E,M,P**

Hewlett-Packard France

15, Avenue de L'Amiral-Bruix

75782 PARIS Cedex 16

Tel: (1) 45-02-75-00

Telex: 613663F

C,P*

Hewlett-Packard France

124, Boulevard Tourasse

64000 PAU

Tel: (59) 80-38-02

Telex: 550365F

C,E*

Hewlett-Packard France

6, Place Sainte Croix

86000 POITIERS

Tel: (49) 41-27-07

Telex: 792335F

C, E*



SALES & SUPPORT OFFICES

Arranged alphabetically by country

FRANCE (Cont'd)

Hewlett-Packard France
47, Rue de Chativessle
51100 **REIMS**
Tel: (26) 88-69-79
C, P*

Hewlett-Packard France
Parc d'activités de la Poterie
Rue Louis Kerautiel-Botmel
35000 **RENNES**
Tel: (99) 51-42-44
Telex: 740912F
A*, C, E, M, P*

Hewlett-Packard France
98 Avenue de Bretagne
76100 **ROUEN**
Tel: (35) 63-57-66
Telex: 770035F
C, E

Hewlett-Packard France
4, Rue Thomas-Mann
Boite Postale 56
67033 **STRASBOURG** Cedex
Tel: (88) 28-56-46
Telex: 890141F
C, E, M, P*

Hewlett-Packard France
Le Périgole
3, Chemin du Pigeonnier de la Cépière
3108 **TOULOUSE** Cedex
Tel: (61) 40-11-12
Telex: 531639F
A, C, E, M, P*

Hewlett-Packard France
Les Cardoulines
Batiment B2
Route des Dolines
Parc d'activité de Valbonne
Sophia Antipolis
06560 **VALBONNE** (Nice)
Tel: (93) 65-39-40
C

Hewlett-Packard France
9, Rue Baudin
26000 **VALENCE**
Tel: (75) 42-76-16
C**

Hewlett-Packard France
Carolor
ZAC de Bois Briand
57640 **VIGY** (Metz)
Tel: (8) 771 20 22
C

Hewlett-Packard France
Parc d'activité des Prés
1, Rue Papin
59658 **VILLENEUVE D'ASCQ** Cedex
Tel: (20) 47 78 78
Telex: 160124F
C, E, M, P

Hewlett-Packard France
Parc d'activités Paris-Nord 11
45, Rue des 3 Soeurs
93420 **VILLEPINTE**
Tel: (1) 48 63 80 80
Telex: 211032F
C, E, M, P*

GABON

Sho Gabon
P.O. Box 89
LIBREVILLE
Tel: 721 484
Telex: 5230

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Vertriebszentrum Mitte
Hewlett-Packard-Strasse
D-6380 **BAD HOMBURG**
Tel: (06172) 400-0
Telex: 410 844 hpbhg
A, C, E, M, P

Hewlett-Packard GmbH
Geschäftsstelle
Keithstrasse 2-4
D-1000 **BERLIN** 30
Tel: (030) 21 99 04-0
Telex: 018 3405 hpbld
A, C, E, M, P

Hewlett-Packard GmbH
Vertriebszentrum Südwest
Schickardstrasse 2
D-7030 **BÖBLINGEN**
Tel: (07031) 645-0
Telex: 7265 743 hep
A, C, CM, E, M, P

Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 **DORTMUND**-41
Tel: (0231) 45001
Telex: 822858 hepdd
A, C, E

Hewlett-Packard GmbH
Vertriebszentrum Nord
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: (040) 63804-1
Telex: 021 63 032 hphh d
A, C, E, M, P

Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
Tel: (0511) 5706-0
Telex: 092 3259
A, C, CM, E, M, P

Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
Tel: (0621) 70 05-0
Telex: 0462105
A, C, E

Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 **NEU ULM**
Tel: (0731) 70 73-0
Telex: 0712816 HP ULM-D
A, C, E*

Hewlett-Packard GmbH
Geschäftsstelle
Emmericher Strasse 13
D-8500 **NÜRNBERG** 10
Tel: (0911) 5205-0
Telex: 0623 860 hpnbg
C, CM, E, M, P

Hewlett-Packard GmbH
Vertriebszentrum West
Berliner Strasse 111
D-4030 **RATINGEN** 3
Tel: (02102) 494-0
Telex: 589 070 hprad
A, C, E, M, P

Hewlett-Packard GmbH
Vertriebszentrum Süd
Eschenstrasse 5
D-8028 **TAUFKIRCHEN**
Tel: (089) 61 20 7-0
Telex: 0524985
A, C, CM, E, M, P
Hewlett-Packard GmbH
Geschäftsstelle
Ermlisallee
7517 **WALDBRONN** 2
Tel: (07243) 602-0
Telex: 782 838 hepck
A, C, E

GREAT BRITAIN See United Kingdom

GREECE

Hewlett-Packard A.E.
178, Kifissias Avenue
6th Floor
HALANDRI-ATHENS
Greece
Tel: 6471543, 6471673, 6472971
Telex: 221 285 HPHLGR
A, C, CM** , E, M, P

Kostas Karayannis S.A.
8, Omirou Street
ATHENS 133
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
A, C*, CM, E
Impexin

Intellect Div.
209 Mesogion
11525 **ATHENS**
Tel: 6474481/2
Telex: 216286
P

Haril Company
38, Mihalakopoulou
ATHENS 612
Tel: 7236071
Telex: 218767
M*

Heilamco
P.O. Box 87528
18507 **PIRAEUS**
Tel: 4827049
Telex: 241441
A

GUATEMALA

IPESA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 317853, 66471/5
Telex: 3055765 IPESA GU
A, C, CM, E, M, P

HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road
HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPACK HONG KONG
E, C, P

CET Ltd.
10th Floor, Hua Asia Bldg.
64-66 Gloucester Road

HONG KONG

Tel: (5) 200922
Telex: 85148 CET HX
CM

Schmidt & Co. (Hong Kong) Ltd.
18th Floor, Great Eagle Centre
23 Harbour Road, Wanchai

HONG KONG

Tel: 5-8330222
Telex: 74766 SCHMC HX
A, M

ICELAND

Hewlett-Packard Iceland
Hoefdabakka 9
110 **REYKJAVIK**
Tel: (1) 67 1000
A, C, CM, E, M, P

INDIA

Computer products are sold through
Blue Star Ltd. All computer repairs and
maintenance service is done through
Computer Maintenance Corp.

