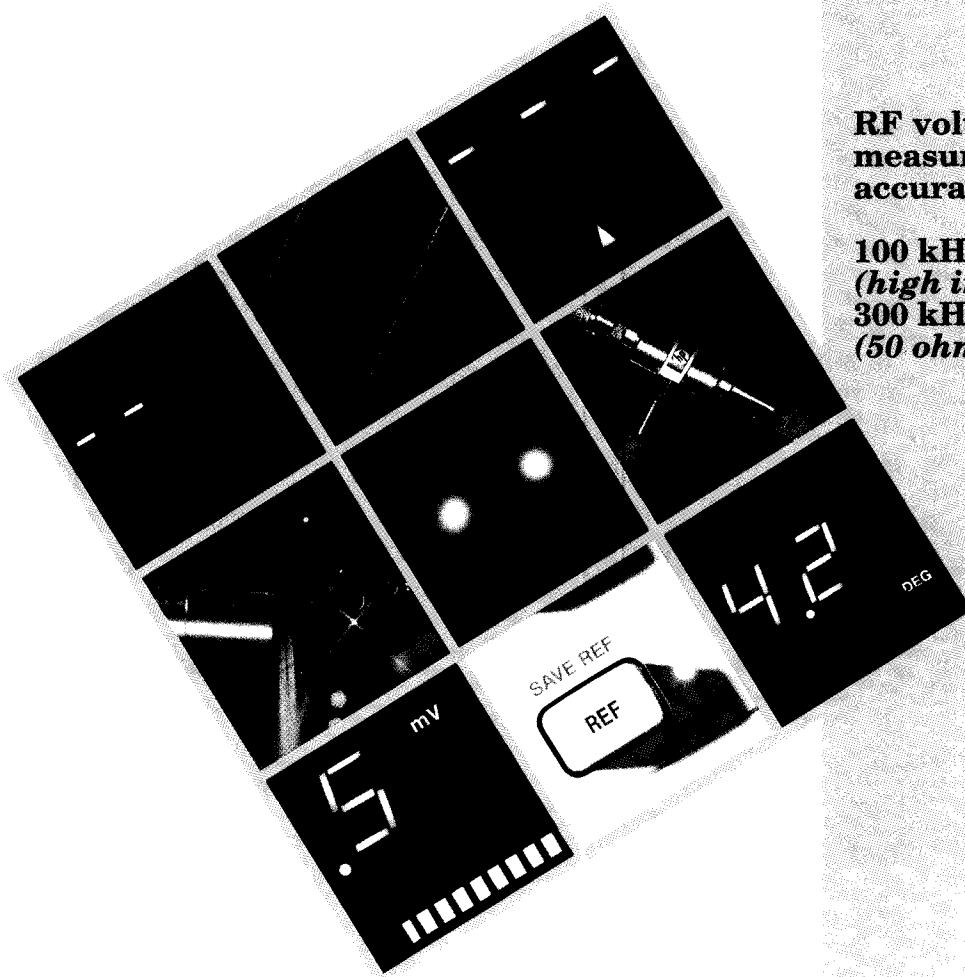


# HP 8508A Vector Voltmeter

DATA SHEETS  
(RETURN TO RED BINDERS)



**RF voltage and phase  
measurements made  
accurately and simply**

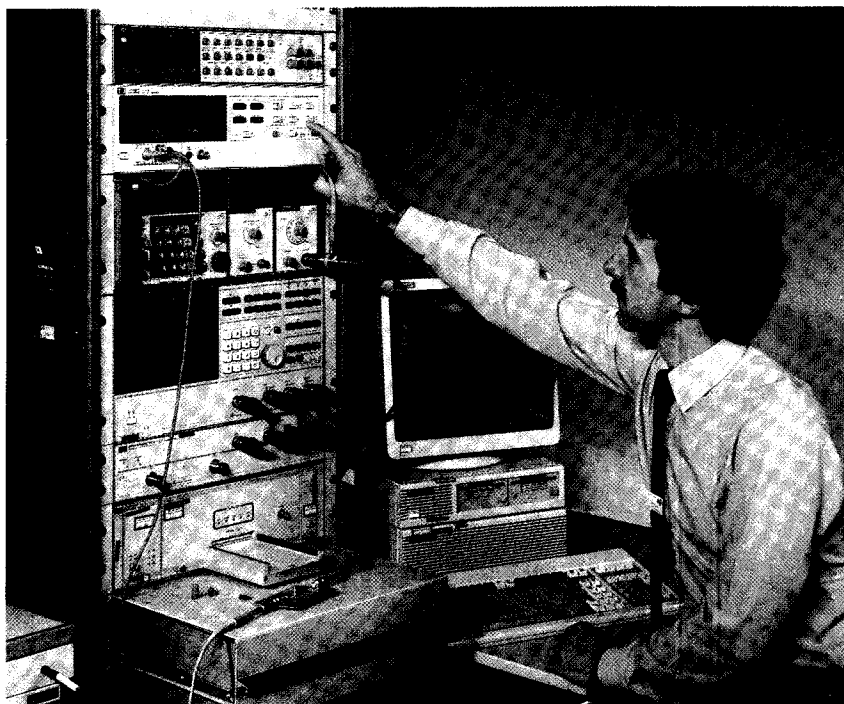
**100 kHz to 1 GHz  
(high impedance probes)  
300 kHz to 2 GHz  
(50 ohm inputs)**

