HP 8757A
SCALAR NETWORK ANALYZER

SERIAL NUMBERS AND FIRMWARE REVISIONS

This manual applies directly to any HP 8757A scalar network analyzer having:

a serial number prefixed 2501A, 2513A, or 2546A and revision 2.0 firmware.

For additional information about serial numbers and firmware revisions, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

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HEWLETT PACKARD

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 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 at the back of this manual.

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SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).

Indicates hazardous voltages.

Indicates earth (ground) terminal.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

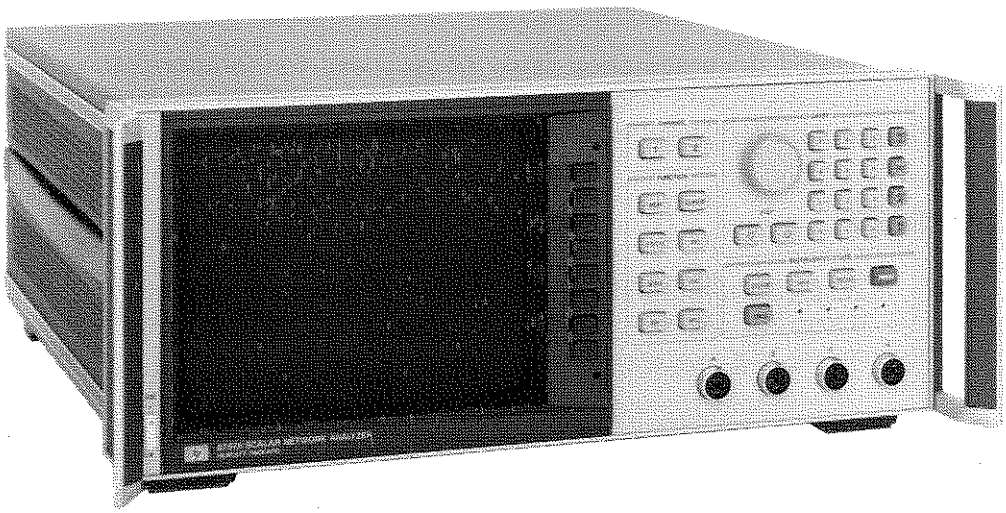
The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SERVICING

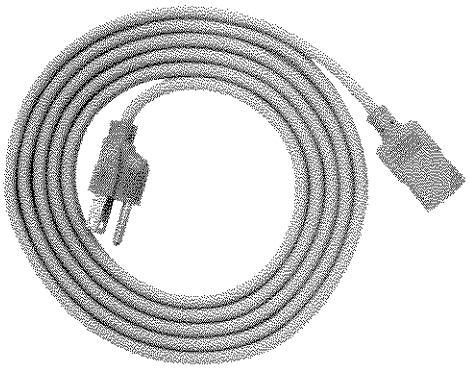
WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

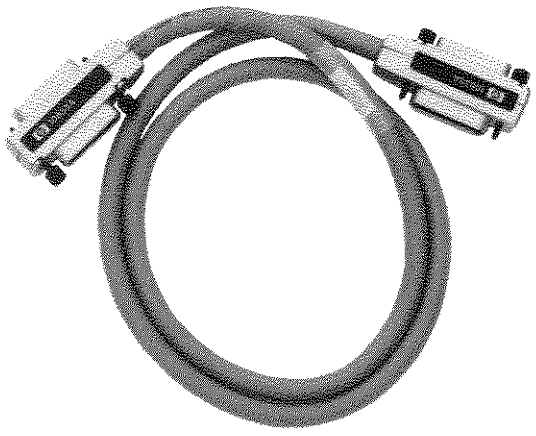
Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.



HP 8757A NETWORK ANALYZER



POWER CABLE*



HP-IB INTERFACE CABLE

*POWER CABLE/PLUG SUPPLIED DEPENDS ON COUNTRY OF DESTINATION.
REFER TO SECTION II FOR PART NUMBER INFORMATION.

Figure 1-1. HP 8757A Option 001 Scalar Network Analyzer and Accessories Supplied

SECTION I
GENERAL INFORMATION

INTRODUCTION

This Operating Manual contains information required to install, operate, and test the Hewlett-Packard Model 8757A scalar network analyzer. Information required to adjust and service the HP 8757A is provided in a separate Service Manual (HP part number 08757-90003). Figure 1-1 shows the HP 8757A Option 001, with accessories supplied.

This manual is divided into four sections which provide the following information:

a. SECTION I, GENERAL INFORMATION, includes a brief description of the instrument and available options, safety considerations, accessories supplied, equipment available, and tables of specifications and supplemental performance characteristics.

b. SECTION II, INSTALLATION, provides information for initial inspection, preparation for use, line voltage and fuse selection, connectors and cables, rack mounting, storage and shipment.

c. SECTION III, OPERATION, is divided into subsections. Operating Information is a complete detailed reference for operating the HP 8757A. The Operating Note provides tutorial information on local operation of the HP 8757A with other instruments. Two programming notes are supplied: the Introductory Operating Guide and the Quick Reference Guide. These provide information on remote operation of the HP 8757A with a controller.

d. SECTION IV, PERFORMANCE TESTS, contains a list of recommended test equipment, and tests to verify that instrument performance is in accordance with the specifications listed in Section I.

The separate Service Manual is divided into five sections as follows:

a. SECTION IV, PERFORMANCE TESTS, is a duplicate of Section IV in the Operating Manual.

b. SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repair or replacement of an assembly.

c. SECTION VI, REPLACEABLE PARTS, provides lists and illustrations of all replaceable parts and assemblies in the instrument, together with ordering information.

d. SECTION VII, MANUAL BACKDATING CHANGES, contains backdating information required to make this manual compatible with earlier shipment configurations of the instrument.

e. SECTION VIII, SERVICE, supplies information to troubleshoot and repair the instrument. An overall block diagram is provided, and each assembly is documented separately with a circuit description, schematic diagram, component locations diagram, and troubleshooting information.

On the title page of this manual is a microfiche part number. This number can be used to order 10 × 15 centimeter (4 × 6 inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes sheet as well as all pertinent Service Notes.

Refer any questions regarding this manual, the Manual Changes sheet, or the instrument to the nearest Hewlett-Packard Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. A worldwide listing of HP Sales/Service Offices is provided at the back of this manual.

INSTRUMENTS COVERED BY MANUAL

Attached to the rear panel of the instrument is a serial number plate (illustrated in Figure 1-2). The serial number is in two parts. The first four digits followed by a letter comprise the serial number prefix; the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply directly to instruments with the serial number prefix(es) and the firmware revision(s) listed under SERIAL NUMBERS AND FIRMWARE REVISIONS on the title page.

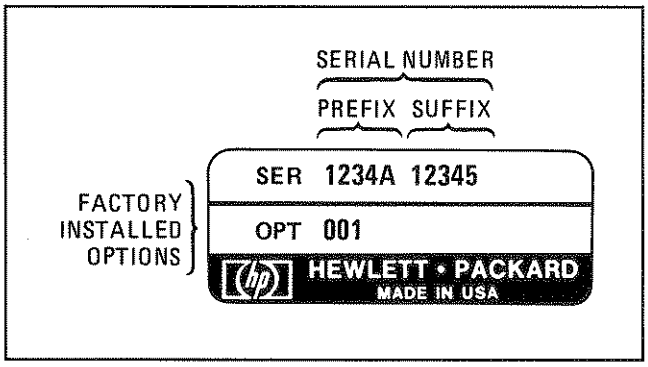


Figure 1-2. Typical Serial Number Plate

An instrument manufactured after the printing of this manual may have a serial number prefix or a software revision number that is not listed on the title page. An unlisted serial prefix or revision number indicates that the instrument is different from those documented in this manual. In this case, the manual for the newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains change information that explains how to adapt the manual to the newer instrument. In addition to change information, the supplement may contain information that applies to all instruments, regardless of their serial prefix or software revision number.

To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard Sales/Service Office.

SAFETY CONSIDERATIONS

This product has been manufactured and tested in accordance with international safety standards. Before operation, this product and related documentation must be reviewed for familiarization with safety markings and instructions. A complete listing of safety considerations precedes Section I of this manual and is also supplied in the Service Manual.

SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested. Table 1-2 lists supplemental performance characteristics. These are not specifications but are intended to provide information useful in applying the instrument by giving typical but non-warranted performance parameters.

DESCRIPTION

The HP 8757A is a microprocessor-based receiver capable of making scalar (magnitude only) reflection and transmission measurements over a frequency range determined by the external detectors used. It has a large screen for display of measurement results. It is programmable over the Hewlett-Packard Interface Bus (HP-IB). HP-IB is Hewlett-Packard's hardware, software, documentation, and support for IEEE-488 and IEC-625, worldwide standards for interfacing instruments. Whether or not the HP 8757A is being controlled remotely over HP-IB, it can control a specific plotter and/or source through the 8757 System Interface. A measurement with the HP 8757A requires the connection of detector(s) and/or directional bridge(s) to the detector inputs on the front panel, and the use of a compatible RF/microwave source.

The HP 8757A is locally operated by front panel controls and by menu selection using "soft" keys adjacent to the CRT. It has four independent but identical measurement channels, allowing simultaneous viewing of up to four measurement parameters with independent resolutions. The standard instrument has three detector inputs (A, B, and R), while the Option 001 has four detector inputs (A, B, C, and R). Detailed information concerning operation of the front panel controls and the menus and soft keys is provided in Section III, Operation, of this manual.

AC and DC Detection

The HP 8757A uses either AC or DC detection techniques in conjunction with its detectors. AC detection provides very stable measurements even with temperature variations and RF interference. DC detection should be used for modulation-sensitive devices, such as nonlinear amplifiers and narrow-band filters; and for devices that cannot be modulated, such as oscillators.

In AC detection, an RF or microwave signal is amplitude modulated with a 27.778 kHz square wave, providing the stimulus to the device under test. The output signal from the device under test is then detected by a compatible detector, and the HP 8757A filters, digitizes, and displays the response. A 27.778 kHz modulation signal is available from the rear panel of the HP 8757A to drive an external modulator for a source without internal amplitude modulation capability.

In DC detection, an unmodulated CW (continuous wave) signal provides the stimulus to the device under test. This signal is rectified by the detector and then transformed into an AC detectable signal. The transformation is accomplished by the detector's chopping and sampling circuitry. The rectified signal is chopped at 27.778 kHz and made to resemble a square wave.

HEWLETT-PACKARD INTERFACE BUS (HP-IB)

The HP 8757A is factory equipped with a remote programming interface using the Hewlett-Packard Interface Bus (HP-IB). This provides a remote operator with the same control of the instrument available to the local operator, except for control of the power line switch and internal tests. Remote control is maintained by a controlling computer that sends commands or instructions to and receives data from the HP 8757A using the HP-IB. Several output modes are available for outputting data. Through a subset of HP-GL (Hewlett-Packard Graphics Language), user graphics can be plotted on the HP 8757A CRT. A complete general description of HP-IB is provided in "Condensed Description of the Hewlett-Packard Interface Bus" (HP part number 59401-90030).

Whether or not the HP 8757A is being controlled remotely over HP-IB, it can control a specific plotter or printer and/or source through the 8757 System Interface. A separate interface connector for the 8757 System Interface is located on the rear panel of the HP 8757A. The HP 8757A itself controls the 8757 System Interface and there must be no other controllers attached to this connector.

OPTIONS AVAILABLE

The following are available as optional versions of the HP 8757A.

Option 001

The HP 8757A Option 001 is supplied with four front panel detector inputs (A, B, C, and R).

Option 908, Rack Mount Without Handles

The HP 8757A Option 908 is supplied with a rack mount kit containing a pair of flanges and the necessary hardware to mount the instrument without handles in an equipment rack with 482.6 mm (19 inches) horizontal spacing. Refer to Section II of this manual for installation instructions for this kit.

Option 909, Rack Mount With Handles

Option 909 is supplied with a kit containing the necessary hardware for preparing the standard instrument to mount on an equipment rack with 482.6 mm (19 inches) horizontal support spacing. Refer to Section II of this manual for installation instructions for this kit.

Option 910, Extra Operating and Service Manuals

The standard instrument is supplied with one Operating Manual and one Service Manual. Option 910 provides an additional Operating Manual and Service Manual. To order extra Operating Manuals or Service Manuals after initial shipment, order by manual part number, listed on the title page and the rear cover of each manual.

Option 914, Deletes Service Manual

Option 914 deletes the Service Manual.

ACCESSORIES SUPPLIED

Figure 1-1 shows the HP 8757A scalar network analyzer with its HP-IB cable and power cable. The power cable supplied depends on the country of destination. Refer to Section II of this manual for further information about cables, connectors, and the part numbers for the different power cables.

EQUIPMENT REQUIRED BUT NOT SUPPLIED

A swept microwave source and from one to four detectors and/or directional bridges are required to make measurements with the HP 8757A. For AC (modulated) measurements, square wave modulation capability at 27.778 kHz is required (internal or through the use of an external modulator). Specific examples are described under EQUIPMENT AVAILABLE.

EQUIPMENT AVAILABLE

Source

The compatible source to supply the swept or CW input signal to the device under test is either the HP 8350B sweep oscillator (serial prefix 2448A/J/U and above) or the HP 8340A or 8341A synthesized sweeper. When used with any of these sources, the HP 8757A provides annotated CRT displays (both sweep limits and markers), Save/Recall of both instrument front panel settings, alternated sweeps, and a single Instrument Preset from either instrument. In effect, the source and the HP 8757A perform as a single instrument. The HP 8757A acts as a system controller by managing the source through the 8757 System Interface.

The HP 8350B is used with one of a range of RF plug-ins that provide a combined frequency range from 10 MHz to 60 GHz. Depending on the RF plug-in used, the HP 8350B can be configured for different application requirements such as high output power, low harmonics, economy, or broad frequency range. The HP 8350B, used with an HP 83500-series plug-in, has 27.778 kHz $\pm$20 Hz internal square wave modulation capability if the serial number prefix is 2448 or higher. Instruments with a lower serial number prefix can be upgraded to this higher frequency accuracy and stability with a special retrofit kit available from Hewlett-Packard. The HP 8350B can also be used with an HP 86200-series RF plug-in with 11869A adapter, though some of the HP 86200-series plug-ins require an external modulator for AC compatibility with the HP 8757A. The HP 8350B and 8350A can be phase locked using the HP 5344S microwave source synchronizer.

The HP 8350A sweep oscillator is similar to the 8350B, and is manually compatible with the HP 8757A. However, it cannot be controlled by the HP 8757A through the 8757 System Interface. Retrofit kits are available from Hewlett-Packard to update the HP 8350A for interface performance comparable to the HP 8350B.

The HP 8340A and 8341A synthesized sweepers are phase-locking analog sweep synthesizers that provide increased frequency accuracy and stability. Each of these sweepers offers an alternative in one unit to a combination of sweep oscillator and source-locking counter. The HP 8340A generates synthesized output frequencies from 10 MHz to 26.5 GHz, and the HP 8341A from 10 MHz to 20 GHz. Frequency resolution for both instruments is better than 4 Hz. Both the HP 8340A and 8341A can be square wave modulated at 27.778 kHz with the modulator drive signal from the HP 8757A scalar network analyzer.

Detectors

From one to four detectors are used with the HP 8757A for making measurements. The HP 11664A/E and 85025A/B are low SWR detectors that minimize measurement uncertainty by reducing mismatch error. Low SWR, or high return loss, is particularly important in testing low insertion loss devices.

The HP 11664A/E detectors use the AC detection system. They can detect a modulated signal to produce a 27.778 kHz square wave whose peak-to-peak voltage corresponds to the magnitude of the signal at the detector input. AC detection offers greater immunity to noise and drift with time and temperature. The dynamic range of the HP 11664A/E detectors is 76 dB. The frequency range of the HP 11664A is 10 MHz to 18 GHz. It is available with a type-N female input connector in the standard instrument or an APC-7* connector in the Option 001. The HP 11664E has an APC-3.5 input connector and a frequency range of 10 MHz to 26.5 GHz.

The HP 11664D waveguide detector detects AC modulated signals in the frequency range of 26.5 to 40 GHz. It is used in conjunction with the HP 8350B sweep oscillator and HP 83572A/B RF plug-in.

The HP 85025A/B detectors can use either the AC (modulated) or the DC (unmodulated) detection system. In DC mode they can detect an unmodulated CW signal and transform it into an AC detectable signal. The detected signal is chopped at 27.778 kHz and made to resemble a square wave. DC detection offers greater power measurement accuracy and is preferable for measuring oscillators and modulation-sensitive devices. The HP 85025A has a frequency range of 10 MHz to 18 GHz, and is available with type-N connectors in the standard instrument or APC-7 connectors in the Option 001. The HP 85025B has an APC-3.5 connector and a frequency range of 10 MHz to 26.5 GHz.

Detector Adapter

The HP 85025C detector adapter allows the use of standard diode detectors with the HP 8757A for AC (modulated) or DC (unmodulated) measurements. The frequency range of the HP 85025C is limited on the upper end only by the diode detector used, thus extending the operating range of the HP 8757A to enable measurements in the millimeter range above 40 GHz.

Directional Bridges

The HP 85020A/B and 85027A/B/C are directional bridges used in conjunction with the HP 8757A for making simultaneous transmission and reflection measurements. A zero-biased Schottky diode detector in the bridge samples the return loss of a device under test for reflection measurements. Transmission measurements can be made with the addition of a detector. A power splitter can be used with the bridge for ratio measurements.

An HP 85027A/B/C provides both AC (modulated) and DC (unmodulated) capabilities. The HP 85027B has precision APC-3.5 connectors for measuring devices with SMA or 3.5 mm connectors, over the 10 MHz to 26.5 GHz frequency range. For devices with other connector types, the HP 85027A (APC-7) or 85027C (precision type-N) cover the 10 MHz to 18 GHz frequency range.

The HP 85020A and 85020B directional bridges cover the frequency ranges of 10 MHz to 4.3 GHz and 10 MHz to 2.4 GHz respectively. Both bridges have type-N female connectors, with a nominal impedance of 50 ohms in the HP 85020A and 75 ohms in the HP 85020B.

Dual-Directional Coupler

A coupler separates the incident and reflected signals from the transmitted signal. The HP 11692D 2 to 18 GHz dual-directional coupler is used with the HP 85025A/B detectors for DC (unmodulated RF) reflection measurements or with the HP 11664 detectors for AC (modulated RF) reflection measurements.

Modulator

The HP 11665B modulator is required for AC measurements if the RF signal source used does not have the capability of modulation at 27.778 kHz. The HP 11665B modulates test signals from 15 MHz to 18 GHz with the 27.778 kHz modulator drive signal from the HP 8757A.

* APC-7 is a registered trademark of the Bunker-Ramo Corporation.

Power Splitters

The HP 11667A/B power splitters are two-way, two-resistor splitters that provide good input and output source match for ratio measurement and source leveling applications. The HP 11667A, with type-N connectors, operates from DC to 18 GHz with output match >17 dB and tracking <0.25 dB. The HP 11667B, with APC-3.5 connectors, operates from DC to 26.5 GHz and has output source match >18 dB and tracking <0.4 dB. These parameters allow wideband ratio measurements that improve effective source match and thus reduce measurement uncertainty.

Power Dividers

The HP 11636A/B are two-way, three-resistor power dividers for use in non-ratio measurements. They can also be used as power combiners for combining two independent signals. They are used for fault location measurements made with the HP 8757A in a computer-controlled system using the HP 85016A transmission line test software.

Low Pass Filter Kit

The HP 11678A low pass filter kit contains five low pass filters with cutoff frequencies of 2.8 GHz, 4.4 GHz, 6.8 GHz, 9.56 GHz, and 13.0 GHz. Their use is recommended for reducing undesirable harmonics generated by the RF source.

High Pass Filter

The HP 11668A high pass filter is recommended for use with the HP 11665B modulator for making AC measurements on active devices that have gain below 50 MHz. Use of the HP 11668A, placed after the modulator, reduces the modulator drive feedthrough from 8 mV to 1 mV and prevents possible amplifier saturation. Use of the HP 11668A filter is not necessary for passive measurements since the feedthrough from the HP 11665B is −65 dBm and causes little degradation in system performance.

System Verification Kits

The HP 85023A/B/C/D system verification kits each contain an open, a short, a 10 dB attenuator, a termination, and a source-to-bridge adapter. The HP 85023D also includes two HP 11852A 50-to-75 ohm minimum loss pads for 50/75 ohm impedance conversion. The HP 85023A has a frequency range of DC to 18 GHz with APC-7 connectors. The HP 85023B has a frequency range of DC to 26.5 GHz with APC-3.5 connectors. The HP 85023C has a frequency range of DC to 18 GHz with type-N connectors and a nominal impedance of 50 ohms. The HP 85023D has a frequency range of DC to 1.3 GHz with type-N connectors and a nominal impedance of 75 ohms.

Extension Cables

For applications where it is not convenient to have the network analyzer near the test device, the HP 11679A 25-foot extension cable or the HP 11679B 200-foot extension cable fits directly between the HP 11664 detector and the display. The extension cables do not cause degradation in performance.

Microwave Amplifier

The HP 8349B microwave amplifier delivers >20 dBm (100 mW) of output power with >15 dB of gain and <13 dB typical noise figure across a 2 to 20 GHz frequency range. The HP 8349B can be a powerful source accessory to the HP 8350B for applications such as mixer testing, long RF cable testing, antenna pattern analysis, and RFI measurements. A built-in directional detector can be used in external leveling applications to deliver up to +20 dBm directly to the test device.

Microwave Source Synchronizer

The HP 5344S microwave source synchronizer can be used with the HP 8350B to phase lock the RF output signal to a high stability quartz oscillator in the HP 5344S. This greatly increases the frequency accuracy and repeatability of the HP 8350B in CW or swept operation.

Plotters

Hard copy plots can be output from the HP 8757A directly to an HP-GL graphics plotter or the HP 2225A ThinkJet printer without the use of a computer, through the 8757 System Interface. All or any part of a plot can be plotted. Compatible plotters are the HP 7470A, 7550A, 9872C, and 7475A.

Software

The HP 85015B system software enables automatic scalar measurements using an HP 9000 series 200 or 300 computer with the HP 8757A and a compatible source. The user can make menu selections to customize a scalar measurement test procedure. Once created, this test procedure can be easily stored on the computer disc.

The HP 85016B transmission line test software adds distance-to-fault measurements to the capabilities of the HP 85015B software. Using frequency domain reflectometry (FDR), frequency response data is transformed to the distance domain enabling the user to see the location and magnitude of impedance mismatches.

Service Accessories

A service accessory kit, HP part number 08757-60048, is available for servicing the HP 8757A. This kit consists of:

- One 15-pin printed circuit board extender (HP part number 08757-60014). This board is provided for use in troubleshooting the log amplifier assemblies A7, A8, A9 (Option 001 only), and A10.
- One special purpose printed circuit board extender (HP part number 08756-60015). This board is provided to aid in troubleshooting the A3 through A6 assemblies. Two +5V test points and two digital ground test points are provided for powering digital troubleshooting devices (logic probe, logic pulser, current tracer).

RECOMMENDED TEST EQUIPMENT

Equipment required to maintain the HP 8757A is listed in Table 4-1 of this manual. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table.

Table 1-1. Specifications and General Requirements (1 of 2)

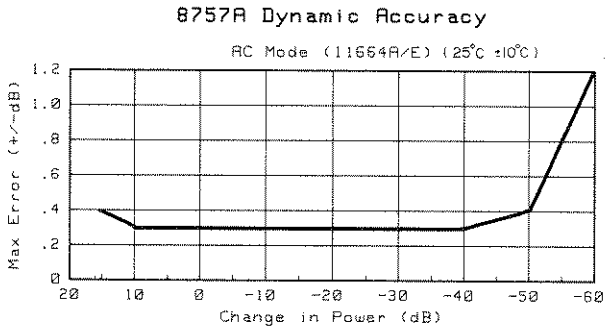
SPECIFICATIONS*

Function: The HP 8757A has four independent display channels that process the signals from the HP 85025 or 11664 detectors and the HP 85020/21 bridges for logarithmic display, in single channel or ratio mode, on the internal CRT. Three inputs are provided (four in the Option 001).

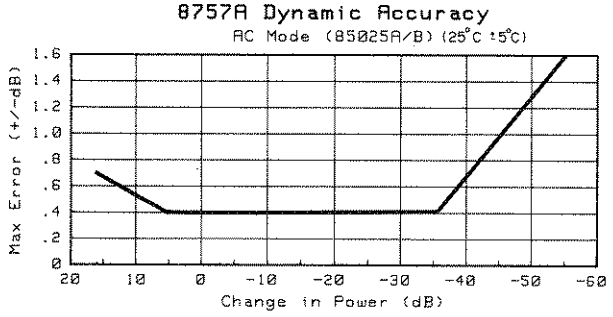
Dynamic Range:

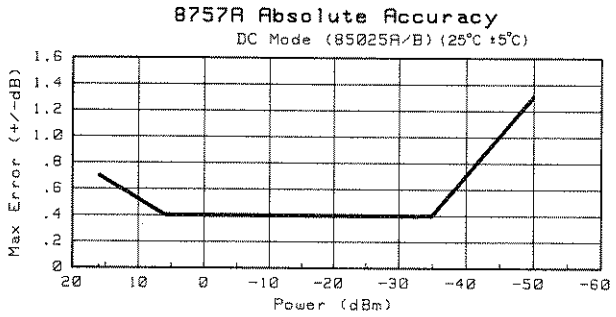
With HP 11664A/E detector	(25°C ± 10°C):	+16 to −60 dBm
With HP 11664D detector	(25°C ± 5°C):	+10 to −50 dBm
With HP 85025A/B detector	(25°C ± 5°C)	
	AC mode:	+16 to −55 dBm
	DC mode:	+16 to −50 dBm

Dynamic Power Accuracy (Measured at 50 MHz, referenced at 0 dBm):
(The modulated RF signal must meet listed modulation requirements for AC mode.)



Note: For ⩽ 20 dB change of power within +10 to −40 dBm the specification for the HP 8757A with the HP 11664A/E is ±(0.1 dB + 0.01 dB/dB).





Modulator Drive: One modulator drive for driving one HP 11665B modulator or the HP 8340/8341 synthesized sweeper or HP 8350B sweep oscillator. Modulation drive may be turned on and off via the front panel or HP-IB. In the OFF state the modulator drive signal turns the HP 11665B fully on for minimum insertion loss.

Frequency: 27.778 ±0.012 kHz Symmetry: 50% ±1%

*After one hour warm up.

Table 1-1. Specifications and General Requirements (2 of 2)

GENERAL REQUIREMENTS

Sweep Time: Minimum sweep time and maximum number of display traces depend on horizontal resolution.

# Points	Minimum Sweep Time (ms)			
	1 Trace	2 Traces	3 Traces	4 Traces
101	40	50	60	70
201	50	75	90	100
401	100	100	150	200
801	200	250	NA	NA
1601	400	NA	NA	NA

RF Input Signal Modulation Requirements: (for HP 11664 detectors and for HP 85020/21 bridges and HP 85025 detectors in AC mode)

Square-wave amplitude modulation
Frequency: 27.778 ±0.02 kHz
≥30 dB on/off ratio
45% to 55% symmetry

Sweep Voltage Requirements (Sweep In): Horizontal sweep voltage, from 0 to 10 volts, provided by the sweep oscillator through the SWEEP IN 0-10V input on the rear panel of the HP 8757A. Other sweep voltages can also be accepted by using the non-standard sweep mode of the HP 8757A.

Marker and Blanking Requirements (Pos Z Blank): Blanking and marker signals are provided by the sweep oscillator through the POZ Z BLANK input on the rear panel of the HP 8757A.

Voltage levels:	Blanked	+5V typical
	Unblanked	0V typical
	Marker	−4V typical
	Active Marker	−8V typical

Table 1-2. Supplemental Performance Characteristics (1 of 2)

NOTE

Values in this table are not specifications, but are intended to provide information useful in applying the instrument by giving typical but non-warranted performance parameters.

DISPLAY CHARACTERISTICS

Scale Resolution: 0.1, 0.2, 0.5, 1, 2, 5, 10, or 20 dB per division. Independently controlled for each channel.

Reference Offset: Offset level adjustable in 0.01 increments from −70 to +20 dBm (power measurement) or −90 to +90 dB (ratio measurement).

Display Resolution:

Vertical:	0.003 dB for single input measurement
	0.006 dB for ratio measurement
	0.01 dB for "Display Cursor"
Horizontal:	101, 201, 401, 801, or 1601 data points

(When MEAS-MEM is used, display resolution is half of the above.)

Averaging: 2, 4, 8, 16, 32, 64, 128, or 256 successive traces may be averaged.

Smoothing: Provides a linear moving average of adjacent data points. The smoothing aperture defines the trace width (number of data points) to be averaged, and ranges from 0.1% to 20% of the trace width.

Normalization: Traces are stored and normalized with the highest resolution, independent of display scale/division or offset. Calibration data can be saved and recalled with the instrument states and is interpolated when the frequency span is decreased.

Graticules: 8 vertical × 10 horizontal divisions.
1 division = approximately 13 mm.

REAR PANEL CONNECTORS

Stop Sweep: Used with the HP 8350B, 8341A, or 8340A when it is controlled by the 8757 System Interface, to stop the sweep at band crossings and at end of sweep.

DAC Out: An output connector used for diagnostic testing.

ADC In: An input connector for auxiliary voltage input in the −10 to +10 volt range.

HP-IB CHARACTERISTICS

Interface: HP-IB operates according to IEEE 488-1978 and IEC-625 interface standards.

Interface Function Codes: SH1, AH1, T6, TE0, L4, LE0, SR1, RL1, PP0, DC1, DT0, C0, E1.

Transfer Formats: Data may be transferred either as ASCII strings (nominally 8 characters per reading) or as 16-bit integers (most significant byte first). Reading may be taken at a single point, or an entire trace may be transferred at once.

Transfer Speed (includes command to initiate output):

ASCII format, 401 point trace:	500 ms typical
ASCII format, single point:	10 ms typical
Binary format, 401 point trace:	30 ms typical
Binary format, single point:	7 ms typical

Programmable Functions: All front panel functions, except power on/off and CRT intensity and focus, are programmable. The HP 8757A is compatible with all HP 8756A scalar network analyzer programming codes.

User-Accessible Graphics: Number of vectors: typically 1500 5-cm vectors with 60 Hz refresh rate.
Writing speed: typically 10 ms per vector.

Table 1-2. Supplemental Performance Characteristics (2 of 2)

HP-IB CHARACTERISTICS (Cont'd)

Interrupts: HP-IB service interrupts (SRQs) are generated for the following conditions:

Front panel key pressed	Numeric entry completed
Soft key only pressed	Limit test failed
Operation complete (sweep or plot)	Action requested not possible
Syntax error	Knob activity
Instrument self-test error	Low battery voltage

SYSTEM INTERFACE

Description: The 8757 System Interface is a dedicated HP-IB port used exclusively by the HP 8757A to control and extract information from a swept source and a digital plotter and printer.

GENERAL SPECIFICATIONS

Temperature Range: Operating: 0 to 55 °C
Storage: −40 to 75 °C

Power Requirements: 48 to 62 Hz, 100/120/220/240V ±10%, typically 155 VA.

Dimensions: 178 H × 425 W × 482 mm D (7.0 × 16.75 × 19.0 in).

Weight: Net 21 kg (46.5 lb). Shipping (with manual) 33 kg (73 lb).

X-RAY RADIATION NOTICE

ACHTUNG

Model 8757A

WARNING

Während des Betriebs erzeugt dieses Gerät Röntgenstrahlung. Das Gerät ist so abgeschirmt, daß die Dosisleistung weniger als 36 pA/kg (0,5 mR/h) in 5cm Abstand von der Oberfläche der Katodenstrahlröhre beträgt. Somit sind die Sicherheitsbestimmungen verschiedener Länder, u.A. der deutschen Röntgenverordnung eingehalten.

Die Stärke der Röntgenstrahlung hängt im Wesentlichen von der Bauart der Katodenstrahlröhre ab, sowie von den Spannungen, welche an dieser anliegen. Um einen sicheren Betrieb zu gewährleisten, dürfen die Einstellungen der Niederspannungs- und des Hochspannungsnetzteils nur nach der Anleitung in Kapitel V des Handbuches vorgenommen werden.

Die Katodenstrahlröhre darf nur durch die gleiche Type ersetzt werden. (Siehe Kapitel Vi für HP — Ersatzteile).

Das Gerät ist in Deutschland zugelassen unter

der Nummer: BW/195/85/RÖ

When operating, this instrument emits x-rays; however, it is well shielded and meets safety and health requirements of various countries, such as the X-ray Radiation Act of Germany.

Radiation emitted by this instrument is less than 0.5 mR/hr at a distance of five (5) centimeters from the surface of the cathode-ray tube. The x-ray radiation primarily depends on the characteristics of the cathode-ray tube and its associated low-voltage and high-voltage circuitry. To ensure safe operation of the instrument, adjust both the low-voltage and high-voltage power supplies as outlined in Section V of this manual (if applicable).

Replace the cathode-ray tube with an identical CRT only. Refer to Section VI for proper HP part number.

Number of German License: BW/195/85/RÖ

GEWERBEAUFSICHTSAMT STUTTGART

- Zentrale Stelle für Sicherheitstechnik und Vorschriftenwesen in Baden-Württemberg -

Gewerbeaufsichtsamt · Breitscheidstr. 48 · Postfach 703 · 7000 Stuttgart 1

Stuttgart, den 13.03.1985

Fernsprecher
(07 11) 2 05 01 (Behördenzentrum)
Durchwahl 20 50 - 4798
Aktenzeichen: Z 5108/HP/Ws/Vg
(Bitte bei Antwort angeben)

Hewlett-Packard GmbH
Herrenberger Straße 110

7030 Böblingen

Betr.: Durchführung der Röntgenverordnung (RöV)

Bezug: Ihr Antrag vom 07.03.1985 - PSD/US/ab

Zulassungsschein Nr. BW/195/85/Rö

Hiermit wird Ihnen gemäß § 7 Abs. 2 der Röntgenverordnung vom 1.März 1973 (BGBl. I S. 173) die Zulassung der Bauart der nachstehend beschriebenen Störstrahler erteilt:

Gegenstand	: Anzeigeteil HP 1349A/D eingebaut in Netzwerkanalysator HP 8757A
Bildröhre	: Hewlett Packard Typ: 5083-6350
Betriebsbedingungen	: Hochspannung: max. 23,5 kV Strahlstrom : max. 12 uA
Hersteller	: Hewlett-Packard Co. 1400 Fountaingrove Parkway Santa Rosa, CA 95401, USA
Bauartunterlagen	: Manual Nr. 01349-90901 vom August 1984
Prüfungsschein	: Physikalisch-Technische Bundesanstalt Braunschweig Nr. 6.62-S 262 vom 08.02.85

Die Zulassung wird befristet bis 13.03.1995.