Blue Star Ltd.
B. D. Patel House
Near Sardar Patel Colony
AHMEDABAD 380 014
Tel: 403531, 403532
Telex: 0121-234
Cable: BLUE FROST
A, C, CM, E

Blue Star Ltd.
40/4 Lavelle Road
BANGALORE 560 001
Tel: 57881, 567780
Telex: 0845-430
Cable: BLUESTAR
A, C*, CM, E

Blue Star Ltd.
Band Box House
Prabhadevi

BOMBAY 400 025
Tel: 4933101, 4933222
Telex: 011-71051
Cable: BLUESTAR
A, M

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
BOMBAY 400 025
Tel: 430-6155, 430-6556
Telex: 011-71193 BSSS IN
Cable: FROSTBLUE
A, CM, E, M

Blue Star Ltd.
Kalyan, 19 Vishwas Colony
Alkapuri, **BORODA**, 390 005
Tel: 65235, 65236
Cable: BLUE STAR
A

Blue Star Ltd.
7 Hare Street
CALCUTTA 700 001
Tel: 230131, 230132
Telex: 031-61120 BSNF IN
Cable: BLUESTAR
A,M,C,E

Blue Star Ltd.
133 Kodambakkam High Road
MADRAS 600 034
Tel: 472056, 470238
Telex: 041-379
Cable: BLUESTAR
A,M

Blue Star Ltd.
13 Community Center
New Friends Colony
NEW DELHI 110 065
Tel: 633182, 636674
Telex: 031-61120
Cable: BLUEFROST
A,C*,CM,E,M

Blue Star Ltd.
15/16 C Wellesley Rd.
PUNE 411 011
Tel: 22775
Cable: BLUE STAR
A

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
SECUNDERABAD 500 003
Tel: 72057, 72058
Telex: 0155-459
Cable: BLUEFROST
A,C,E

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthunkuzhi
TRIVANDRUM 695 013
Tel: 65799, 65820
Telex: 0884-259
Cable: BLUESTAR
E

Computer Maintenance Corporation
Ltd.
115, Sarojini Devi Road
SECUNDERABAD 500 003
Tel: 310-184, 345-774
Telex: 031-2960
C**

INDONESIA

BERCA Indonesia P.T.
P.O.Box 496/Jkt.
Jl. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL IA
Cable: BERSAL JAKARTA
P

BERCA Indonesia P.T.
P.O.Box 2497/Jkt
Antara Bldg., 11th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 343989

Telex: 46748 BERSAL IA
A,C,E,M,P
BERCA Indonesia P.T.
Jalan Kutai 24
SURABAYA
Tel: 67118
Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA
A*,E,M,P

IRAQ

Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 9B/3/7
BAGHDAD
Tel: 551-49-73
Telex: 212-455 HEPAlRAQ IK
C

IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 0001 608800
Telex: 30439
C,E,P
Cardiac Services Ltd.
128 Dublin Industrial Estate
DUBLIN 11
Tel: (01) 307499
Telex: 32254
M

ISRAEL

Eldan Electronic Instrument Ltd.
P.O.Box 1270
JERUSALEM 91000
16, Ohaliav St.
JERUSALEM 94467
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL
A,M

Computation and Measurement
Systems (CMS) Ltd.
11 Masad Street
67060

TEL-AVIV

Tel: 388 388
Telex: 33569 Motil IL
C,CM,E,P

ITALY

Hewlett-Packard Italiana S.p.A.
Traversa 99C
Via Giulio Petroni, 19
I-70124 **BARI**
Tel: (080) 41-07-44
C,M
Hewlett-Packard Italiana S.p.A.
Via Emilia, 51/C
I-40011 **BOLOGNA** Anzola Dell'Emilia
Tel: (051) 731061
Telex: 511630
C,E,M

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43G/C
I-95126 **CATANIA**
Tel: (095) 37-10-87
Telex: 970291
C

Hewlett-Packard Italiana S.p.A.
Via G. di Vittorio 9
20094 **CORSICO** (Milano)
Tel: (02) 448351

Hewlett-Packard Italiana S.p.A.
Viale Brigata Bisagno 2
16129 **GENOVA**
Tel: (010) 541141

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 **GENOVA PEGLI**
Tel: (010) 68-37-07
Telex: 215238
C,E

Hewlett-Packard Italiana S.p.A.
Via G. di Vittorio 9
I-20063 **CERNUSCO SUL NAVIGLIO**
(Milano)
Tel: (02) 923691
Telex: 334632
A,C,CM,E,M,P

Hewlett-Packard Italiana S.p.A.
Via Nuova Rivoltana 95
20090 **LIMITO** (Milano)
Tel: (02) 92761
Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco a
Capodimonte, 62/A
I-80131 **NAPOLI**

Tel: (081) 7413544
Telex: 710698
A*,C,E,M
Hewlett-Packard Italiana S.p.A.
Via Orazio 16
80122 **NAPOLI**
Tel: (081) 7611444

Hewlett-Packard Italiana S.p.A.
Via Pellizzo 15
35128 **PADOVA**
Tel: (049) 8070166
Telex: 430315
A,C,E,M

Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 **ROMA EUR**
Tel: (06) 54831
Telex: 610514
A,C,E,M,P*

Hewlett-Packard Italiana S.p.A.
Via di Casellina 57/C
I-50018 **SCANDICCI-FIRENZE**
Tel: (055) 753863
C,E,M

Hewlett-Packard Italiana S.p.A.
Corso Svizzera, 185
I-10144 **TORINO**
Tel: (011) 74 4044
Telex: 221079
A*,C,E

IVORY COAST

S.I.T.E.L.
Societe Ivoirienne de
Telecommunications
Bd. Giscard d'Estaing
Carrefour Marcory
Zone 4.A.
Boite postale 2580
ABIDJAN 01
Tel: 353600
Telex: 43175
E

S.I.T.I.
Immeuble "Le General"
Av. du General de Gaulle
01 BP 161
ABIDJAN 01
Tel: 321227
C,P

JAPAN

Yokogawa-Hewlett-Packard Ltd.
152-1, Onna
ATSUGI, Kanagawa, 243
Tel: (0462) 25-0031
C,CM,E

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei Chiba Bldg.
3-1 Hon Chiba-Cho
CHIBA, 280
Tel: (0472) 25 7701
C,E

Yokogawa-Hewlett-Packard Ltd.
Yasuda-Seimei Hiroshima Bldg.
6-11, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: (082) 241-0611

Yokogawa-Hewlett-Packard Ltd.
Towa Building
2-3, Kaigan-dori, 2 Chome Chuo-ku
KOBE, 650
Tel: (078) 392-4791
C,E

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi 82 Bldg.
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
C,CM,E

Yokogawa-Hewlett-Packard Ltd.
Asahi Shinbun Daiichi Seimei Bldg.
4-7, Hanabata-cho
KUMAMOTO, 860
Tel: (0963) 54-7311
C,E

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614, Higashi-Shiokoji-cho
Karasuma-Nishiiru
Shiokoji-dori, Shimogyo-ku
KYOTO, 600
Tel: 075-343-0921
C,E

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg.
4-73, Sanno-maru, 1 Chome
MITO, Ibaraki 310
Tel: (0292) 25-7470
C,CM,E

SALES & SUPPORT OFFICES

Arranged alphabetically by country

JAPAN (Cont'd)

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei Kokubun Bldg.
7-8 Kokubun, 1 Chome, Sendai
MIYAGI, 980
Tel: (0222) 25-1011
C,E

Yokogawa-Hewlett-Packard Ltd.
Gohda Bldg. 2F
2-10 Gohda 1 Chome
Okaya-Shi
NAGANO, 394
Tel: (0266) 23 0851
C,E

Yokogawa-Hewlett-Packard Ltd.
Nagoya Kokusai Center Building
47-1, Nagoya, 1 Chome
Nakamura-ku
NAGOYA, 450
Tel: (052) 571-5171
C,CM,E,M

Yokogawa-Hewlett-Packard Ltd.
Sai-Kyo-Ren Building
1-2 Dote-cho
OHMIYA OHMIYA, Saitama 330
Tel: (0486) 45-8031