aggi

## HP 8508A Vector Voltmeter

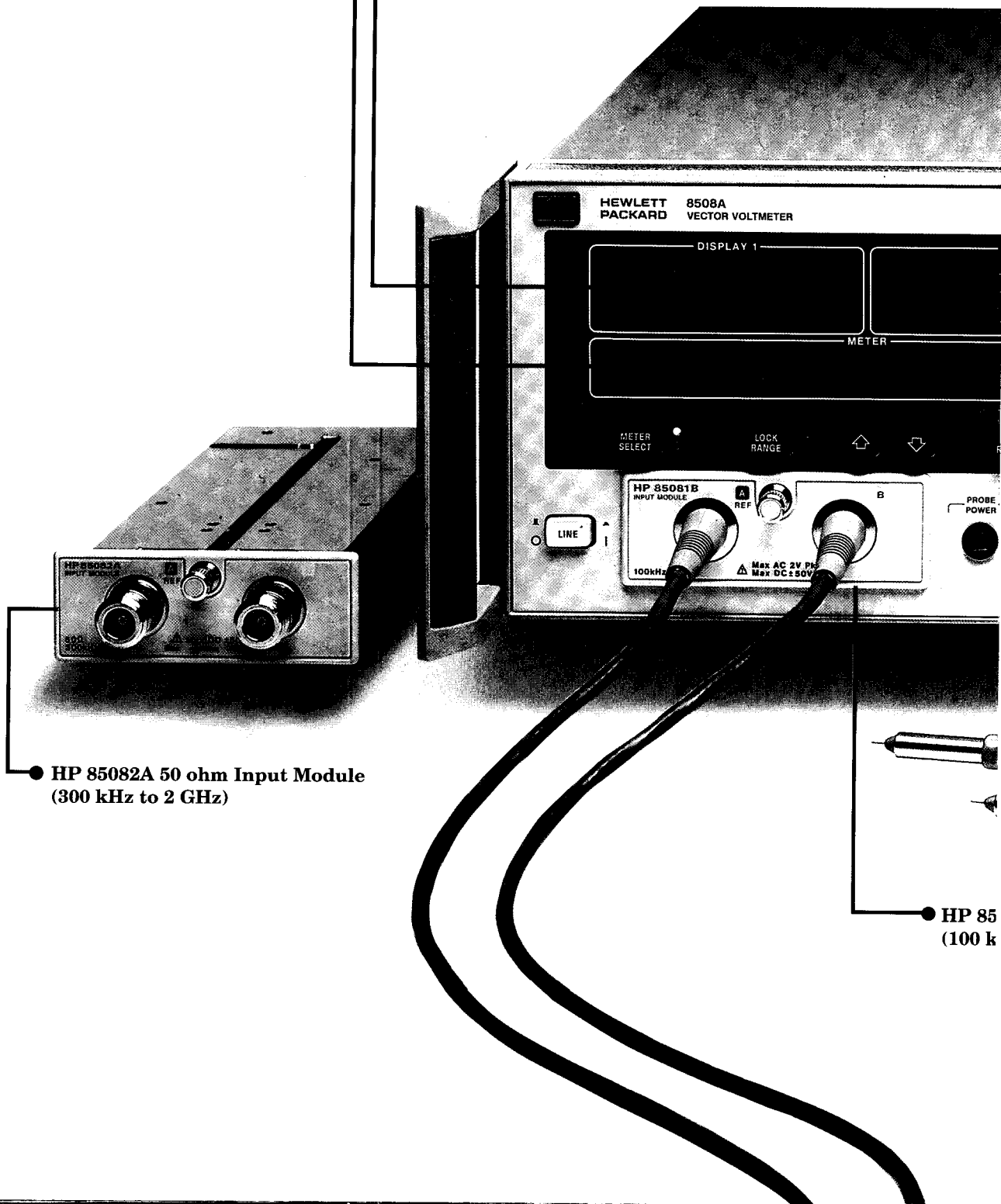


HP 8508A Vector Voltmeter in a bench testing application



Incoming inspection of RF devices using the HP 8508A

- Peaking/nulling indicator to ease circuit adjustment
- Large, legible displays for easy reading