Auf § 8 Abs. 2 RöV wird hingewiesen.

GEWERBEAUFSICHTSAMT STUTTGART - Zentrale Stelle für Sicherheitstechnik und Vorschriftenwesen in Baden-Württemberg -

Blatt 2 zum Bescheid vom 13.03.1985 Kennzeichen: BW/195/85/Rö

Für den Strahlenschutz wesentliche Merkmale:

1. Die Art und Qualität der Bildröhre,
2. die der Hochspannungserzeugung und -stabilisierung dienenden Bauelemente.

Auflagen:

Die Zulassung wird gemäß § 8 Abs. 1 der RöV mit folgenden Auflagen verbunden:

1. Die Geräte sind einer Stückprüfung daraufhin zu unterziehen, ob sie bezüglich der für den Strahlenschutz wesentlichen Merkmale der Bauartzulassung entsprechen. Die Prüfung muß umfassen:

   a) Kontrolle der Hochspannung an jedem einzelnen Gerät,
   b) Messung der Dosisleistung nach näherer Angabe der Zulassungsbehörde.

   Die Ergebnisse der Dosisleistungsmessung sind, den Herstellnummern der Geräte zugeordnet, aufzuzeichnen, drei Jahre aufzubewahren und der Zulassungsbehörde auf Verlangen einzusenden. Die Zulassungsbehörde ist berechtigt, einzelne Geräte nach eigener Auswahl anzufordern, um das Vorliegen der für den Strahlenschutz wesentlichen Merkmale zu überprüfen oder überprüfen zu lassen.

2. Die Herstellung und die Stückprüfung sind durch einen von der Zulassungsbehörde bestimmten Sachverständigen überwachen zu lassen.

3. Die Geräte sind deutlich sichtbar und dauerhaft mit dem Kennzeichen

   BW/195/85/Rö

   zu versehen sowie mit einem Hinweis folgenden Mindestinhalts:

   "Die in diesem Gerät entstehende Röntgenstrahlung ist ausreichend abgeschirmt.
   Beschleunigungsspannung maximal 23,5 kV."

GEWERBEAUFSICHTSAMT STUTTGART - Zentrale Stelle für Sicherheitstechnik und Vorschriftenwesen in Baden-Württemberg -

Blatt 3 zum Bescheid vom 13.03.1985 Kennzeichen: BW/195/85/Rö

4. Jedem Erwerber eines Gerätes ist ein Abdruck des Zulassungsscheins auszuhändigen, auf dem das Ergebnis der Stückprüfung (Auflage 1) bestätigt sein muß.

Jedem Gerät ist ferner eine Betriebsanleitung beizufügen, in der auf den in Auflage 3 genannten Hinweis aufmerksam gemacht wird, und welche die für die Durchführung von Reparaturmaßnahmen und Wartungsarbeiten notwendigen Sicherheitsmaßnahmen bezüglich des Strahlenschutzes enthält.

Hinweis für den Benutzer des Geräts:

Unsachgemäße Eingriffe, insbesondere Verändern der Hochspannung oder Auswechseln der Bildröhre können dazu führen, daß Röntgenstrahlung in erheblicher Stärke auftritt. Ein so verändertes Gerät entpricht nicht mehr dieser Zulassung und darf infolgedessen nicht mehr betrieben werden.

Reutter

GEWERBEAUFSICHTSAMT STUTTGART

Dieses Gerät wurde nach den Auflagen der Zulassungsbehörde einer Stückprüfung unterzogen und entspricht in den für den Strahlenschutz wesentlichen Merkmalen der Bauartzulassung. Die Beschleunigungsspannung beträgt maximal 23,5 kV.

Hewlett-Packard Co.
1400 Fountaingrove Parkway
Santa Rosa, CA 95401, USA

SECTION II
INSTALLATION

INTRODUCTION

This section provides installation instructions for the HP 8757A scalar network analyzer and its accessories. This section also includes information about initial inspection, damage claims, preparation for using the instrument, packaging, storage, and shipment.

INITIAL INSPECTION

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 contents of the shipment should be as shown in Figure 1-1. Procedures for checking electrical performance are given in Section IV. If the instrument does not pass the electrical performance tests, refer to the adjustments in Section V of this manual. If a circuit malfunction is suspected, refer to troubleshooting information in Section VIII. If the instrument does not pass the above electrical tests, or if the shipment contents are incomplete, or if there is mechanical damage or defect, 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 materials for the carrier's inspection. The HP office will arrange for repair or replacement without waiting for a claim settlement.

PREPARATION FOR USE

Power Requirements

The HP 8757A scalar network analyzer requires a power source of 100, 120, 220, or 240 Vac, ±10%, 50 to 60 Hz, single-phase. Power consumption is approximately 155 volt-amps.

Line Voltage and Fuse Selection

Figure 2-1 illustrates the line voltage selection card and fuse location in the power line module on the rear panel of the HP 8757A. Select the line voltage and fuse as follows:

a. Measure the AC line voltage.

b. Refer to Table 2-1. At the instrument rear panel power line module, select the line voltage (100, 120, 220, or 240 volts) closest to the voltage you measured in step a. Note that the available line voltage must be within ±10% of the line voltage selection as shown in Table 2-1. If it is not, you must use an autotransformer between the power source and the HP 8757A.

Table 2-1. Line Voltage/Fuse Selection

Measured AC Line Voltage	PC Selector Board Position	Fuse/ HP Part Number
90 to 110 volts	100	2.5A 2110-0083
108 to 132 volts	120	2.5A 2110-0083
198 to 242 volts	220	1.5A 2110-0043
216 to 264	240	1.5A 2110-0043

c. Make sure the correct fuse is installed in the fuse holder. The required fuse rating for each line voltage is indicated in Table 2-1 and below the power line module on the rear panel of the HP 8757A.

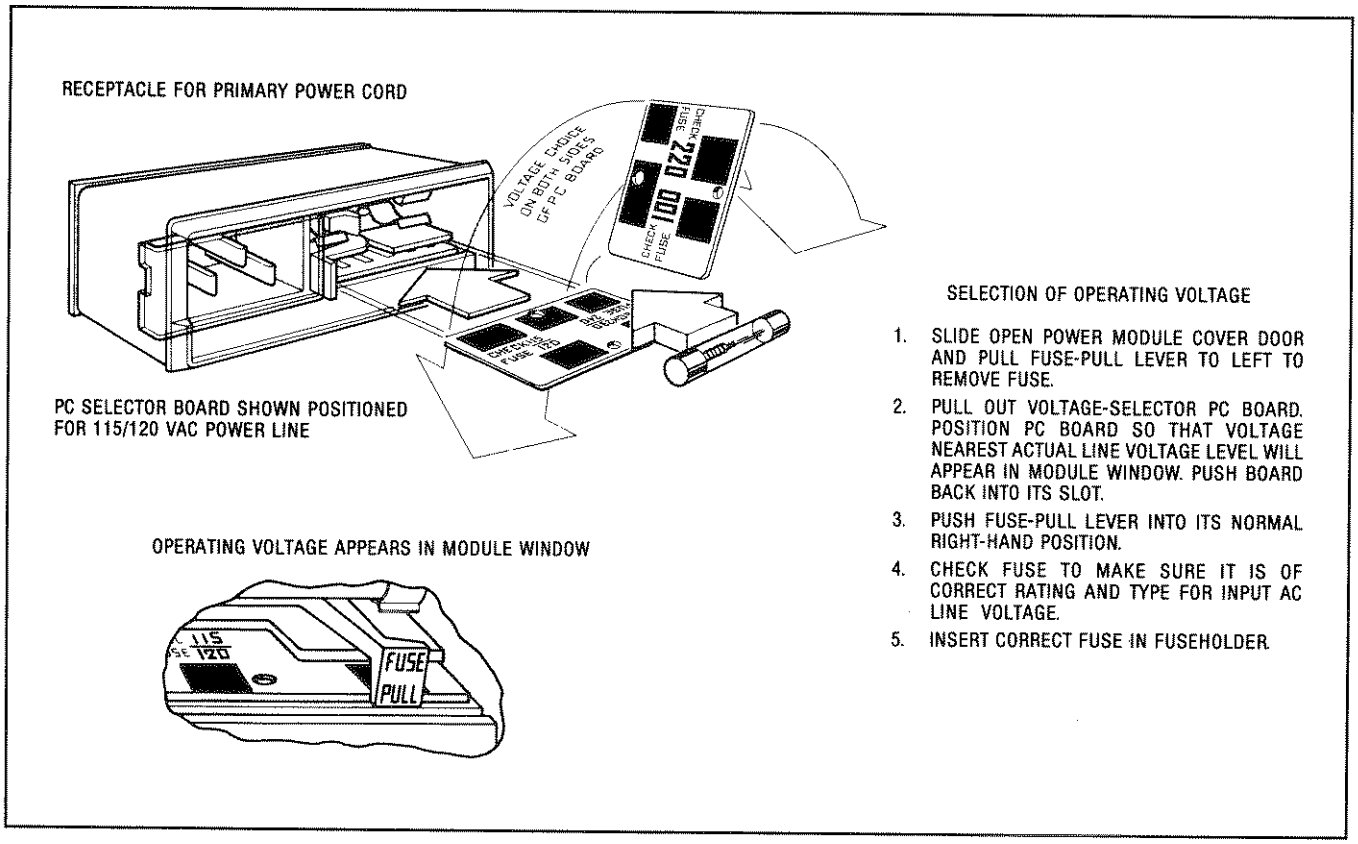


Figure 2-1. Power Line Module

CAUTION

To prevent damage to the instrument, make the correct line voltage and fuse selection before connecting line power to the instrument.

NOTE

The HP 8757A contains internal factory installed fuses which are not operator serviceable or replaceable.

WARNING

To insure adequate cooling and proper operation of the HP 8757A, check at regular intervals and clean as required the instrument's fan filter.

POWER CABLE

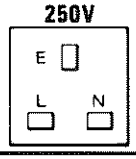
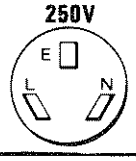
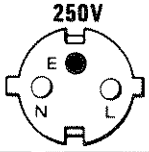
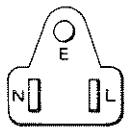
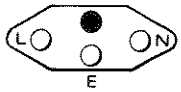
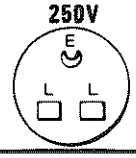
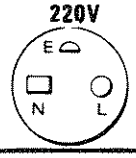
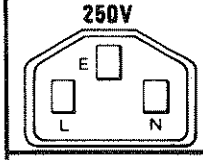
In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate outlet, this cable grounds the instrument cabinet. Table 2-2 shows the styles of plugs available on power cables supplied with HP instruments. Each HP part number in column two refers to a complete power cable (including the plug illustrated in column one). The type of power cable/plug shipped with the instrument depends upon the country of destination.

WARNING

Before switching on this instrument, be sure that only the specified power cable is used. The instrument is provided with a three-wire power cord which grounds the instrument cabinet. This power cord should only be inserted in a socket outlet provided with a protective earth contact. This protective action should not be negated by the use of an extension cord (power cable) without a protective conductor (ground). Grounding one conductor of a two-conductor outlet is not sufficient protection.

The offset pin of the three-prong connector is the grounding pin. When operating the HP 8757A from a two-contact outlet, the protective grounding feature may be preserved by using a three-prong to two-prong adapter (USA connectors only, HP part number 1251-0048) and connecting the green wire of the adapter to ground.

Table 2-2. AC Power Cables Available

Plug Type [1]	Cable HP Part Number [2]	CD [3]	Plug Description [2]	Cable Length (inches)	Cable Color	For Use in Country
250V 	8120-1351 8120-1703	0 6	Straight BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	0 4	Straight NZSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	7 2	Straight CEE7-VII 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, Republic of So. Africa, India (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	5 5 7 1 6 2	Straight NEMA5-15P 90° Straight NEMA5-15P Straight NEMA5-15P 90° Straight NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	3	Straight SEV1011.1959 24507, Type 12	79	Gray	Switzerland
250V 	8120-0698	6	Straight NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	2 3	Straight DHCK 107 90°	79 79	Gray Gray	Denmark
250V 	8120-1860	6	Straight CEE22-VI (System Cabinet Use)			

1. E = Earth Ground; L = Line; N = Neutral
2. Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.
3. The Check Digit (CD) is a coded digit that represents the specific combination of numbers used in the HP Part Number. It should be supplied with the HP Part Number when ordering any of the power assemblies listed above, to expedite speedy delivery.

HP-IB Address Selection

The HP 8757A may be operated directly through the front panel controls or under remote control. In the remote control mode, the controller and the HP 8757A communicate via HP-IB. The controller refers to the HP 8757A by an HP-IB "address". Each instrument on the bus must have a unique address code. **Do not** set the HP 8757A address to the same address as any other instrument (for example: sweeper, plotter, printer) connected to the System Interface.

Twenty-nine different address codes are available (1 to 29). The HP 8757A is shipped from the factory preset to address 16. In all standard HP 8757A instruments, the HP-IB address is read by the processor from firmware upon initial power on only. This HP-IB address remains in effect until it is changed through the front panel functions. It may be read on the CRT screen by pressing firmkey **[LOCAL]** and softkey **[8757]**.

To change the HP-IB address at this point, press the desired numerical "Entry" key(s) and then press **[ENT]**. The display will now show the new HP-IB address. This address is not affected by turning the LINE switch off, or by using the PRESET command.

Individual HP-IB address labels are available by ordering HP part number 7120-6853. (See Figure 2-2). These labels allow easy reference to the HP-IB address of each system component.

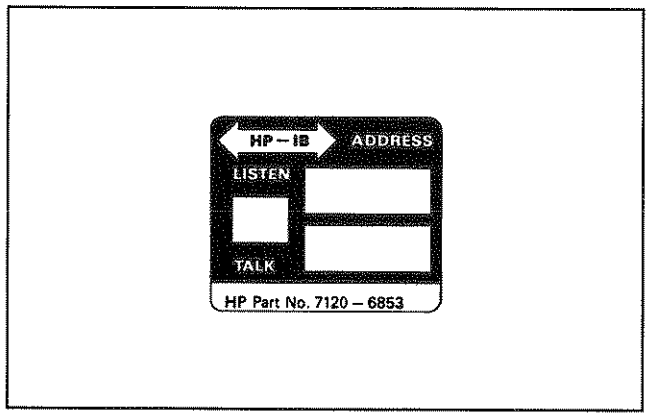


Figure 2-2. HP-IB Address Label

Mating Connectors

All of the externally mounted connectors HP 8757A are listed in Table 2-3. Opposite each HP 8757A connector is an industry identification, the part number of a mating connector, and the part number of an alternate source for the mating connector. For HP part numbers of the externally mounted connectors themselves, refer to Section VI, Replaceable Parts.

HP Interface Bus and 8757 System Interface Connectors and Cables

The HP Interface Bus connector is located on the rear panel of the HP 8757A. J2 allows the HP 8757A to be connected to a controller via HP-IB with or without additional instruments. An illustration of pin configuration and signals on the HP Interface Bus connector is given in Figure 2-3.

The 8757 System Interface connector is located on the rear panel of the HP 8757A. J1 allows the HP 8757A to be connected to the HP 8350B, HP 8340A, or HP 8341A swept microwave sources, and/or digital plotters and printers. The HP 8757A itself controls the 8757 System Interface and there must be no other controllers attached to this connector. (See Figure 2-3.)

All instruments on the HP Interface Bus or the 8757 System Interface are interconnected by HP-IB interface cables. A list of the available HP-IB cables and their part numbers is given in Figure 2-4. As many as 15 instruments may be connected in parallel on the HP-IB or the 8757 System Interface. To achieve design performance on the bus, proper voltage levels and timing relationships must be maintained. If the system cable is too long or if the accumulated cable length between instruments is too long, the data and control lines cannot be driven properly and the system may fail to perform. Therefore, observe the following restrictions:

a. Four metres (12 feet) is the maximum cable length with two instruments in a system.

b. Two metres (6 feet) is the maximum cable length to each instrument when more than two instruments are connected on the bus.

c. Twenty metres (65 feet) is the maximum total cable length between all units.

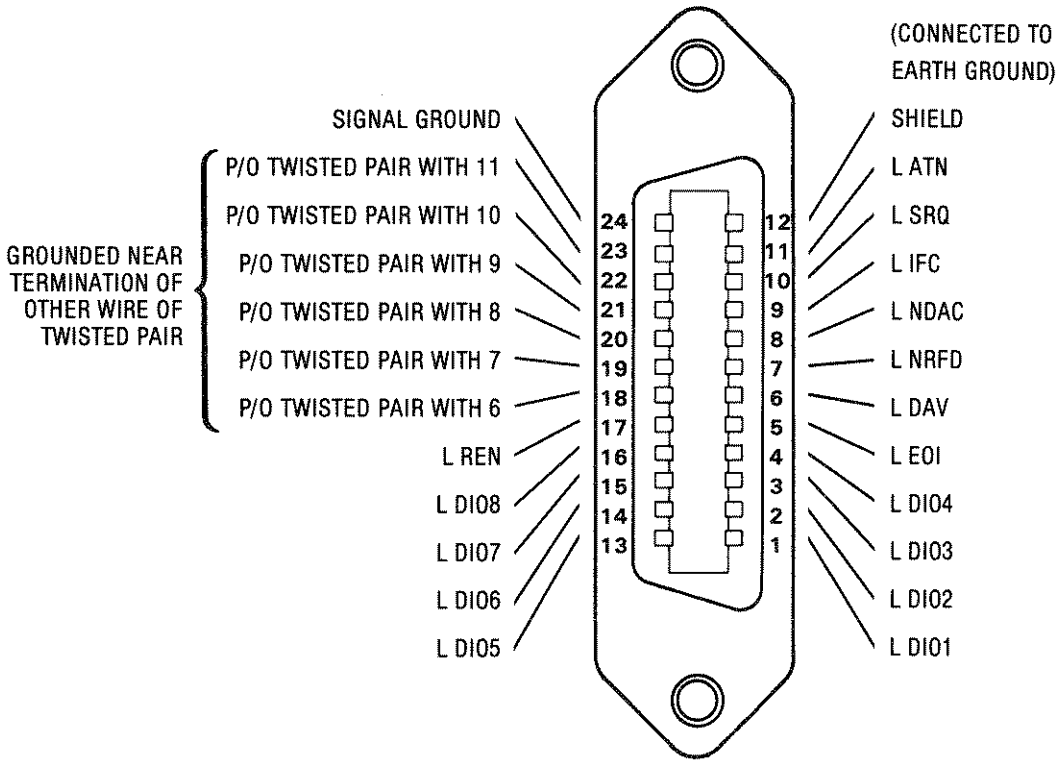
Operating Environment

Temperature. The instrument may be operated in temperatures from 0°C to +55°C.

Humidity. The instrument may be operated in environments with relative humidity from 5% to 80% at +25°C to +40°C. However the HP 8757A should be protected from temperature extremes that could cause condensation within the instrument.

Altitude. The instrument may be operated at altitudes up to 4,572 metres (approximately 15,000 feet).

8757 SYSTEM INTERFACE CONNECTOR J1
and HP INTERFACE BUS CONNECTOR J2
(as viewed from rear of instrument)



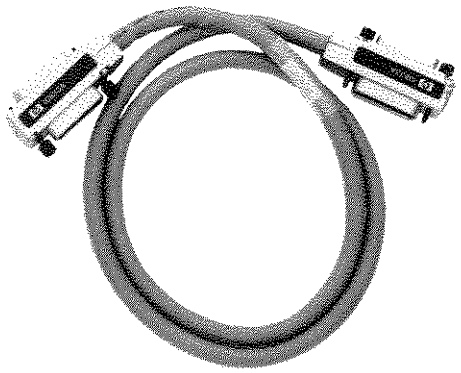
HP-IB Logic Levels:
True (low) State ≤0.8 Vdc; False (high) State ≥+2.4 Vdc.

NOTE: Mnemonics on the wiring list for J1 and J2 are coded B and A to differentiate between the two. (L BDIO5=8757 System Interface; L ADIO5=HP Interface Bus)

MNEMONICS TABLE

Mnemonic	Description
L ATN	LOW = Attention control line
L DAV	LOW = Data Valid control line
L DIO1 through 8	LOW = Data Input/Output lines
L EOI	LOW = End Or Identify control line
L IFC	LOW = Interface Clear control line
L NDAC	LOW = Data Not Accepted control line
L NRFD	LOW = Not Ready For Data control line
L REN	LOW = Remote Enable control line
L SRQ	LOW = Service Request control line

Figure 2-3. 8757 System Interface Connector and HP-IB Connector Signal/Pin Configuration



HP-IB Cable Part Numbers	Lengths
HP 10833A	1 m (3.3 ft.)
HP 10833B	2 m (6.6 ft.)
HP 10833C	4 m (13.2ft.)
HP 10833D	0.5 m (1.6 ft.)

Figure 2-4. HP-IB Interface Cables Available

Cooling. Clearance for ventilation should be at least 10 cm (4 inches) at the rear of the cabinet and 7.6 cm (3 inches) at the sides. The clearances provided by the plastic feet in bench stacking and filler strips in rack mounting are adequate for the top and bottom cabinet surfaces. The fan mounted on the rear of the HP 8757A moves air into the instrument and out through the sides. Ensure that the air intake and exhaust clearances are met and that the fan filter is cleaned regularly.

CAUTION

When installing rack mount kits, ensure that the correct screws, specified in the Replaceable Parts List in Section VI, are used. Use of screws longer than specified may result in damage to internal components located behind the screw mounting holes in the instrument.

Rack Mounting without Front Handles (Option 908)

Instruments with Option 908 contain a Rack Mount Kit. This kit supplies the necessary hardware and installation instructions for preparing the instrument to mount on an equipment rack with 482.6 mm (19 inch) support spacing. Installation instructions are also given in Figure 2-5. Additional Option 908 Kits may be ordered as HP part number 5061-9678.

Rack Mounting with Front Handles (Option 909)

Instruments with Option 909 contain a Rack Mount Kit with Front Handles. This kit supplies the necessary hardware and installation instructions for preparing the standard instrument with handles to mount on an equipment rack with 482.6 mm (19 inch) support spacing. Installation instructions are also given in Figure 2-6. Additional Option 909 kits may be ordered as HP part number 5061-9684.

STORAGE AND SHIPMENT

Environment

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

Temperature . . . . . −40°C to +75°C

Humidity . . . . 5% to 95% relative at 0°C to +40°C

Altitude . . . . . Up to 15,240 metres (approximately 50,000 feet)

The instrument should be protected from temperature extremes that could cause condensation in the instrument.

Packaging

Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. A complete diagram and listing of packaging materials used for the HP 8757A is shown in Figure 2-8. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number and full serial number (located on the rear panel serial plate). Service tags are located at the end of this section. Mark the container FRAGILE to ensure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

Other Packaging. The following general instructions should be used for repackaging with commercially available packaging materials:

a. If the instrument has rack-mount flanges, remove them as illustrated in Figure 2-7.

b. Wrap the instrument in heavy paper or plastic. If shipping to a Hewlett-Packard Office or Service Center, attach a tag indicating the type of service required, return address, model number and full serial number.

c. Use a stout shipping container.

d. Use enough shock-absorbing material around all sides of the instrument to provide a firm cushion and to prevent movement inside the container. Protect the control panel with cardboard.

e. Seal the shipping container securely.

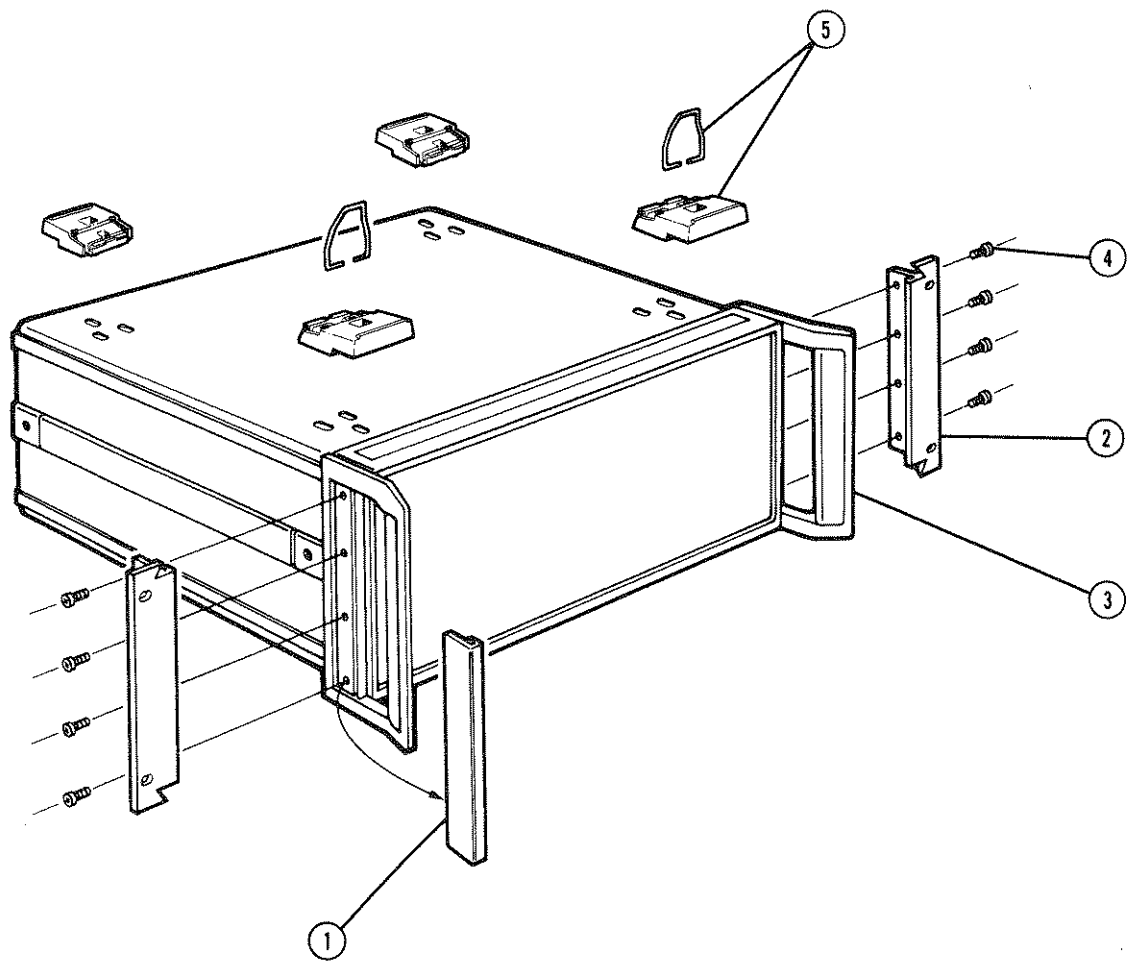
f. Mark the shipping container FRAGILE to ensure careful handling.

g. In any correspondence, refer to the instrument by model number and full serial number.

Table 2-3. HP 8757A Mating Connectors

Panel Connector	8757 Connector		Mating Connector	
	Connector Name	Industry Identification	HP Part Number	Alternate Source
Front	Input A (P/O W1)	Audio 5-Pin Connector	1251-1865	Switchcraft 12 CL5M
	Input B (P/O W2)	Audio 5-Pin Connector	1251-1865	Switchcraft 12 CL5M
	Input C (Opt 001) (P/O W3)	Audio 5-Pin Connector	1251-1865	Switchcraft 12 CL5M
	Input R (P/O W4)	Audio 5-Pin Connector	1251-1865	Switchcraft 12 CL5M
Rear	*J1 8757 System Interface	24-Pin Micro Ribbon	1251-0293	Amphenol 57-30240
	*J2 HP Interface Bus	24-Pin Micro Ribbon	1251-0293	Amphenol 57-30240
	J3 Pos Z Blank	BNC	1250-0256	Specialty Connector 25-P118-1
	J4 Stop Sweep	BNC	1250-0256	Specialty Connector 25-P118-1
	J5 Sweep In 0-10V	BNC	1250-0256	Specialty Connector 25-P118-1
	J6 Modulator	BNC	1250-0256	Specialty Connector 25-P118-1
	J7 DAC Out 0-10V	BNC	1250-0256	Specialty Connector 25-P118-1
	J8 ADC In	BNC	1250-0256	Specialty Connector 25-P118-1
	J9 Control 1	BNC	1250-0256	Specialty Connector 25-P118-1
	J10 Control 2	BNC	1250-0256	Specialty Connector 25-P118-1

* Refer to Figure 2-4 for HP-IB interface cable information. Signals and pin configuration for the 8757 System Interface connector (J1) and for the HP Interface Bus connector (J2) are given in Figure 2-3.



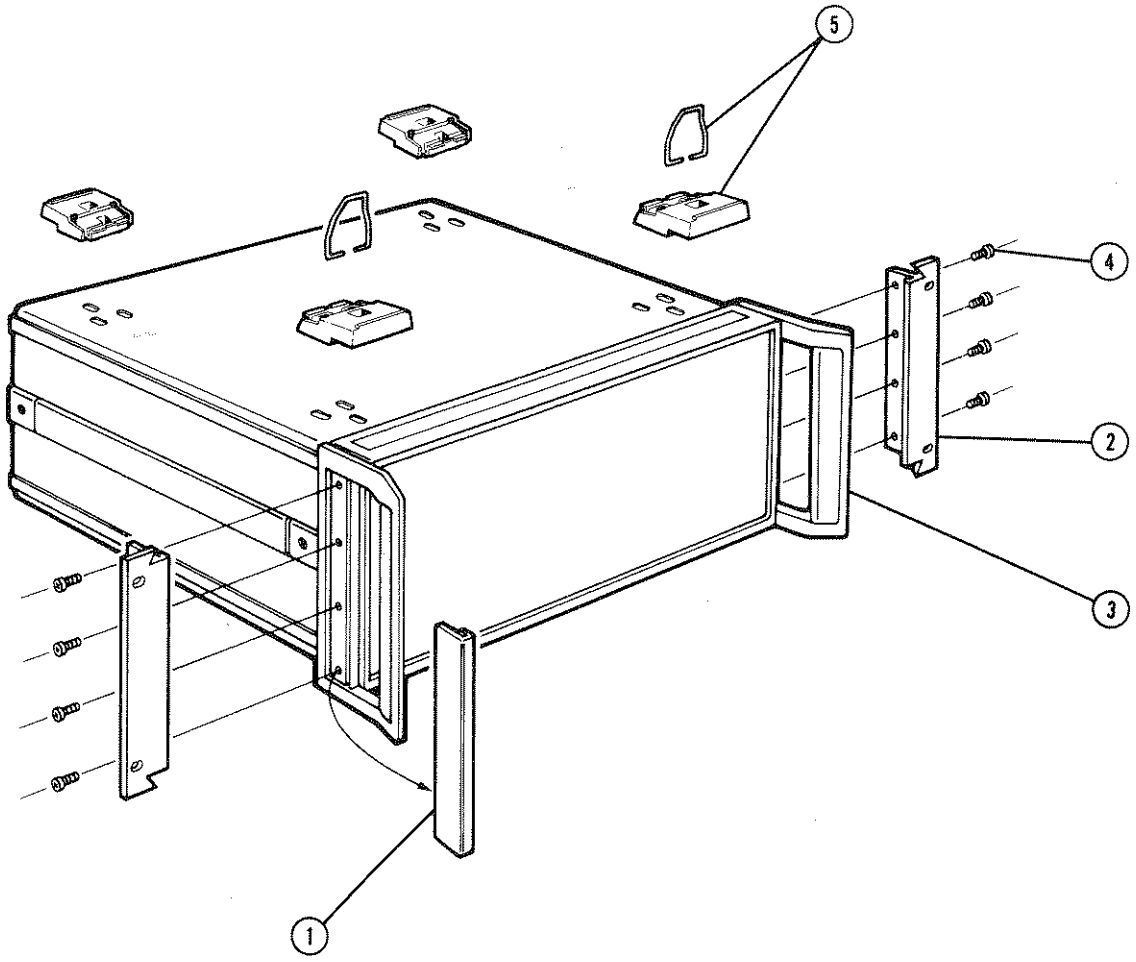
OPTION 908
INSTALLATION INSTRUCTIONS

1. REMOVE EACH FRONT HANDLE TRIM **1** BY INSERTING TIP OF SCREWDRIVER BETWEEN BACK EDGE OF TRIM AND FRONT HANDLE **3** AND PULLING FORWARD.
2. REMOVE FOUR SCREWS (M4 × 0.7 ×10 SCREW, FLATHEAD, 90 DEGREES) **4** AND ONE FRONT HANDLE ASSEMBLY **3** PER SIDE.
3. ATTACH ONE RACK MOUNT FLANGE **2** WITH FOUR M4 × 0.7 × 10 PANHEAD SCREWS **4** PER SIDE.
4. REMOVE FEET AND TILT STANDS **5** BEFORE RACK MOUNTING.
5. SAVE FLATHEAD SCREWS AND FRONT HANDLE ASSEMBLIES FOR POSSIBLE REUSE (I.E. SHIPPING).