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.,
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-6021
Telex: YHPOSA 523-3624
C,CM,E,M,P*

Yokogawa-Hewlett-Packard Ltd.
27-15, Yabe, 1 Chome
SAGAMIHARA Kanagawa, 229
Tel: 0427 59-1311

Yokogawa-Hewlett-Packard Ltd.
Motoshiro-cho Dai-ichi Seimei Bldg. 1F
219-21 Motoshiro-cho,
Hamamatsu-shi
SHIZUOKA, 430
Tel: (0534) 56 1771
C,E

Yokogawa-Hewlett-Packard Ltd.
Daiichi Seimei Bldg.
7-1, Nishi Shinjuku, 2 Chome
Shinjuku-ku, **TOKYO** 160
Tel: 03-348-4611
C,E,M

Yokogawa Hewlett-Packard Ltd.
9-1, Takakura-cho
Hachioji-shi, **TOKYO**, 192
Tel: 0426-42-1261
C,E

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaide-Higashi, 3 Chome
Suginami-ku **TOKYO** 168
Tel: (03) 331-6111
Telex: 232-2024 YHPTOK
C,CM,E,P*

Yokogawa Hokushin Electric
Corporation
Shinjuku-NS Bldg. 10F
4-1 Nishi-Shinjuku 2-Chome
Shinjuku-ku
TOKYO, 163
Tel: (03) 349-1859
Telex: J27584
A

Yokogawa Hokushin Electric Corp.
9-32 Nokacho 2 Chome
2 Chome Musashino-shi
TOKYO, 180
Tel: (0422) 54-1111
Telex: 02822-421 YEW MTK J
A

Yokogawa-Hewlett-Packard Ltd.
Meiji-Seimei
Utsunomiya Odori Building
1-5 Odori, 2 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 33-1153
C,E

Yokogawa-Hewlett-Packard Ltd.
Yasuda Seimei Nishiguchi Bldg.
30-4 Tsuruya-cho, 3 Chome
Kanagawa-ku, **YOKOHAMA** 221
Tel: (045) 312-1252
C,CM,E

JORDAN

Scientific and Medical Supplies Co.
P.O. Box 1387

AMMAN

Tel: 24907, 39907
Telex: 21456 SABCO JO
C,E,M,P

KENYA

ADCOM Ltd., Inc., Kenya
P.O.Box 30070

NAIROBI

Tel: 331955
Telex: 22639
E,M

KOREA

Samsung Hewlett-Packard Co. Ltd.
Dongbang Yeoeuido Building
12-16th Floors
36-1 Yeoeuido-Dong
Youngdeungpo-Ku
SEOUL

Tel: 784-4666, 784-2666
Telex: 25166 SAMSAN K
C,CM,E,M,P

Young In Scientific Co., Ltd.
Youngwha Building
547 Shinsa Dong, Kangnam-Ku
SEOUL 135

Tel: 546-7771
Telex: K23457 GINSCO
A

Dongbang Healthcare
Products Co. Ltd.
Suite 301 Medical Supply Center
Bldg. 1-31 Dongsungdong
Jong Ro-gu, **SEOUL**
Tel: 764-1171, 741-1641
Telex: K25706 TKBKO
Cable: TKBEEKPO
M

KUWAIT

Al-Khaldiya Trading & Contracting
P.O. Box 830
SAFAT
Tel: 424910, 411726
Telex: 22481 AREEG KT
Cable: VISCOUNT
E,M,A

Gulf Computing Systems
P.O. Box 25125

SAFAT

Tel: 435969
Telex: 23648
P

Photo & Cine Equipment
P.O. Box 270

SAFAT

Tel: 2445111
Telex: 22247 MATIN KT
Cable: MATIN KUWAIT
P

W.J. Towell Computer Services
P.O. Box 5897
SAFAT
Tel: 2462640/1
Telex: 30336 TOWELL KT
C

LEBANON

Computer Information Systems S.A.L.
Chammas Building
P.O. Box 11-6274 Dora
BEIRUT
Tel: 89 40 73
Telex: 42309
C,E,M,P

LIBERIA

Unichemicals Inc.
P.O. Box 4509
MONROVIA
Tel: 224282
Telex: 4509
E

MADAGASCAR

Technique et Precision
12, rue de Nice
P.O. Box 1227
101 **ANTANANARIVO**
Tel: 22090
Telex: 22255
P

LUXEMBOURG

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

MALAYSIA

Hewlett-Packard Sales (Malaysia)
Sdn. Bhd.
9th Floor
Chung Khiaw Bank Building
46, Jalan Raja Laut
50350 **KUALA LUMPUR**
Tel: 2986555
Telex: 31011 HPSM MA
A,C,E,M,P*
Protel Engineering
P.O.Box 1917
Lot 6624, Section 64
23/4 Pending Road
Kuching, **SARAWAK**
Tel: 36299
Telex: 70904 PROMAL MA
Cable: PROTELENG
A,E,M

MALTA

Philip Toledo Ltd.
Birkirkara P.O. Box 11
Notabile Rd.
MRIEHEL
Tel: 447 47, 455 66, 4915 25
Telex: Media MW 649
E,M,P

MAURITIUS

Blanche Birger Co. Ltd.
18, Jules Koenig Street
PORT LOUIS
Tel: 20828
Telex: 4296
P

MEXICO

Hewlett-Packard de Mexico,
S.A. de C.V.
Rio Nio No. 4049 Desp. 12
Fracc. Cordoba
JUAREZ
Tel: 161-3-15-62
P

Hewlett-Packard de Mexico,
S.A. de C.V.
Condominio Kadereyta
Circuito del Mezon No. 186 Desp. 6
COL. DEL PRADO - 76030 Qro.
Tel: 463-6-02-71
P

Hewlett-Packard de Mexico,
S.A. de C.V.
Monti Morelos No. 299
Fraccionamiento Loma Bonita 45060
GUADALAJARA, Jalisco
Tel: 36-31-48-00
Telex: 0684 186 ECOME
P
Microcomputadoras Hewlett-Packard,
S.A.

Monti Pelvoux 115
LOS LOMAS, Mexico, D.F.
Tel: 520-9127
P

Microcomputadoras Hewlett-Packard,
S.A. de C.V.
Monte Pelvoux No. 115
Lomas de Chapultepec, 11000
MEXICO, D.F.
Tel: 520-9127
P

Hewlett-Packard de Mexico,
S.A. de C.V.
Monte Pelvoux No. 111
Lomas de Chapultepec
11000 **MEXICO, D.F.**
Tel: 5-40-62-28, 72-66, 50-25
Telex: 17-74-507 HEWPACK MEX
A,C,CM,E,M,P
Hewlett-Packard De Mexico (Polanco)
Avenida Ejercito Nacional #579
2day3er piso
Colonia Granada 11560
MEXICO D.F.
Tel: 254-4433
P

Hewlett-Packard de Mexico,
S.A. de C.V.
Czda. del Valle
409 Ote. 4th Piso
Colonia del Valle
Municipio de Garza Garcia Nuevo Leon
66220 **MONTERREY**, Nuevo León
Tel: 83-78-42-40
Telex: 382410 HPMY
C