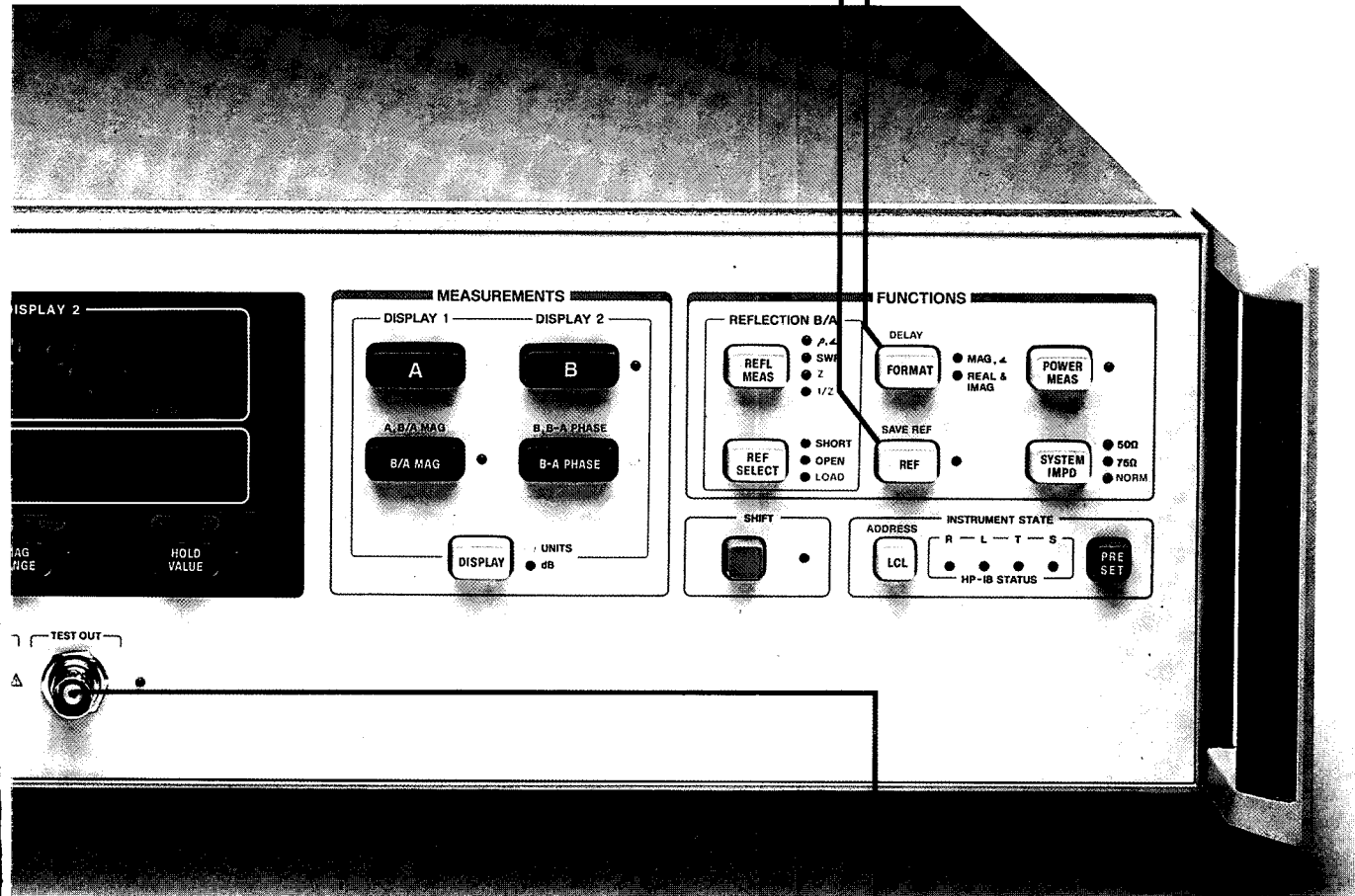


● HP 85082A 50 ohm Input Module  
(300 kHz to 2 GHz)

● HP 85  
(100 k)

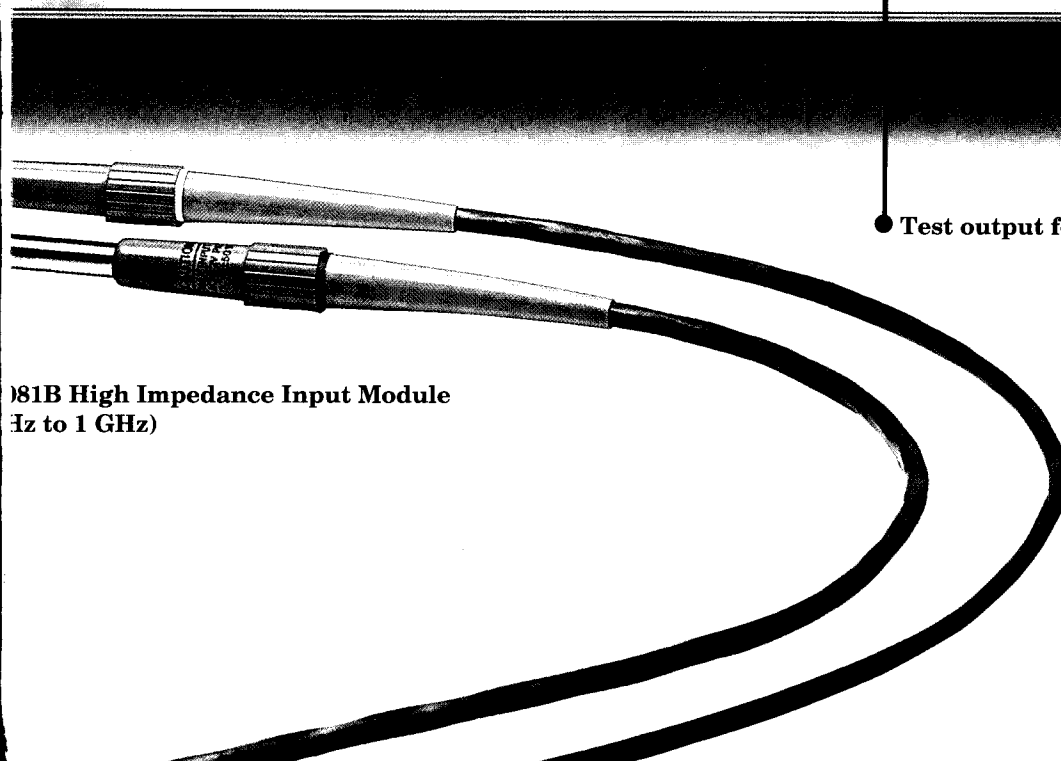
● Measurements to your choice of reference

● Choice of polar and cartesian measurement formats for user convenience



● Test output for operator confidence checks

81B High Impedance Input Module  
(100Ω to 1 GHz)



## Sensitive RF voltage and phase measurements

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### HP 8508A Vector Voltmeter

The HP 8508A Vector Voltmeter is a two channel receiver that makes high frequency voltage measurements easy. Its narrowband measuring technique gives it a sensitivity of 10  $\mu$ V to help you measure even the smallest signal. But that's only part of its capability. The HP 8508A also measures the phase between two signals – so you can use it for another complete set of measurements – like group delay and electrical length.

### Fast, accurate circuit probing

#### In Design . . .

. . . probing on the circuit allows measurement of each section under normal operating conditions – to give a better check on design margins. Measure amplifiers, matching sections, filters, attenuators and sources with ease.

#### In Manufacturing . . .

. . . it's faster and easier to probe on a circuit to align individual stages. Or troubleshoot by measuring the RF voltages to establish the location of a fault directly. Isolate the faulty component with confidence and reduce manufacturing time and cost.

#### In Maintenance . . .

. . . the RF voltages in circuit sections can easily be read on the large display, measured as absolute voltage or as gain and loss from any desired reference. The HP 8508A is designed to stack with other full-rack-width instruments on a bench. It's light enough for portable applications too (only 18 lb/ 11 kg). The HP 8508A can be used with any source – even the circuit's internal source – so in-circuit testing is easy and troubleshooting time is minimized.

### Component Measurements

For simple component checking, the wide dynamic range of the HP 8508A makes it suitable for tests on both active and passive components, from amplifier gain to filter band-stop rejection. Built-in measurement functions (for example, normalized impedance and SWR) make reflection measurements easy. The HP 8508A is ideal for simple manual test or in an automatic system – and built-in the basic performance to do the job. Full HP-IB programmability allows the HP 8508A to be used as part of a computer-controlled measurement system for data collection and repeatable testing.

### Measurement Systems

Easy programming helps you incorporate the HP 8508A to make the magnitude and phase measurements that are a basic requirement in many automated RF measurement systems. In measurement systems where uptime is critical (for example, production test), the outstanding reliability of the HP 8508A helps keep the system operational.

## Vector Voltmeter Specifications

**Specifications** describe the instrument's warranted performance over the temperature range 0 to 55 degC unless otherwise stated.

**Supplemental characteristics** are intended to provide information useful in applying the instrument by giving non-warranted performance parameters. These are denoted as "typical", "nominal" or "approximate".