OPTION 908 (HP Part No. 5061-9678) CONTENTS

Item	Qty.	HP Part No.	CD	Description
2	2	5020-8875	2	Rack Mount Flange
4	6	0515-1114	8	M4 × 0.7 × 10 Screw, Panhead

Figure 2-5. Option 908 Rack Mount Kit without Handles



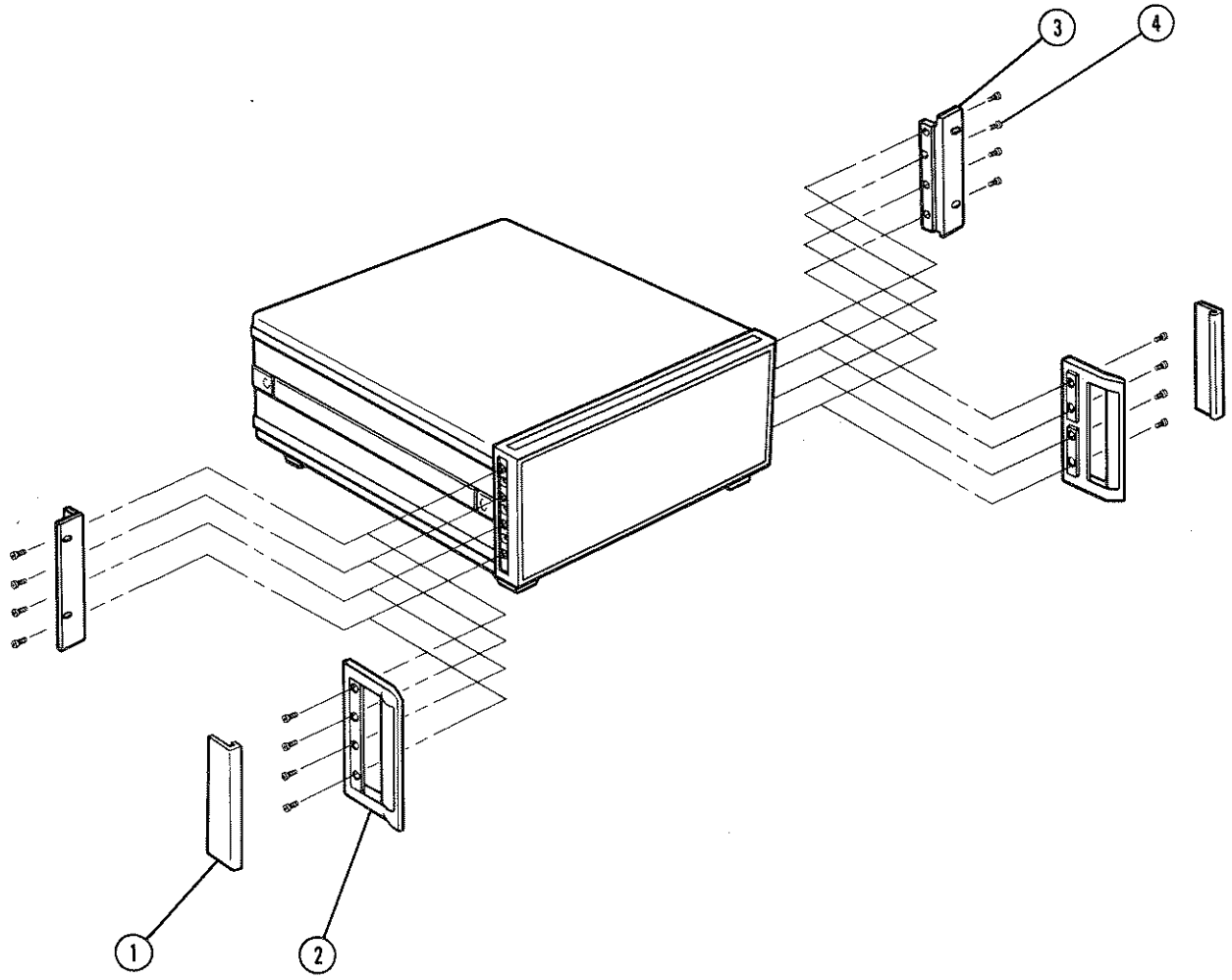
OPTION 909
INSTALLATION INSTRUCTIONS

1. REMOVE EACH FRONT HANDLE TRIM **1** BY INSERTING TIP OF SCREWDRIVER BETWEEN BACK EDGE OF TRIM AND FRONT HANDLE **3** AND PULLING FORWARD.
2. REMOVE FOUR FLATHEAD SCREWS **4** AND ONE FRONT HANDLE ASSEMBLY **3** PER SIDE.
3. ATTACH ONE RACK MOUNT FLANGE **2** AND ONE FRONT HANDLE ASSEMBLY **3** WITH FOUR PANHEAD SCREWS **4** PER SIDE.
4. REMOVE FEET AND TILT STANDS **5** BEFORE RACK MOUNTING.
5. SAVE FLATHEAD SCREWS FOR POSSIBLE REUSE (I.E. SHIPPING).

OPTION 909 (HP Part No. 5061-9684) CONTENTS

Item	Qty.	HP Part No.	CD	Description
2	2	5020-8875	2	Rack Mount Flange
4	8	0515-1106	2	M4 × 0.7 × 16 Screw, Panhead

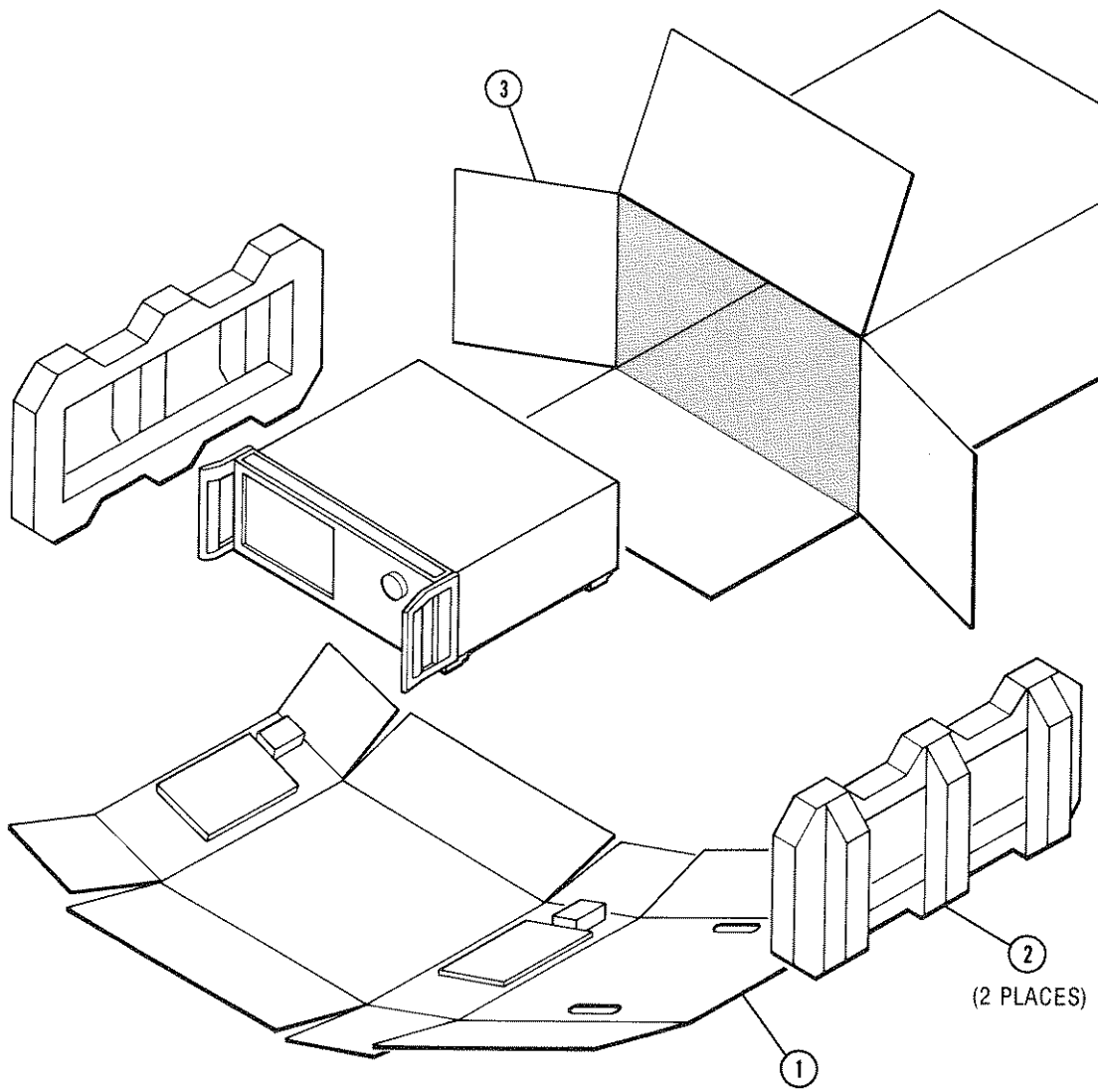
Figure 2-6. Option 909 Rack Mount Kit with Handles



SHIPMENT PREPARATION INSTRUCTIONS

1. IF STANDARD HP 8757A WITH HANDLES ONLY, SHIP.
2. IF OPTION 909 (WITH RACK MOUNT FLANGES), REMOVE FOUR PANHEAD SCREWS (M4 × 0.7 ×16) **4** AND ONE RACK MOUNT FLANGE PER SIDE.
3. REINSTALL ONE FRONT HANDLE ASSEMBLY **3** WITH FOUR FLATHEAD SCREWS (M4 × 0.7 × 10, 90 DEGREES) PER SIDE AND SHIP.
4. IF THE HP 8757A LACKS HANDLES, PERFORM STEP 3.

Figure 2-7. Preparation of Instrument for Shipment



Ref. Desig.	HP Part No.	CD	Description
1	08756-80009	2	Carton – Inner
2	08756-80010	5	Side Rail
3	9211-4499	7	Carton – Outer

Figure 2-8. Packaging for Shipment Using Factory Packaging Materials

SECTION III
OPERATION

The Operation section of this manual consists of the following subsections:

LOCAL OPERATION

1. **Operating Information** (HP part number 08757-90030) provides complete information necessary for the correct setup and local operation of the HP 8757A scalar network analyzer. This information includes front and rear panel operating features, and soft key operation with details of all the soft key menus. An operator's check is supplied for daily instrument verification, incoming inspection, or verification after repair or replacement of digital circuits. A duplicate of the appendix "In Case of Difficulty" is included.

2. **Operating Note** "Basic Network Measurements Using HP 8757A Scalar Network Analyzer and HP 8350B Sweep Oscillator" (HP part number 08757-90011). This provides tutorial information on local operation of the HP 8757A in a system configuration.

REMOTE OPERATION

1. **Programming Note** "Introductory Operating Guide for the HP 8757A Scalar Network Analyzer with the HP 9000 Series 200 and 300 Desktop Computers(BASIC)" (HP part number 5954-1561). This describes the remote operation of the HP 8757A when used with an HP 9000 series 200 or 300 computer. Included in this guide are several short programs that demonstrate the use of the HP 8757A with HP-IB commands, and a diagram of system connections for remote control. This note assumes familiarity with local (non-remote) operation of the HP 8757A.

2. **Programming Note** "Quick Reference Guide for the HP 8757A Scalar Network Analyzer" (HP part number 5954-1562). This is a reference guide for the remote operation of the HP 8757A. This note is intended for use by those familiar with HP-IB programming and the basic functions of the HP 8757A.

IN CASE OF DIFFICULTY

This appendix explains what to do when a problem is encounted using the HP 8757A. It presents suggestions for minor problems that do not involve defects in the internal circuitry. If a problem is encountered that is not solved using any of these suggestions, refer to Section VIII of the Service Manual.

FIRMWARE REVISION HISTORY

This section describes the various HP 8757A firmware revisions, with a brief description of the additional features over the previous revisions. This is only a summary. For more detail, refer to the HP 8757A Operating Information and Quick Reference Guide.

REVISION 1.0 (first shipped April 16,1985)

1. Private Bus Status renamed System Interface Status.
2. Softkey label **[PVT BUS ON OFF]** becomes **[SYSINTF ON OFF]**.

REVISION 1.2 (first shipped July 15, 1985)

Fixed the following revision 1.0 problems:

1. Trace jump due to incorrect internal calibration.
2. Compatible with HP 9872C plotter.
3. Compatible with HP 8350B firmware revision 6 when used with the HP 85025A/B firmware revision 6.

Added the following features:

1. Plots include vertical lines between flat limits with the same frequency breakpoints.
2. New HP-IB command to disable/enable automatic internal calibration: CT0 = AUTOCAL OFF; CT1 = AUTOCAL ON.
3. HP-IB command OI changed revision format to XX.X.

REVISION 2.0 (first shipped February, 1986)

Added the following instrument features:

1. SWR trace display: **[TRC FMT SWR dB]**
2. Printer menu added: **[PRINT GRAPH]** (same as **[PRINT ALL]** on previous revisions), **[PRINT DATA]** and **[PRINT MKRS]** functions added.
3. **[PRINT GRAPH]** now includes title and PASS/FAIL status for channels 1 and 2.
4. Plots now include active entry area.
5. Supports the HP 85025C detector adapter: **[EXT DET CAL]** under second CAL menu, **[COARSE ZERO]** under DC DET ZERO menu.
6. Supports the HP R/Q/U 85026A detectors.
7. External voltage display: **[AUX]** under last DISPLAY menu. Allows display of voltage at ADC IN on rear panel.
8. CRT Status line for display of current system settings.
9. Limit Lines can now be entered in SWR for **[DISPLAY]**, **[TRC FMT SWR]** or in volts for **[MEAS]**, **[AUX]**.
10. **[AUTOCAL ON OFF]** selection in second CAL menu.
11. UNCAL status included in STATUS LINE and in status byte.
12. Repeat autozero timer is no longer preset to 5 minutes on Instrument Preset.

Added the following HP-IB features:

1. HP-IB commands for all new instrument features listed above.
2. Extended ASCII format (DDD.DDD) for accessing measurements >99.99 dB.
3. Status byte includes UNCAL status bit.
4. New terminators for volts and SWR.
5. Repeat autozero timer is now programmable.

HP 8757A
SCALAR NETWORK ANALYZER

For instruments having serial prefix 2513A, 2501A, 2533A, or 2546A, and revision 2.0 firmware.

HP PART NUMBER 08757-90030
P/O HP Part Number 08757-90034

Printed: JANUARY 1986

HEWLETT PACKARD

OPERATING INFORMATION

INTRODUCTION

This subsection provides complete information necessary for the correct setup and operation of the HP 8757A scalar network analyzer. Additional information on operating the HP 8757A with the HP 8350B sweep oscillator is provided in the Operating Note titled "Basic Network Measurements Using HP 8757A Scalar Network Analyzer and HP 8350B Sweep Oscillator," HP part number 08757-90011. Refer to the HP 8757A Programming Notes, "Introductory Operating Guide" (HP literature number 5954-1509) and "Quick Reference Guide" (HP literature number 5954-1508) for information on using the HP 8757A with a computer controller and HP-IB (Hewlett-Packard Interface Bus). HP-IB is Hewlett-Packard's hardware, software, documentation, and support for IEEE-488 and IEC-625, worldwide standards for interfacing instruments. The Operating Note and the Programming Notes are separately bound documents provided in Section III of this HP 8757A Operating Manual. In case of difficulty in operating the HP 8757A, refer to the Appendix at the back of this section.

OPERATING CHARACTERISTICS

The HP 8757A is a microprocessor-based receiver capable of making scalar (magnitude only) reflection and transmission measurements over a frequency range determined by the external detectors used. It has a large screen for display of measurement results. It is programmable over the Hewlett-Packard Interface Bus (HP-IB). Whether or not it is being controlled remotely through HP-IB, it can control a specific plotter and/or source through the 8757 System Interface, a private interface bus. A measurement with the HP 8757A requires the connection of detector(s) and/or directional bridge(s) to the detector inputs on the front panel, and the use of a compatible RF/microwave source.

The HP 8757A is locally operated by front panel controls and by menu selection using "soft" keys adjacent to the CRT. It has four independent but identical measurement channels, allowing simultaneous viewing of up to four measurement parameters with independent resolutions. The standard instrument has three detector inputs (A, B, and R), while the Option 001 has four detector inputs (A, B, C, and R).

The HP 8757A uses either AC (modulated) or DC (unmodulated) detection techniques in conjunction with its detectors. AC detection provides very stable measurements even with temperature variations and RF interference. DC detection (with HP 85025 and 85026 Series detectors only) should be used for modulation-sensitive devices, such as nonlinear amplifiers and narrow-band filters; and for devices that cannot be modulated, such as oscillators.

In AC detection, an RF or microwave signal is amplitude modulated with a 27.778 kHz square wave, providing the stimulus to the device under test. The output signal from the device under test is then detected by a compatible detector, and the HP 8757A filters, digitizes, and displays the response. A 27.778 kHz modulation signal is available from the rear panel of the HP 8757A to drive an external modulator for a source without internal amplitude modulation capability, or for use with the HP 8340A or 8341A synthesized sweeper.

In DC detection, an unmodulated CW (continuous wave) signal provides the stimulus to the device under test. This signal is rectified by the detector and then transformed into an AC detectable signal. The transformation is accomplished by the detector's chopping and sampling circuitry. The rectified signal is chopped at 27.778 kHz and made to resemble a square wave.

The HP 8350B sweep oscillator (serial prefix 2448A/J/U and above) has internal square wave modulation capability to provide the required 27.778 kHz modulated signal. All HP 83500-series RF plug-ins and most HP 86200-series RF plug-ins with the HP 11869A adapter are compatible with this internal modulation. (The HP 86220A, 86230B, 86241A, 86250A, 86250B, 86260A, 86260B, and 86260C RF plug-ins require the use of an external modulator for AC compatibility with the HP 8757A.) The HP 8350A sweep oscillator must be updated for full compatibility with the HP 8757A.

The HP 8340A and 8341A synthesized sweepers can accept the 27.778 kHz modulation signal from the HP 8757A. In the SHIFT PULSE mode they can then output a 27.778 kHz square wave modulated signal compatible with the AC mode of the HP 8757A. Note that in this mode, the AM LED is lit and connections are made to the AM BNC input.

The HP 8757A is factory equipped with a remote programming interface using the Hewlett-Packard Interface Bus (HP-IB). This provides a remote operator with the same control of the instrument available to the local operator, except for control of the power line switch and internal tests. Remote control is maintained by a controlling computer that sends commands or instructions to and receives data from the HP 8757A using the HP-IB. Several output modes are available for outputting data. Through a subset of HP-GL (Hewlett-Packard Graphics Language), user graphics can be plotted on the HP 8757A CRT. A complete description of HP-IB is provided in "Condensed Description of the Hewlett-Packard Interface Bus" (HP part number 59401-90030).

The interface connectors for HP-IB and the 8757 System Interface private bus are located on the rear panel of the HP 8757A. The HP 8757A itself controls the 8757 System Interface and there must be no other controllers attached to this connector.

OPERATING INSTRUCTIONS

This Operating Information section provides the following information:

- Front Panel Operating Features
- Soft Key Operating Features
- Rear Panel Operating Features
- Operator's Check
- HP-IB Commands
- In Case of Difficulty: Appendix A

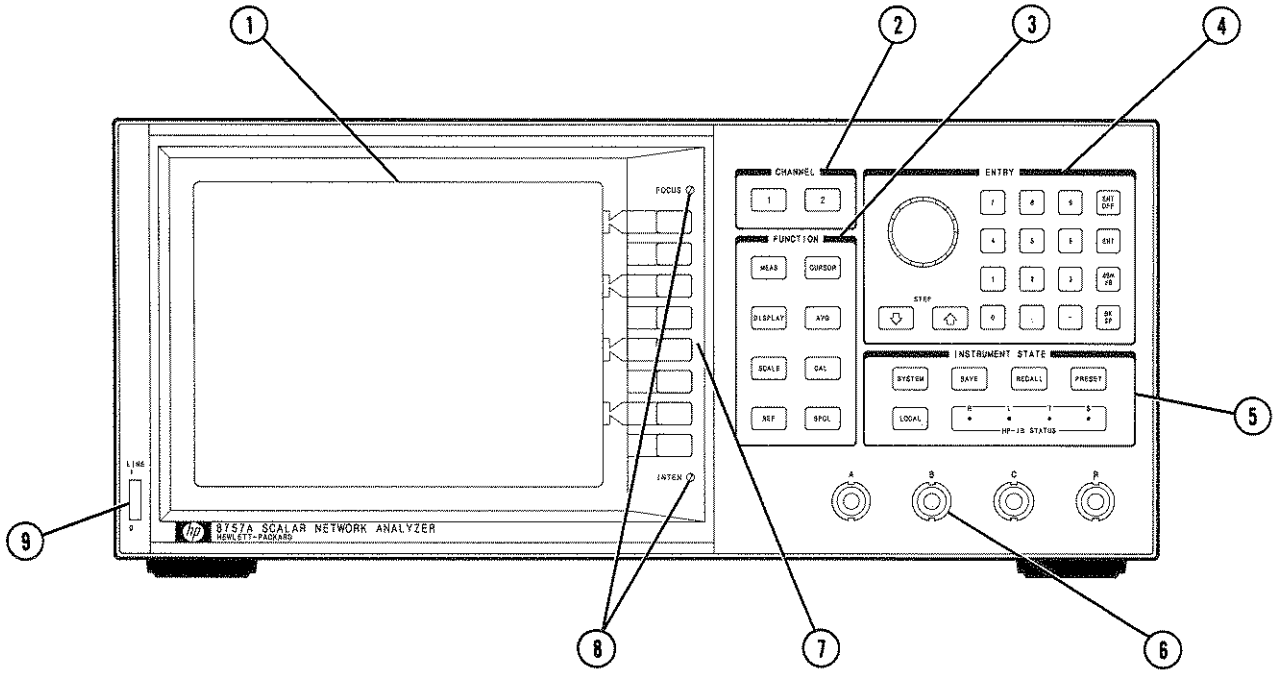
OPERATOR'S CHECK

The Operator's Check verifies that the HP 8757A is functioning correctly. It does not thoroughly check all specifications to their limits, but is an appropriate test for daily instrument verification, incoming inspection, or verification after repair or replacement of digital circuits.

ERROR MESSAGES

Error messages are shown in the active entry area of the CRT display when conditions indicate a problem with the HP 8757A. A list of the error messages is provided in Appendix A, In Case of Difficulty, and in Section VIII, Service, in the HP 8757A Service Manual.

FRONT PANEL OPERATING FEATURES



1. CRT display of measurement annotation, soft key labels, data traces, and other information.
2. CHANNEL keys select the active channel.
3. FUNCTION keys are used to activate functions and present menus that apply to the active channel only.
4. The ENTRY area includes the knob, the STEP keys, and the number pad. These are used for entering data.
5. INSTRUMENT STATE keys are used to control system functions that do not apply to a single channel but to the entire instrument state.
6. Detector inputs are used for connection of compatible detectors and/or directional bridges.
7. Soft keys are used for selection of functions in the menus and for instrument status information.
8. CRT display controls.
9. LINE switch controls AC power to the HP 8757A.

Figure 3-1. The HP 8757A Option 001 Front Panel

CRT DISPLAY

The display for the HP 8757A is divided into several information areas, described below.

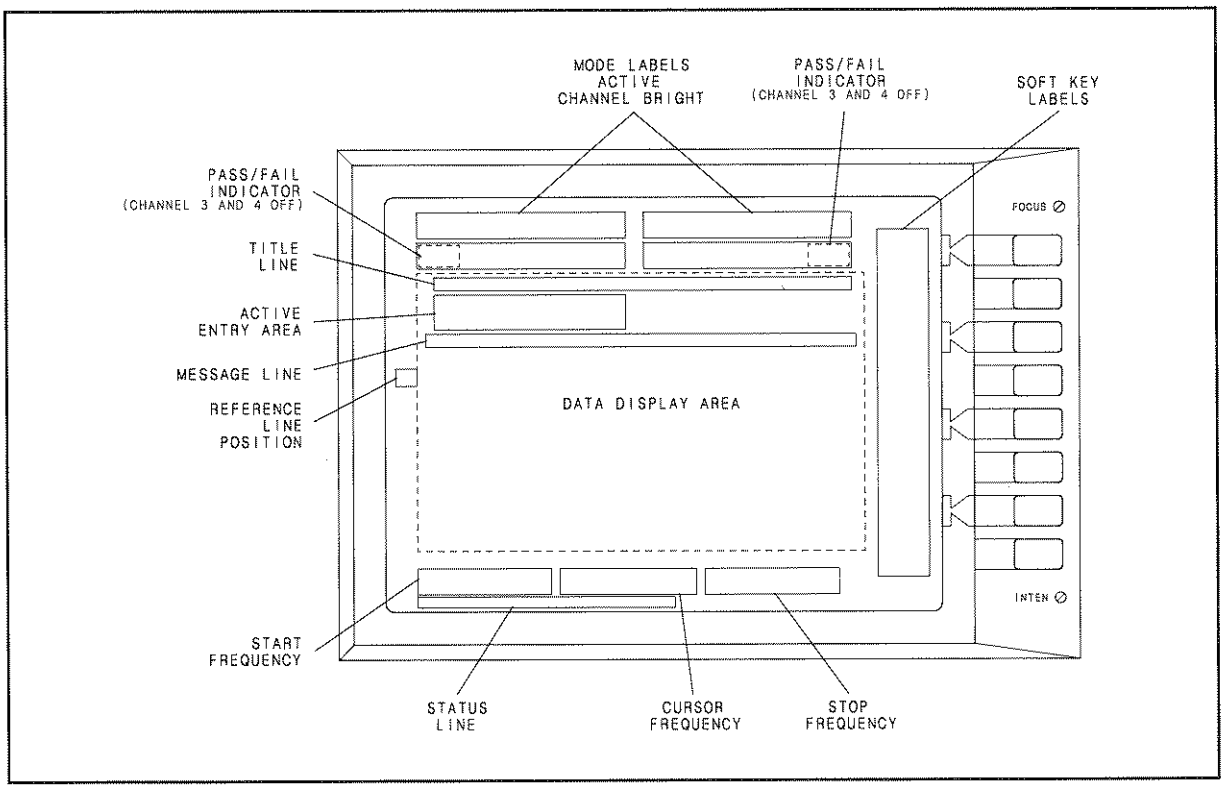
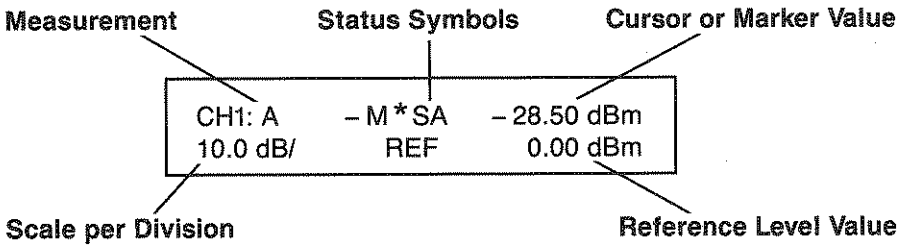


Figure 3-2. The CRT Display

Mode Labels. This area is used to display the ratio or power measurement, the cursor amplitude (or HP 8350B/8340A/8341A active marker amplitude), the scale per division, and the reference level value. The channel 1 and channel 3 labels are shown on the left side, the channel 2 and channel 4 labels on the right side. The active channel labels are shown with higher display intensity.



Pass/Fail Indicators. These labels display the pass/fail status based on the limit lines entered for that channel. The pass/fail indicators can be displayed only with both channels 3 and 4 off.

Soft Key Labels. The soft key labels define the functions of the soft keys to the right of the labels for the particular menu displayed.

Title Line. This line displays the user title (if any) entered from the system menu.

Active Entry Area. The last entry or HP-IB command function selected is shown here. Exceptions are PRESET, MEAS, and DISPLAY.

Message Line. This line displays occasional messages and warnings (depending on the function selected) to inform the user.

Reference Line Positions for channels 1, 2, 3, and 4 are indicated by > on the left margin of the graticule grid. The reference line lies on major graticule lines only.

Data Display Area. The measurement data traces are displayed in this area for as many as four channels simultaneously.

Frequency Labels. When the HP 8350B sweep oscillator or the HP 8340A or 8341A synthesized sweeper is connected to the 8757 SYSTEM INTERFACE connector on the rear panel, the start, cursor (or source active marker), and stop frequencies are annotated. The cursor frequency takes precedence over the active marker frequency. Alternate sweep frequencies are also displayed if that function is selected.

Status Line. This line, illustrated in the figure below, displays the current status of the HP 8757A. Note that the status line entries that do not apply are not displayed. They are left blank.

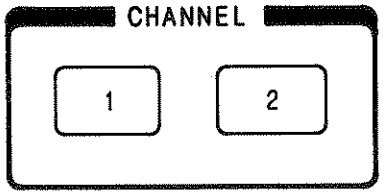
Status Line

AC	1601 PTS	DETOFS ABCR	MAN CW NON	UNCAL ABCR	SYSINTF OFF
1	2	3	4	5	6

1. AC or DC detection mode.
2. # trace points: 101, 201, 401, 801, 1601.
3. Non-zero detector offset for A, B, (C), or R detectors.
4. Sweep mode other than standard swept mode:
   - MAN — manual sweep mode
   - CW — CW mode
   - NON — non-standard sweep mode
5. Uncalibrated condition for A, B, (C), or R detectors.
   This message occurs only when AUTOCAL OFF is selected in the CAL menu and an input has drifted out of calibration. **[CONFIG SYSTEM]** is required to force calibration. See **CALIBRATION MENUS** for more information.
6. System interface is off.

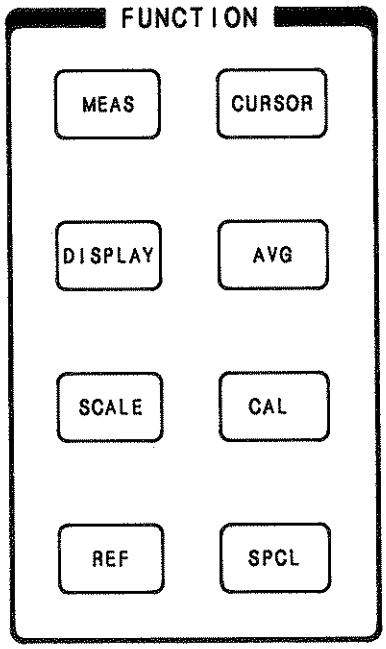
CHANNEL KEYS

These two keys are used to make either channel the "active" channel. Any functions that are then entered apply to this active channel. Either of these keys also presents the channel menu, which allows access to channels 3 and 4, and allows any channel to be turned off.



FUNCTION KEYS

The eight function keys are used to activate functions and present menus that apply to the active channel only. The soft key menu selections are made by pressing the key immediately to the right of the soft key label on the CRT display.



The **[MEAS]** key is used to access the measurement menu, which presents the possible parameters to be measured on the active channel. These parameters are either one input or a ratio combination of two inputs. For example, if **[A]** is selected, the displayed data is the measured value at input A in dBm (decibel power compared to one milliwatt). If **[A/R]** is selected, the displayed data is the measured value at input A in dBm minus the measured value at input R in dBm. Since the values are in dBm, a logarithmic subtraction equals the linear division A/R. An additional menu in the standard instrument, or two additional "layered" menus in the Option 001, are required to access all of the possible ratios. Also available is the selection **[AUX]** for display in volts of the rear panel ADC input.

The **[DISPLAY]** key presents the display menu, which lets you control the display mode for the active channel. This menu lets you display (1) the measurement, (2) the trace memory of the active channel, or (3) the difference between these for normalization. It also lets you enter the measurement into memory, or the measurement minus memory into memory. Using the **[FORMAT]** selection, reflection data can be displayed as return loss in dB or as standing wave ratio (SWR) on channels 1 and 2 only.

The **[SCALE]** key activates the SCALE FACTOR function and presents the scale menu. When scale factor is the active function, use the STEP keys, knob, or number pad to change the scale per division. The available choices for scale per division are described on page 3-18. The only label in the SCALE menu is **[AUTOSCALE]**, which changes the scale to the highest resolution and adjusts the reference level for viewing all of the trace data.

REF

Pressing the **[REF]** key makes REF LEVEL the active function, and presents the reference menu. This menu lets you set the reference level, reference position, and reference level step size. The reference level line on the display is the value (dB, dBm, SWR, V) to which measurements are compared, and serves as the horizontal line about which the display is expanded when the scale per division is decreased. Varying this level allows easy measurement of any point on the display trace. Use the knob, STEP keys, and numeric keypad to enter the reference level.

CURSOR

The **[CURSOR]** key activates the cursor on all displayed channels, and presents the cursor menu. The cursor is used for quickly reading the measured value of key points on the trace. Use the knob to move the cursor (+ symbol) to the desired position on the trace. When the cursor is on, the current value of the active channel trace at the cursor position is displayed in the CRT active entry area. The cursor value for each channel is also displayed in the mode labels area above the grid, and the frequency value is displayed centered at the bottom of the grid.

The cursor menu contains several useful cursor functions that can simplify many measurement procedures. **[MAX]** finds the maximum power of the active trace, while **[MIN]** finds the minimum power point. **[SEARCH]** provides for finding interpolated amplitude values to the left or right of the current cursor position. This allows for finding critical amplitudes that may not be found with a finite number of points on the display. **[BANDWIDTH]** determines the n-dB bandwidth for the device under test, where n is the search value.

AVG

The **[AVG]** function averages a programmable number of sweeps and then displays the averaged trace. The technique used is called "stable averaging." This technique improves accuracy and resolution in calibration or measurement traces. The average menu is used to turn averaging on or off, to set the average factor, and to restart the averaging process after it is turned on. The default average factor (number of sweeps averaged) is 8. The available choices for the average factor are 2, 4, 8, 16, 32, 64, 128, and 256.

CAL

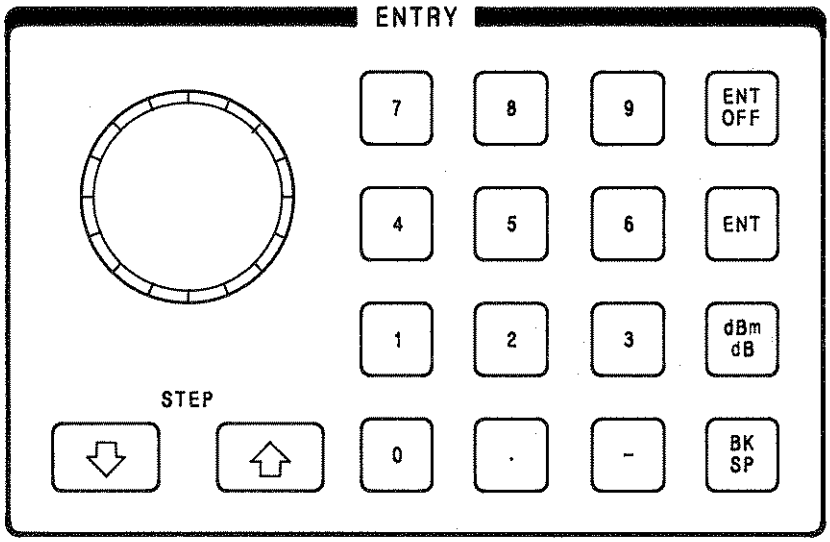
The **[CAL]** key presents the calibration menu, which includes several functions to enable more accurate measurements. The **[SHORT/OPEN]** key initiates a short/open calibration sequence for reflection measurements. The **[THRU]** key initiates a thru calibration sequence for transmission measurements. In each case a series of prompts on the CRT leads you through the calibration procedure. **[MEAS→MEM]** stores the current measured data into memory as a reference. **[MEAS–M→MEM]** stores the normalized data into memory. **[DC DET ZERO]** enables the calibration procedure when HP 85025 or 85026 series detectors are used in DC mode. This removes unwanted DC components such as diode thermal drift from the detectors. **[CONFIG SYSTEM]** reads the detector inputs and calibrates them individually for optimum measurement accuracy.