Infograficas y Sistemas del Noreste,
S.A.
Rio Orinoco #171 Oriente
Despacho 2001
Colonia Del Valle
MONTERREY
Tel: 559-4415, 575-3837
Telex: 483164
A,E

Hewlett-Packard de Mexico,
S.A. de C.V.
Blvd. Independencia No. 2000 Ote.
Col. Estrella
TORREON, COAH.
Tel: 171-18-21-99
P

MOROCCO

Etablissement Hubert Dolbeau & Fils
81 rue Karatchi
B.P. 11133
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerep
2, rue Agadir
Boite Postale 156
CASABLANCA 01
Tel: 272093, 272095
Telex: 23 739
P

Sema-Maroc
Dept. Seric
6, rue Lapebie
CASABLANCA
Tel: 260980
Telex: 21641
C,P

NETHERLANDS

Hewlett-Packard Nederland B.V.
Startbaan 16
NL-1187 XR **AMSTELVEEN**
P.O. Box 667
NL-1180 AR **AMSTELVEEN**
Tel: (020) 547-6911
Telex: 13 216 HEP NL
A,C,CM,E,M,P

Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906VK **CAPELLE A/D IJSSEL**
P.O. Box 41
NL 2900AA **CAPELLE A/D IJSSEL**
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
C,E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV **EINDHOVEN**
P.O. Box 2342
NL 5600 CH **EINDHOVEN**
Tel: (040) 326911
Telex: 51484 hepae nl
C,E,P

NEW ZEALAND

Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, **AUCKLAND**
Tel: 687-159
Cable: HEWPAK Auckland
C,CM,E,P*
Hewlett-Packard (N.Z.) Ltd.
184-190 Willis Street
WELLINGTON
P.O. Box 9443
Courtenay Place, **WELLINGTON 3**
Tel: 877-199
Cable: HEWPAK Wellington
C,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: 488-873
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

NIGERIA

Elmeco Nigeria Ltd.
46, Calcutta Crescent Apapa
P.O. Box 244and
LAGOS
E

NORTHERN IRELAND

See United Kingdom

NORWAY

Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 **FYLLINGSDALEN** (Bergen)
Tel: 0047/5/16 55 40
Telex: 76621 hpnas n
C,E,M

Hewlett-Packard Norge A/S
Osterndalen 16-18
P.O. Box 34
N-1345 **OESTERAAS**
Tel: 0047/2/24 60 90
Telex: 76621 hpnas n
A,C,CM,E,M,P

Hewlett-Packard Norge A/S
Boehmergt. 42
Box 2470
N-5037 **SOLHEIMSVIK**
Tel: 0047/5/29 00 90

OMAN

Khimjil Ramdas
P.O. Box 19
MUSCAT/SULTANATE OF OMAN
Tel: 795 901
Telex: 3489 BROKER MB MUSCAT
P

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT/SULTANATE OF OMAN
Tel: 734 201-3
Telex: 5274 BAHWAN MB
E

Imtac LLC
P.O. Box 9196
MINA AL FAHAL/SULTANATE OF OMAN
Tel: 561 695, 5602078, 561010
Telex: 5298 Tawoos On
A,C,M

PAKISTAN

Mushko & Company Ltd.
House No. 16, Street No. 16
Sector F-6/3
ISLAMABAD
Tel: 824545
Cable: FEMUS Islamabad
A,E,P*
Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
KARACHI 0302
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi
A,E,P*

PANAMA

Electronico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 64-2700
Telex: 3483 ELECTRON PG
CM,E,M,P

PERU

Cia Electro Médica S.A.
Los Flamencos 145
San Isidro
Casilla 1030
LIMA 1
Tel: 41-4325, 41-3705
Telex: Pub. Booth 25306 PEC PISIDR
CM,E,M,P
SAMS S.A.
Arenida Republica de Panama 3534
San Isidro, **LIMA**
Tel: 419928/417108
Telex: 20450 PE LIBERTAD
A,C,P

PHILIPPINES

The Online Advanced Systems Corp.
2nd Floor, Electra House
115-117 Esteban Street
Legaspi Village, Makati
Metro **MANILA**
Tel: 815-38-10 (up to 16)
Telex: 63274 ONLINE PN
A,C,E,M,P

PORTUGAL

Mundinter Intercambio
Mundial de Comércio S.A.R.L.
Av. Antonio Augusto Aguiar 138
Apartado 2761
LISBON
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M
Soquimica
Av. da Liberdade, 220-2
1298 **LISBOA** Codex
Tel: 56-21-82
Telex: 13316 SABASA
A

Telectra-Empresa Técnica de
Equipamentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
LISBON 1
Tel: (19) 68-60-72
Telex: 12598
CM,E

C.P.C.S.I.
Rua de Costa Cabral 575
4200 **PORTO**
Tel: 499174/495173
Telex: 26054
C,P

PUERTO RICO

Hewlett-Packard Puerto Rico
101 Muñoz Rivera Av
Esu. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800
A,C,CM,M,E,P

QATAR

Computer Arabia
P.O. Box 2750
DOHA
Tel: 428555
Telex: 4806 CHPARB
P

Nasser Trading & Contracting
P.O.Box 1563
DOHA
Tel: 422170
Telex: 4439 NASSER DH
M

SAUDI ARABIA

Modern Electronics Establishment
Hewlett-Packard Division
P.O. Box 281
Thuobah
AL-KHOBAR 31952
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
C,E,M



SALES & SUPPORT OFFICES

Arranged alphabetically by country

SAUDI ARABIA (Cont'd)

Modern Electronics Establishment
Hewlett-Packard Division
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH

Tel: 644 96 28
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH
A,C,CM,E,M,P

Modern Electronics Establishment
Hewlett-Packard Division
P.O.Box 22015
RIYADH 11495

Tel: 491-97 15, 491-63 87
Telex: 202049 MEERYD SJ
C,E,M

Abdul Ghani El Ajou Corp.
P.O. Box 78
RIYADH

Tel: 40 41 717
Telex: 200 932 EL AJOU
P

SCOTLAND

See United Kingdom

SENEGAL

Societe Hussein Ayad & Cie.
76, Avenue Georges Pompidou
B.P. 305

DAKAR
Tel: 32339
Cable: AYAD-Dakar
E

Moneger Distribution S.A.
1, Rue Parent
B.P. 148

DAKAR
Tel: 215 671
Telex: 587
P

Système Service Conseil (SSC)
14, Avenue du Parchois

DAKAR ETOILE
Tel: 219976
Telex: 577
C,P

SINGAPORE

Hewlett-Packard Singapore (Sales)
Pte. Ltd.