**Measurement conditions:** All specifications apply to measurements in a 50 ohm system and with autoranging off, unless otherwise stated. For the HP 85081B High Impedance Input Module, measurements are made with the probes mounted in an HP 11536A Feedthru Tee unless otherwise stated.

### With HP 85081B High Impedance Input Module:

#### Frequency Range

100 kHz to 1 GHz

#### Measurement Range

A and B Channel maximum input levels for:

*Magnitude measurements*  
300 mV, 100 kHz to 1 MHz  
1 V, 1 MHz to 1 GHz

*Phase measurements*  
300 mV, 300 kHz to 1 GHz

*A (Ref) Channel minimum input levels for Magnitude and Phase measurements*

10 mV, 100 kHz to 300 kHz

1 mV, 300 kHz to 3 MHz

300 uV, 3 MHz to 1 GHz

*B (Meas) Channel noise floor*

10 uV rms, 1 MHz to 1 GHz

#### Input Crosstalk

>100 dB, 100 kHz to 500 MHz

>80 dB, 500 MHz to 1 GHz

#### Impedance

SWR <1.15, 100 kHz to 750 MHz

SWR <1.45, 750 MHz to 1 GHz

Probe: 100 kohm shunted by 2.5 pF (nominal).

#### Maximum Input (damage level)

2 V ac peak,  $\pm 50$  Vdc

#### Measurement bandwidth

1 kHz (nominal)

### With HP 85082A 50 ohm Input Module:

#### Frequency Range

300 kHz to 2 GHz

#### Measurement Range

A and B Channel maximum input levels for:

*Magnitude Measurements*  
3 dBm, 300 kHz to 1 MHz,  
1 GHz to 2 GHz

13 dBm, 1 MHz to 1 GHz

*Phase Measurements*

3 dBm, 300 kHz to 2 GHz

*A (Ref) Channel minimum input levels for Magnitude and Phase measurements*

-47 dBm, 300 kHz to 3 MHz

-57 dBm, 3 MHz to 2 GHz

*B (Meas) Channel noise floor <sup>1</sup>*

-87 dBm, 1.0 MHz to 2 GHz

#### Input Crosstalk

>100 dB, 300 kHz to 500 MHz

>80 dB, 500 MHz to 1 GHz

>70 dB, 1 GHz to 2 GHz.

#### Impedance

SWR <1.2, 300 kHz to 1.5 GHz

SWR <1.5, 1.5 GHz to 2 GHz

#### Maximum Input (damage level)

16 dBm,  $\pm 50$  V dc

#### Measurement bandwidth

1 kHz (nominal)

#### Input connectors

50 ohm type-N

Footnote

<sup>1</sup> 0 to 30 degrees C. Add 1 dB per 5 deg C outside this range.

## Applies to HP 85081B and HP 85082A

### Magnitude Characteristics

**Resolution:** 3 1/2 digits.

The HP 8508A converts the incoming signal into a 20 kHz IF while maintaining the same magnitude and phase relationship as the input signal. The 20 kHz IF is rectified and the rms value of the input signal is displayed on the instrument front panel.

**Accuracy:** Amplitude accuracy is specified for ratio and absolute measurements. Each case has two components of uncertainty:

*Accuracy vs Level* (refer to graph 1 for ratio measurements and graph 2 for absolute measurements)

*Accuracy vs Frequency* (refer to graph 3).

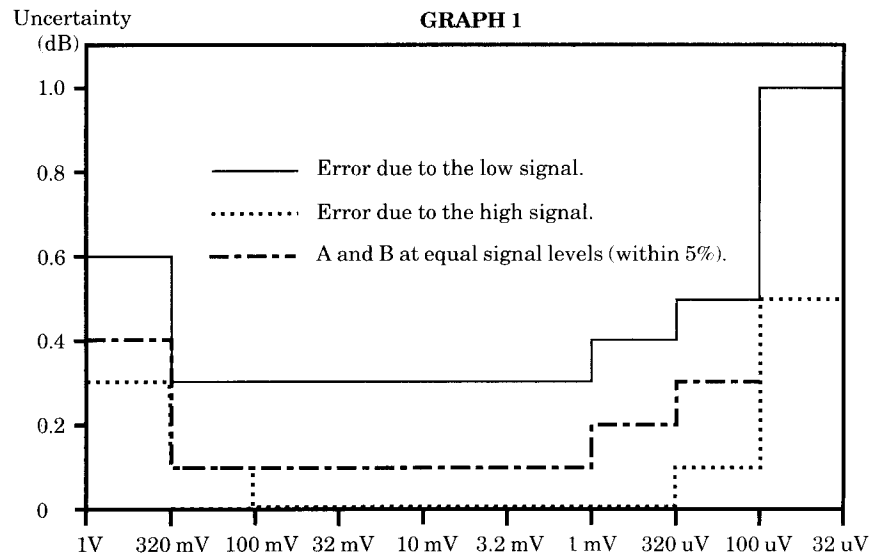
To obtain the absolute measurements total uncertainty value, add the values obtained from Graphs 2 and 3. When making ratio measurements, at a single frequency, use the uncertainty value obtained from Graph 1; for ratio measurements (where the reference and measurement frequencies are different), add the values obtained from Graphs 1 and 3.

### Ratio Amplitude Accuracy vs Level<sup>2,3,4</sup>

Use this uncertainty value when making ratio measurements at any single frequency.

When the lower level signal is <320  $\mu$ V, the uncertainty value increases due to the significance of the noise component. (For best accuracy, keep the A Channel between 10 mV and 100 mV.) When the signals are >100 mV, gain compression effects cause additional sources of error.

Example: A Channel = 200  $\mu$ V;  
B Channel = 200 mV; A and B Channels  
at any single frequency.  
Uncertainty due to A =  $\pm 0.5$  dB;  
uncertainty due to B =  $\pm 0.1$  dB.  
Total ratio measurement  
uncertainty =  $\pm 0.6$  dB.