SPCL

The **[SPCL]** key allows access to a menu of special functions for the active channel. One of these functions is **[SMOOTH ON OFF]**. Smoothing low-pass or video filters the active channel trace by performing a moving average of the data. The aperture of the moving average is a percent of the sweep span, not greater than 20%. Smoothing is different from averaging in that averaging computes each data point based on the average value during several sweeps, while smoothing computes each data point based on one sweep, but on the average of data points on both sides of that data point in the current sweep. Another function available from the special functions menu is **[ENTER LIM LNS]** (enter limit lines). This lets you select up to 12 upper and/or lower limits for limit testing with the active measurement trace.

ENTRY AREA

The ENTRY area provides the numeric and units keypad, the knob, and the STEP keys used with **[SCALE]**, **[REF LEVEL]**, **[AVG]**, and other functions to enter data. The features of the entry area are described in detail below.

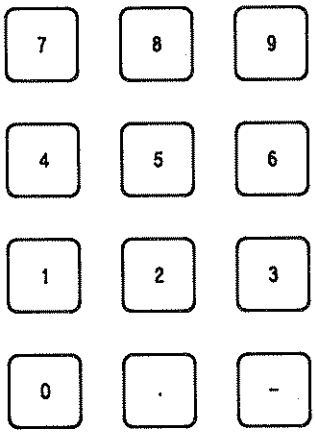


ENT OFF **[ENT OFF]** clears the active entry area.

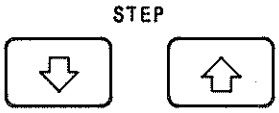
ENT **[ENT]** serves as a terminator for unitless entries.

dBm dB **[dBm/dB]** is used to terminate numeric keypad entries, such as **[SCALE]**, **[REF LEVEL]**, **[SEARCH VALUE]**, **[DET OFFSET]** (in the calibration menu), limit line entries, etc.

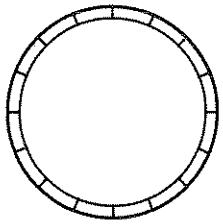
BK SP **[BK SP]** provides a backspace capability to delete the last digit(s) entered.



The numeric keypad is used to select digits, decimal point, and minus sign for numerical entries (except cursor function entries). A terminator (**[ENT]** or **[dBm/dB]**) is required, except for **[SAVE]** and **[RECALL]** entries.



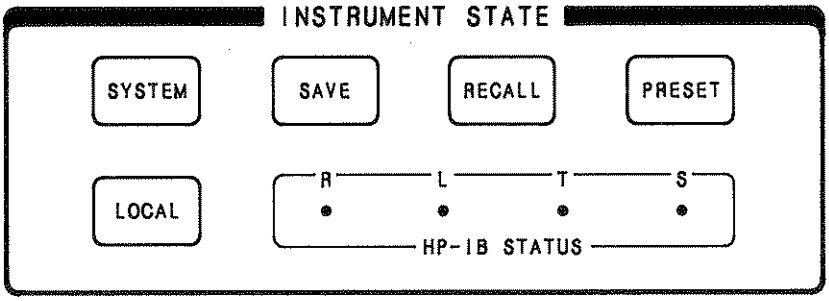
The STEP keys are used to increment or decrement the numerical value of a function to the next allowed value (except cursor functions).



The knob is used to change current values for various functions such as **[SCALE]**, **[REF LEVEL]**, and more. In many cases, the knob, STEP keys, and numeric keypad can be used interchangeably.

INSTRUMENT STATE KEYS

The keys in the INSTRUMENT STATE area of the front panel are used to control system functions that are not channel specific but apply to the entire instrument state.



The **[SYSTEM]** key presents the system menus, which allow access to a variety of miscellaneous soft key functions. These include plotting and printing, DC detection mode, number of trace points, and service. The **[SERVICE]** key allows access to a series of menus that are described in detail in Section VIII of the Service Manual. Details of the system menu functions are described in more detail later in this section.

The **[SAVE]** key allows retention of the current front panel settings. Up to nine settings can be stored by pressing this key followed by a single digit 1 through 9 on the keypad. No terminating key is needed.

The stored memory for channels 1 and 2 only is saved along with the instrument state in registers 1 through 4 only. This memory trace is saved at 401 points regardless of the number of points selected for the measurement. If a different number of points was selected, the data is adjusted by duplicating points (for 101 or 201 points selected) or taking every second point (for 801) or every fourth point (for 1601).

Registers 1 through 4 can also save the title and the limit line entries (for channels 1 and 2 only) with each instrument state. Register 9 of the compatible source is used by the autozero function when the HP 85025 or 85026 series AC/DC detectors are used.

The saved information is stored in non-volatile memory, and will be available even if power goes off, until the registers are written over, or cleared using the **[CLEAR SAV/RCL]** function in the system menu. The SAVE/RECALL registers of the System Interface compatible source are also cleared.

The **[RECALL]** key allows recovery of the information that has been previously retained in storage registers using the **[SAVE]** key. The stored instrument settings are selected by pressing this key followed by a single digit 1 through 9. No terminating key is needed.

NOTE

When the HP 8350B sweep oscillator or the HP 8340A or 8341A synthesized sweeper is connected to the 8757 System Interface, [SAVE] and [RECALL] are performed on both the source and the network analyzer. In addition, the alternate sweep feature of these sources may be enabled by selecting [ALT n], where n is the register in which the alternate sweep and front panel settings are to be stored. The digit for n must be selected on the keypad of the source.

PRESET

When the **[PRESET]** key is pressed, or when the "IP" command is received from a system controller, a self test is performed. This is followed by presetting of the HP 8757A and the instruments connected to the 8757 System Interface. All functions are turned off, then the following instrument states are set:

1. HP 8757A: channels 1 and 2 on, and the channel menu is displayed in the soft key label area of the CRT.

    a. Measure power A on channel 1, measure power B on channel 2
    b. Display measurement data, log magnitude format
    c. Scale 20 dB/div.
    d. Reference level 0 dB/dBm for all channels
    e. Reference level step size = 20 dB
    f. Averaging factor = 8 (off)
    g. Cursor off
    h. All labels on
    i. Channel 1 as the active channel
    j. Modulation drive on
    k. Number of trace points = 401
    l. Detector mode set for AC detection
    m. Smoothing aperture set for 5.0% of span (off)
    n. Cursor format = log magnitude (dB)
    o. Search value = −3 dB
    p. Autocalibration on
    q. Standard sweep mode on

2. Source:

    a. Instrument preset
    b. Sweep time 200 ms.
    c. HP 8350B square wave modulation on
    d. HP 8340/8341 SHIFT pulse on; RF output on

3. Plotter:

    a. Abort plot if in progress
    b. Positions of P1 and P2 unchanged
    c. Default conditions set

4. Printer:

    a. Abort plot or printout in progress

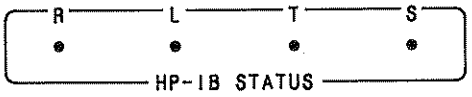
The following are not changed during a **[PRESET]** or "IP" command execution:

a. Reference position
b. Trace memory
c. Save/recall registers
d. HP-IB addresses
e. Request mask
f. Limit lines
g. Title
h. Detector offset
i. Custom defined plot
j. 8757 System Interface private bus control on/off
k. Repeat Autozero timer

The **[LOCAL]** key returns the HP 8757A to local operation from the remote (computer controlled) operation state unless a Local Lockout command has been received over HP-IB. Pressing the **[LOCAL]** key a second time presents a menu that allows setting the HP-IB addresses for the HP 8757A, sweeper, plotter, and printer. The default addresses are as follows:

HP 8757A:	16
Sweeper:	19
Plotter:	05
Printer:	01

Allowable address values are 1 to 29. 0, 30, and 31 decimal are not accessible. Addresses can be changed by using the numerical keypad and terminating with the **[ENT]** key. When an instrument address is changed using this menu, the HP-IB address on the external device may need to be physically reset.

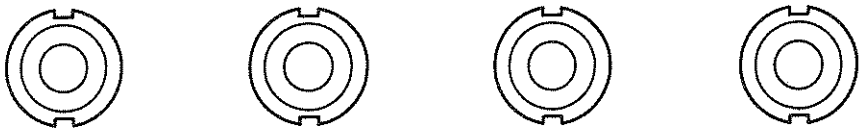


The HP-IB STATUS indicators display the current status of the HP 8757A, where:

R = Remote operation
L = Listen mode
T = Talk mode
S = Service request (SRQ) asserted

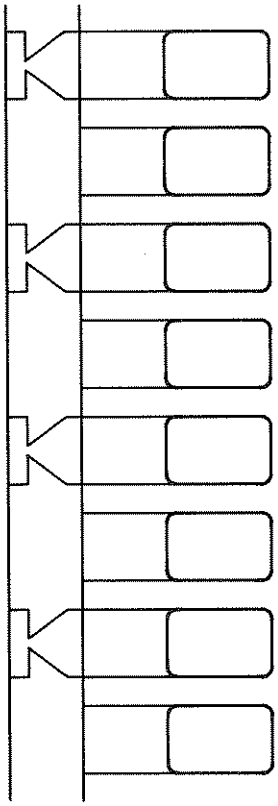
DETECTOR INPUTS

Each input has identical characteristics and allows connection of HP 8757A compatible detectors and/or bridges. Input A is typically used for the connection of a directional bridge for reflection measurements. Input B is typically used for the connection of a detector for transmission measurements. Input C (Option 001 only) is an optional channel used to measure a fourth parameter (for example, where a device under test has more than one output). Input R is typically used for the reference detector input for ratio measurements.



A B C (Option 001 only) R

SOFT KEYS



These keys provide for additional functions of the HP 8757A beyond those of the front panel keys explained above. Related functions are grouped into each soft key menu. Each menu function displayed in the soft key labels area of the CRT is selected by pressing the key to the immediate right of the label. Refer to Soft Key Operating Features for details.

CRT DISPLAY CONTROLS

INTEN ○ The **INTENSITY** control allows for screwdriver adjustment of the CRT display brightness.

FOCUS ○ The **FOCUS** control allows for screwdriver adjustment of the focus of the CRT display.

SOFT KEY OPERATING FEATURES

The front panel keys are used to access soft key menus that expand the capabilities of the HP 8757A without adding front panel complexity. Several related functions are grouped into each soft key menu. Each menu function displayed in the soft key labels area of the CRT is selected by pressing the key to the immediate right of the label. Some of the soft key menus lead into other menus. Some menus make further choices available that can be reached by pressing the soft key **[MORE]**. To return to the previous menu from a **[MORE]** menu, press **[PRIOR MENU]**. The menus accessed from the keys in the FUNCTION area of the front panel are specific to the active channel, while the menus accessed from the INSTRUMENT STATE keys apply to the entire instrument.

CHANNEL MENU

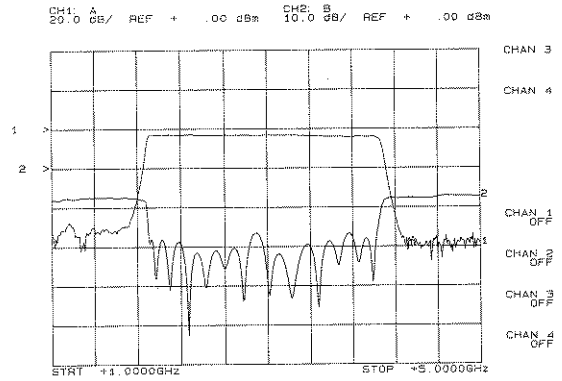


Figure 3-3. The Channel Menu

Figure 3-3 illustrates the channel menu. This menu is displayed on the CRT when CHANNEL **[1]** or **[2]** or **[PRESET]** is pressed. At **[PRESET]** channel 1 becomes the active channel; otherwise the channel number pressed is active. The trace for the active channel measurement has higher intensity. This menu also provides access to channels 3 and 4 through the soft keys labeled **[CHAN 3]** and **[CHAN 4]**. **[CHAN 1 OFF]** removes the channel 1 trace and all other information relating to channel 1 from the screen. Information for the other channels can be turned off with the other **[CHAN OFF]** keys.

It is possible to de-activate the channel menu by using **[SYSTEM] [MORE] [CH MENU ON OFF]**. To turn off either the channel 1 or channel 2 mode labels when the channel menu is off, press the appropriate CHANNEL key twice. The first press activates the channel, and the second turns it off. If the channel menu is turned off, it will not appear when the CHANNEL keys are pressed.

MEASUREMENT MENUS

When the **[MEAS]** function key is pressed, the first of several measurement menus is displayed on the CRT as illustrated in Figure 3-4. (The standard instrument has only two measurement menus, Option 001 has three.) This menu presents some of the possible parameters that can be measured on the active channel. These parameters are either one detector input or a ratio combination of two inputs. The second and third measurement menus present all the other possible measurement parameters, and can be accessed by pressing the **[MORE]** soft key. To return to the previous measurement menu, press the **[PRIOR MENU]** soft key. The selection **[AUX]** allows the display in volts of the rear panel ADC IN (+10 to −10V) on the active channel. For example, this function could be used for displaying the control voltage input to a voltage controlled device.

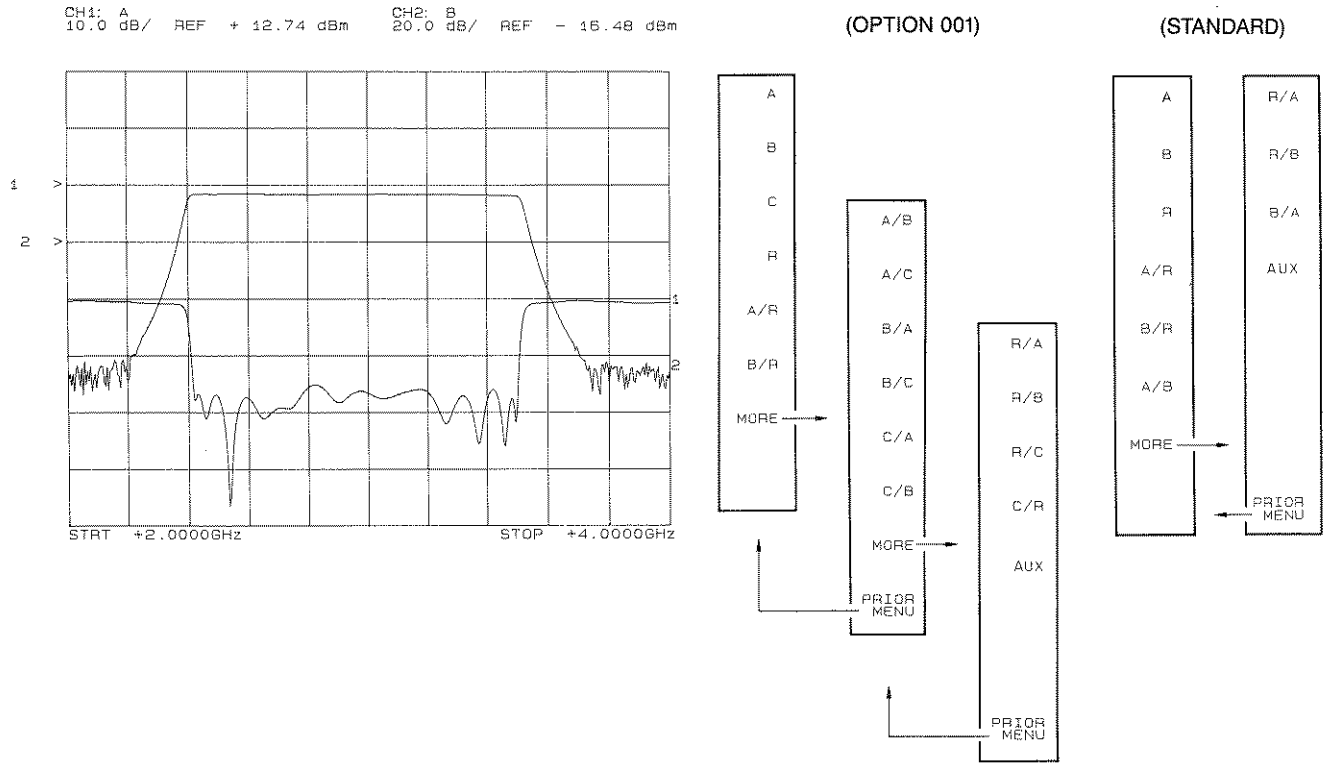


Figure 3-4. The Measurement Menus

DISPLAY MENU

When the **[DISPLAY]** function key is pressed, the display menu appears on the CRT as illustrated in Figure 3-5. This menu lets you control the display mode for the active channel.

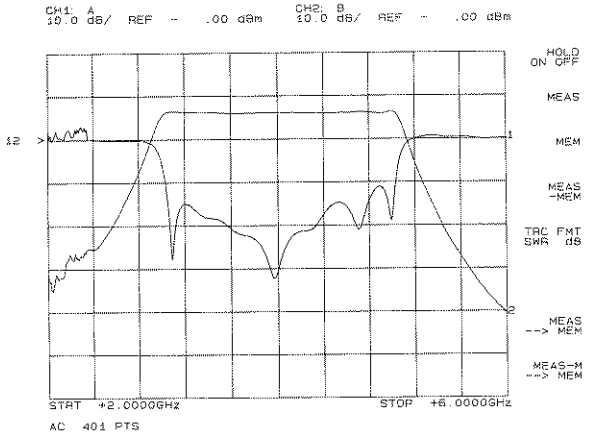


Figure 3-5. The Display Menu

[HOLD ON OFF] freezes the active channel trace on the display.

[MEAS] displays on the active channel the measurement trace of the parameters selected in the measurement menu.

[MEM] displays a trace that has been previously stored in the memory of the active channel.

[MEAS–MEM] is used to subtract the data stored in memory from the measured data. This can be used to subtract calibration data to produce a normalized trace. "–M" is displayed in the mode labels area for any channel where this function is selected.

[TRC FMT SWR dB] provides a choice of data formats for reflection data as standing wave ratio (SWR) or as return loss (dB). The SWR selection is available only for ratioed (A/R) or normalized **[MEAS-MEM]** measurements on channels 1 and 2 with 401, or fewer, points.

SWR is calculated using a lookup table that is generated when SWR format is selected. This initial calculation takes approximately 5 seconds, but the display is "real time" thereafter.

[MEAS→MEM] causes the displayed trace to be stored in memory. "MEM" is displayed in the mode labels area for any channel where this function is selected. Even in SWR format, the trace data is saved in dB/dBm format. Voltage data (ADC) can also be stored and normalized.

[MEAS–M→MEM] causes the displayed measurement minus the memory (the normalized trace) to be stored in memory (ratio measurements only).

Display Resolution. The horizontal display resolution of the HP 8757A can be from 101 to 1601 points, depending on the user's choice and the number of measurement traces as shown in this table.

# Points	Minimum Sweep Time (ms)			
	1 Trace	2 Traces	3 Traces	4 Traces
101	40	50	60	70
201	50	75	90	100
401	100	100	150	200
801	200	250	NA	NA
1601	400	NA	NA	NA

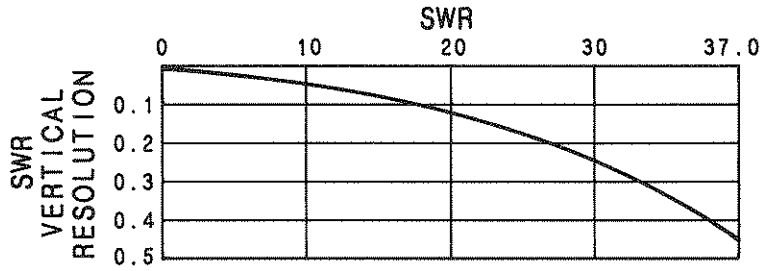
Memory data is always stored at the highest resolution (0.003 dB for single input measurements and 0.006 dB for detector ratios), regardless of the display, scale per division, or reference level. Viewing normalized dB data will reduce resolution by one-half.

Vertical display resolution and display range for the various display modes are shown in the table below.

Display Mode	Display Range	Vertical Display Resolution
dBm	−70 to +20 dBm	0.003 dB*
dB	−90 to +90 dBm	0.006 dB*
SWR	1.0 to 37.0	See waveform below
AUX	−10 to +10 V**	0.001 V

* 0.01 dB for display cursor.
** −20 to +20 V for normalized AUX.

SWR is calculated from dB data. SWR resolution varies with the SWR being measured:



SCALE MENU

When the **[SCALE]** function key is pressed, the scale menu is displayed as illustrated in Figure 3-6, and the SCALE FACTOR is activated. Scale factor lets you select the scale per divison for display of measurement data. The possible choices for each of the display modes are shown in the table below. You can change the scale factor with the knob, the STEP keys, or the numeric keypad. If the keypad is used to enter the scale factor, the entry must be terminated with the **[dBm/dB]** or **[ENT]** key.

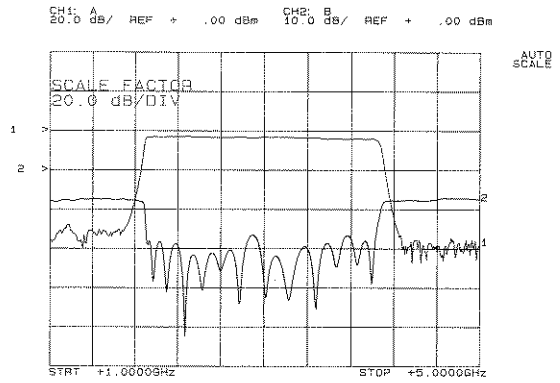


Figure 3-6. The Scale Menu

Display Mode	Available Scales Per Division
dB/dBm	20, 10, 5, 2, 1, 0.5, 0.2, and 0.1 per division
SWR	10, 4, 2, 1, 0.4, 0.2, 0.1, 0.04, and 0.02 SWR units per division
AUX (ADC IN)	5, 2.5, 1, 0.5, 0.25, 0.1, 0.05, and 0.025 volts per division

[AUTO SCALE] automatically changes the scale to the highest resolution and adjusts the reference level for viewing all of the trace data.

REFERENCE MENU

When the **[REF]** key is pressed, the reference menu is displayed as shown in Figure 3-7, and REF LEVEL becomes the active function.

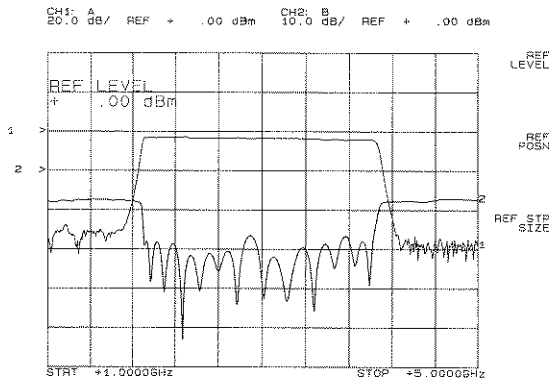


Figure 3-7. The Reference Menu

[REF LEVEL] lets you change the reference level value using the knob, the STEP keys, or the numeric keypad. The reference line is the horizontal line indicated by the reference position indicator on the left side of the screen. The value of this line relative to the measurement selected is equal to the reference level. As shown in Figure 3-7 above, the reference level for channel 1 is 0 dBm. Thus, with a scale of 20 dB/div, the top line represents +40 dBm and the bottom line represents −120 dBm. Varying the reference level allows easy measurement of any point on the display trace.

[REF POSN] sets the position of the reference level line to any of the major graticules, using the knob or the STEP keys.

[REF STP SIZE] sets the size of the steps used with the STEP keys to increment or decrement the reference level value. The reference step size can be set with the keypad only.

CURSOR MENUS

Pressing the **[CURSOR]** function key presents the cursor menu and activates the cursor (+ symbol) on all the displayed data traces. Figure 3-8 (a) illustrates the cursor menu with the cursor on.

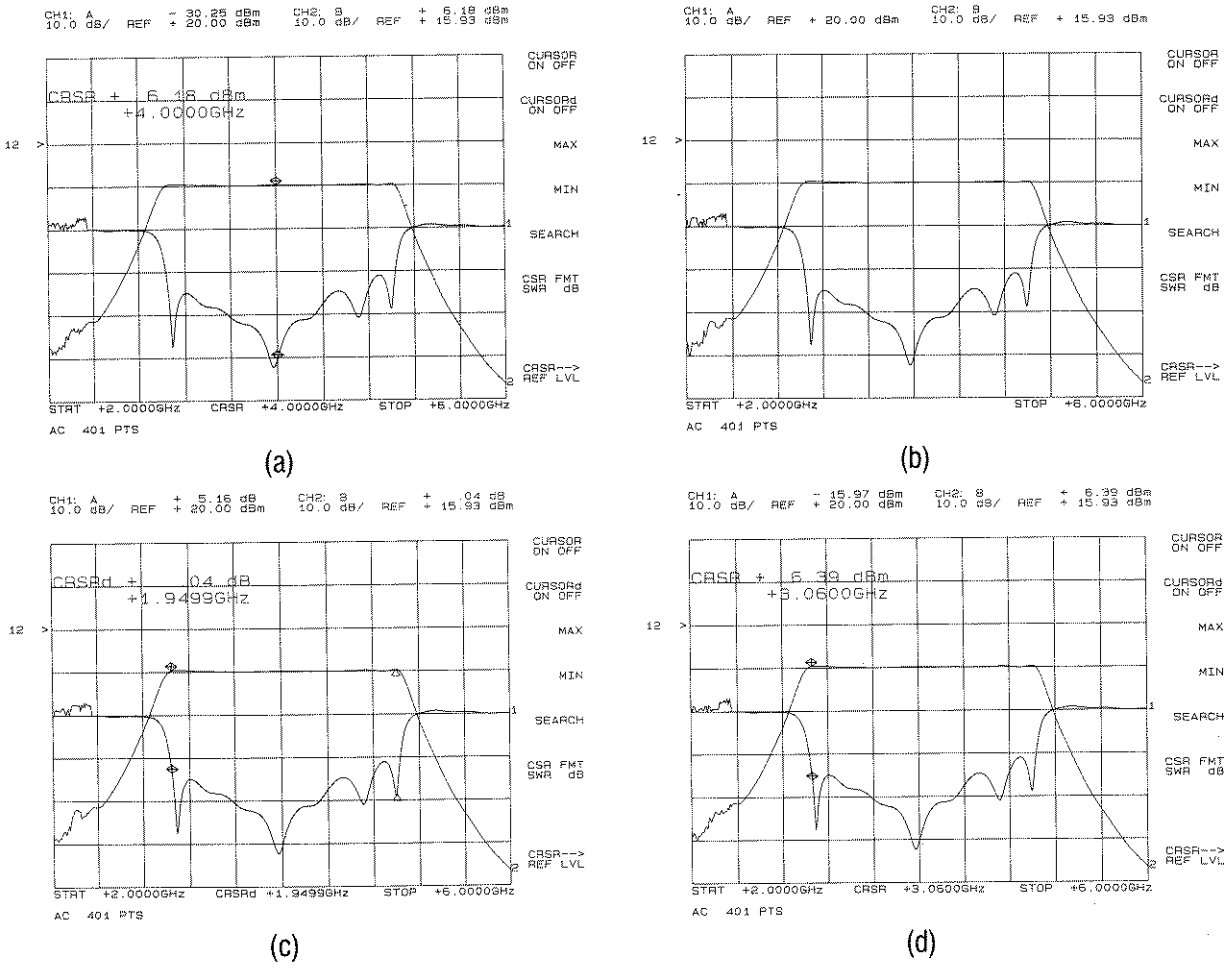


Figure 3-8. The Cursor Menu Showing Cursor and Cursor Delta

[CURSOR ON OFF] toggles the cursor on or off. Figure 3-8 (b) shows the cursor menu with the cursor turned off. The knob can be used to move the cursor to any point on the data traces. The amplitude of the trace at the cursor position appears in the mode labels area of the CRT for each displayed trace. The cursor amplitude for the active channel also appears in the active entry area. The cursor value is always resolved to 0.01 dB, 0.001 V, or 0.001 SWR, regardless of the scale per division.

The value read by the cursor depends upon the measurement and display mode selections. These are accessed by pressing the appropriate FUNCTION key, **[MEAS]** or **[DISPLAY]**. With **[DISPLAY] [MEAS]** selected, the cursor value either represents the power difference in dB between the two selected inputs (measured ratio) or the absolute power in dBm at the selected input (measured power). With **[DISPLAY] [MEAS–MEM]** selected, the cursor value represents the power difference in dB between the current measurement trace and the stored reference trace (stored by **[MEAS→MEM]**). With **[DISPLAY] [TRC FMT SWR]** selected, the cursor is displayed in SWR with 0.001 units resolution.

If either the HP 8350B sweep oscillator or the HP 8340A or 8341A synthesized sweeper is connected to the 8757 System Interface, the cursor frequency is displayed in the frequency labels area, and also in the active entry area for the active channel. When alternate sweep is selected, the cursor frequencies for both sweeps are displayed in the frequency labels area.

[CURSOR △ ON OFF] toggles the cursor △ function on and off. When it is on, the △ marks the last set position of the cursor, regardless of whether the cursor was on or off. Figure 3-8 (c) illustrates the cursor menu with the cursor △ function activated, and Figure 3-8 (d) with cursor △ off. This function makes it possible to obtain an instant reading of the difference in magnitude (and frequency if an appropriate HP-IB source is used) between two points on the trace, marked by the + and the △. This magnitude (and frequency) difference value for the active channel is displayed in the active entry area. (The frequency difference value is also displayed in the frequency labels area.) When alternate sweep is selected, the cursor △ frequencies for both sweeps are displayed in the frequency labels area.

[MAX] positions the cursor to the maximum value point on the active channel trace.

[MIN] positions the cursor to the minimum value point on the active channel trace.

[SEARCH] lets you search for a particular value in dB or dBm, either to the left or to the right of the current cursor position. Use this function with **[CURSOR ON]** to find an absolute power value in dBm or a relative value in dB, or with **[CURSOR △ ON]** to find a power difference in dB. Search functions, including **[BANDWIDTH]**, cannot be used with the SWR format or with **[MEAS] [AUX]** selected.

Pressing **[SEARCH]** brings up the search menu, illustrated in Figure 3-9. When this menu first appears, the active entry area displays the last set search value. This value can be changed using the knob, the STEP keys, or the numeric keypad.

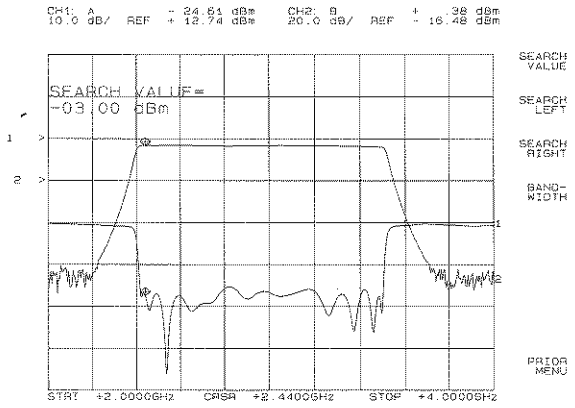


Figure 3-9. The Search Menu

[SEARCH LEFT] or **[SEARCH RIGHT]** causes the cursor to move to the first left or right position nearest the amplitude value selected. If the value cannot be found, the message "Error: Cursor Value not found" is displayed in the active entry area. In a normalized measurement, the search function finds the n-dB point from the 0 dB reference line. In cursor △ mode, search values are found for the n-dB points from the △ marker. The bandwidth function, described below, finds the n-dB points from the peak of the trace.

[BANDWIDTH] determines the trace bandwidth at a specified value down from the maximum trace value. The n-dB value for the bandwidth can be set with the STEP keys or the keypad. The HP 8757A searches automatically for the maximum trace amplitude, then finds the n-dB down points on both sides and displays the bandwidth in the active entry area. Thus, **[BANDWIDTH]** effectively performs the following series of functions: **[CURSOR]**, **[MAX]** or **[MIN]**, **[CURSOR △ ON]**, **[SEARCH]**, **[SEARCH LEFT]** (write down the frequency = f1), **[SEARCH RIGHT]** (write down the frequency = f2), calculate f2-f1. However, this function produces results only when a compatible HP-IB sweep oscillator or synthesized sweeper is used. Note that this is different from a cursor search in a normalized measurement, where the search values are referenced to the 0 dB reference line.

[CSR FMT SWR dB] allows convenient readout of cursor data only in SWR (standing wave ratio) rather than dB (return loss), if preferred. The cursor format is independent of the display format, which determines the format of the entire trace.

[CURSOR→REF LEVEL] moves the trace so that the reference level value is equal to the cursor reading. This makes it possible to expand the trace about the cursor for detailed viewing without losing information off the screen.

AVERAGE MENU

When the **[AVG]** key is pressed, the average menu is displayed as illustrated in Figure 3-10. Averaging computes each data point based on the average value during a specified number of sweeps. The number of sweeps over which the trace is averaged is termed the averaging factor. The averaging technique used is termed "stable averaging." Regardless of the averaging factor selected, the first trace is averaged using an averaging factor=1, the second trace AF=2, traces 3 and 4 with AF=4, and increasing powers of 2 until the desired averaging factor is reached. Regardless of display format, dB or SWR, the averaging is performed on the logarithmic data. The SWR conversion is performed on averaged data. **[AUX]** voltage data (ADC IN) can also be averaged.

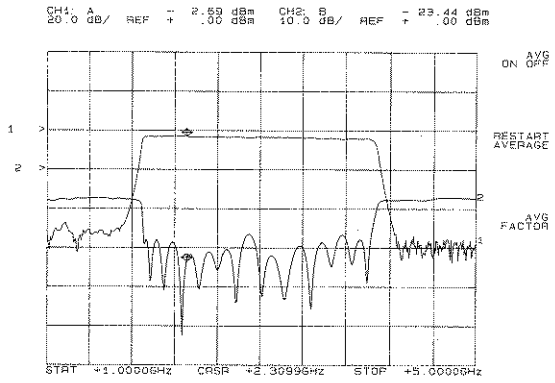


Figure 3-10. The Average Menu

[AVG ON OFF] turns the averaging function on for the active channel. The averaging factor previously set is displayed in the active entry area. The default averaging factor is 8. An "A" is displayed in the mode labels area for any channel that has averaging on.

[RESTART AVERAGE] starts the averaging process from the beginning.