#08-00 Inchcape House
450-2 Alexandra Road
Alexandra P.O. Box 58
SINGAPORE, 9115

Tel: 4731788
Telex: 34209 HPSGSO RS
Cable: HEWPACK, Singapore
A,C,E,M,P

Dynamar International Ltd.
Unit 05-11 Block 6
Kolam Ayer Industrial Estate
SINGAPORE 1334

Tel: 747-6188
Telex: 26283 RS
CM

SOUTH AFRICA

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 120
Howard Place **CAPE PROVINCE 7430**
Pine Park Center, Forest Drive
Pinelands

CAPE PROVINCE 7405

Tel: (021) 53 7954
Telex: 57-20006
A,C,CM,E,M,P

Hewlett-Packard So Africa (Pty.) Ltd.
2nd Floor Juniper House
92 Overport Drive
DURBAN 4067

Tel: (031) 28-4178
Telex: 6-22954
C

Hewlett-Packard So Africa (Pty.) Ltd.
6 Linton Arcade
511 Cape Road
Linton Grange
PORT ELIZABETH 6001

Tel: 041-301201
Telex: 24-2916
C

Hewlett-Packard So Africa (Pty.) Ltd.
Fountain Center
Kalkoen Str.
Monument Park Ext 2

PRETORIA 0105
Tel: (012) 45 5725
Telex: 32163
C,E

Hewlett-Packard So Africa (Pty.) Ltd.
9 Eastern Service Road
Eastgate Ext. 3
SANDTON 2144

Tel: 802-5111, 802-5125
Telex: 4-20877 SA
Cable: HEWPACK Johannesburg
A,C,CM,E,M,P

SPAIN

Hewlett-Packard Española, S.A.
Calle Entenza, 321
08029 **BARCELONA**
Tel: 3/322 24 51, 321 73 54

Telex: 52603 hpbee
A,C,E,M,P

Hewlett-Packard Española, S.A.
Calle San Vicente S/N
Edificio Albia II-7B
48001 **BILBAO**

Tel: 4/423 83 06
A,C,E,M

Hewlett-Packard Española, S.A.
Ctra. de la Coruña, Km. 16, 400
Las Rozas

E-MADRID
Tel: (1) 637.00.11
Telex: 23515 HPE
C,M

Hewlett-Packard Española, S.A.
Avda. S. Francisco Javier, S/N
Planta 10. Edificio Sevilla 2
41005 **SEVILLA**
Tel: 54/64 44 54
Telex: 72933
A,C,M,P

Hewlett-Packard Española, S.A.
Isabel La Catolica, 8
46004 **VALENCIA**
Tel: (96) 351 59 44
Telex: 63435
C,P

Hewlett-Packard Española, S.A.
Av. de Zugazarte, 8
Edificio El Abra 4
Las Arenas-Guecho
VIZCAYA
Tel: (94) 464 3255, 464 2933
Telex: 33032

SWEDEN

Hewlett-Packard Sverige AB
Östra Tullgatan 3
S-20011 **MALMÖ**
Box 6132
Tel: (040) 70270
Telex: (854) 17886 (via Spånga office)
C,P

Hewlett-Packard Sverige AB
Västra Vintergatan 9
S-70344 **ÖREBRO**
Tel: (19) 10-48-80
Telex: (854) 17886 (via Spånga office)
C

Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
Box 19
S-16393 **SPÅNGA**
Tel: (08) 750-2000
Telex: (854) 17886
Telefax: (08) 7527781
A,C,CM,E,M,P

Hewlett-Packard Sverige AB
Box 266
Topasgatan 1A
S-42123 **VÄSTRA-FRÖLUNDA**
(Gothenburg)
Tel: (031) 89-10-00
Telex: (854) 17886 (via Spånga office)
A,C,CM,E,M,P

SUDAN

Mediterranean Engineering & Trading
Co. Ltd.
P.O. Box 1025
KHARTOUM
Tel: 41184
Telex: 24052
C,P

SWITZERLAND

Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 **BASEL**
Tel: (61) 33-59-20
A,C,E,P

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case postale 365
CH-1217 **MEYRIN 1**
Tel: (0041) 22-83-11-11
Telex: 27333 HPAG CH
A,C,CM,E,M,P

Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 **WIDEN**
Tel: (0041) 57 31 21 11
Telex: 53933 hpag ch
Cable: HPAG CH
A,C,CM,E,M,P

Hewlett-Packard (Schweiz) AG
Schwamendingenstrasse 10
8050 **ZÜRICH**
Tel: (0041) 1 315 81 81
Telex: 823 537 HPAG CH
C,P

SYRIA

General Electronic Inc.
Nuri Basha Ahnaf Ebn Kays Street
P.O. Box 5781
DAMASCUS
Tel: 33-24-87
Telex: 411 215
Cable: ELECTROBOR DAMASCUS
E

Middle East Electronics
P.O.Box 2308
Abu Rumaneh
DAMASCUS
Tel: 33 45 92
Telex: 411 771
M

TAIWAN

Hewlett-Packard Taiwan Ltd.
THM Office
2, Huan Nan Road
CHUNG LI, Taoyuan
Tel: (034) 929-666
C
Hewlett-Packard Taiwan Ltd.
Kaohsiung Office
11/F, 456, Chung Hsiao 1st Road
KAOHSIUNG
Tel: (07) 2412318
C,E

Hewlett-Packard Taiwan Ltd.
8th Floor, Hewlett-Packard Building
337 Fu Hsing North Road
TAIPEI
Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable: HEWPACK Taipei
A,C,CM,E,M,P

Ing Lih Trading Co.
6th Floor, 112, Sec. 1,
Chung Hsiao East Road
TAIPEI 100
Tel: (02) 394-8191
Telex: 22894 SANKWANG
A

THAILAND

Unimesa Co. Ltd.
30 Patpong Ave., Suriwong
BANGKOK 10500
Tel: 235-5727, 234-0991/3
Telex: 84439 Simonco TH
Cable: UNIMESA Bangkok
A,C,E,M

Bangkok Business Equipment Ltd.
5/5-6 Dejo Road
BANGKOK
Tel: 234-8670, 234-8671
Telex: 87699-BEQUIPT TH
Cable: BUSIQUIPT Bangkok
P

TOGO
Societe Africaine De Promotion
B.P. 12271
LOME
Tel: 21-62-88
Telex: 5304
P

TRINIDAD & TOBAGO
Caribbean Telecoms Ltd.
Corner McAllister Street &
Eastern Main Road, Laventille
P.O. Box 732

PORT-OF-SPAIN
Tel: 624-4213
Telex: 22561 CARTEL WG
Cable: CARTEL, PORT OF SPAIN
CM,E,M,P

Computer and Controls Ltd.
P.O. Box 51
66 Independence Square
PORT-OF-SPAIN

Tel: 623-4472
Telex: 3000 POSTLX WG, ACCT
LOGO AGENCY 1264
A,P

Feral Assoc.
8 Fitzgerald Lane
PORT-OF-SPAIN
Tel: 62-36864, 62-39255
Telex: 22432 FERALCO
Cable: FERALCO
M

TUNISIA
Tunisie Electronique S.A.R.L.
31 Avenue de la Liberte
TUNIS
Tel: 280-144
C,E,P

Tunisie Electronique S.A.R.L.
94, Av. Jugurtha, Mutuelleville
1002 **TUNIS-BELVEDERE**
Tel: 280144
Telex: 13238
C,E,P

Corema S.A.
1 ter. Av. de Carthage
TUNIS
Tel: 253-821
Telex: 12319 CABAM TN
M

TURKEY
E.M.A
Mediha Eldem Sokak No. 41/6
Yenisehir
ANKARA
Tel: 319175
Telex: 42321 KTX TR
Cable: EMATRADE ANKARA
M

Teknim Company Ltd.
Iran Caddesi No. 7
Karaklidere
ANKARA
Tel: 275800
Telex: 42155 TKNM TR
C,E
Kurt & Kurt A.S.
Mithatpasa Caddesi No. 75
Kat 4 Kizilay
ANKARA
Tel: 318875/6/7/8
Telex: 42490 MESR TR
A