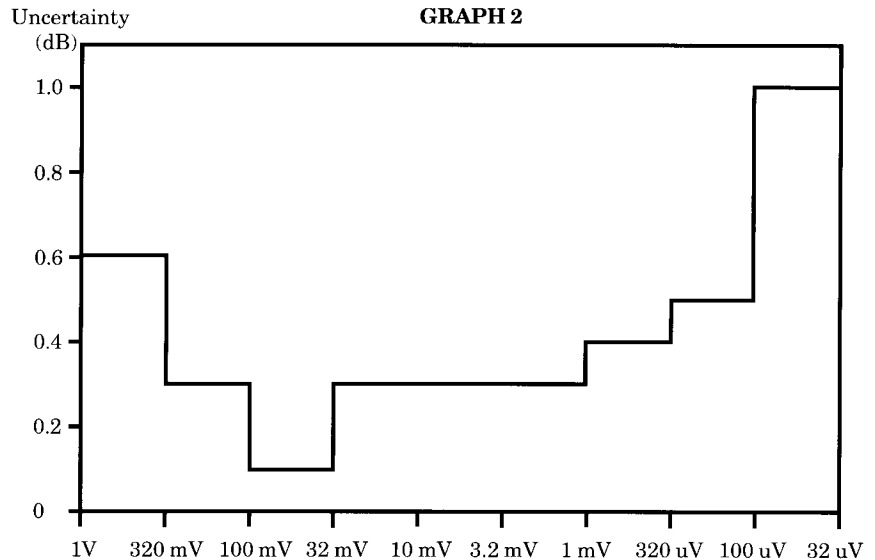


#### Footnotes

- <sup>2</sup> 15 to 30 degrees C. Add  $\pm 0.1$  dB per 5 deg C outside this range.
- <sup>3</sup> A minimum input level depends on frequency. See Measurement Range.
- <sup>4</sup> Add  $\pm 0.5$  dB for signals above 100 mV at frequencies greater than 500MHz.

### Absolute Amplitude Accuracy vs Level <sup>2, 3, 4</sup>

Use this uncertainty value when making absolute measurements at any single frequency.

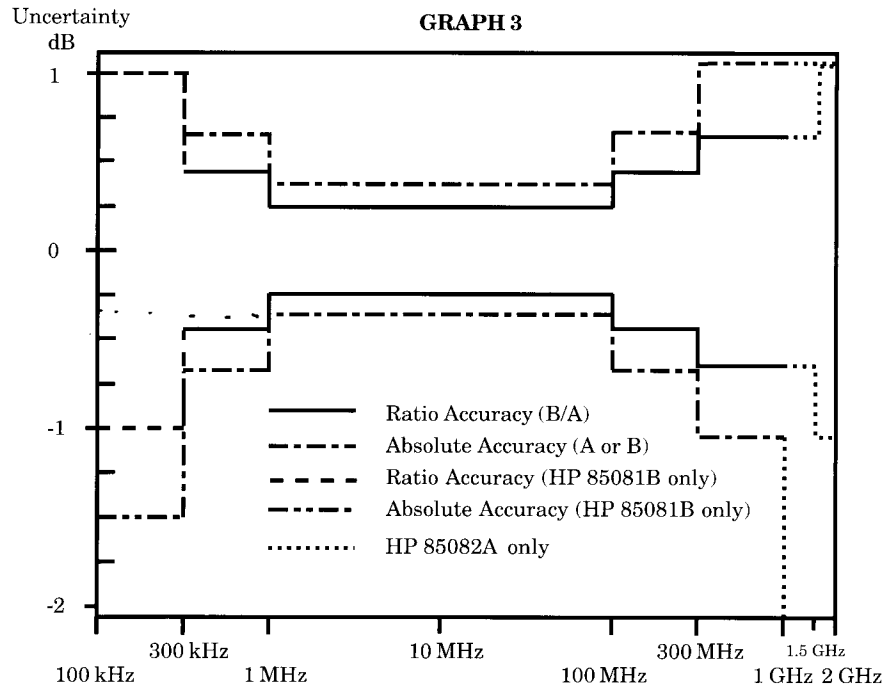


### Amplitude Accuracy vs Frequency <sup>2, 5</sup> (A and B, 100 mV nominal)

Use this uncertainty value when making absolute measurements and 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.

Example: Ratio accuracy (B/A) uncertainty at 200 MHz =  $\pm 0.4$  dB.  
 Absolute accuracy (A or B) uncertainty with the B Channel = 200 MHz, 200 mV. Frequency uncertainty component =  $\pm 0.7$  dB (from Graph 3).  
 Level uncertainty component =  $\pm 0.3$  dB (from Graph 2). Total absolute accuracy uncertainty =  $\pm 1.0$  dB.



#### Footnotes

- <sup>2</sup> 15 to 30 degrees C. Add  $\pm 0.1$  dB per 5 deg C outside this range.
- <sup>3</sup> A minimum input level depends on frequency. See Measurement Range.
- <sup>4</sup> Add  $\pm 0.5$  dB for signals above 100 mV at frequencies greater than 500MHz.
- <sup>5</sup> A and B absolute value includes  $\pm 0.15$  dB source traceability error.



## Phase Characteristics

**Display Range:** -179.9 to +180 degrees

**Display Resolution:** 0.1 degrees

**Accuracy:** Phase accuracy has two components of uncertainty: *Phase Accuracy vs Level* and *Phase Accuracy vs Frequency*. Use the information beside each graph to decide if the uncertainty applies to your particular application. To obtain the phase accuracy total uncertainty value, add the values obtained from Graphs 4 and 5.

### Phase Accuracy vs Level<sup>5, 6, 7, 8</sup>

Use this term when making phase measurements at any single frequency.

If the A and B Channel signals are at equal levels, apply the low signal graph to one channel and the high signal graph to the other channel in order to obtain the total uncertainty value.

Example: A Channel = 5 mV; A and B Channels at any single frequency.  
Uncertainty due to A = 0 degrees;  
uncertainty due to B =  $\pm 0.4$  degrees.  
Total phase accuracy uncertainty =  $\pm 0.4$  degrees.