[AVG FACTOR] lets you set the averaging factor. Allowable values are 1, 2, 4, 8, 16, 32, 64, 128, and 256. The averaging factor can be changed using the knob, STEP keys, or number pad.

CALIBRATION MENUS

When the **[CAL]** function key is pressed, the calibration menu is displayed as illustrated in Figure 3-11. This menu is used to perform calibrations of the system prior to making measurements. A short/open average calibration is provided for reflection measurements, and a thru calibration for transmission measurements. Additional calibration features are described below. Many of the calibration features involve putting trace data into memory. Data is stored in dBm (or dB) regardless of the display format (dB or SWR). *It is not possible to store SWR data into memory.*

Data is stored in memory at the highest resolution, regardless of scale settings and reference levels and regardless of what is displayed (MEAS, MEM, MEAS-MEM). The trace does not need to be visible on-screen for storing valid data into memory.

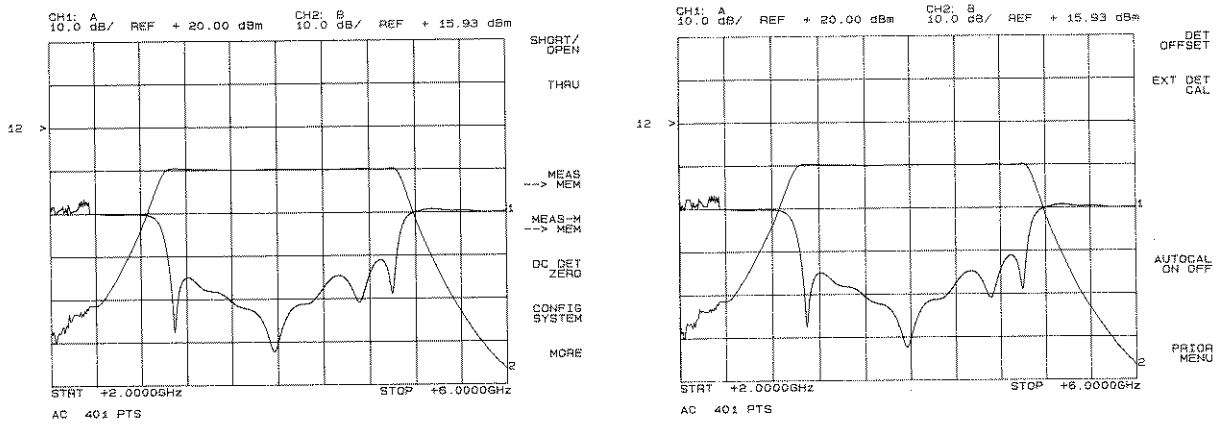


Figure 3-11. The Calibration Menus

[SHORT/OPEN] begins a series of prompts to lead you through a short circuit/open circuit average calibration, which is automatically stored in memory for reference (stored in dB/dBm regardless of format). When the **[SHORT/OPEN]** soft key is pressed, the prompt "CONNECT SHORT. . .STORE WHEN READY" is displayed in the active entry area of the CRT, and soft key #1 is labeled **[STORE SHORT]** (see Figure 3-12 (a)). If desired, the averaging function can be turned on with the **[AVERAGE ON OFF]** soft key to reduce noise on the trace. The averaging factor is the last value set. Connect a calibrated short circuit to the test port of the directional bridge or coupler and press **[STORE SHORT]**.

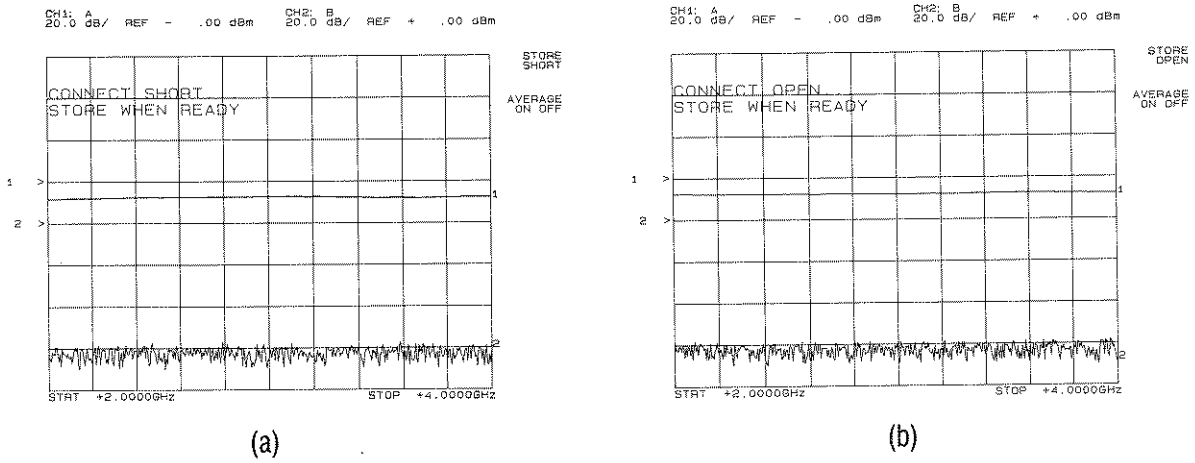


Figure 3-12. The Short/Open Calibration Prompts

Now the prompt "CONNECT OPEN. . .STORE WHEN READY" is displayed on the CRT, and soft key #1 is labeled **[STORE OPEN]** (Figure 3-12 (b)). Connect a shielded open circuit to the test port (at low

frequencies, below about 1 GHz, the test port can simply be left unterminated), and press **[STORE OPEN]**. The message "SHORT/OPEN CAL SAVED IN CH1 (or CH2, CH3, CH4) MEM" is displayed to acknowledge that the calibration data is stored in the memory of the selected channel (see Figure 3-13). Press **[DISPLAY] [MEAS–MEM]** to view the normalized trace.

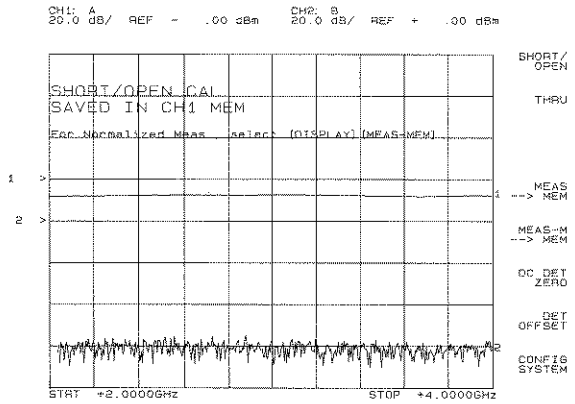


Figure 3-13. Calibration Data Saved in Memory

[THRU] begins the thru calibration for transmission measurements. When the **[THRU]** soft key is pressed, the message "CONNECT THRU. . .STORE WHEN READY" is displayed on the CRT, and soft key #1 is labeled **[STORE THRU]** (see Figure 3-14). If desired, the averaging function can be turned on with the **[AVERAGE ON OFF]** soft key to reduce noise on the trace. The averaging factor is the last value set. Connect the thru (connect the two points between which the device under test will be connected), and press **[STORE THRU]**. The message "THRU. . .CHAN 1 (2, 3, 4) MEAS TO MEMORY" is displayed to acknowledge that the calibration data is stored in the memory of the selected channel. (The thru calibration can also be done with the **[MEAS→MEM]** soft key.) Press **[DISPLAY] [MEAS–MEM]** to view the normalized trace.

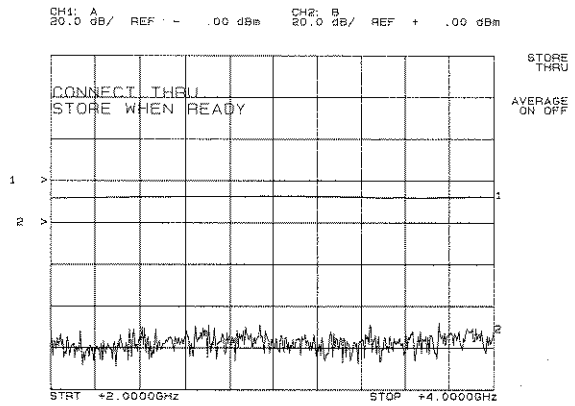


Figure 3-14. The Thru Calibration Prompt

[MEAS→MEM] stores the current measured data in memory, as a reference trace. The trace is stored with full resolution, regardless of scale and reference settings on the front panel.

[MEAS–M→MEM] causes the displayed measurement minus the memory (the normalized trace) to be restored into memory. This writes over the original memory.

The **[DC DET ZERO]** soft key label appears in the calibration menu only when AC/DC detectors are connected to the detector inputs at power-on or preset. If AC/DC detectors are connected after power-on, the system must be reconfigured using **[CONFIG SYSTEM]** (see below) or by **[PRESET]**. Pressing **[DC DET ZERO]** presents the DC detector zero menu, illustrated in Figure 3-15 (a). This menu is used for zeroing of DC detectors necessary to compensate for the effects of DC drift (this is not required for the

AC detection mode). Zeroing also eliminates small DC voltages present in the detectors, and establishes the displayed noise floor with no RF signal applied. When the menu appears, the message "SELECT DC DET ZERO" is displayed on the CRT. This is the prompt to choose either manual or automatic zeroing.

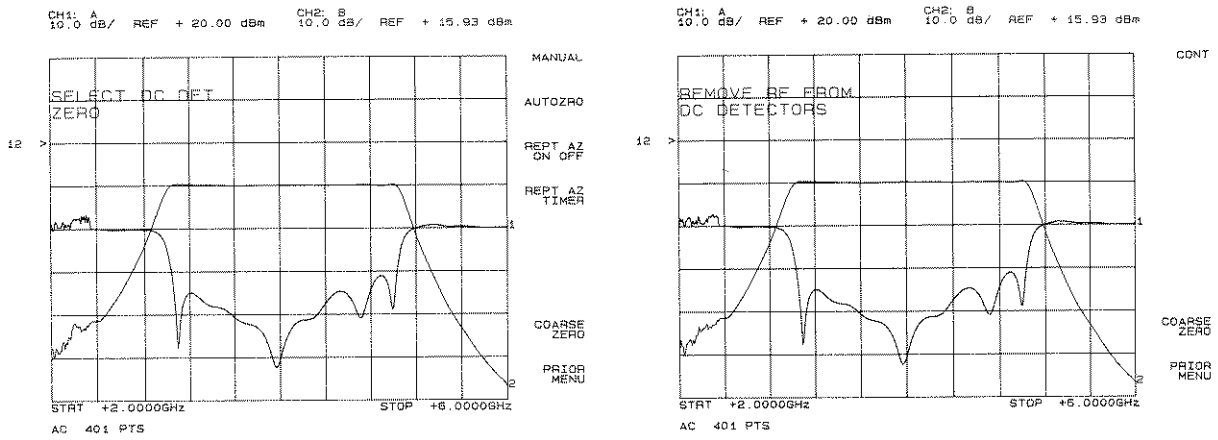


Figure 3-15. The DC Detector Zero Menus

[MANUAL] is used when the RF signal must be removed from the detectors manually. This is the case when the source is not connected to the network analyzer through the 8757 System Interface, or when a small RF signal is present in the device under test. Devices that may have small RF signals present include amplifiers, mixers, and oscillators. When the **[MANUAL]** soft key is pressed, the message "REMOVE RF FROM DC DETECTORS" is displayed on the CRT, and soft key #1 is labeled **[CONT]** (see Figure 3-15 (b)). Disconnect the detectors from the device under test or turn off the RF signal, and press **[CONT]**. (Do not disconnect the detectors from the network analyzer as this will cause an incorrect zero. The HP 8757A must read the detector voltage and control circuitry for correct zeroing.) The detectors are zeroed, and the calibration menu is returned to the screen.

[AUTOZRO]* is used for zeroing the detectors when the source (HP 8350B, 8340A, or 8341A) is connected to the HP 8757A through the 8757 System Interface. When **[AUTOZRO]** is pressed, the HP 8757A turns off the RF signal from the source and automatically zeroes the detectors. The calibration menu is then returned to the screen. An autozero can be performed whenever desired, even when the repeat autozero mode is enabled.

[REPT AZ ON OFF]* provides for periodic repeats of the autozero process. The default time between repeats is five minutes. An autozero will not interrupt the repeat autozero cycle time.

[REPT AZ TIMER]* lets you change the time interval between autozero repeats. Time intervals from 1 minute to 60 minutes can be set using the numeric keypad.

[COARSE ZERO] appears in the DC detector zero menu only if one or more HP 85025C detector adapters are connected. Refer to the *HP 85025C Operating Manual* for a description of this procedure.

[PRIOR MENU] brings back the calibration menu.

[CONFIG SYSTEM] is used to force computation of the internal calibration tables for all detector inputs that are being displayed on the analyzer. The tables for detector inputs that are not being displayed are computed if necessary. See **HP 8757A Self-Calibration** for more details.

* These functions are available only with a compatible source (HP 8350B, 8340A, or 8341A) connected on the private bus. Otherwise, when **[DC DET ZERO]** is pressed, the prompt for manual zeroing is displayed as described above.

NOTE

With AUTOCAL on, the [CONFIG SYSTEM] key is not required. With AUTOCAL off, [CONFIG SYSTEM] is recommended whenever the accessory configuration is changed, to immediately obtain optimum accuracy for all accessories.

[MORE] brings up the second **[CAL]** menu.

[DET OFFSET] in the calibration menu makes provision for setting an offset value (dB only) for each detector individually, to provide increased measurement accuracy. This can be used to enter an offset that is the difference in value between a power reading at one of the inputs of the HP 8757A and a power reading with a power meter. It is also useful for entering the value of attenuation when an attenuator is connected in front of a detector. When **[DET OFFSET]** is pressed, the detector offset menu illustrated in Figure 3-16 is presented, and the message "SELECT DETECTOR OFFSET" is displayed on the CRT. When **[DET A]**, **[DET B]**, **[DET C]**, or **[DET R]** is pressed, the current value of offset for that detector is displayed in the active entry area. The offset value can be changed using the numeric keypad, knob or STEP keys. The range of values is +60 dBm to −60 dBm. Note that the detector offsets are valid during calibration (**[MEAS→MEM]**) as well as measurement.

NOTE: It is important to know that the detector offsets remain in effect until they are changed: **[PRESET]** or power on/off does NOT reset the offset values to zero. Since these offsets affect the detector input, they always apply to a measurement regardless of whether a different channel selects the same measurement or a different register is recalled using the **[RECALL]** key. The detectors with non-zero offsets are listed on the status line of the display.

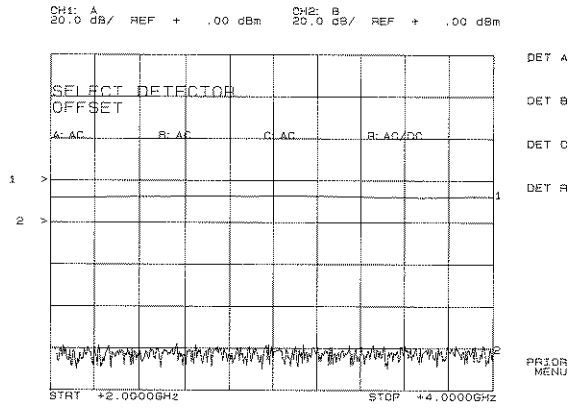


Figure 3-16. The Detector Offset Menu (Option 001)

[EXT DET CAL] in the calibration menu appears only when at least one HP 85025C detector adapter is connected. Selecting **[EXT DET CAL]** displays the external detector calibration menu (Figure 3-15). Using the external detector calibration menu, you can calibrate the analyzer to any separate detector, regardless of its frequency range.

The calibration sequence (**[DET PWR CAL]**) consists of providing the analyzer with two known power levels. Once you perform the calibration with a given detector, the analyzer identifies that detector by its calibration value (**[CAL VALUE]**). You can use the detector and enter its calibration value on any analyzer input.

For operating details, refer to the *HP 85025C Operating and Service Manual*.

[AUTOCAL ON OFF] provides user control over the automatic regeneration of the internal calibration tables for the detector inputs. **[AUTOCAL ON]** is recommended for most applications. See **HP 8757A Self-Calibration** for more details.

[PRIOR MENU] returns the first **[CAL]** menu.

HP 8757A Self-Calibration

The soft keys **[CONFIG SYSTEM]** and **[AUTOCAL ON OFF]** relate to the internal calibration of the HP 8757A. This section describes this calibration and how these soft keys should be used.

NOTE

DC detector zeroing ([AUTOZERO], [REPT AZ], and [MANUAL ZERO]) is not included in the [CONFIG SYSTEM] and [AUTOCAL ON OFF] functions. Zeroing must be performed separately when using DC mode.

The HP 8757A automatically maintains absolute and dynamic power accuracy for each detector input using two digital correction processes:

1. A continuous compensation for small temperature changes.
2. A regeneration of the internal calibration tables whenever:
   a. A large change in temperature has occurred (approximately 5°C).
   b. The accessory configuration is changed.

Continuous temperature compensation, 1 above, is performed on every re-trace, regardless of whether **AUTOCAL** is **ON** or **OFF**.

Table regeneration, 2 above, is also performed automatically if AUTOCAL is on. Depending on the configuration, this process can last from 1 to 4 seconds. During this time, the message "Configuration in Progress" appears on the display.

To regenerate the calibration tables, the HP 8757A determines the following for each detector input:

1. Detector/bridge type (AC only, AC/DC).
2. Detector/bridge power vs. voltage characteristics.
3. Temperature of the detector (AC/DC accessories only) and the log amplifier.

Using these readings, the HP 8757A automatically computes the internal calibration tables (if necessary) under any of the following conditions:

1. Instrument **[PRESET]**, power-on, or **[RECALL]** instrument state.
2. Detector configuration changed.
3. **[CONFIG SYSTEM]** soft key pressed (under **[CAL]**).
4. At a fixed 5-minute interval (unless **AUTOCAL OFF**).
5. Large temperature change occurred (unless **AUTOCAL OFF**).

If the detectors are connected at **[PRESET]** or power-on, the HP 8757A automatically generates the calibration tables. The configuration is checked, and updated automatically, whenever required.

[AUTOCAL ON]. With **[AUTOCAL ON]** (second [CAL] menu), the calibration tables are always maintained, and the process is transparent to the user. **[AUTOCAL ON]** is recommended for most applications and is set automatically at preset or power-up.

If 5 minutes have elapsed since the the last table regeneration or if a large temperature change has occurred, the calibration tables are recomputed as required. If the HP 8757A is in a thermally

stable environment (drift $< 5°C$), then thermal drift in the log amplifiers is minimal. The detectors, however, may be exposed to significant changes in temperature, for example when the detector is connected to a device under test on a hot/cold plate or in an environmental chamber. With **[AUTOCAL ON]**, all temperature changes are accounted for automatically.

[AUTOCAL OFF]. In some applications, automatic calibration is not desired. When a calibration table regeneration occurs (either at the end of the 5-minute interval or when excessive temperature drift has occurred), a slight shift in the display trace may occur (approximately 0.05 dB). When trace stability is very important, such as when viewing the data at very high resolution or when comparing a trace to one taken previously, it may be desirable to disable the **AUTOCAL** feature. With **[AUTOCAL OFF]**, the tables will not be regenerated, so the trace shift will not occur. Continuous temperature compensation is still provided. However, if excessive temperature drift occurs, the compensation will no longer provide accurate results, and the **UNCAL** message for the appropriate detector input will be activated in the **STATUS LINE**. To force table regeneration, press **[CONFIG SYSTEM]**.

NOTE

HP 8757A performance is not specified for a detector input when the UNCAL condition exists.

SPECIAL FUNCTIONS MENU

Figure 3-17 illustrates the special functions menu, which is presented when the **[SPCL]** key is pressed. This menu provides additional functions specific to the active channel.

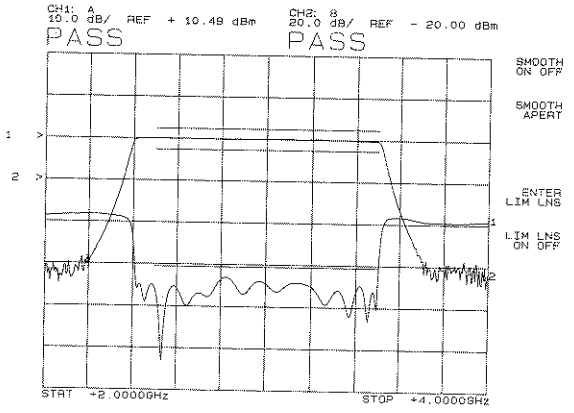


Figure 3-17. The Special Functions Menu

[SMOOTH ON OFF] allows smoothing to be turned on or off. Smoothing (video filtering) calculates a moving average of the active channel data. Smoothing is different from averaging. Averaging computes each data point based on the average value during several sweeps. Smoothing computes each data point based on one sweep, but on the average of a "window" of many data points for the current sweep. The "window" or smoothing aperture is a percent of the span swept, less than or equal to 20%. When **[SMOOTH ON]** is pressed, the percentage value of the smoothing aperture is displayed in the active entry area. In addition, an "S" is displayed in the mode labels area for any channel that has smoothing activated.

[SMOOTH APERT] lets you change the value of the smoothing aperture. The default value is 5%. Use the knob or STEP keys to change the smoothing aperture value, or use the numeric keypad and terminate with the **[ENT]** key.

[ENTER LIM LNS] is used to access the first of two limit lines menus, illustrated in Figure 3-18. With these menus, you can define limit lines or device specifications with which to compare the device under test. The limit lines are displayed on the CRT for comparison and adjustment of the measurement trace. An out-of-limit test condition is shown with a PASS or FAIL message on the CRT below the mode labels area. Limits are defined in terms of upper and lower specifications for a particular frequency or band of frequencies. Three types of limits are available: point, flat line, and sloped line. A limit line can include as many as 12 segments, where each segment is one of the three types. Segments are numbered sequentially when they are entered from the front panel. If entered through HP-IB, segment numbers can be entered at random. Limit lines are available only for channels 1 and 2, and are entered for the active channel. Limit lines can be stored only in save/recall registers 1 through 4. Limit lines are restricted to traces with 401 points or fewer. Limit entries can be made in dB, dBm, or SWR, depending on the display format. However, in SWR mode, the limits cannot be saved in trace memory (see **[UPPER (LOWER) LIMIT→MEM]**). Limit entries can also be made in volts when **[MEAS] [AUX]** is selected.

[LIM LNS ON OFF] is used to turn the limit line test on or off after the limits have been entered using the limits menu.

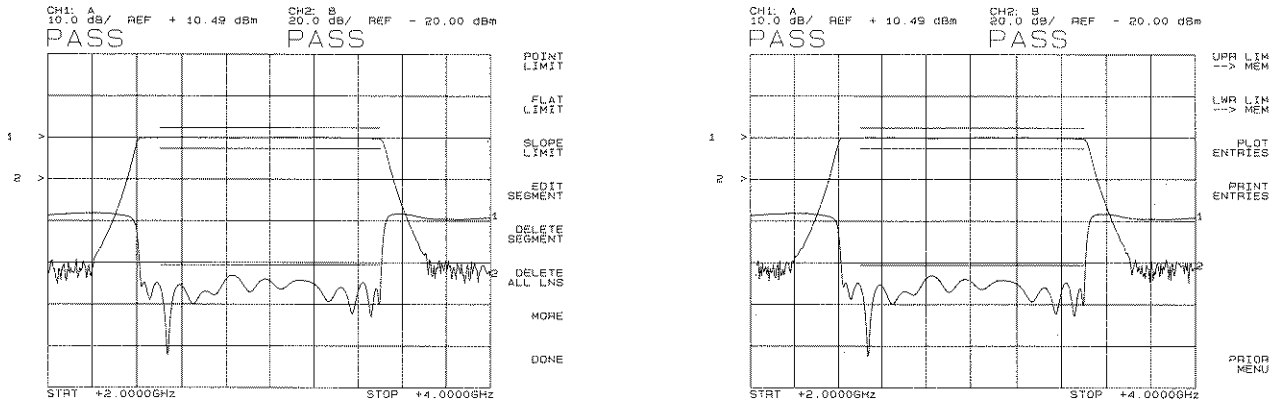


Figure 3-18. The Limit Lines Menus

When the **[POINT LIMIT]**, **[FLAT LIMIT]**, or **[SLOPE LIMIT]** soft key is pressed, the active entry area of the CRT displays prompts for frequency and upper and lower limits. Use the numeric keypad to enter the limit data, and terminate with the soft keys for frequency and the **[dBm dB]** or **[ENT]** key for the limits. If you do not want either the upper or the lower limit, press the **[dBm dB]** or **[ENT]** key immediately after the prompt. The tabular columns on the CRT are updated as data is entered, and the soft keys are blanked except for an **[ABORT ENTRY]** key that deletes the current entry and returns to the menu shown in Figure 3-18. The limit lines appear on the CRT as they are entered if the **[LIM LIN ON]** function is selected.

Note that when you specify loss limits, as in passband rejection, they should be entered as negative values.

[POINT LIMIT] lets you define an upper and a lower limit for a single CW frequency. To define a point limit, you are prompted to enter the frequency, then upper limit, then lower limit. The values you enter will be displayed on the CRT.

[FLAT LIMIT] lets you define a flat limit line that is constant with frequency. You are prompted to enter the limit data in this order: frequency 1, upper limit, lower limit, frequency 2. The values you enter will be displayed on the CRT.

[SLOPE LIMIT] lets you define a sloped limit line that is linear with frequency. You are prompted to enter the limit data in this order: frequency 1, upper limit 1, lower limit 1; frequency 2, upper limit 2, lower limit 2.

[EDIT SEGMENT] first deletes a limit line segment already defined, in order to make changes. When this soft key is pressed, a prompt for the segment number appears in the active entry area. Use the numeric keypad to enter the number of the segment to be edited, then press **[ENT]** to terminate the entry. You can then enter the new frequency and limit data in that segment, and the table will be updated.

[DELETE SEGMENT] lets you specify the number of a limit line segment to be deleted. When this key is pressed, a prompt for the segment number appears in the active entry area. Use the numeric keypad to enter the number of the segment to be deleted, then press **[ENT]** to terminate the entry. When a segment is deleted, the table is updated.

[DELETE ALL LNS] is used to erase all limit line segments for the active channel only. Use this function before starting to define a new limit line set.

[MORE] brings up the second limits menu.

[DONE] is used to terminate limit line data entry for the active channel.

[UPR LIM→MEM] places the upper limit line into the active trace memory.

[LWR LIM→MEM] places the lower limit line into the active trace memory.

Whenever either of the limit line to memory keys is pressed, the memory for the active channel is initialized with a reference level = 0 dB (or 0 dBm). The appropriate limits are then updated into memory in the order in which the segments were entered. (Thus, for overlapping limits, the last entry will overwrite any overlap of the previous entry, and points with no limit data will be entered as 0 dB or 0 dBm.) The limit line to memory features cannot be used with SWR display format.

[PLOT ENTRIES] enables the plotting of the limit line frequency and amplitude values when data is plotted.

[PRINT ENTRIES] allows the limit line frequency and amplitude values to be output with data to the ThinkJet printer.

[PRIOR MENU] brings back the first limits menu.

SYSTEM MENUS

When the **[SYSTEM]** key in the INSTRUMENT STATE section is pressed, the first of two system menus is displayed as illustrated in Figure 3-19. The second menu is accessed by pressing **[MORE]**. Several additional menus accessible from the system menus are described below. The menus accessed with the INSTRUMENT STATE keys are not channel specific but apply to the entire instrument state.

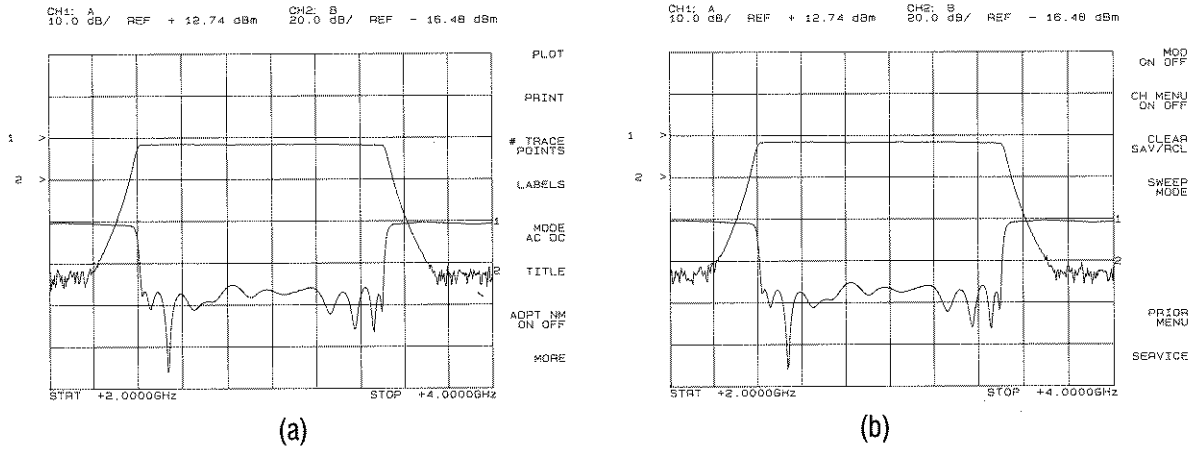


Figure 3-19. The System Menus

[PLOT] presents the plot menu illustrated in Figure 3-20. This menu is used to specify the plots made on a plotter connected to the 8757 System Interface. The compatible plotters are the HP 7470A, 7440A, 7475A, 7550A, or 7090A. The plotter address must be correctly specified (factory set to 5), and can be set using the **[LOCAL]** key and its associated menu. The plotter's default values for P1 and P2 are the lower left limit and the upper right limit respectively, but these can be changed at any time after the plotter is powered on. Refer to the plotter Operating Manual for the procedure to change P1 and P2.

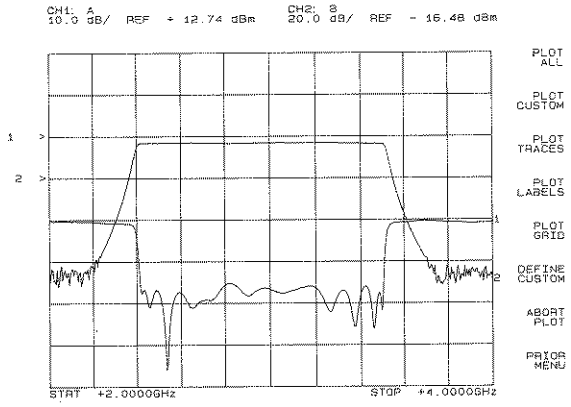


Figure 3-20. The Plot Menu

When one of the **[PLOT]** menu soft keys is pressed, the CRT display is frozen, the plotter begins plotting, and the message "PLOTTING" is displayed in the active entry area of the CRT. When the plot is finished, the message "PLOTTING COMPLETED" is displayed.

If the plotter is incorrectly addressed, or improperly connected to the 8757 System Interface, the message "NO PLOTTER AVAIL" in the active entry area indicates that no plotter is available.

If the plotter is properly connected to the 8757 System Interface, but has no paper loaded or is otherwise not ready to plot, the message "PLOTTER NOT READY" is displayed.

When the source (HP 8350B sweep oscillator or HP 8340A or 8341A synthesized sweeper) is connected to the network analyzer through the 8757 System Interface, annotation of the start, stop, and cursor frequencies will appear on the bottom of the plots for **[PLOT ALL]** or **[PLOT LABELS]**. If the cursor is off and a source marker or markers are on, the active marker frequency will be annotated in place of the cursor frequency and will appear on the trace as a flag.

[PLOT ALL] instructs the plotter to draw the grid, labels, trace data, limit lines, cursor, markers, and title. The trace data and limit lines are plotted only if the channel is on. Also displayed is the active entry area if there is a message displayed. This allows the display of cursor, search, and bandwidth values. To avoid this annotation, press **[ENT OFF]** before plotting to clear the active entry.

Plots do not include the status line information.

[PLOT CUSTOM] instructs the plotter to draw a plot using only the plot elements specified using the **[DEFINE CUSTOM]** function described below.

[PLOT TRACES] draws the data traces and limit lines for all displayed channels, together with the cursor (denoted as +), the cursor △, and the markers (denoted as o). (The active marker is highlighted with a flag.)

[PLOT LABELS] draws the mode labels, reference line position labels, frequency labels (if they are on), and status line.

[PLOT GRID] plots the horizontal and vertical graticule lines.

[ABORT PLOT] terminates plotting of a plot currently in progress. The message "PLOTTING ABORTED" is displayed in the active entry area of the CRT.

[DEFINE CUSTOM] presents the custom plot menu, illustrated in Figure 3-21 (a), and displays the prompt "DEFINE CUSTOM PLOT." This menu lets you specify which plot element or combination of elements is to be plotted in a custom-defined plot format. The format you define is plotted when **[PLOT CUSTOM]** is selected. This is convenient for plotting repetitions of the same plot format. The soft key labels for the elements you select to plot are highlighted on the CRT.

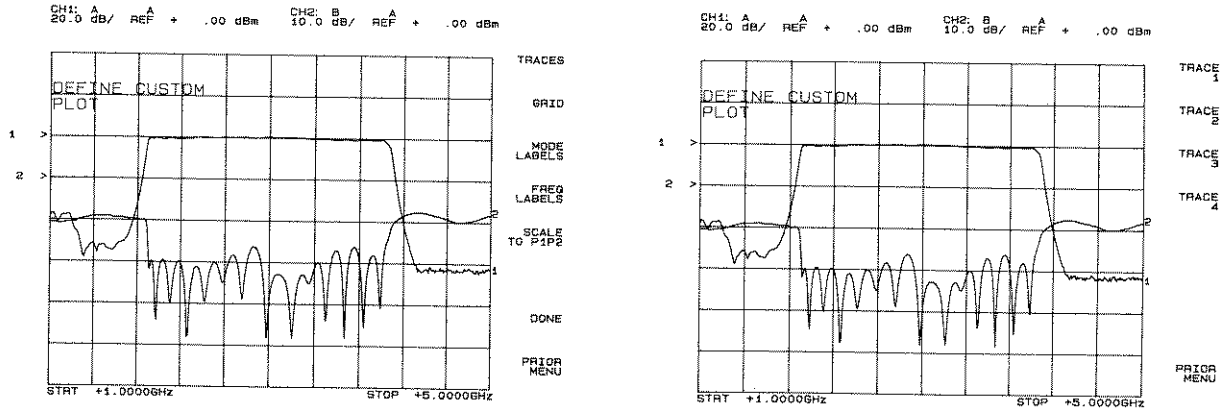


Figure 3-21. The Custom Plot Menu and the Traces Menu

[TRACES] leads to the traces menu, illustrated in Figure 3-21 (b). This menu lets you specify the trace or traces to be drawn on the plot. Each of the **[TRACE]** soft keys in this menu toggles on and off to allow the associated trace to be plotted or not plotted. From zero to four traces can be plotted. When any of the soft keys are toggled on, the associated soft key labels are highlighted on the CRT. Note that only displayed traces can be plotted. **[PRIOR MENU]** in the traces menu returns to the custom plot menu.