Saniva Bilgisayar Sistemleri A.S.
Buyukdere Caddesi 103/6
Gayrettepe
ISTANBUL
Tel: 1673180
Telex: 26345 SANI TR
C,P

Best Inc.
Esentepe, Gazeteciler Sitesi
Keskın Kalem
Sokak 6/3, Gayrettepe
ISTANBUL
Tel: 172 1328, 173 3344
Telex: 42490
A

UNITED ARAB EMIRATES

Emitac Ltd.
P.O. Box 1641
SHARJAH
Tel: 591181
Telex: 68136 EMITAC EM
Cable: EMITAC SHARJAH
E,C,M,P,A
Emitac Ltd.
P.O. Box 2711
ABU DHABI
Tel: 820419-20
Cable: EMITACH ABUDHABI
Emitac Ltd.
P.O. Box 8391
DUBAI
Tel: 377591

Emitac Ltd.
P.O. Box 473
RAS AL KHAIMAH
Tel: 28133, 21270

UNITED KINGDOM ENGLAND

Hewlett-Packard Ltd.
Miller House
The Ring, **BRACKNELL**
Berks RG12 1XN
Tel: 0344 424898
Telex: 848733
E
Hewlett-Packard Ltd.
Elstree House, Elstree Way
BOREHAMWOOD, Herts WD6 1SG
Tel: 01 207 5000
Telex: 8952716
C,E

Hewlett-Packard Ltd.
Oakfield House, Oakfield Grove
Clifton **BRISTOL**, Avon BS8 2BN
Tel: 0272 736806
Telex: 444302
C,E,P

Hewlett-Packard Ltd.
9 Bridewell Place
LONDON EC4V 6BS
Tel: 01 583 6565
Telex: 298163
C,P
Hewlett-Packard Ltd.
Pontefract Road
NORMANTON, West Yorkshire WF6 1RN
Tel: 0924 895566
Telex: 557355
C,P

Hewlett-Packard Ltd.
The Quadrangle
106-118 Station Road
REDHILL, Surrey RH1 1PS
Tel: 0737 68655
Telex: 947234
C,E,P

Hewlett-Packard Ltd.
Avon House
435 Stratford Road
Shirley, **SOLIHULL**, West Midlands
B90 4BL
Tel: 021 745 8800
Telex: 339105
C,E,P

Hewlett-Packard Ltd.
Heathside Park Road
Cheadle Heath
STOCKPORT
Cheshire
SK3 ORB
Tel: 061-428-0828
Telex: 668068
A,C,E,M,P

Hewlett-Packard Ltd.
Harmon House
No. 1 George Street
UXBRIDGE, Middlesex UX8 1YN
Tel: 895 720 20
Telex: 893134/5
C,CM,E,M,P
Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847178
A,C,E,M,P

NORTHERN IRELAND
Hewlett-Packard (Ireland) Ltd.
Carrickfergus Industrial Centre
75 Belfast Road, Carrickfergus
CO. ANTRIM BT38 8PM
Tel: 09603 67333
C,E

Cardiac Services Company
95A Finaghy Road South
BELFAST, BT10 OBY
Tel: 0232-625566
Telex: 747626
M

SCOTLAND
Hewlett-Packard Ltd.
1/3 Springburn Place
College Milton North
EAST KILBRIDE, G74 3NU
Tel: 03552-49261
Telex: 779615
C,E

Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031 331 1188
Telex: 72682
C,CM,E,M,P

UNITED STATES

Alabama
Hewlett-Packard Co.
2100 Riverchase Center
Building 100 - Suite 118
BIRMINGHAM, AL 35244
Tel: (205) 988-0547
A,C,M,P*

Hewlett-Packard Co.
420 Wynn Drive
HUNTSVILLE, AL 35805
Tel: (205) 830-2000
C,CM,E,M*

Alaska
Hewlett-Packard Co.
3601 C St., Suite 1416
ANCHORAGE, AK 99503
Tel: (907) 563-8855
C,E

Arizona
Hewlett-Packard Co.
8080 Pointe Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000
A,C,CM,E,M,P

Hewlett-Packard Co.
3400 East Britannia Dr.
Bldg. C, Suite 124
TUCSON, AZ 85706
Tel: (602) 573-7400
C,E,M**

California
Hewlett-Packard Co.
99 South Hill Dr.
BRISBANE, CA 94005
Tel: (415) 330-2500
C

Hewlett-Packard Co.
5060 E. Clinton Avenue, Suite 102
FRESNO, CA 93727
Tel: (209) 252-9652
C,M

Hewlett-Packard Co.
1421 S. Manhattan Av.
FULLERTON, CA 92631
Tel: (714) 999-6700
C,CM,E,M

Hewlett-Packard Co.
7408 Hollister Ave. #A
GOLETA, CA 93117
Tel: (805) 685-6100
C,E



SALES & SUPPORT OFFICES

Arranged alphabetically by country

UNITED STATES (Cont'd)

Hewlett-Packard Co.
2525 Grand Avenue
LONG BEACH, CA 90815
Tel: (213) 498-1111
C

Hewlett-Packard Co.
5651 West Manchester Ave.
LOS ANGELES, CA 90045
Tel: (213) 337-8000
Telex: 910-325-6608
C,M

Hewlett-Packard Co.
3155 Porter Drive
PALO ALTO, CA 94304
Tel: (415) 857-8000
C,E

Hewlett-Packard Co.
4244 So. Market Court, Suite A
SACRAMENTO, CA 95834
Tel: (916) 929-7222
A*,C,E,M

Hewlett-Packard Co.
9606 Aero Drive
SAN DIEGO, CA 92123
Tel: (619) 279-3200
C,CM,E,M

Hewlett-Packard Co.
5725 W. Las Positas Blvd.
PLEASANTON, CA 94566
Tel: (415) 460-0282
C

Hewlett-Packard Co.
3003 Scott Boulevard
SANTA CLARA, CA 95054
Tel: (408) 988-7000
Telex: 910-338-0586
A,C,CM,E

Hewlett-Packard Co.
2150 W. Hillcrest Dr.
THOUSAND OAKS, CA 91320
(805) 373-7000
C,CM,E

Colorado

Hewlett-Packard Co.
2945 Center Green Court South
Suite A
BOULDER, CO 80301
Tel: (303) 499-6655
A,C,E

Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000
A,C,CM,E,M

Connecticut

Hewlett-Packard Co.
500 Sylvan Av.
BRIDGEPORT, CT 06606
Tel: (203) 371-6454
C,E

Hewlett-Packard Co.
47 Barnes Industrial Road South
WALLINGFORD, CT 06492
Tel: (203) 265-7801
A,C,CM,E,M

Florida

Hewlett-Packard Co.
2901 N.W. 62nd Street
FORT LAUDERDALE, FL 33309
Tel: (305) 973-2600
C,E,M,P*

Hewlett-Packard Co.
6800 South Point Parkway
Suite 301
JACKSONVILLE, FL 32216
Tel: (904) 636-9955
C*,M**

Hewlett-Packard Co.
255 East Drive, Suite B
MELBOURNE, FL 32901
Tel: (305) 729-0704
CM,E