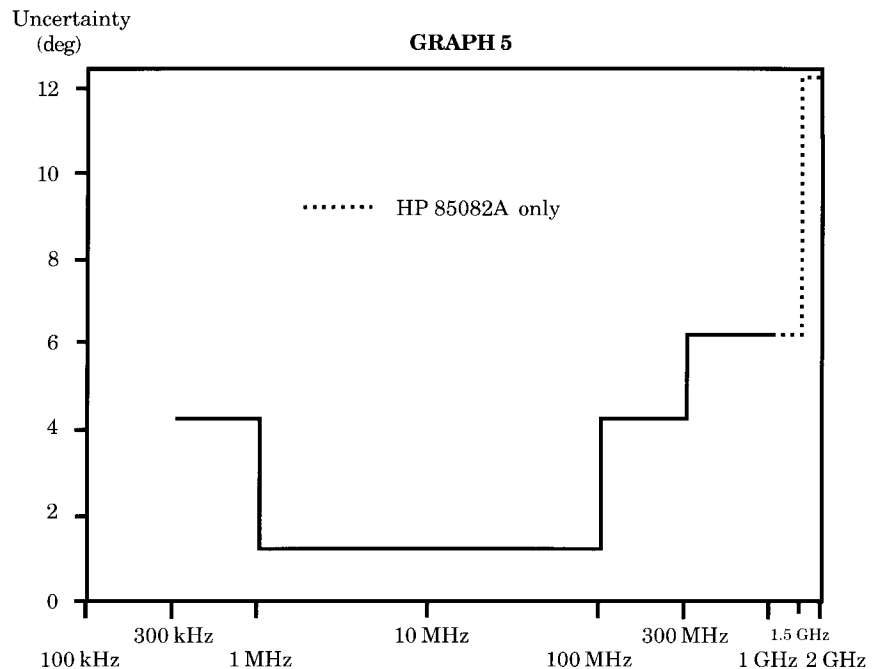
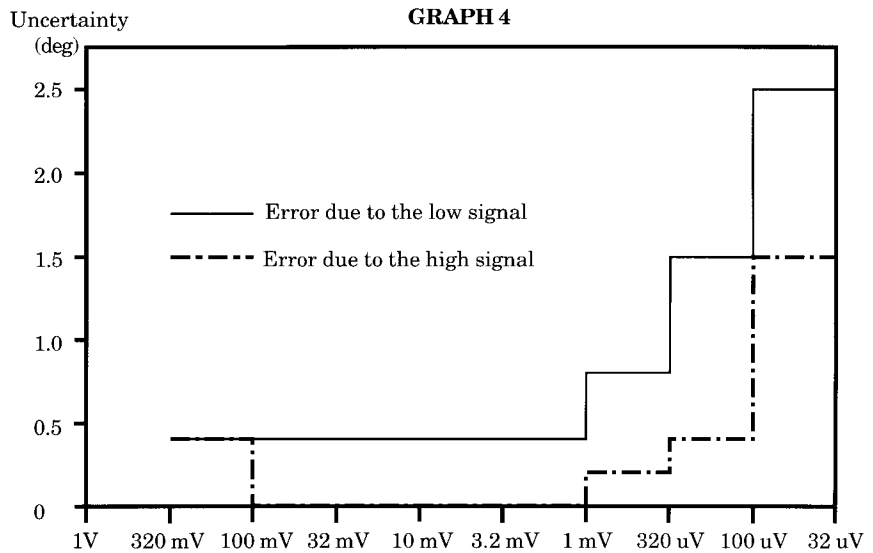
### Phase Accuracy vs Frequency<sup>6, 7</sup>

(A and B, 100 mV nominal)  
Use this uncertainty value when making phase measurements over a frequency range (when the reference and measurement frequencies are different).

Ignore this term when making phase measurements where the measurement is normalized to a reference at each new frequency, refer to Graph 4.

#### Footnotes

- <sup>5</sup> A and B absolute value includes  $\pm 0.15$  dB source traceability error.  
<sup>6</sup> 15 to 30 degrees C. Add 1 deg per 5 deg C outside this range.  
<sup>7</sup> Add  $\pm 3$  deg for signals above 100 mV at frequencies greater than 500 MHz.  
<sup>8</sup> Add  $\pm 0.4$  deg phase non-linearity for measurements other than 0 deg.



## Magnitude and Phase Characteristics (HP 85081A)

These specifications apply to the HP 85081A High Impedance Input Module (A and B 100mV nominal).

### Absolute Amplitude

#### Accuracy

*High Impedance Probes:*

±1 dB, 100 kHz to 100 MHz (nominal)

*with HP 11576A 10:1 Divider:*

±1 dB, 100 kHz to 100 MHz (nominal)

*with HP 10216A Isolator:*

±1 dB, 100 kHz to 200 MHz (nominal)

### Phase Accuracy

*High Impedance Probes:*

±4 deg, 300 kHz to 100 MHz (nominal).

*Probe with HP 11576A*

*10:1 Divider:*

±4 deg, 300 kHz to 100 MHz (nominal).

*Probe with HP 10216A Isolator:*

±6 deg, 300 kHz to 200 MHz (nominal).

## General Characteristics

### Lockup time

(Within 1 range)

40 ms, frequencies up to 3 MHz

20 ms, frequencies greater than 3 MHz

### Rear Panel Outputs

**Normal Operation:** Analog representation of the digital display values, including internal correction factors.

OUTPUT 1 corresponds to

DISPLAY 1,

OUTPUT 2 corresponds to

DISPLAY 2.

**Sensitivity:** 1 mV per display digit.

**Update rate:** Approximately 3 readings per second.

**Direct Analog Output:** Continuous direct output from the internal magnitude and phase detectors via 800 Hz low-pass filters. No internal correction.

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

OUTPUT 2 corresponds to B-A phase.

### Accessories Furnished

*HP 85081B only*

2 ea HP 10218A BNC Adapter,

6 ea replacement probe tip

(HP 5020-0457),

probe tip extractor

(HP 8710-0087).

#### *Option 801*

HP 8508A opt 801 additional accessories furnished:

2 each HP 10216A Isolator,

2 each HP 11576A 10:1 Divider,

6 each grounding clip.

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

### Probe Power Supply

**Supplies:** +12V, -12 V and ground to operate one 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 4500 m (0 to 14800 ft) (operating),

0 to 15000 m

(0 to 50000 ft) (storage).

### RFI

Conducted and radiated interference is within the requirements of Messemppfaenger-Postverfuergung 526/527/79.