[GRID] includes the horizontal and vertical graticule lines in the custom plot format.

[MODE LABELS] includes the mode labels in the custom plot format.

[FREQ LABELS] includes the frequency labels in the custom plot format (unless they are turned off).

[SCALE TO P1P2] expands the plot so that the lower left corner of the grid is at the P1 position of the plotter and the upper right corner of the grid is at the P2 position of the plotter. In this case, the mode labels and frequency labels, if plotted, are drawn inside the grid.

[DONE] is used to terminate definition of the custom plot format. When this key is pressed the plot menu returns.

[PRIOR MENU] in the custom plot menu returns to the plot menu shown in Figure 3-20.

(This ends the description of soft keys in the plot menu and the custom plot menu.)

Returning to the system menu (Figure 3-19), **[PRINT]** leads to the print menu shown in Figure 3-22. This menu allows data output to the HP ThinkJet printer, either a graphics plot or tabular listings.

When one of the **[PRINT]** menu soft keys is pressed, the CRT display is frozen, the printer begins printing, and the message "PRINTING" is displayed in the active entry area of the CRT. When the printer is finished, the message "PRINTING COMPLETED" is displayed.

If the printer is incorrectly addressed, or improperly connected to the 8757 System Interface, the message "NO PRINTER AVAIL" in the active entry area indicates that no printer is available.

If the printer is properly connected to the 8757 System Interface, but has no paper loaded or is otherwise not ready to plot, the message "PRINTER NOT READY" is displayed.

Graphics written to the CRT through HP-IB are not drawn on this plot; however, the plotter can be accessed by means of passthrough commands as described in the Introductory Operating Guide.

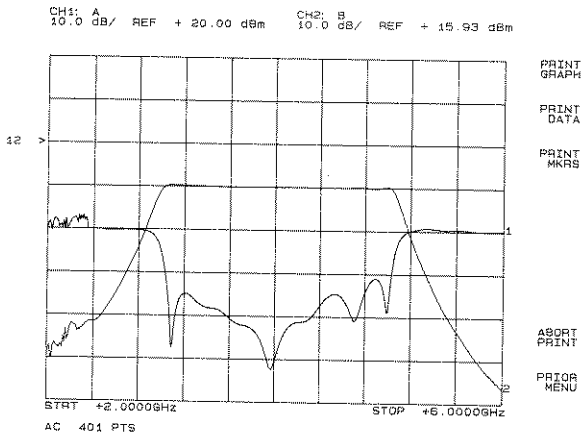
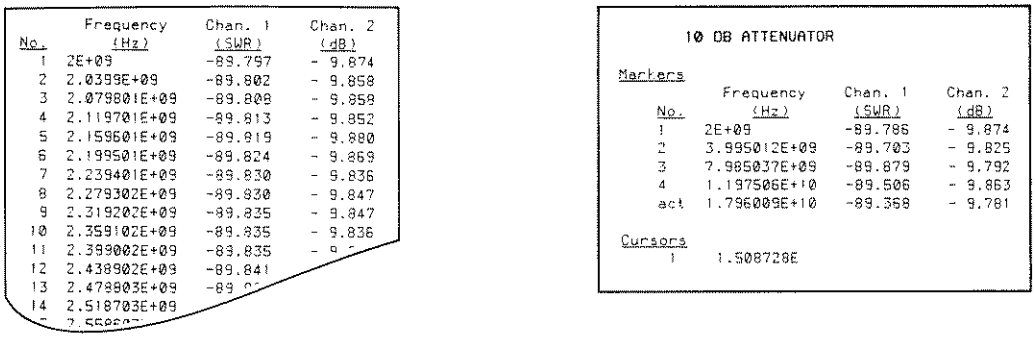


Figure 3-22. The Print Menu

The soft key **[PRINT GRAPH]** instructs the HP 2225A ThinkJet printer to draw the grid, labels, trace data, cursor, markers, title, and PASS/FAIL indicators. Graphics written to the CRT through HP-IB are not drawn on this print; however, the printer can be accessed by means of passthrough commands, described in the Introductory Operating Guide. Unlike the plot, the graphics print does **not** include limit lines or the active entry area.

[PRINT DATA] instructs the HP ThinkJet printer to list all data (up to four channels) in tabular form (see Figure 3-23). The number of data points listed is the number selected under **[# TRACE POINTS]** in the SYSTEM menu. The configuration and status line information are not included.

[PRINT MKRS] instructs the HP ThinkJet printer to list the data at the frequencies of the source markers that are turned on. The markers are indicated by their number, except for the active marker, which is labeled **act**. If the cursor is on, the cursor data and frequency are also printed. A marker printout is shown in Figure 3-23. The configuration and status information are **not** included.



No.	Frequency (Hz)	Chan. 1 (SWR)	Chan. 2 (dB)
1	2E+09	-89.797	- 9.874
2	2.0399E+09	-89.802	- 9.858
3	2.079801E+09	-89.808	- 9.858
4	2.119701E+09	-89.813	- 9.852
5	2.159601E+09	-89.819	- 9.880
6	2.199501E+09	-89.824	- 9.869
7	2.239401E+09	-89.830	- 9.836
8	2.279302E+09	-89.830	- 9.847
9	2.319202E+09	-89.835	- 9.847
10	2.359102E+09	-89.835	- 9.836
11	2.399002E+09	-89.835	- 9.[illegible]
12	2.438902E+09	-89.841	
13	2.478803E+09	-89.[illegible]	
14	2.518703E+09		
[illegible]	[illegible]		

(a)

10 DB ATTENUATOR

Markers

No.	Frequency (Hz)	Chan. 1 (SWR)	Chan. 2 (dB)
1	2E+09	-89.786	- 9.874
2	3.995012E+09	-89.703	- 9.825
3	7.985037E+09	-89.879	- 9.792
4	1.197506E+10	-89.506	- 9.863
act	1.796009E+10	-89.368	- 9.781

Cursors

1 1.508728E

(b)

Figure 3-23. Typical Printout for (a) ***[PRINT DATA]*** *and (b)* ***[PRINT MKRS]***

If alternate sweep is on, the printouts will include only the channel pair with the active channel (channels 1 and 3 **or** channels 2 and 4). To display the other channel pair, activate one of the channels in that pair, and print the data again.

[# TRACE POINTS] presents the number of trace points menu, illustrated in Figure 3-24. This menu is used to select the number of data points to be used by the network analyzer for processing and displaying the data. Selecting fewer points means lower resolution but lets you use faster sweep times and more traces. The maximum number of trace points available for each of four traces is 401, 801 for each of two traces, and 1601 for one trace using channel 1 or 2 only. The default value for the number of trace points is 401. The table shows the minimum sweep time and the maximum number of traces for each selection in this menu. Limit testing, SWR format, smoothing, and averaging slow down the sweep times.

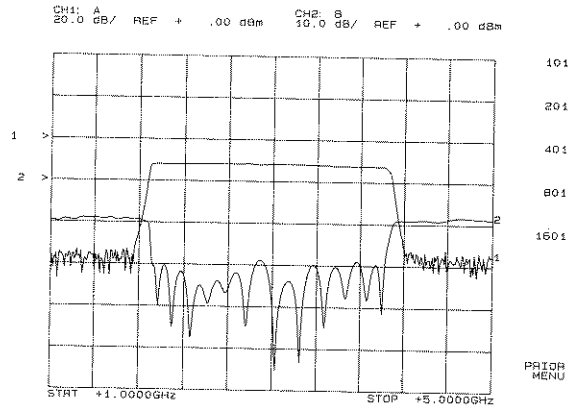


Figure 3-24. The Number of Trace Points Menu

# Points	Minimum Sweep Time (ms)			
	1 Trace	2 Traces	3 Traces	4 Traces
101	40	50	60	70
201	50	75	90	100
401	100	100	150	200
801	200	250	NA	NA
1601	400	NA	NA	NA

[LABELS] leads to the labels menu, illustrated in Figure 3-25. This menu lets you choose to have one or more of the labels displayed or blanked.

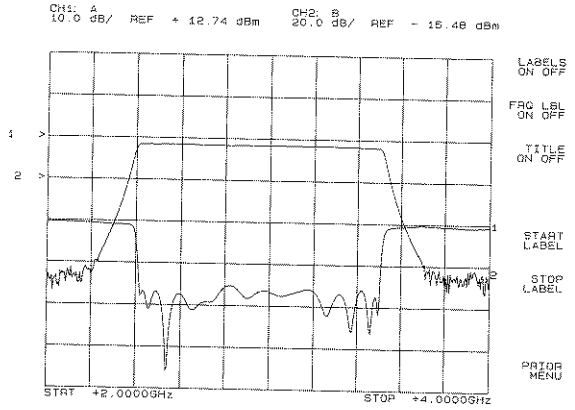


Figure 3-25. The Labels Menu

[LABELS ON OFF] turns the mode labels, the frequency labels, the display status line, and the title on

or off on the CRT. Note that if limit lines are enabled, the PASS/FAIL indicator will not be blanked until limit lines are disabled.

[FRQ LBL ON OFF] turns only the frequency labels on or off. If the frequency labels are off, the frequency readout of the source connected to the private bus is also blanked. The frequency labels will not be plotted or printed.

[TITLE ON OFF] controls the title label display, but does not erase the title.

[START LABEL] is used to specify the start value of the left graticule. This label can only be used with the system interface off.

[STOP LABEL] is used to specify the stop value of the right graticule. This label can only be used with the system interface off.

[PRIOR MENU] returns to the system menu.

[MODE AC DC] in the system menu is used to switch between AC and DC detection modes. The AC (square wave modulated) mode can be used with the HP 11664 , 85025, or 85026 series detectors and the HP 85020, 85021, or 85027 series directional bridges. The DC (no modulation) mode can be used only with the HP 85025 and 85026 series detectors and the HP 85027 series directional bridges. If an HP source is connected to the system interface, the source modulation is controlled automatically: "on" for AC, "off" for DC. This function also controls the **[MOD ON OFF]** function. When AC is selected, the HP 8757A modulation output is ON. In DC, the modulation is OFF.

[TITLE] in the system menu presents the title menu, illustrated in Figure 3-26. At the same time, the active entry area displays the letters of the alphabet, digits 0 through 9, and the mathematical symbols ()+−/= and decimal point, together with the message "SELECT CHAR WITH KNOB OR SOFT KEYS." This menu is used to define a title that is displayed on the CRT and plotted with the data. The title is composed of characters selected from the display in the active entry area. This title can be turned on and off using the labels menu.

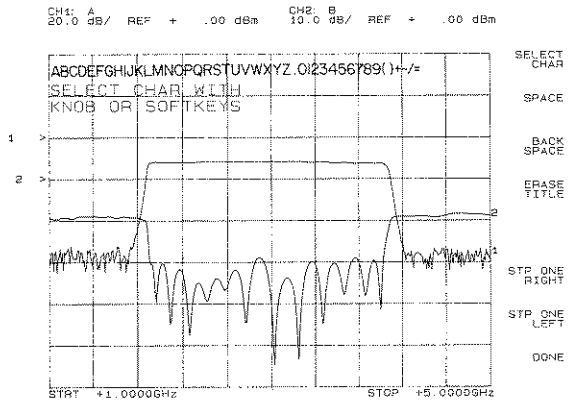


Figure 3-26. The Title Menu

[SELECT CHAR] is used to enter a character you have selected. To select a character, rotate the knob or repeatedly press the **[STP ONE RIGHT]** or **[STP ONE LEFT]** keys until the desired character in the active entry area is highlighted. Then press **[SELECT CHAR]**. As each character is selected, it is displayed in the upper left corner of the grid.

[SPACE] inserts a space in the title.

[BACK SPACE] is used to go back and delete a character that has already been entered.

[ERASE TITLE] deletes the entire title.

[STP ONE RIGHT] is used to advance to the right one letter at a time to select characters.

[STP ONE LEFT] is used to advance to the left one letter at a time to select characters.

[DONE] is used to enter the complete title and return to the system menu.

[ADPT NM ON OFF] in the system menu controls the adaptive normalization feature, which adjusts the calibration data stored in memory as the frequency range is changed. This makes it possible to narrow in on part of the calibrated frequency range without recalibrating. Note that the resolution of the narrower range viewed is not changed as the trace is expanded, and the calibration data is interpolated between the available points. Therefore it is advisable to select a high number of trace points for the original frequency range. Adaptive normalization should not be used if the calibration trace varies rapidly with frequency. An asterisk * is displayed in the mode labels area for any channel that has adaptive normalization activated, as long as **[MEM]** or **[MEAS–MEM]** in the display menu is selected. If the trace is expanded beyond the frequency range of calibration, the calibration data outside that frequency range is extrapolated as a straight line from the calibration data at the start and stop frequencies. In this case, the asterisk * is overwritten with a U (uncalibrated). Adaptive normalization is off at preset.

[MORE] in the system menu (Figure 3-19) leads to the second system menu, illustrated in Figure 3-27.

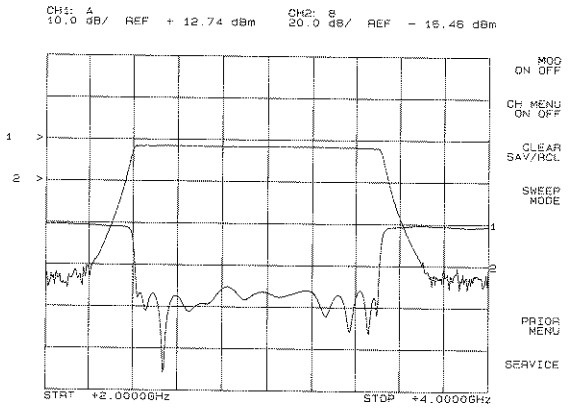


Figure 3-27. The Second System Menu

[MOD ON OFF] controls the 27.778 kHz modulation drive output on the rear panel of the HP 8757A.

[CH MENU ON OFF] is used to disable the channel menu accessed from the channel keys. With **[CH MENU OFF]**, only channels 1 and 2 can be controlled. To make one of these channels active, press the appropriate channel key. To turn off a channel, first press the channel key once, making this the active channel, then press it again. The channel will be turned off, and the other channel will become the active channel.

[CLEAR SAV/RCL] is used to clear all of the save/recall registers by resetting them to the preset state. If a compatible source is connected to the 8757 System Interface, its save/recall registers are also preset.

[SWEEP MODE] leads to the sweep mode menu illustrated in Figure 3-28. This menu is used to specify the type of sweep supplied by a source not compatible with the 8757 System Interface or to control the System Interface status. The sweep mode and System Interface status are displayed in the status line.

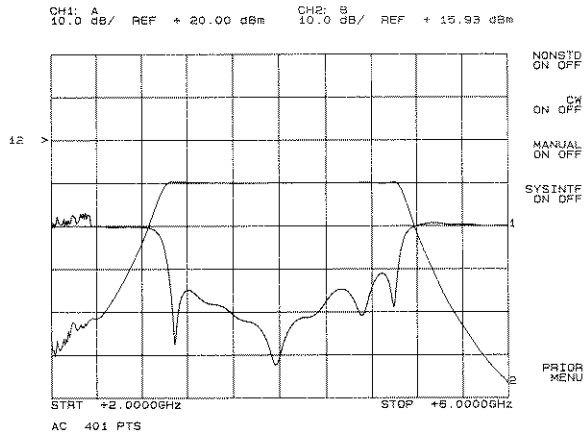


Figure 3-28. The Sweep Mode Menu

[NONSTD ON OFF] enables the HP 8757A to track a sweep ramp other than the normal 0-10 volt sweep ramp. The nonstandard sweep must be within the 0-10 volt range. See product note 8757-5 (Part no. 5954-1537) for a more detailed description of this mode. However, if a sweep in excess of 10V is to be used, the A4 ADC assembly can be modified to accept it. Refer to Section VIII of the Service Manual for details. In the nonstandard sweep mode, disconnect the POS Z BLANK, the STOP SWEEP, and the 8757 System Interface connection to the source. Only the SWEEP IN should be connected. The number of trace points selected using the **[# TRACE POINTS]** feature is still retained for the nonstandard sweep.

[CW ON OFF] is intended for use with a source that is not compatible with the 8757 System Interface. This feature allows the display to be continuously updated when the non-compatible source is in CW mode with no sweep ramp applied to the network analyzer. With **[CW ON]**, the network analyzer provides its own continuous internal horizontal display update, so that any stable input will be displayed as a straight line. If the source used is System Interface compatible, this function is selected automatically when the source is in CW mode.

[MANUAL ON OFF] is intended for use with a source that is not compatible with the 8757 System Interface. This feature allows manual sweep control by a non-compatible source, using a sweep input signal. With **[MANUAL ON]**, and the source in manual mode, the network analyzer displays a cursor (+ symbol) whose vertical position represents amplitude and whose horizontal position can be manually swept from the source. If the source used is System Interface compatible, this function is selected automatically when the source is in manual mode.

[SYS INTF ON OFF] disables the HP 8757A as the system controller on the 8757 System Interface private bus. This allows another instrument connected on the 8757 System Interface to control the sweeper, plotter, or printer. The setting of this function is not changed at **[PRESET]**. **SYS INTF OFF** is also displayed in the display status line.

[PRIOR MENU] returns the second system menu.

[SERVICE] provides access to a series of automated tests of the various functional blocks of the HP 8757A. These tests are described in detail in Section VIII of the Service Manual.

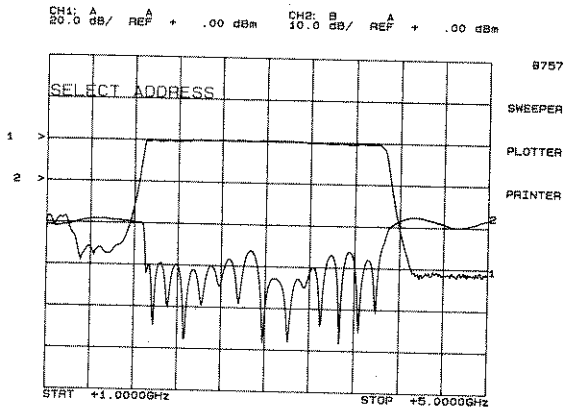


Figure 3-29. The Local Menu

When the **[LOCAL]** key in the INSTRUMENT STATE AREA is pressed, the HP 8757A is returned to local operation from remote (computer controlled) operation. If the network analyzer is already in local mode, the local menu is displayed as illustrated in Figure 3-29. This menu is used to change the HP-IB addresses of the HP 8757A, sweeper, plotter, and printer. Allowable address values are 1 to 29. 0, 30, and 31 decimal are not accessible. No two devices can be at the same address. Use the numerical keypad to enter a new address, and terminate with the **[ENT]** key. When an instrument address is changed using this menu, the HP-IB address on the instrument itself may need to be physically reset.

[8757] is used to change the HP-IB address of the HP 8757A. The factory set address is 16.

[SWEEPER] is used to changed the HP-IB address of the source (HP 8350B sweep oscillator or HP 8340A or 8341A synthesized sweeper). The factory set address for these sources is 19.

[PLOTTER] is used to change the HP-IB address of the plotter (HP 7470A, 7440A, 7475A, or 7550A). The factory set address is 05.

[PRINTER] is used to change the HP-IB address of the HP 2225A ThinkJet printer. The factory set address is 01.

MENU STRUCTURE

Figure 3-30 shows the complete HP 8757A menu structure.

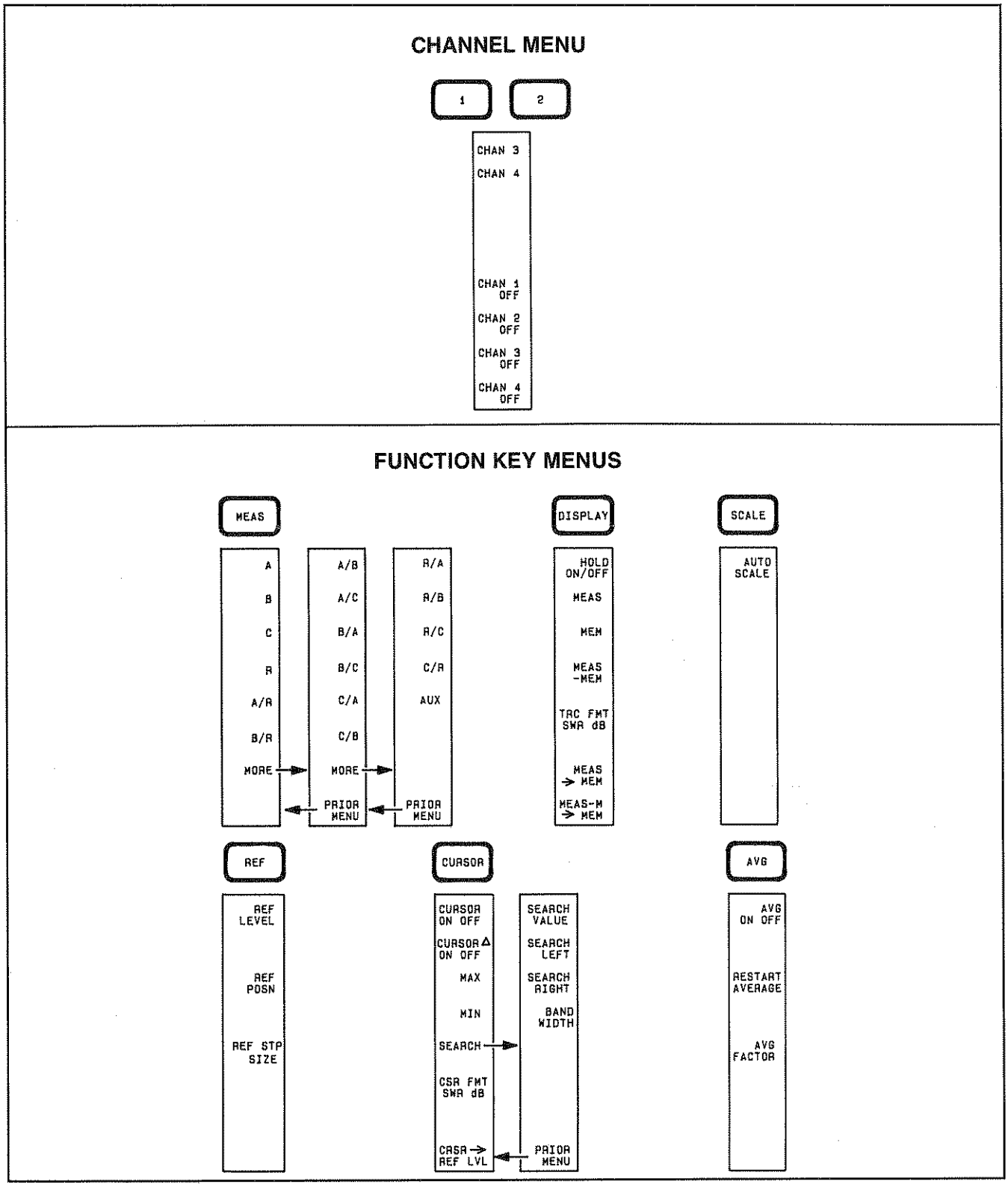


Figure 3-30. HP 8757A Menu Structure (1 of 3)

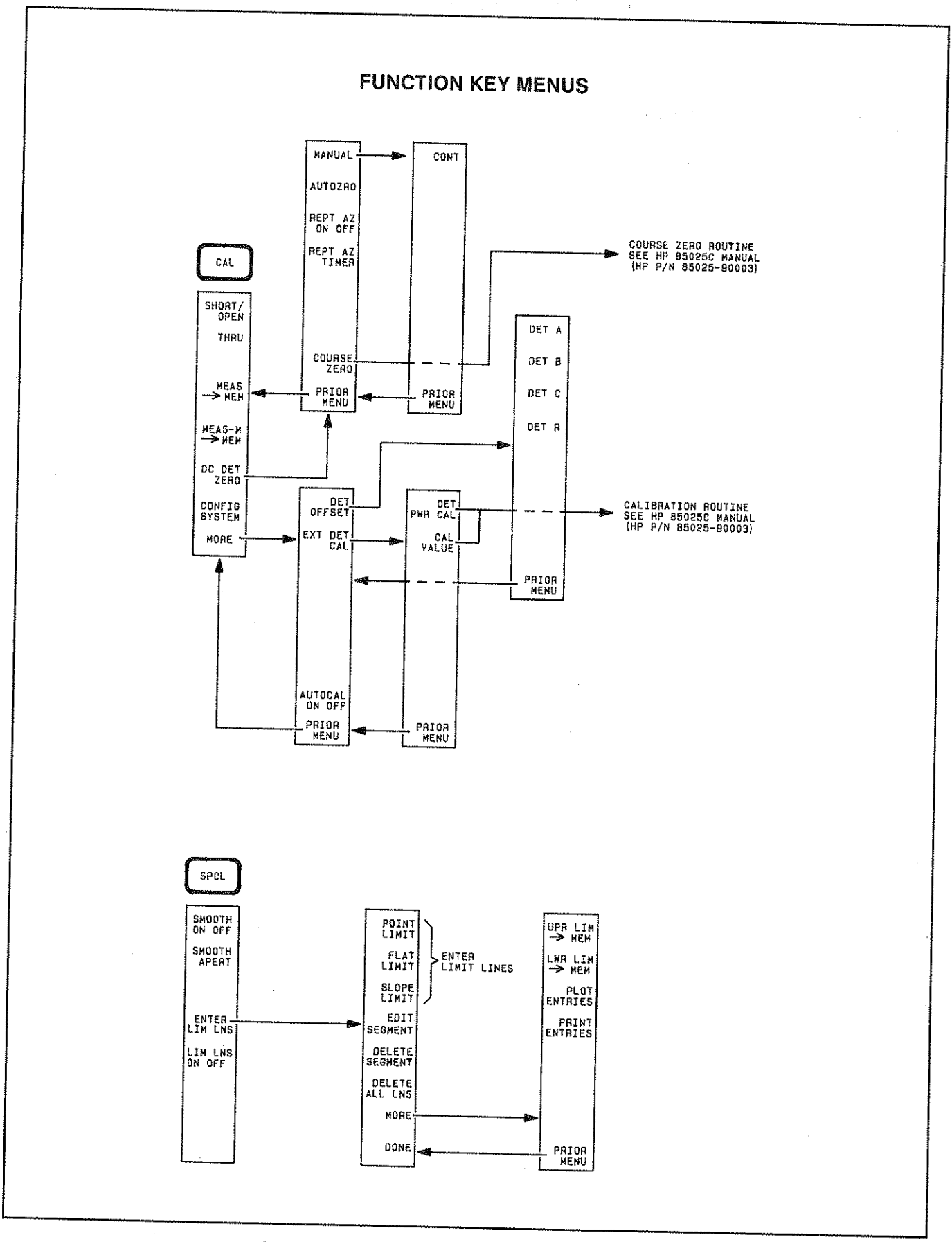


Figure 3-30. HP 8757A Menu Structure (2 of 3)

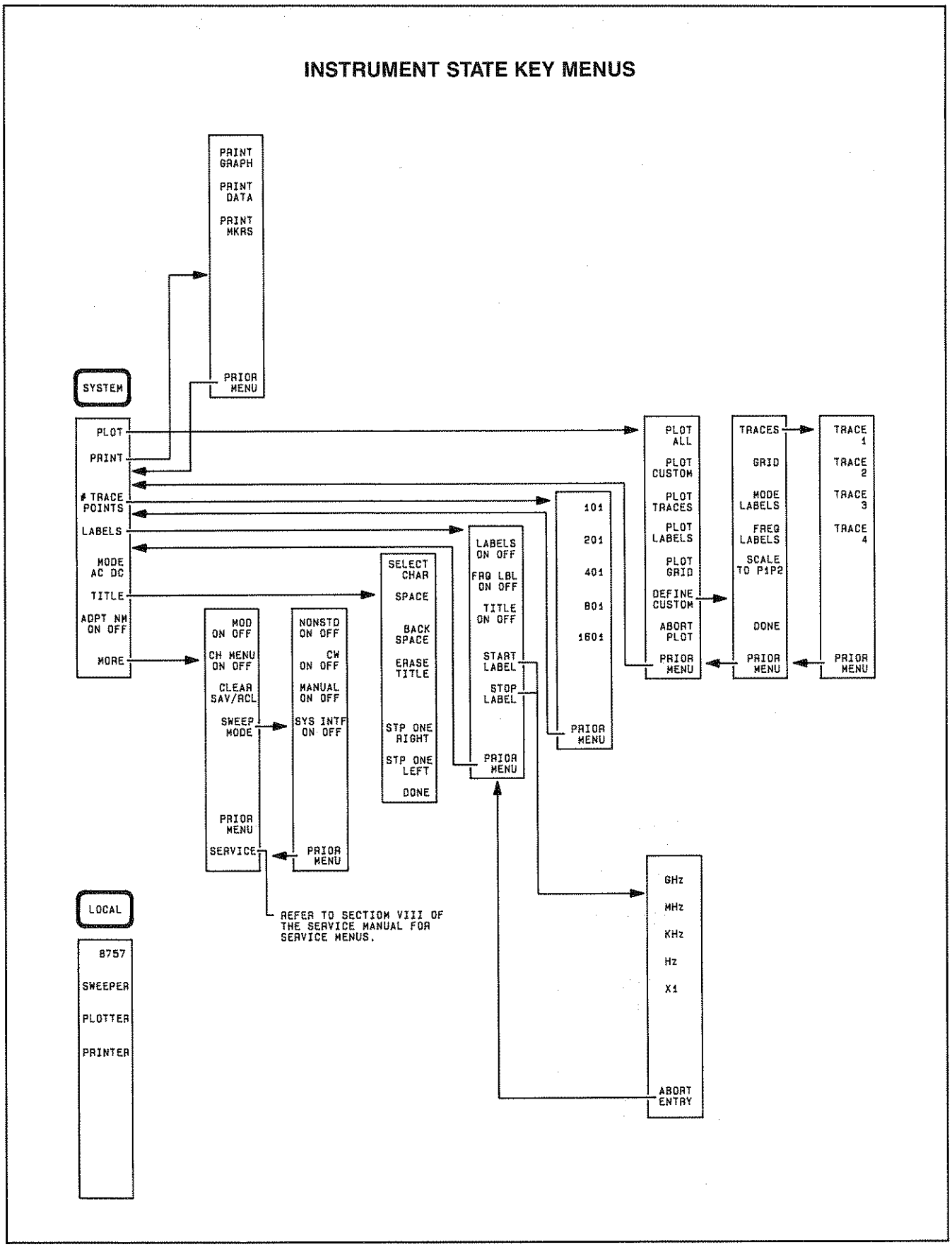


Figure 3-30. HP 8757A Menu Structure (3 of 3)

REAR PANEL OPERATING FEATURES

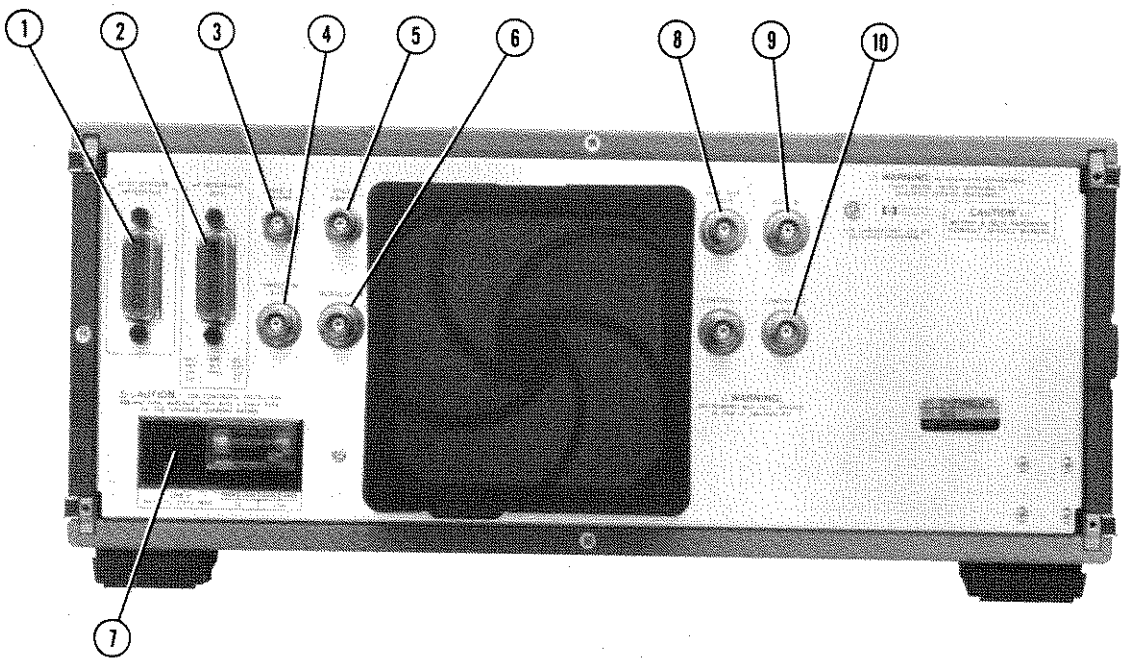


Figure 3-31. The HP 8757A Rear Panel

1. The 8757 SYSTEM INTERFACE connector is used to connect the private bus that lets the HP 8757A control the source, plotter, and printer. Since the HP 8757A itself controls the 8757 System Interface, other controllers must not be attached to this connector, unless the **[SYS INTF OFF]** function has been selected.

   The 8757 System Interface control of the HP 8350B sweep oscillator or HP 8340A or 8341A synthesized sweeper provides frequency annotation shown in the frequency labels area of the CRT. In addition, the **[SAVE]**, **[RECALL]**, and **[PRESET]** keys of either the source or the network analyzer control these functions in both instruments. Alternate sweep capability is also available in both instruments.

2. The HP INTERFACE BUS input/output connector allows interfacing with a computer controller and other HP-IB instruments.

3. The POS Z BLANK input connector accepts positive retrace and bandswitch blanking and negative intensity marker (z-axis modulation) signals. The signal levels sensed on this input are +5V for blanking, 0V for display, −4V for markers, and −8V for the active marker.