Hewlett-Packard Co.
6177 Lake Ellenor Drive
ORLANDO, FL 32809
Tel: (305) 859-2900
A,C,CM,E,P*

Hewlett-Packard Co.
4700 Bayou Blvd.
Building 5
PENSACOLA, FL 32503
Tel: (904) 476-8422
A,C,M

Hewlett-Packard Co.
5550 W. Idlewild, #150
TAMPA, FL 33614
Tel: (813) 884-3282
C,E,M,P

Georgia

Hewlett-Packard Co.
2000 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500
Telex: 810-766-4890
A,C,CM,E,M,P*

Hewlett-Packard Co.
3607 Parkway Lane
Suite 300
NORCROSS, GA 30092
Tel: (404) 448-1894
C,E,P

Hawaii

Hewlett-Packard Co.
Kawaiahao Plaza, Suite 190
567 South King Street
HONOLULU, HI 96813
Tel: (808) 526-1555
A,C,E,M

Idaho

Hewlett-Packard Co.
11309 Chinden Blvd.
BOISE, ID 83707
Tel: (208) 323-2700
C

Illinois

Hewlett-Packard Co.
304 Eldorado Road
P.O. Box 1607
BLOOMINGTON, IL 61701
Tel: (309) 662-9411
A,C,E,M**

Hewlett-Packard Co.
525 W. Monroe, #1308
CHICAGO, IL 60606
Tel: (312) 930-0010
C

Hewlett-Packard Co.
1200 East Diehl Road
NAPERVILLE, IL 60566
Tel: (312) 357-8800
C

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800
Telex: 910-687-1066
A,C,CM,E,M

Indiana

Hewlett-Packard Co.
11911 N. Meridian St.
CARMEL, IN 46032
Tel: (317) 844-4100
A,C,CM,E,M

Hewlett-Packard Co.
111 E. Ludwig Road
Suite 108
FT. WAYNE, IN 46825
Tel: (219) 482-4283
C,E

Iowa

Hewlett-Packard Co.
4070 22nd Av. SW
CEDAR RAPIDS, IA 52404
Tel: (319) 390-4250
C,E,M

Hewlett-Packard Co.
4201 Corporate Dr.
WEST DES MOINES, IA 50265
Tel: (515) 224-1435
A**,C,M**

Kansas

Hewlett-Packard Co.
7804 East Funston Road, Suite 203
WICHITA, KS 67207
Tel: (316) 684-8491
C,E

Kentucky

Hewlett-Packard Co.
10300 Linn Station Road, Suite 100
LOUISVILLE, KY 40223
Tel: (502) 426-0100
A,C,M

Louisiana

Hewlett-Packard Co.
160 James Drive East
ST. ROSE, LA 70087
P.O. Box 1449
KENNER, LA 70063
Tel: (504) 467-4100
A,C,E,M,P

Maryland

Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 644-5800
Telex: 710-862-1943
A,C,CM,E,M

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370
A,C,CM,E,M

Massachusetts

Hewlett-Packard Co.
1775 Minuteman Road
ANDOVER, MA 01810
Tel: (617) 682-1500
A,C,CM,E,M,P*

Hewlett-Packard Co.
32 Hartwell Avenue
LEXINGTON, MA 02173
Tel: (617) 861-8960
C,E

Michigan

Hewlett-Packard Co.
4326 Cascade Road S.E.
GRAND RAPIDS, MI 49506
Tel: (616) 957-1970
C,M

Hewlett-Packard Co.
39550 Orchard Hill Place Drive
NOVI, MI 48050
Tel: (313) 349-9200
A,C,E,M

Hewlett-Packard Co.
1771 W. Big Beaver Road
TROY, MI 48084
Tel: (313) 643-6474
C

Minnesota

Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100
A,C,CM,E,M

Missouri

Hewlett-Packard Co.
1001 E. 101st Terrace Suite 120
KANSAS CITY, MO 64131-3368
Tel: (816) 941-0411
A,C,CM,E,M

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MO 63044
Tel: (314) 344-5100
A,C,E,M

Nebraska

Hewlett-Packard
11626 Nicholas St.
OMAHA, NE 68154
Tel: (402) 493-0300
C,E,M

New Jersey

Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07653
Tel: (201) 265-5000
A,C,CM,E,M

Hewlett-Packard Co.
20 New England Av. West
PISCATAWAY, NJ 08854
Tel: (201) 562-6100
A,C,CM,E



New Mexico

Hewlett-Packard Co.
7801 Jefferson N.E.
ALBUQUERQUE, NM 87109
Tel: (505) 823-6100
C,E,M

Hewlett-Packard Co.
1460 Trinity Dr., Suite 3
LOS ALAMOS, NM 87544
Tel: (505) 662-6700
C,E

New York

Hewlett-Packard Co.
5 Computer Drive South
ALBANY, NY 12205
Tel: (518) 458-1550
A,C,E,M

Hewlett-Packard Co.
9600 Main Street
CLARENCE, NY 14031
Tel: (716) 759-8621
C,E

Hewlett-Packard Co.
200 Cross Keys Office Park
FAIRPORT, NY 14450
Tel: (716) 223-9950
A,C,CM,E,M

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820
A,C,CM,E,M

Hewlett-Packard Co.
No. 1 Pennsylvania Plaza
55th Floor
34th Street & 8th Avenue
MANHATTAN NY 10119
Tel: (212) 971-0800
C,M*

Hewlett-Packard Co.
15 Myers Corner Rd.
Hollowbrook Park, Suite 2D
WAPPINGER FALLS, NY 12590
Tel: (914) 298-9125
CM,E

Hewlett-Packard Co.
2975 Westchester Avenue
PURCHASE, NY 10577-2590
Tel: (914) 935-6300
C,CM,E

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 682-7800
A,C,CM,E,M

North Carolina

Hewlett-Packard Co.
305 Gregson Dr.
CARY, NC 27511
Tel: (919) 467-6600
C,CM,E,M,P*

Hewlett-Packard Co.
9600-H Southern Pine Blvd.
CHARLOTTE, NC 28210
Tel: (704) 527-8780
C*

Hewlett-Packard Co.
5605 Roanne Way
GREENSBORO, NC 27420
Tel: (919) 852-1800
A,C,CM,E,M,P*

Ohio

Hewlett-Packard Co.
2717 S. Arlington Road
AKRON, OH 44312
Tel: (216) 644-2270
C,E

Hewlett-Packard Co.
4501 Erskine Road
CINCINNATI, OH 45242
Tel: (513) 891-9870
C,M

Hewlett-Packard Co.
15885 Sprague Road
CLEVELAND, OH 44136
Tel: (216) 243-7300
A,C,CM,E,M

Hewlett-Packard Co.
9080 Springboro Pike
MIAMISBURG, OH 45342
Tel: (513) 433-2223
A,C,CM,E*,M

Hewlett-Packard Co.
One Maritime Plaza, 5th Floor
720 Water Street
TOLEDO, OH 43604
Tel: (419) 242-2200
C

Hewlett-Packard Co.
675 Brooksedge Blvd.
WESTERVILLE, OH 43081
Tel: (614) 891-3344
C,CM,E*