### Physical

#### Size and Weight:

*Standard Size:* 133 mm H x

425.5 mm W x 473.3 mm D

(5.25 in x 19.75 in x 20.65 in)

*Option 001 Size:* 158.8 mm H x

524.5 mm W x 501.65 mm D

(6.25 in x 19.75 in x 20.65 in)

*Standard Weight:* 8.1 kg (18 lb) (net), 11 kg (24 lb) (shipping)

*Option 001 Weight:* 9.4 kg (21 lb) (net), 12.5 kg (27.5 lb) (shipping)

### Power

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

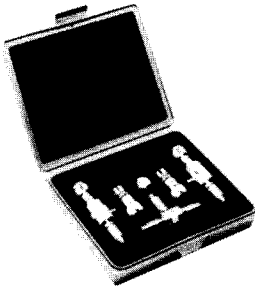
## Related products and accessories

### HP 11570A Accessory Kit

This Accessory Kit allows measurements in a 50 ohm system using the probes of the standard HP 85081B.

#### Kit contents:

2 ea HP 11536A 50 ohm Tee.  
For monitoring signals on 50 ohm transmission lines.  
Connectors 50 ohm type-N (f).  
1 ea HP 11549A 50 ohm Power Splitter. Connectors type-N (f).  
1 ea HP 908A 50 ohm Termination. Connector type-N (m).  
1 ea HP 11512A Shorting Plug. Connector type-N (m).



### HP ~~11570A~~ <sup>Now 85081-80018</sup> 10:1 Probe Divider

Input impedance 1 Mohm shunted by 2 pF. Used to reduce voltage input 10 to 1.



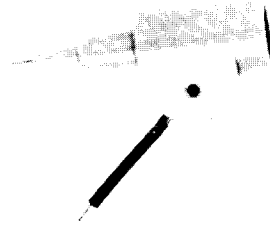
### Now 85081-80017 HP 10216A Isolator

Input impedance nominally 100 kohm shunted by 5 pF. Used to eliminate errors due to effects of changing test point impedance.



### HP 5060-0549 Spanner Tip Assembly

Fits on to probe tip to provide protection for the tip and a probe ground.



### HP 11852B 50 to 75 ohm Minimum Loss Pad

Allows 50 ohm source and receiver to measure 75 ohm devices. Connectors 50 ohm type-N (m), 75 ohm type-N (f).

### HP 85044A/B Transmission/ Reflection Test Sets

Provide the capability to measure the transmission and reflection characteristics of 50 ohm (HP 85044A) and 75 ohm (HP 85044B) devices without reconnecting the device. Test port connectors are precision 7 mm and 75 ohm type-N (f) respectively. The HP 85044A is supplied with a precision 7 mm to type-N (f) adapter, and the HP 85044B is supplied with an HP 11852B Minimum Loss Pad. Both require the HP 11851B Cable Kit.

### HP 11851B RF Cable Kit

Three 610 mm (24 in) 50 ohm cables phase matched to  $\pm 4$  deg at 1.3 GHz, and one cable 860 mm (34 in). Connectors are type-N (m). Used with HP 85044A/B Transmission/Reflection Test Sets.

### HP 8721A 50 ohm 0.01 to 110 MHz Directional Bridge HP 8721A option 008 75 ohm version

Bridges for signal separation at lower frequencies. Connectors BNC (f).

### HP 778D 100 MHz to 2 GHz Dual Directional Coupler

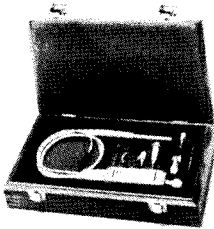
20 dB coupling, 36 dB directivity, broadband coupler for reflection measurements on broadband components. (Other dual directional couplers with reduced frequency ranges are also available.)

## Software and Suggested Sources

## Typical measurement configurations

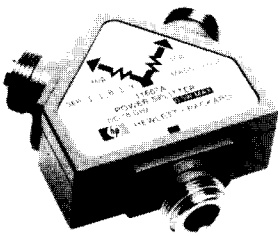
### HP 85024A High Impedance Probe (300 kHz to 3 GHz)

Used with the HP 85082A Input Module, the 0.7 pF input capacitance and 1 Mohm input impedance of this probe allows high frequency measurements without excessive loading on the circuit under test.



### HP 11667A/B dc to 18 GHz/26.5 GHz Power Splitters

Two-resistor splitters for ratio measurements. HP 11667A is dc to 18 GHz, connectors 50 ohm type-N (f). HP 11667B is dc to 26.5 GHz, connectors APC 3.5 (f).



### HP 08508-10001 Stimulus Response Software for the HP 8508A and HP 8657A

Many applications require simple voltage and phase measurements as a function of frequency. This program allows these measurements to be automated.

### HP 08508-10004 Delay Measurement Software for the HP 8508A Vector Voltmeter

Many applications require the measurement of the delay due to a device when the input and output of the device are at different frequencies. This program describes a method of making these measurements using an amplitude modulation technique.

### Suggested Sources HP 8656B/HP 8657A/B Signal Generator

These programmable synthesized signal generators provide frequency coverage from 100 kHz to 990 MHz (HP 8656B), 1040 MHz (HP 8657A), 2080 MHz (HP 8657B). They are fully HP-IB programmable providing flexibility in system configuration.

### For measurements using high impedance probes

HP 8508A Vector Voltmeter recommended additional equipment:  
 HP 11570A Accessory Kit (50 ohm accessories)  
 HP 8656B Synthesized Signal Generator external source  
 HP 10216A Isolator (probing accessory)  
 HP 11576A 10:1 Divider (probing accessory)  
 HP 5060-0549 Spanner Top Assembly (probing accessory)

### For measurements of component gain and loss

HP 8508A option 050 Vector Voltmeter  
 HP 11667A dc to 18 GHz Power Splitter or HP 11549A dc to 1 GHz Power Splitter (part of HP 11570A Accessory Kit)  
 HP 8656B Synthesized Signal Generator  
*Recommended additional equipment*  
 HP 11852B Minimum Loss Pad (2 required for 75 ohm measurements)

### For measurements of gain/loss and reflection in a 50 ohm system

HP 8508A option 050 Vector Voltmeter  
 HP 85044A Transmission/Reflection Test Set  
 HP 11851B Cable Kit  
 HP 8657B Synthesized Signal Generator  
*Recommended additional equipment*  
 HP 85044B Transmission/Reflection Test Set (in place of HP 85044A for 75 ohm measurements)  
 HP 11852B Minimum Loss Pad (required for 75 ohm measurements)

## Modular Measurement System (MMS) Vector Voltmeter Module

### HP 70000 Modular Measurement System

The HP 70000 Modular Measurement System offers state-of-the-art measurement capability with all of the benefits of modularity. As your needs change or new modules are developed, you can expand or upgrade your system economically by adding new or different modules. Each Modular Measurement System contains many measurement functions, all controlled by a single display. This central display gives the user a single interface point, and can present the results from up to four instruments simultaneously. It can be located up to two kilometers from the measurement instruments while linked via the Modular System Interface Bus (MSIB).