4. The SWEEP IN 0-10V input connector accepts a 0V to 10V sweep signal from a sweep oscillator. Using the non-standard sweep mode, it can also accept a different sweep ramp within the 0-10V range. The A4 ADC assembly can be modified to allow sweep ramps greater than +10V.

5. The STOP SWEEP connector provides the interface signal to stop the sweep of the HP 8350B or 8340A/8341A when it is controlled over the private bus. The HP 8757A also uses this connector to sense when the source has stopped the sweep.

NOTE

Connection of a sweep signal to the SWEEP IN 0-10V connector is the minimum requirement for use of the HP 8757A as a receiver. The POS Z BLANK must be connected to provide marker information on the screen. If the source is connected to the network analyzer through the 8757 System Interface, the STOP SWEEP must also be connected.

6. The MODULATOR output connector provides a 27.778 kHz square wave signal, nominally ±6V open circuit, for driving an external modulator or the external amplitude or pulse modulation input of the HP 8350B sweep oscillator or the HP 8340A or 8341A synthe sized sweeper.

7. The LINE V ±10% input connector accepts primary line voltage to power the instrument. The line voltage of 100V, 120V, 220V or 240V is selected by correctly inserting the printed circuit selector board. Refer to Section II, Installation, for instructions on line voltage and fuse selection.

8. The DAC OUT 0-10V connector is provided for future enhancements with later revisions of firmware. It can also be used for troubleshooting purposes, as described in the Service Manual.

9. The ADC IN connector allows the 8757 display of an external voltage using **[MEAS] [AUX]**. It is referred to as **AUX** input. It can also be used for troubleshooting purposes, as described in the Service Manual.

10. The CONTROL 1 and CONTROL 2 connectors provide digital output signals (TTL open-collector) as a user convenience for driving other peripheral equipment in an HP-IB controlled system. The CONTROL 1 signal is used as an oscilloscope trigger source when continuous loop service-related tests are performed.

OPERATOR'S CHECK

DESCRIPTION

The operator's check verifies that the HP 8757A is functioning properly. It does not thoroughly check all specifications to their limits, but is an appropriate test for daily instrument verification, incoming inspection, or verification after repair or replacement of digital circuits. It consists of a check of self-tests, HP-IB, and the 8757 System Interface; followed by an insertion loss measurement of a standard device. The insertion loss data should be saved as a reference for comparison with future operator's checks. The standard device should be kept exclusively for these operator's checks, so that future comparisons will be valid. A bandpass filter is used in this example so that the entire dynamic range of the HP 8757A is visible on the screen at one time.

EQUIPMENT

HP-IB Cable	HP 10833A/B/C/D
Sweep Oscillator Mainframe	HP 8350B
RF Plug-In	HP 83592B*
Detector	HP 11664A/E
Microwave Test Device	
e.g. 50 MHz Bandpass Filter	HP P/N 08757-80027
Graphics Plotter	HP 7470A

*Any RF plug-in with output power capabilties of +16 dBm at the frequency of interest can be substituted.

PROCEDURE

1. To verify the instrument self-tests, HP-IB, and 8757 System Interface private bus, perform the test procedure described in paragraph 4-5 of Section IV, Performance Tests.

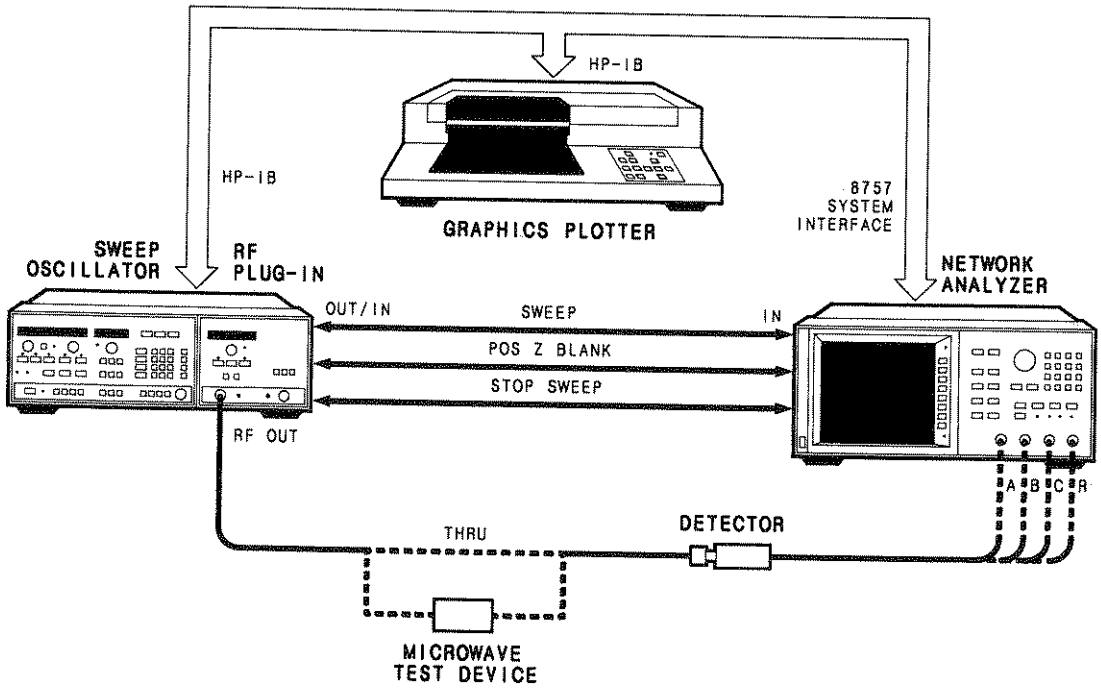


Figure 3-32. Equipment Setup for Operator's Check

2. Set up the equipment as illustrated in Figure 3-32, with the detector connected to the A input of the HP 8757A. Connect the detector input to the RF output of the sweep oscillator for a "thru" (0 dB insertion loss) connection. Turn on the instruments and allow 30 minutes warm-up time.

3. On the HP 8757A, press **[PRESET]** to preset both the HP 8757A and 8350B. The HP 8757A is preset automatically to channel 1 and input A. Then press **[CAL]**, **[CONFIG SYSTEM]**.

4. Adjust the start and stop frequencies of the sweep oscillator to include the frequency range of the microwave test device. These frequencies will be plotted with the data for a permanent record.

5. On the HP 8757A, press the **[CHAN 2 OFF]** soft key to turn off the channel 2 trace.

6. On the HP 8757A, press **[CURSOR]** and a cursor (+ symbol) will appear at the center of the trace. Press **[MAX]** to put the cursor at the trace maximum. Note the CRSR value displayed in the active entry area of the CRT. Adjust the output power of the RF plug-in until the cursor value on the CRT reads +16 dBm. This value is the upper limit of the dynamic range of the HP 8757A.

7. Press **[DISPLAY]** **[MEAS→MEM]** to store the trace in memory. The message "CHAN 1 MEAS TO MEMORY" will be displayed on the CRT.

8. Disconnect the detector from the RF output of the sweep oscillator. Press **[AVG]** then soft key **[AVG ON OFF]** to turn on averaging with the default average factor of 8. Wait about 7 seconds to allow the trace to settle.

9. Press **[CURSOR]** **[MAX]**. A cursor value of −60 dBm or lower should be displayed in the active entry area. This is the noise floor power level.

10. Insert the microwave test device between the RF output of the sweep oscillator and the detector. On the HP 8757A, press **[DISPLAY]** **[MEAS→MEM]**. Wait about 7 seconds to allow the trace to settle.

11. Press **[CURSOR]** **[MAX]** to find the trace maximum. The CRSR value displayed in the active entry area now represents the minimum insertion loss of the microwave test device. This value will be plotted with the data trace.

12. Press **[SYSTEM]** **[PLOT]** **[PLOT ALL]** to generate a hard copy plot. Retain this plot for comparison with future operator's checks.

13. Disconnect the detector from the A input and connect it to the B input. Remove the microwave test device from the circuit and connect the input of the detector to the RF output of the sweep oscillator. Press **[MEAS]** **[B]**. Repeat steps 6 to 12.

14. If the instrument is an Option 001, disconnect the detector from the B input and connect it to the C input. Remove the microwave test device from the circuit and connect the input of the detector to the RF output of the sweep oscillator. Press **[MEAS]** **[C]**. Repeat steps 6 to 12.

15. Connect the detector to the R input. Remove the microwave test device from the circuit and connect the input of the detector to the RF output of the sweep oscillator. Press **[MEAS]** **[R]**. Repeat steps 6 to 12.

HP-IB COMMANDS

Remote operation of the HP 8757A is accomplished with HP-IB (Hewlett-Packard Interface Bus), which is the Hewlett-Packard implementation of IEEE standard 488 dated 1978, and IEC 625-1. Information on HP-IB is provided in "Condensed Description of the Hewlett-Packard Interface Bus" (HP part number 5940l-90030), and "Tutorial Description of the Hewlett-Packard Interface Bus" (HP literature number 5959-0156).

NOTE

Remote operation of the HP 8757A applies strictly to operations where a computer controller is connected to the HP INTERFACE BUS connector on the rear panel of the HP 8757A. Do not connect an HP-IB controller to the 8757 SYSTEM INTERFACE connector.

In the LISTEN mode, the HP 8757A accepts specific programming commands for selecting front panel key functions, soft key functions, and special HP-IB only functions. It outputs data from a designated channel measurement trace or memory trace in binary or ASCII format as specified by the user, as well as other TALK functions. In addition, the HP 8757A can pass through HP-IB commands to a source (HP 8350B sweep oscillator or HP 8340A or 8341A synthesized sweeper), a plotter (HP 7470A, 7475A, 7550A, or 9872C), and a printer (HP 2225A ThinkJet printer).

A list of the HP 8757A programming commands is provided in Table 3-1. For comprehensive information on remote operation of the HP 8757A, refer to the Programming Notes "Introductory Operating Guide" (HP literature number 5954-1509) and "Quick Reference Guide" (HP literature number 5954-1508). These are separately bound documents provided in Section III of this Operating Manual.

Table 3-1. Alphabetical Listing of HP 8757A Programming Commands (1 of 3)

CODE	ACTION
A0	Averaging off
AB	A/B ratio measurement
AC	A/C ratio measurement*
AFd	Averaging On and Factor d
ANm	Adaptive Normalization on/off
AR	A/R ratio measurement
AS	Autoscale
AZm	Auto Zero repeat on/off of the DC detectors
AZ2	Auto Zero the DC detectors once
BA	B/A ratio measurement
BC	B/C ratio measurement*
BL0	Restore CRT to normal mode
BL1	Blank frequency labels
BL2	Blank all labels
BL3	Blank active channel trace
BL4	Blank softkey labels
BL5	Blank all (except user CRT graphics)
BL6	Blank title
BL7	Blank mode labels
BL8	Blank the active entry area
BL9	Blank the limit lines
BR	B/R ratio measurement
BW	Display the search bandwidth on the CRT
C0	Channel off
C1	Channel 1 on/active
C2	Channel 2 on/active
C3	Channel 3 on/active
C4	Channel 4 on/active
CA	C/A ratio measurement*
CB	C/B ratio measurement*
CDm	Cursor Delta on/off
CL	Perform system configuration calibration of detectors and channels
CN	Cursor to minimum
CR	C/R ratio measurement*
CS	Clear Status bytes
CTm	Auto System Calibration on/off†
CUm	Cursor on/off
CWm	CW mode on/off
CX	Cursor to maximum
DAd	Detector A Offset set to d
DBd	Detector B Offset set to d
DCd	Detector C Offset set to d*
DHm	Display Hold on/off of the active channel trace.
DM0	All inputs set to DC detection
DM1	All inputs set to AC detection
DN	Step down (decrement)
DRd	Detector R Offset set to d
DS0	Display trace data in log magnitude format†
DS1	Display trace data in Standing Wave Ratio (SWR) format†
ER0	Erase all save/recall registers
FA	Graticule start label
FB	Graticule stop label
FD0	Format Data ASCII
FD1	Format Data binary

Table 3-1. Alphabetical Listing of HP 8757A Programming Commands (2 of 3)

CODE	ACTION
FD2	Format Data Extended ASCII†
FR0	Display cursor data in log magnitude format
FR1	Display cursor data in SWR format
IA	Input A absolute power measurement
IB	Input B absolute power measurement
IC	Input C absolute power measurement*
ILs	Input Learn string
IP	Instrument Preset
IR	Input R absolute power measurement
IX	External ADC Input ("AUX") voltage measurement†
LE	Erase limit lines for active channel**
LFs	Enter limit test flat line data**
LL	Store lower limit line into memory**
LPs	Enter limit test point data**
LSs	Enter limit test sloped line data**
LTm	Limit line test on/off**
LU	Store upper limit line into memory**
M–	Display normalized data (measurement–memory)
MDm	Modulation on/off
ME	Display Measurement data
MM	Display the Channel Menu (main menu)
MN	Display normalized data (same as M-)
MR	Marker (or cursor) to reference line
MSm	Manual sweep mode on/off
MU0	Display the Measurement Menu
MU1	Display the Display Menu
MU2	Display the Scale Menu
MU3	Display the Reference Menu
MU4	Display the Cursor Menu
MU5	Display the Average Menu
MU6	Display the Calibration Menu
MU7	Display the Special Menu
MU8	Display the System Menu
MY	Display Memory data
MZ	Manual zero of DC detectors
NSm	Non-standard sweep mode on/off
OC	Output Cursor value
OD	Output Trace data
OI	Output Identity
OK	Output Keycode of last key pressed
OL	Output Learn string
OM	Output Memory data
ON	Output Normalized (measurement–memory) data
OPxx	Output Interrogated Parameter value xx = AF, BW, DA, DB, DC, DR, RL, RP, SD, SL, SO, SP, SR, SS, ST
OR	Output Rotary Knob value ($-32768 \leq$ value $\leq +32767$)
OS	Output Status bytes
OT1m	Control Output #1 on/off
OT2m	Control Output #2 on/off
OV	Output CW value
P1	Plot channel 1 trace on external plotter
P2	Plot channel 2 trace on external plotter
P3	Plot channel 3 trace on external plotter
P4	Plot channel 4 trace on external plotter

Table 3-1. Alphabetical Listing of HP 8757A Programming Commands (3 of 3)

CODE	ACTION
PA	Plot all on external plotter
PBm	System Interface control on/off
PC	Plot labels on external plotter
PD	Plot custom plot on external plotter
PG	Plot grid on external plotter
PR1	Print all graphics to external printer
PR2	Print tabular trace data to external printer†
PR3	Print tabular marker/cursor data to external printer†
PTd	Pass Through address set to d
R1	R/A ratio measurement
R2	R/B ratio measurement
R3	R/C ratio measurement*
RCn	Recall register n
RLd	Reference Level set to d
RMd	Service Request Mask set to d
RPq	Reference Position set to vertical division q
RS	Restart averaging
SCd	Set Cursor to horizontal position d
SDd	Scale per division set to d
SKq	Select Soft Key q: q = 1 to 8
SL	Cursor Search Left
SM	Store Measurement into memory
SN	Store Normalized data (measurement–memory) into memory
SOd	Smoothing set to d % of frequency span
SPd	Number of Points set to d: d = 101, 201, 401, 801, 1601
SR	Cursor Search Right
SSd	Cursor search value set to d
STd	Reference level step size set to d
SUd	Specify custom plot according to d
SVn	Save register n
SW0	Non-swept mode. Non-swept operation
SW1	Swept mode. Normal swept operation
SW2	Sweep Hold mode. Non-swept mode with HP-IB bus hold off until completion of TSd
TSd	Take d Sweeps, then hold display
UP	Step up (increment)
WKs	Write soft key label
WMs	Write to channel memory
WTs	Write Title, s is an ASCII string of up to 50 characters
XAd	External Detector Cal Value for detector A set to d†
XBd	External Detector Cal Value for detector B set to d†
XCd	External Detector Cal Value for detector C set to d†*
XRd	External Detector Cal Value for detector R set to d†
ZTd	Repeat Auto Zero Timer interval set to d†

* Valid only for HP 8757A Option 001 (C detector).
** Limit line functions valid only for channels 1 or 2.
† Functions new in Revision 2.0.

NOTES

n = decimal integer 1 to 9
d = variable length numeric
m = 0 for off
= 1 for on
q = unique value
s = ASCII or binary string

APPENDIX A
IN CASE OF DIFFICULTY

INTRODUCTION

This appendix explains what to do when a problem is encountered using the HP 8757A. It presents suggestions for minor problems that do not involve defects in the internal circuitry. The information provided here is divided into three main topics: manual operation problems, system operation problems, and inaccurate operation.

MANUAL OPERATION

Line Power Problems

If the power switch is turned on but all front panel LEDs are off and the fan is not operating, suspect a power problem.

- Make sure the line cord is properly connected.
- Check that the correct line voltage is selected at the rear panel power line module. The voltage selection PC board must be correctly installed. Refer to Section II for installation instructions.
- Make sure the correct fuse is installed in the fuse holder of the power line module. The required fuse rating for each line voltage is indicated in Table 2-1 and below the power line module on the rear panel of the HP 8757A.

Instrument Problems

After verifying that there is power to the instrument, look for internal instrument power problems.

- Check the internal fuses on the power supply assembly A12, especially the ±15V supply fuses A12F1-A12F4.
- Pay particular attention to the fuses in the A14 display assembly, because if the display is not operating the main troubleshooting features of the HP 8757A are not available.

Error Codes

When the front panel **[PRESET]** key is pressed, the HP 8757A performs a series of self-tests before establishing the preset conditions. If any of these tests fails, an error code from 0 to 15 is displayed in binary form with lighted LEDs. This error code appears in two places: on the front panel in the instrument state area, using the LEDs labeled R, L, T, and S; and on the A3 CPU assembly using the four LEDs near the top left corner of the board. In some cases, an error message is also displayed on the CRT. The most reliable failure indication is the LED display on the CPU assembly, since the front panel LEDs will not light in the event of a front panel failure. Table A-1 provides a list of error codes with the tests performed and most probable cause of failure.

SYSTEM OPERATION

If the HP 8757A is configured as a system controller with a sweeper, a plotter, and a printer, problems may occur in the configuration itself rather than in a specific instrument.

General

- Press **[PRESET]** on each instrument. This may correct the problem.
- Make sure that none of the devices (sweeper, plotter, or printer) is preventing proper system operation. Disconnect each instrument and see if the problem is solved.
- Make sure the filters are not clogged. All instrument filters should be cleaned regularly, once a month or more often. A clogged filter will cause overheating and consequent degradation of performance.
- If the system cannot be controlled from the HP 8757A front panel, cycle the power on the HP 8757A.
- Be sure that the source is compatible with the HP 8757A. Compatible sources are the HP 8350B sweep oscillator (serial prefix 2448A/J/U and above), used with an HP 83500-series RF plug-in, and the HP 8340A and 8341A synthesized sweepers. The HP 8350B can also be used with an HP 86200-series RF plug-in with 11869A adapter, though some of these plug-ins require an external modulator for AC compatibility with the HP 8757A.

  The HP 8350A sweep oscillator is manually compatible with the HP 8757A. However, it cannot be controlled by the HP 8757A through the 8757 System Interface private bus. Retrofit kits are available from Hewlett-Packard to update the HP 8350A for interface performance comparable to the HP 8350B.

Table A-1. Summary of Error Codes

LED Reading 8-4-2-1	Error Code	Test Description/Explanation	Probable Cause of Failure
1-1-1-1	15	Microprocessor kernel	A3U22, A3U42, A3U21 (CPU)
1-1-1-0	14	ROM checksum has started	A3U27, A3U4
1-1-0-1	13	ROM A checksum	A3U27, A3U4
1-1-0-0	12	ROM B checksum	A3U28, A3U5
1-0-1-1	11	ROM C checksum	A3U29, A3U6
1-0-1-0	10	RAM A (MSB)	A3U2
1-0-0-1	9	RAM A (LSB)	A3U25
1-0-0-0	8	RAM B (MSB)	A3U3
0-1-1-1	7	RAM B (LSB)	A3U26
0-1-1-0	6	RAM checksum failure	A3U2, A3U3, A3U25, A3U26
0-1-0-1	5	Instrument bus test	A3U41, 38, 39, A6, A11
0-1-0-0	4	CRT interface bus test	A14, W8
0-0-1-1	3	Unexpected interrupt	A4, A6, A2, A3U44, A3U8
0-0-1-0	2	Other self-test failure	As indicated on CRT
0-0-0-1	1	Unexpected key pressed	A1, A2U10
0-0-0-0	0	Pretest pass	—

HP-IB Connections and Addresses

If the instrument addresses are not set correctly, or if the HP-IB cables are not connected properly, a system malfunction may occur.

- Verify that the HP-IB cables are functional.
- Make sure that the sweep oscillator, plotter, and printer HP-IB cables are connected to the 8757 SYSTEM INTERFACE connector, not the HP INTERFACE BUS connector.
- Check that the HP-IB address of each instrument is set correctly and that no two instruments are set to the same address. To check the expected address for each instrument in the system, press **[LOCAL]**. Then press the soft keys **[8757]**, **[SWEEPER]**, **[PLOTTER]**, and **[PRINTER]**, and the expected addresses will be displayed on the CRT. Check the address settings on the instruments and verify that they correspond to the expected addresses.

  If the addresses do not agree, change the expected address using the local menu. Alternatively, the HP-IB address on the instrument itself can be physically reset.

Other Cable Connections

For most uses, the following connections must be made between the network analyzer and the sweeper. Other connections may be necessary for different applications.

- Connect the STOP SWEEP of the HP 8757A to the STOP SWEEP of the source.
- Connect the POS Z BLANK of the HP 8757A to the POS Z BLANK of the source.
- Connect the SWEEP IN 0-10V of the HP 8757A to the SWEEP OUT/IN of the source.

INACCURATE OPERATION

If the HP 8757A is functional but you are in doubt about the accuracy of the measurements, the problem may be with calibration or with the modulation frequency of the input signals.

Calibration

- Make sure the system is correctly configured for the detectors connected. The system must be reconfigured whenever a detector is replaced or exchanged. Press **[CAL]** then **[CONFIG SYSTEM]** to enable the HP 8757A to poll the detector inputs to determine the types of detectors connected and to calibrate each input.
- If you are using DC detection, make sure the detectors are zeroed to compensate for the effects of DC drift. Press **[CAL]**, then **[DC DET ZERO]**, and select either manual or automatic zeroing.
- Make sure the correct value of detector offset, if any, is entered. Press **[CAL]**, then **[DET OFFSET]**, and verify or change the offset values for each detector input. Note that **[PRESET]** does not reset the offset values to zero.
- For further information on calibration procedures, refer to "Calibration Menus" in the Operating Information section.

Modulation Frequency

- If you are using AC detection, verify that the modulation frequency of the input signals to the detectors is 27.778 kHz $\pm$20 Hz.

If a problem is encountered that is not solved using any of the suggestions described here, refer to Section VIII of the HP 8757A Service Manual.

DESIGNED FOR HP-IB

Operating Note

HP 8757A/8350B/0000-99A
Supersedes: HP 8757A/8350B/0000-99

JANUARY 1986

Basic Network Measurements Using HP 8757A Scalar Network Analyzer and HP 8350B Sweep Oscillator

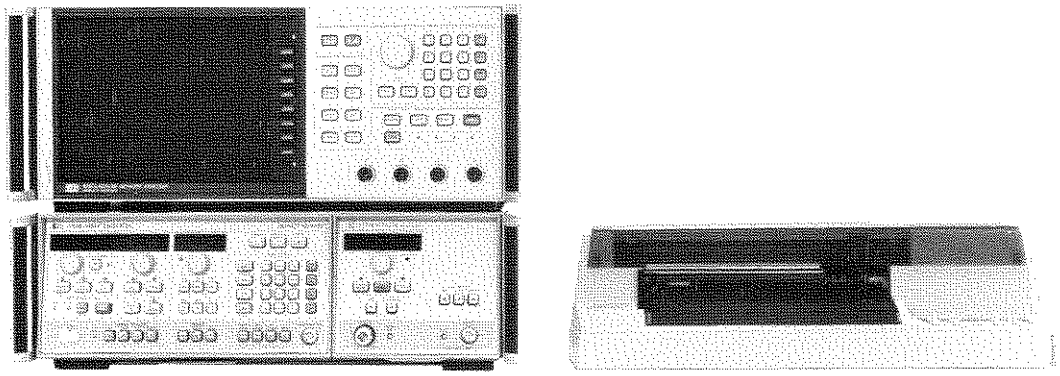


Figure 1. Scalar Network Analyzer System, 10 MHz to 18 GHz

This operating note helps you make transmission and reflection measurements using the HP 8757A scalar network analyzer, the HP 8350B sweep oscillator, and associated accessories. Some previous experience in network analysis techniques is assumed, so the note concentrates on generalized measurement setup, calibration, and measurement sequences using the HP 8757A rather than basic measurement theory. As you become familiar with operation of the instrument, you can modify and extend these sequences to more specialized applications. Further information discussing specific network measurement techniques is found in HP Application Note AN 183.

The first part of this note introduces the HP 8757A as used in a typical setup, then describes the instrument functions using basic front panel control sequences that apply to all measurements. Specific step-by-step procedures used to measure and interpret the response of the test device are found in the Transmission Measurements and Reflection Measurements topics. Summaries at the end of this note describe the function of the HP 8757A controls and indicators and the input/output connections. Additional information on the HP 8757A and its menus and soft key functions is provided in "Operating Information" in the HP 8757A Operating Manual.

Although the HP 8757A is fully programmable via the HP-IB, this note does not describe programming operation. Refer to the HP 8757A Programming Notes (Introductory Operating Guide and Quick Reference Guide), which appear in the Remote Operation section of the Operating Manual. You will want to gain an understanding of the instrument using the front panel controls before writing automated measurement programs.

Scalar network analyzers measure power reflected or transmitted by devices such as filters, amplifiers, mixers, and attenuators. The configuration described here and illustrated in Figure 1 is a complete manually operated system. It consists of the source to provide stimulus to the test device, the directional bridge and detectors to sample the reflected and transmitted signals, the receiver for signal processing and display, and the plotter or printer for hardcopy output. Together, these instruments produce fast, accurate, simultaneous swept displays of transmission loss or gain, and reflection or return loss versus frequency.

HEWLETT PACKARD

SCALAR NETWORK MEASUREMENT SYSTEM

The HP 8757A is a high performance scalar receiver with three identical inputs (four in the Option 001), four independent measurement channels, and an internal microcomputer to simplify operating procedures and automate display processing. A special digital System Interface between the HP 8757A and its companion source, the HP 8350B sweep oscillator, adds measurement capability by providing communication between the source and the receiver. This interface also provides direct data transfer to the digital plotter for neat, permanent records of the measurement display.

Figure 2 shows a block diagram of the source, detectors, and receiver in this setup. The source provides stimulus to the test device and signals for sweep, retrace blanking, and frequency markers. In this setup, the input to each detector is a CW (continuous wave) or swept sinusoid that is amplitude modulated by a 27.778 kHz square wave. The HP 11664 detectors demodulate (envelope detect) this signal to produce a 27.778 kHz square wave whose peak-to-peak voltage corresponds to the magnitude of the AM signal at the detector input. Since only the 27.778 kHz modulated signal is detected, unmodulated broadband noise generated by the test device, and spurious signals like mixer local oscillator feedthrough, are not included in the measurement. This receiver technique is termed AC detection.

With HP 85025A/B detectors, the HP 8757A offers both AC and DC detection. For DC detection, no modulation is required. A DC voltage is produced whose magnitude is proportional to the RF power level. This signal is then chopped in the detector at a 27.778 kHz rate to simulate the signal generated by AC detection. DC detection is useful for swept power measurements and for devices sensitive to modulation. In either AC or DC detection mode, the detectors provide a 27.778 kHz square wave for the receiver.

The HP 8757A scalar receiver provides the signal processing to convert the 27.778 kHz square wave for display. Each of the three (or four) inputs includes a bandpass filter, a logarithmic amplifier, and a rectifier to produce a DC voltage proportional to the detected power. For a 401 point display, the selected inputs are sampled 401 times per sweep with sample timing accomplished by sensing the 0 to 10 volt sweep output from the source. At each positive 0.025 volt change in the sweep voltage, all selected inputs are sampled, converted to a digital value, then stored in memory of the central processing unit (CPU). Using this memory, the CPU performs signal processing, such as normalization, scaling, averaging, ratioing, and detector offsets, then outputs trace data to the display memory. The display memory accepts digital trace data at the source sweep rate and asynchronously converts it for display at a flicker-free rate.

Sources

The HP 8350B sweep oscillator (serial prefix 2448A/J/U and above) has internal square wave modulation capability to provide the required 27.778 kHz modulated signal. All HP 83500-series RF plug-ins and most HP 86200-series RF plug-ins with the HP 11869A adapter are compatible with this internal modulation. (The HP 86220A, 86230B, 86241A, 86250A, 86250B, 86260A, 86260B, and 86260C RF plug-ins require the use of an external modulator for AC compatibility with the HP 8757A). The HP 8350A sweep oscillator can be updated for full compatibility with the HP 8757A.

The HP 8340A and 8341A synthesized sweepers can accept the 27.778 kHz modulation signal from the HP 8757A. In the SHIFT PULSE mode (AM input) they can then output a 27.778 kHz square wave modulated signal compatible with the HP 8757A.

The HP 8350B sweep oscillator and HP 8340A and 8341A synthesized sweepers are fully compatible with the digital 8757 System Interface. The System Interface allows the HP 8757A to act as the system controller by managing the sweeper using standard HP-IB protocol. Capabilities added by the System Interface include start/stop and source marker

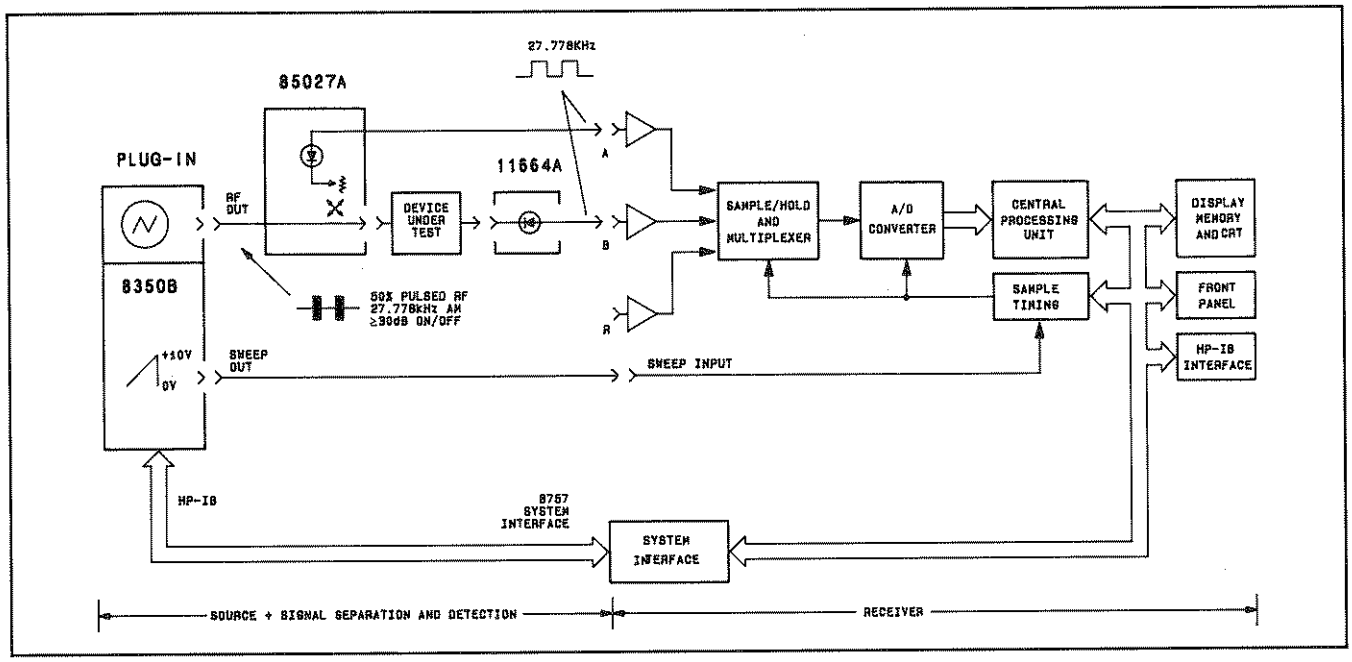


Figure 2. Source, Detectors, and Receiver Block Diagram

frequency annotation on the HP 8757A display, full use of all sweep and marker modes, and control of analyzer and sweeper preset and save/recall functions using HP 8757A controls.

Although the network analyzer can use any CW or swept stimulus having the correct sweep and blanking waveform, without the System Interface its capabilities are reduced. Other sources that can be used with the HP 8757A include the HP 8620C and HP 8350A. To use sources not equipped to connect to the 8757 System Interface, connect the source 0 to 10V sweep output to the HP 8757A SWEEP IN 0-10V, and the source positive z-axis blanking to the HP 8757A POS Z BLANK.

Signal Separation and Detection Devices

The setup described here to measure absolute or relative transmitted and reflected power uses a detector and a directional bridge. The reflected signal is measured using a directional bridge that includes the directional device to sample the reflected signal and the diode to detect it. From Figure 3 note that the bridge exhibits about 6 dB loss from the RF input to the test port and about 6 dB loss from the test port to the diode. In terms of the measurement, this loss results in about −2 dBm appearing at the detector diode with the RF input set to +10 dBm and a short circuit at the test port.

The transmitted signal is measured using a diode detector connected directly to the test device output. This diode is checked over the range of +16 to −60 dBm to verify that its response matches compensation provided by the standard shaping networks in the receiver. Above +16 dBm, measurement non-linearities result due to lack of compensation; the broadband noise floor is at about −62 dBm.

The directional bridges, detectors, and power splitters compatible with the HP 8757A are listed in Table 1.

Calibration Standards

The HP 85023-series verification kits contain a high quality adapter to connect the source RF output to the directional bridge RF input, calibration standards, and standard devices. The APC-7 and APC-3.5 kits contain a precision combination short circuit and shielded open circuit. This unit is designed so that the phase response of the short is exactly opposite to the phase response of the shielded open. This produces maximum benefit from the short/open average reflection calibration routine. The standard devices included in all kits are a 50 ohm termination and a 10 dB pad. These provide a convenient means to verify that the system is making good measurements. The verification kits are listed in Table 2.