Oklahoma

Hewlett-Packard Co.
3525 N.W. 56th St.
Suite C-100
OKLAHOMA CITY, OK 73112
Tel: (405) 946-9499
C,E*,M

Hewlett-Packard Co.
3840 S. 103rd E. Ave., #100
TULSA, OK 74146
Tel: (918) 665-3300
A**,C,E,M*,P*

Oregon

Hewlett-Packard Co.
9255 S. W. Pioneer Court
WILSONVILLE, OR 97070
Tel: (503) 682-8000
A,C,E*,M

Pennsylvania

Hewlett-Packard Co.
50 Dorchester Rd.
HARRISBURG, PA 17112
Tel: (717) 657-5900
C

Hewlett-Packard Co.
111 Zeta Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400
A,C,E,M

Hewlett-Packard Co.
2750 Monroe Boulevard
VALLEY FORGE, PA 19482
Tel: (215) 666-9000
A,C,CM,E,M

South Carolina

Hewlett-Packard Co.
Brookside Park, Suite 122
1 Harbison Way
COLUMBIA, SC 29210
Tel: (803) 732-0400
C,M

Hewlett-Packard Co.
545 N. Pleasantburg Dr.
Suite 100
GREENVILLE, SC 29607
Tel: (803) 232-8002
C

Tennessee

Hewlett-Packard Co.
One Energy Centr. Suite 200
Pellicissippi Pkwy.
KNOXVILLE, TN 37932
Tel: (615) 966-4747
A,C,M

Hewlett-Packard Co.
3070 Directors Row
Directors Square
MEMPHIS, TN 38131
Tel: (901) 346-8370
A,C,M

Hewlett-Packard Co.
220 Great Circle Road, Suite 116
NASHVILLE, TN 37228
Tel: (615) 255-1271
A,C,E,M,P

Texas

Hewlett-Packard Co.
1826-P Kramer Lane
AUSTIN, TX 78758
Tel: (512) 835-6771
C,E,P*

Hewlett-Packard Co.
5700 Cromo Dr
EL PASO, TX 79912
Tel: (915) 833-4400
C,E*,M**

Hewlett-Packard Co.
3952 Sandshell Drive
FORT WORTH, TX 76137
Tel: (817) 232-9500
C

Hewlett-Packard Co.
10535 Harwin Drive
HOUSTON, TX 77036
Tel: (713) 776-6400
A,C,E,M,P*

Hewlett-Packard Co.
3301 Royal Lane
IRVING, TX 75063
Tel: (214) 869-3377
C,E

Hewlett-Packard Co.
109 E. Toronto, Suite 100
McALLEN, TX 78503
Tel: (512) 630-3030
C

Hewlett-Packard Co.
930 E. Campbell Rd.
RICHARDSON, TX 75081
Tel: (214) 231-6101
A,C,CM,E,M,P*

Hewlett-Packard Co.
1020 Central Parkway South
SAN ANTONIO, TX 78232
Tel: (512) 494-9336
A,C,E,M,P*

Utah

Hewlett-Packard Co.
3530 W. 2100 South St.
SALT LAKE CITY, UT 84119
Tel: (801) 974-1700
A,C,E,M

Virginia

Hewlett-Packard Co.
840 Greenbrier Circle
Suite 101
CHESAPEAKE, VA 23320
Tel: (804) 424-7105
C,E,M

Hewlett-Packard Co.
4305 Cox Road
GLEN ALLEN, VA 23060
Tel: (804) 747-7750
A,C,E,M,P*

Hewlett-Packard Co.
Tanglewood West Bldg.
Suite 240
3959 Electric Road
ROANOKE, VA 24018
Tel: (703) 774-3444
C,E,P

Washington

Hewlett-Packard Co.
15815 S.E. 37th Street
BELLEVUE, WA 98006
Tel: (206) 643-4000
A,C,CM,E,M

Hewlett-Packard Co.
North 708 Argonne Road
SPOKANE, WA 99212-2793
Tel: (509) 922-7000
C

West Virginia

Hewlett-Packard Co.
501 56th Street
CHARLESTON, WV 25304
Tel: (304) 925-0492
A,C,M

Wisconsin

Hewlett-Packard Co.
275 N. Corporate Dr.
BROOKFIELD, WI 53005
Tel: (414) 794-8800
A,C,E*,M

URUGUAY

Pablo Ferrando S.A.C. e l.
Avenida Italia 2877
Casilla de Correo 370
MONTEVIDEO
Tel: 80-3805
Telex: Public Booth 901
A,CM,E,M



SALES & SUPPORT OFFICES

Arranged alphabetically by country

URUGUAY (Cont'd)

Olympia de Uruguay S.A.
Maquinas de Oficina
Avda. del Libertador 1997
Casilla de Correos 6644

MONTEVIDEO

Tel: 91-1809, 98-3807
Telex: 6342 OROU UY
P

VENEZUELA

Hewlett-Packard de Venezuela C.A.
3A Transversal Los Ruices Norte
Edificio Segre 2 & 3
Apartado 50933

CARACAS 1050

Tel: (582) 239-4133
Telex: 251046 HEWPACK
A,C,CM,E,M,P

Hewlett-Packard de Venezuela, C.A.
Centro Ciudad Comercial Tamanaco
Nivel C-2 (Nueva Etapa)
Local 53H05

Chuaio, CARACAS

Tel: 928291
P

Albis Venezolana S.R.L.
Av. Las Marias, Ota. Alix,
El Pedregal
Apartado 81025
CARACAS 1080A

Tel: 747984, 742146
Telex: 24009 ALBIS VC
A

Tecnologica Medica del Caribe, C.A.
Multicentro Empresarial del Este
Ave. Libertador
Edif. Libertador
Nucleo "C" - Oficina 51-52

CARACAS

Tel: 339867/333780
M

Hewlett-Packard de Venezuela C.A.
Residencias Tia Betty Local 1
Avenida 3 y con Calle 75

MARACAIBO, Estado Zulia

Apartado 2646
Tel: (5861) 80304
Telex: 62464 HPMAR
C,E*

Hewlett-Packard de Venezuela C.A.
Urb. Lomas de Este
Torre Trebol — Piso 11

VALENCIA, Estado Carabobo

Apartado 3347
Tel: (5841) 222992
C,P

YUGOSLAVIA

Do Hermes
General Zdanova 4
YU-11000 BEOGRAD
Tel: (011) 342 641
Telex: 11433
A,C,E,M,P

Do Hermes
Celovska 73
YU-61000 LJUBLJANA

Tel: (061) 553 170

Telex: 31583

A,C,E,M,P

Elektrotehna

Titova 51

YU-61000 LJUBLJANA

CM

Do Hermes

Kralja Tomislava 1

YU-71000 SARAJEVO

Tel: (071) 35 859

Telex: 41634

C**,P

ZAIRE

Computer & Industrial Engineering
25, Avenue de la Justice

B.P. 12797

KINSHASA, Gombe

Tel: 32063

Telex: 21552

C,P

ZAMBIA

R.J. Tilbury (Zambia) Ltd.
P.O. Box 32792

LUSAKA

Tel: 215590

Telex: 40128

E

ZIMBABWE

Field Technical Sales (Private) Limited
45, Kelvin Road North

P.O. Box 3458

SALISBURY

Tel: 705 231

Telex: 4-122 RH

E,P

August 1986