### HP 70138A Vector Voltmeter

The HP 70138A Vector Voltmeter is one of a growing family of modules available to meet various measurement requirements. It is functionally equivalent to the HP 8508A Vector Voltmeter and is contained in a 2/8 module package.

The standard HP 70138A includes an HP 85081B High Impedance Input Module (100 kHz to 1 GHz). Option 050 includes the HP 85082A input module which has two 50 ohm N-type inputs (300 kHz to 2 GHz).

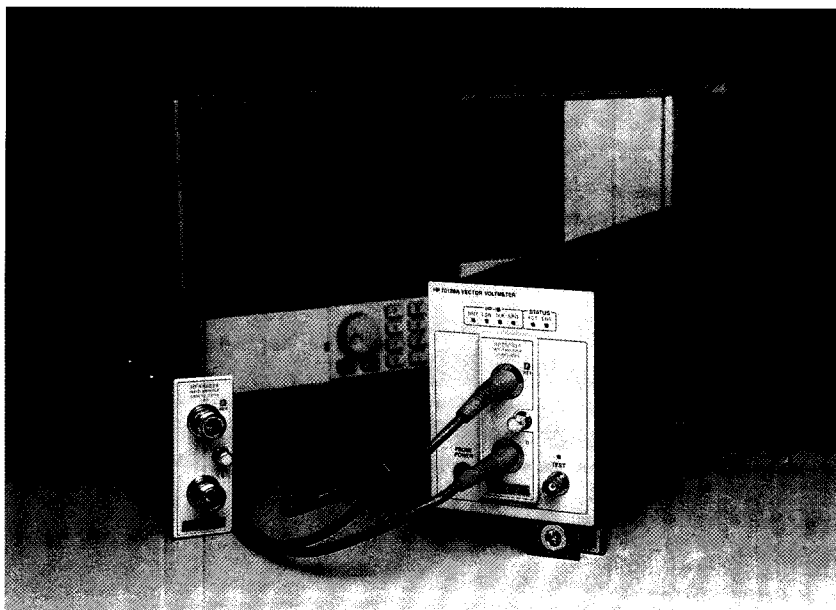
### Equipment Required

To operate, the HP 70138A Vector Voltmeter Module requires a two-eighths slot in a Measurement System Mainframe and a Display is required for local operation.

Color Mainframe/Display:  
HP 70004A Display

Mainframe:  
HP 70001A System Mainframe

Display:  
HP 70205A Graphics Display  
HP 70206A System Graphics Display



## Ordering information

Equipment	US List	Documentation	US List
<b>HP 8508A Vector Voltmeter</b> (includes HP 85081B High Impedance Input Module):	<b>\$5800</b>	<b>HP 8508A User Documentation Options</b>	<b>\$0</b>
<b>Configuration Options</b>		<b>option 030:</b> Japanese Operating Guide	<b>\$0</b>
<b>option 001:</b> adds bail handle, rugged feet and front panel storage cover	<b>\$250</b>	<b>option 031:</b> French Operating Guide	<b>\$0</b>
<b>option 050:</b> replaces HP 85081B with HP 85082A 50 ohm Input Module	<b>\$0</b>	<b>option 032:</b> German Operating Guide	<b>\$0</b>
<b>option 100:</b> deletes Input Module	<b>-\$1500</b>	<b>option 033:</b> Italian Operating Guide	<b>\$0</b>
<b>option 801:</b> additional probe accessories 2 each HP 10216A 2 each HP 11576A	<b>\$470</b>	<b>option 034:</b> Spanish Operating Guide	<b>\$0</b>
<b>option 908:</b> rack mount kit (p/n 5062-3977) for instruments without handles	<b>\$30</b>		
<b>option 913:</b> rack mount kit (p/n 5062-4071) for instruments with handles	<b>\$35</b>		
<b>option W30:</b> additional 2-year, return to HP hardware support	<b>\$140</b>		
<b>option W32:</b> 3 year calibration service as per recommended calibration service.	<b>\$140</b>		
<b>HP 85081B:</b> (additional) 100 kHz to 1 GHz High Impedance Input Module	<b>\$1500</b>		
<b>HP 85082A:</b> (additional) 300 kHz to 2 GHz High Impedance Input Module	<b>\$1500</b>		
<b>HP 11570A:</b> 50 ohm Accessory Kit	<b>\$1100</b>		
<b>HP 10216A:</b> Probe Isolator	<b>\$115</b>		
<b>HP 11576A:</b> 10:1 Probe Divider	<b>\$120</b>		
<b>HP 5060-0549:</b> Spanner Tip Assembly	<b>\$43</b>		

For more information, call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

United States  
Hewlett-Packard Company  
1 Choke Cherry Road  
Rockville, MD 20850

Hewlett-Packard Company  
5201 Tollymore Drive  
Rolling Meadows, IL 60015

Hewlett-Packard Company  
5161 Lankershim Drive  
North Hollywood, CA 91601

Hewlett-Packard Company  
2005 South Park Place  
Atlanta, GA 30329

Canada  
Hewlett-Packard Company  
6575 Glenborough Drive  
Mississauga, ON L4R 1V1

Asia/Pacific/Rest of World  
Hewlett-Packard Company  
11-11 Joseph Street  
Blackburn, Victoria 3133  
Australasia

Europe/Middle East/Africa  
Hewlett-Packard Company  
Chesham Road, Basingstoke  
Hants RG24 0AP  
United Kingdom

Hewlett-Packard Company  
124-100  
Avenue  
St. Denis  
93100

Hewlett-Packard Company  
Tokyo  
2-1-1  
Singapore

Latin America  
Hewlett-Packard Company  
Monte Piedras  
Lomas de Chapultepec  
11000 Mexico City, Mexico