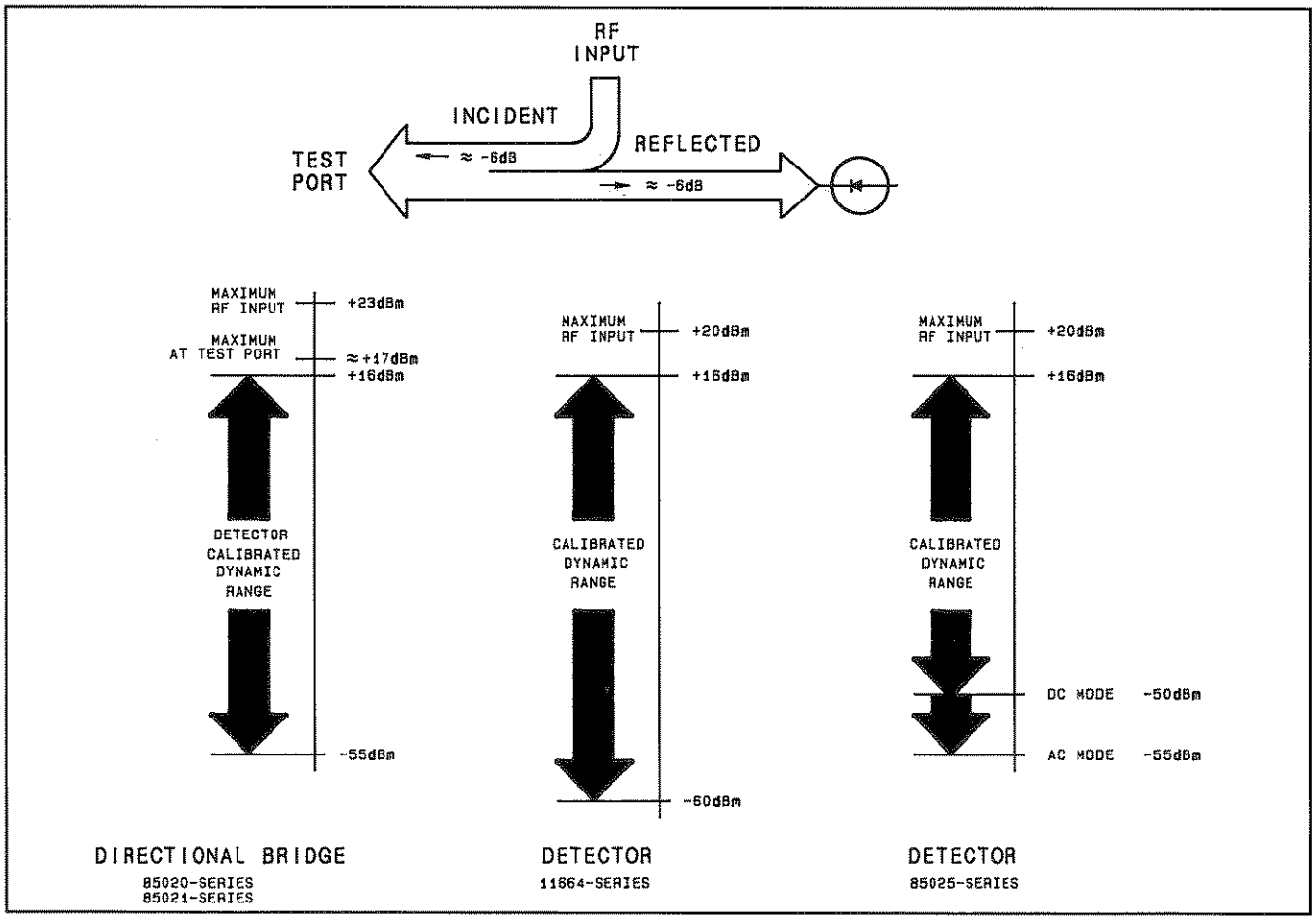


Figure 3. Dynamic Range Considerations

Table 1. Signal Separation and Detection Devices

HP Model Number	Freq. Range (GHz)	Test Port Connector
Directional Bridges		
85020A	0.01–4.3	Type-N (f)
85020B	0.01–2.4	Type-N (f) (75-ohm)
85027A	0.01–18	APC-7® *
85027B	0.01–26.5	APC-3.5 (f)
85027C	0.01–18	Type-N (f)
Detectors		
11664A	0.01–18	Type-N (m)
Option 001	0.01–18	APC-7
11664C	(Adapter)	BNC (m)
11664D	26.5–40	WG size WR28
11664E	0.01–26.5	APC-3.5 (m)
85025A	0.01–18	Type-N (m)
Option 001	0.01–18	APC-7
85025B	0.01–26.5	APC-3.5 (m)
Power Splitters		
11667A	DC–18	Type-N (f)
Option 001	DC–18	APC-7
11667B	DC–26.5	APC-3.5 (f)

Table 2. HP 85023-Series Verification Kits

HP Model Number	Freq. Range (GHz)	Connector Type
85023A	0.01–18	APC-7
85023B	0.01–26.5	APC-3.5 (m)
85023C	0.01–18	Type-N
85023D	0.01–2.4	Type-N (75-ohm)

Accessories

High quality adapters (low insertion loss, low return loss, stable in use, and durable) are necessary to achieve accurate, repeatable measurements. Worn or unstable adapters will increase error contributions due to directivity and mismatch effects. Calibrate for measurement using the same adapters and interconnect cables that will be used during measurement. To ensure repeatable measurements the adapters and cables must be clean, in good condition, and properly tightened. Start with the best available adapters and calibration standards, and replace them when they become unstable. Adapter part numbers are listed in Table 3.

Table 3. Adapters Available

Adapter Type	HP P/N
APC-7 to APC-3.5 (m)	1250-1746
APC-7 to APC-3.5 (f)	1250-1747
APC-3.5 (m) to APC-3.5 (m)	1250-1748
APC-3.5 (m) to APC-3.5 (m)**	08757-60002
APC-3.5 (f) to APC-3.5 (f)	1250-1749
APC-3.5 (m) to APC-3.5(f)**	08757-60003
APC-7 to Type-N (m)	11525A
APC-7 to Type-N (f)	11524A

* APC-7®, is a registered trademark of Bunker-Ramo Corporation.
** Use adapter supplied with HP 85027B when used with HP 85027B.

Other accessories required for the configuration described here include three standard BNC cables (HP 11170B) between the source and receiver, and two standard HP-IB cables (HP 10833A) connecting the source and plotter to the 8757 System Interface. One HP-IB cable is shipped with the instrument.

MEASUREMENT SETUP

The measurement setup used in this example is shown in Figure 4. It consists of the HP 8757A, the HP 8350B with any RF plug-in, a plotter, the directional bridge, the detector, a short circuit, various adapters and cables required to connect the equipment, and a test device with known characteristics. Standard BNC cables are used to make the sweep ramp, blanking, and stop sweep connections. Connect a standard HP-IB cable between the 8757 System Interface and the HP 8350B HP-IB connectors, then use a second HP-IB cable between the HP 8350B and the HP-IB connector of the plotter.

If you have any doubt concerning instrument power requirements or other connections, refer to detailed installation steps in Section II, Installation, of the Operating Manual.

SYSTEM INTERFACE ADDRESS ASSIGNMENTS

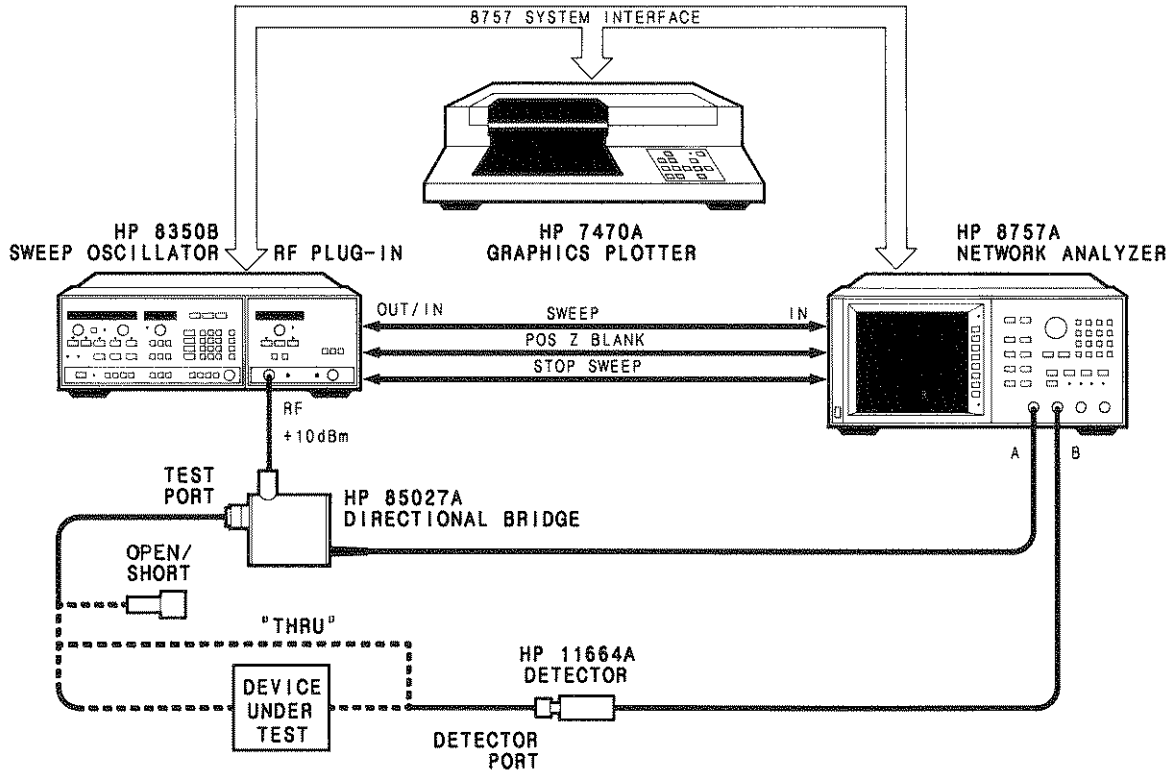
The 8757 System Interface normally expects the source HP-IB address to be set to 19 and the plotter HP-IB address to be set to 05. These are the factory set addresses. However, new addresses can be assigned using the **[LOCAL]** key on the HP 8757A front panel. Be sure that the expected instrument addresses are the same as the settings on the HP-IB address switches.

INTRODUCTORY MEASUREMENT SEQUENCE

The information provided here describes a basic simultaneous reflection and transmission measurement using AC detection mode. Use a bandpass filter or similar device with known characteristics as the device under test for this example. Figure 5 is an abbreviated version of this procedure. Additional information about measurements using DC detection is provided under "Using DC Detection." Calibration and measurement procedures are described in more detail under "Transmission Measurements" and "Reflection Measurements."

Connect Test Setup

Connect the equipment as illustrated in Figure 4 (plotter optional), but do not connect the device under test. If necessary, install high quality adapters at the bridge test port and the detector port to mate with the connectors of the device under test. Connect the directional bridge to the A input of the HP 8757A and the detector to the B input of the HP 8757A. Set the line switch of each instrument on, and allow 30 minutes warm-up time. Refer to "Using DC Detection" for information about system configuration and DC detector zeroing.



System State After HP 8757A [PRESET]

HP 8757A

Channel Menu Displayed
CHANNEL 1 Active
CHANNEL 1 MEAS A. Channel 1 On
CHANNEL 2 MEAS B. Channel 2 On
CHANNEL 3 MEAS B, (C in Option 001)
Channel 3 Off
CHANNEL 4 MEAS R. Channel 4 Off
* DISPLAY MEAS
* SCALE 20 dB/division
* DISPLAY MEAS REF LEVEL 0 dBm
* DISPLAY MEM REF LEVEL 0 dBm
* DISPLAY MEAS–MEM REF LEVEL 0 dB
* REF LEVEL = 0 dBm
* REF POSN Not Changed
* REF LEVEL STEP 20 dB
* CURSOR Off
* Search Value –3 dB
* Averaging Off
* Averaging Factor 8
AC Detection Mode
* 401 Trace Points
* Smoothing Aperture 5%, Smoothing Off
* Adaptive Normalization Off
Modulation Drive On
* Trace Memories Not Changed
* Limit Lines Not Changed
Save/Recall Memories Not Changed
Detector Offsets Not Changed
HP-IB Addresses Not Changed
Title Not Changed
User Defined Plot Not Changed

HP 8350B

Standard Instrument Preset
SWEEP TIME 200 milliseconds ⌐¬ MOD On

HP 7470A

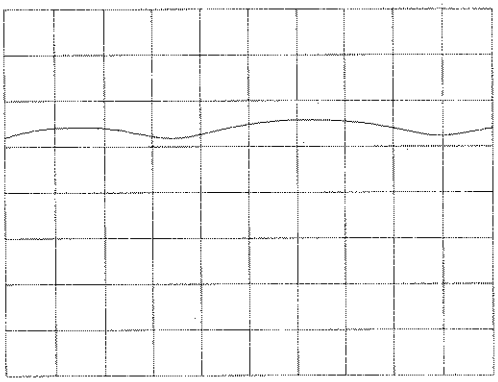
P1 and P2 Not Changed
Default Conditions Set

* All Channels

Figure 4. Example of Test Setup

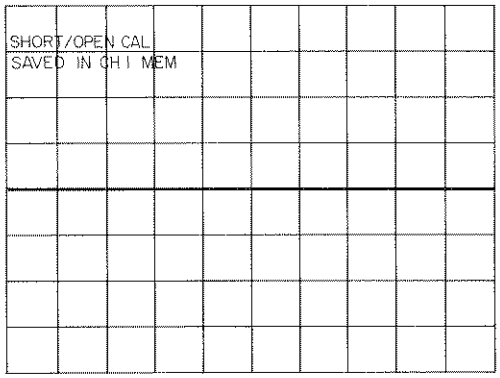
Measurement Setup

- Connect test setup (see Figure 4).
- Press HP 8757A PRESET.
- Connect thru (connect detector port to test port).
- Channel 2 displays power (dBm) incident at test port.
- Use HP 8350B controls to set start/stop sweep and power level.



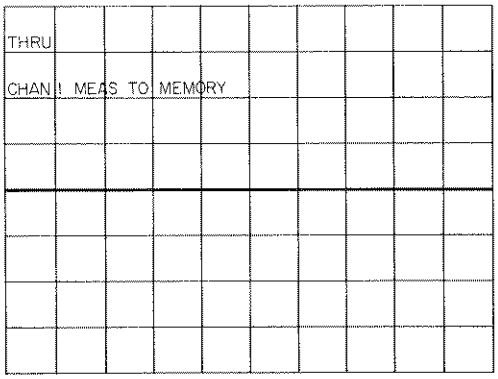
Reflection Calibration

- Press CHANNEL **[1] [CAL]** (function key).
- Press **[SHORT/OPEN]** (soft key).
- Prompt says "CONNECT SHORT. . . STORE WHEN READY."
- Connect short circuit.
- Press **[STORE SHORT]** (soft key).
- Prompt says "CONNECT OPEN . . . STORE WHEN READY."
- Connect open circuit.
- Press **[STORE OPEN]** (soft key).
- Press **[DISPLAY]**, then **[MEAS–MEM]**.



Transmission Calibration

- Press CHANNEL **[2] [CAL]** (function key).
- Press **[THRU]** (soft key).
- Prompt says "CONNECT THRU. . . STORE WHEN READY."
- Connect thru.
- Press **[STORE THRU]** (soft key).
- Press **[DISPLAY]**, then **[MEAS–MEM]**.



Measurement

- Connect device under test.
- Read return loss (dB).
  Press CHANNEL **[1] [SCALE]** (function key)
  [AUTOSCALE] (soft key)
  (Autoscale to position trace).
- Press **[CURSOR]**.
- Use knob to position cursor.
- Read magnitude and frequency from CRT active entry area.
- Read insertion loss (dB).
  Press CHANNEL **[2] [SCALE]** (function key)
  [AUTOSCALE] (soft key)
  (Autoscale to position trace).
- Press **[CURSOR]**.
- Use knob to position cursor.
- Read magnitude and frequency from CRT active entry area.

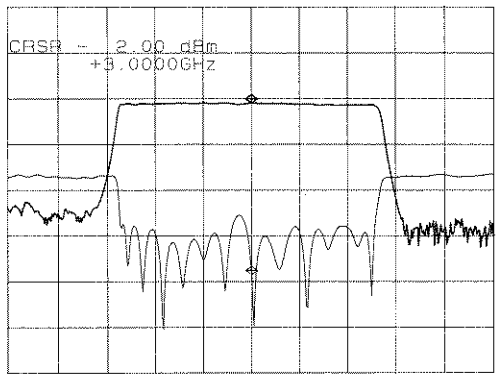


Figure 5. Abbreviated Measurement Sequence

System Preset

On the HP 8757A, press **[PRESET]**. This initializes the HP 8757A, 8350B, and 7470A plotter (if present) to the preset state listed in Figure 4. Channel 1 is set to measure reflected power at input A, and channel 2 is set to measure transmitted power at input B.

Reference Line

Labels 1> and 2> along the left side of the grid identify the position of the channel 1 and channel 2 reference lines. Press **[REF]**, then **[REF POSN]**, and use the knob or the STEP **[↑]** **[↓]** keys to move the channel 1 reference line to mid-screen. Press CHANNEL **[2]** and use the knob or the STEP **[↑]** **[↓]** keys to move the channel 2 reference line to a convenient position.

Set Source Frequency Sweep

Use the controls of the HP 8350B to set a frequency sweep that corresponds to the frequency range of the device under test. For example:

[START] [2] [GHz] [STOP] [6] [GHz]

To test using a CW frequency, press 8350B **[CW]**. This sets the CW mode on the HP 8350B and 8757A.

Other source settings such as square wave modulation on and default sweep time of 0.20 seconds are set by the HP 8757A **[PRESET]**.

Set Source Power Level

Connect the detector to the test port of the directional bridge. Channel 2 now displays the transmission signal path of the test setup. Press HP 8757A CHANNEL **[2]**, **[SCALE]**, then **[AUTOSCALE]** to position the trace for viewing. Press **[CURSOR]** to read the power in dBm at the test port.

Use the controls on the HP 8350B to set the desired RF power level. For example:

[POWER LEVEL] [1] [0] [dBm]

should produce about +4 dBm at the test port because of the 6 dB loss through the bridge. The output power of the HP 8350B after preset depends on the particular RF plug-in used. After setting the power level, disconnect the detector from the bridge test port.

Reflection Calibration (Channel 1)

On the HP 8757A press CHANNEL **[1]**. Press **[CAL]** **[SHORT/OPEN]** and the prompt "CONNECT SHORT . . . STORE WHEN READY" is displayed on the CRT. Connect a calibrated short circuit to the test port and press **[STORE SHORT]**. Now the prompt "CONNECT OPEN . . . STORE WHEN READY" is displayed. Connect a shielded open circuit to the test port (at low frequencies, below about 1 GHz, the circuit can simply be left unterminated), and press **[STORE OPEN]**. The message "SHORT/OPEN CAL SAVED IN CH1 MEM" is displayed to show that the calibration data (the average of the short and the open circuit) is stored in channel 1 memory. Press **[DISPLAY]** **[MEAS–MEM]** to view the normalized trace. Press **[CURSOR]**. The cursor should read near 0 dB at all frequencies.

Transmission Calibration (Channel 2)

Press CHANNEL **[2]** **[CAL]** **[THRU]**, and the prompt "CONNECT THRU . . . STORE WHEN READY" is displayed. Connect the detector port and the bridge test port together. If the adapters required to connect the device under test do not mate, install a detector port adapter that will mate with the test port adapter to make the thru connection. Press **[STORE THRU]**, and the message "THRU SAVED IN CH2 MEM" is displayed to acknowledge that the thru calibration data is stored in channel 2 memory. Press **[DISPLAY]** **[MEAS–MEM]** to view the normalized trace. Press **[CURSOR]** and use the knob to move the cursor to any point on the trace. The cursor should read near 0 dB at all frequencies.

Simultaneous Reflection and Transmission Measurement

Connect the device under test between the test port and the detector port. If the detector port adapter was changed to make the thru connection, install the correct adapter on the detector port. With **[DISPLAY]** **[MEAS–MEM]** selected, the displayed trace represents the current measurement trace minus the stored calibration trace. Channel 1 displays the response of the device under test relative to the 0 dB return loss of the short circuit and the open circuit. Channel 2 displays the response of the device under test relative to the 0 dB insertion loss of the thru connection.

To read the return loss, press CHANNEL **[1]** **[SCALE]** **[AUTOSCALE]** to position the trace, then press **[CURSOR]** and use the knob to move the cursor to any point on the trace. Both the magnitude and the frequency of the cursor are displayed.

To read the insertion loss, press CHANNEL **[2]** **[SCALE]** **[AUTOSCALE]** to position the trace. Press **[CURSOR]** and use the knob to move the cursor and read magnitude and frequency.

To plot the measurement data, press **[SYSTEM]** **[PLOT]** **[PLOT ALL]**.

FRONT PANEL OPERATION

The HP 8757A front panel is divided into five areas: the CRT with eight soft keys directly to the right, the CHANNEL area, the ENTRY area, the FUNCTION area, and the INSTRUMENT STATE area (see Figure 6).

The operation of the HP 8757A is highly dependent on the use of the eight soft keys to the right of the CRT. These keys extend instrument capabilities by adding functions without adding front panel complexity. Pressing any of the soft keys either executes the function labeled next to the key, or presents another set of menu labels. For example, the cursor menu presents all the cursor functions such as cursor **[MIN]** and cursor **[MAX]**. Pressing cursor **[SEARCH]** presents another menu for defining search parameters. The complete menu structure is shown at the rear of this Operating Note.

Access to the various soft key menus is provided by the "hard keys" on the instrument front panel. When the CHANNEL keys **[1]** and **[2]** are pressed, the chosen channel is activated and the channel menu appears. This menu also

allows soft-key access to channels 3 and 4. The FUNCTION keys are used to present menus for control of the various functions on the active channel. The INSTRUMENT STATE keys control system functions that are channel-independent, such as the HP-IB address of the source, or bring up soft key menus that control system functions, such as AC or DC detection modes. Some menu selections bring up other "layered" menus for access to even more functions. For example, the system menu contains the soft key labeled **[MORE]**, which brings up more system selections to choose from. Also, the **[PRIOR MENU]** soft key is used in this "layered" approach to display previous menus.

Any front panel operation can be performed with this four-step procedure:

1. Use the CHANNEL keys **[1]** and **[2]** to activate the desired channel. (This is not necessary for system functions.)
2. Use the FUNCTION keys (or INSTRUMENT STATE keys) to select which function menu will appear on the display.
3. Then use the labeled soft keys to activate the desired function. This may require use of more than one layer of soft keys. Some functions do not require the use of soft keys. The **[CURSOR]**, **[SCALE]**, and **[REF]** function keys activate functions without the use of soft keys. **[CURSOR]** turns the cursor on, **[SCALE]** activates the dB/div function, and **[REF]** activates the reference level function. **[SAVE]** and **[RECALL]** activate the save and recall functions without the use of soft key menus.
4. Use the ENTRY keys (the knob, STEP keys, and number pad) to enter the desired parameters (e.g. 10 dB/div).

For example, the following sequence can be used to move the position of the reference line on channel 2:

1. Press CHANNEL **[2]** to activate channel 2.
2. Press FUNCTION key **[REF]** to bring up the reference menu.
3. Press the soft key labeled **[REF POSN]** to make reference position the active function.
4. Use the STEP **[↑]** **[↓]** keys or the knob to position the reference line on the desired graticule.

The **[SAVE]** and **[RECALL]** keys in the INSTRUMENT STATE area use nine registers in the HP 8757A to save front panel control settings of both the receiver and the sweeper. With the 8757 System Interface connected to the sweeper, press **[SAVE]** then a digit 1 through 9 on the numeric pad to save the HP 8757A and 8350B current front panel settings into non-volatile memory. Press **[RECALL]** then a digit 1 through 9 to recall the saved state. Selecting **[SAVE]** or **[RECALL]** on either the HP 8757A or the source (HP 8350B, 8340A, or 8341A) will save or recall the state of both instruments.

The CRT (Figure 7) displays the grid on which the measurement data is plotted, the currently selected measurement traces, and other information describing the measurement. When a measurement channel is on, the mode labels at the top of the grid show the **[MEAS]** selection (ratio or power), the cursor value (if **[CURSOR ON]** is selected), the display units per division scale factor, and the reference line value. The mode labels also display status symbols: "S" for smoothing on, "A" for averaging on, "*" for adaptive normalization on, "M" for **[MEAS–MEM]** selected, and "MEM" for **[MEAS→MEM]** selected. The active channel appears brighter than the inactive channels. Frequency labels along the bottom of the grid display the sweeper start and stop frequencies (if the HP 8350B, 8340A, or 8341A is used); and the cursor frequency (if **[CURSOR ON]** is selected) or the source active marker frequency (if markers are on).

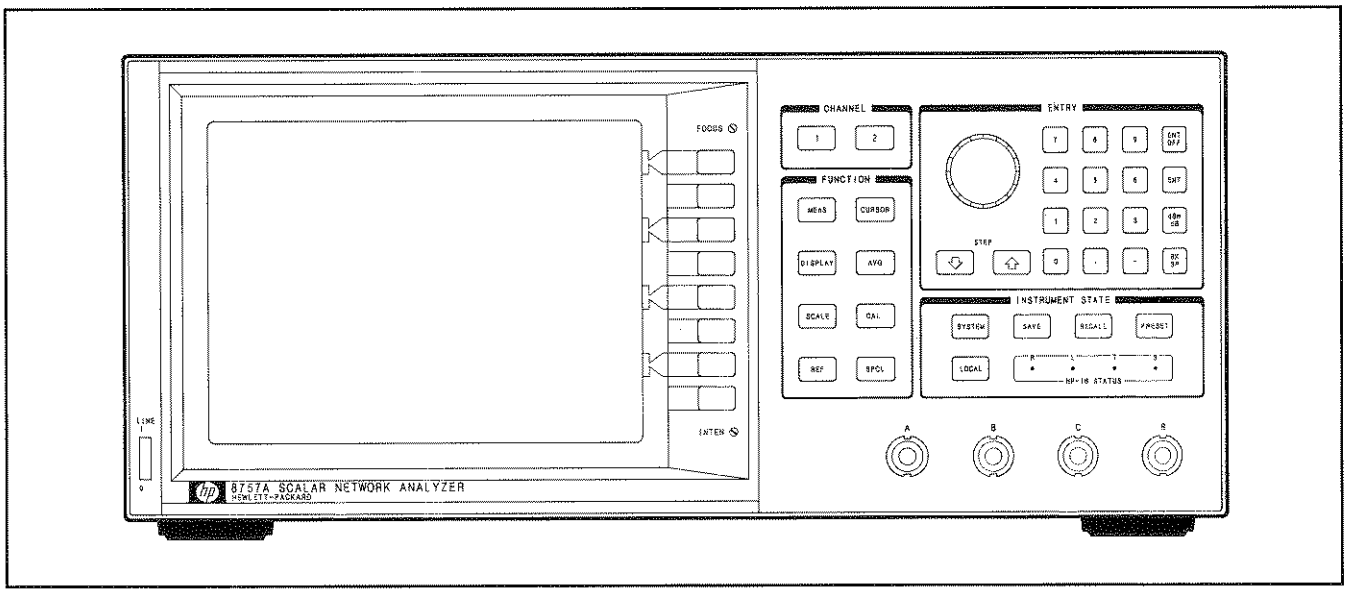


Figure 6. HP 8757A Option 001 Front Panel

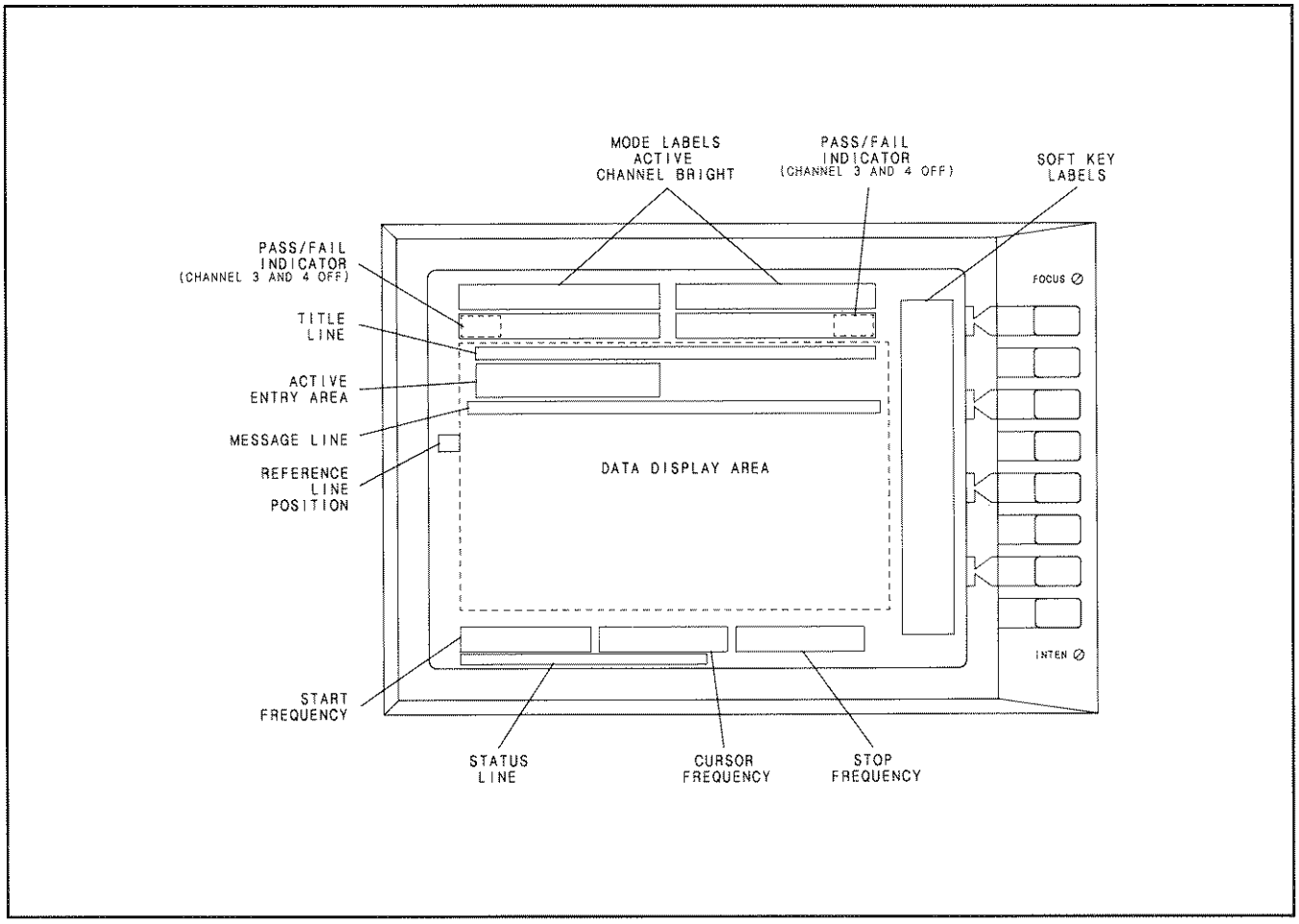


Figure 7. HP 8757A CRT Display

The labels 1> and 2> on the left side of the grid identify the reference line position for measurement channels 1 and 2, respectively. The reference line is the position from which scale factor changes expand or contract the trace. After **[PRESET]** the reference line value is 0 dBm and the trace is positioned above or below the reference line depending upon whether the response is positive or negative. The reference menu controls the reference line position and value for each channel. Select **[REF LEVEL]** then use the knob, STEP keys, or numeric entry followed by **[dB]** to change its value. Select **[REF POSN]** then use the knob or STEP keys to move the reference line to the desired position. The cursor value is not changed by changes to reference line value or position.

The active entry area in the upper left corner of the grid displays the currently selected active function. For example, pressing CHANNEL **[1]** then **[SCALE]** displays the current dB per division scale factor for channel 1 as the active function, and causes the channel 1 mode labels and measurement trace to intensify, thus indicating that the active function displayed relates to channel 1.

The STATUS line displays information about the current instrument status, such as the number of points per trace, the detection mode (AC or DC) and detector offsets.

The remainder of this section describes the functions of the front panel keys in the ENTRY, CHANNEL, FUNCTION and INSTRUMENT STATE areas.

ENTRY Area

The ENTRY area provides the numeric and units keypad, the knob, and the STEP keys used with **[SCALE]**, **[REF LEVEL]**, and other functions, to enter data. For example, pressing **[SCALE]** activates the ENTRY area allowing you to change the displayed dB per division scale factor for the active measurement channel. Use the STEP keys or knob to change the displayed scale factor, or enter the desired dB/division by pressing the numeric keys then terminate the entry by pressing the **[dB]** units key.

CHANNEL Keys

The two CHANNEL keys labeled **[1]** and **[2]** are used to make either channel the "active" channel. Any functions which are then entered apply to this active channel.

The CHANNEL keys also present the channel menu for the soft keys, shown in Figure 8. These keys allow access to channels 3 and 4, and enable you to turn any channel off.

It is possible to de-activate the channel menu from the system menu by pressing **[SYSTEM] [MORE] [CH MENU OFF]**. If the channel menu is turned off, it will not appear when the CHANNEL keys are pressed. Turning off channel 1 or 2 when the channel menu is off is accomplished by pressing the CHANNEL key twice.

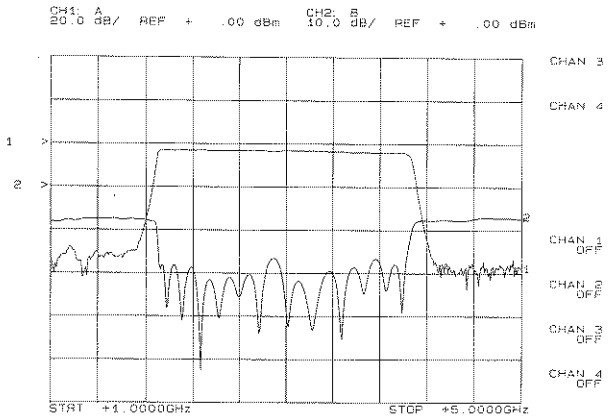


Figure 8. The Channel Menu

FUNCTION Keys

The eight FUNCTION keys **[MEAS]**, **[DISPLAY]**, **[SCALE]**, **[REF]**, **[CURSOR]**, **[AVG]**, **[CAL]**, and **[SPCL]** are used to activate functions and present menus that apply to the active channel only. A description of each key and its associated menu is given here.

[MEAS]

The **[MEAS]** key is used to access the measurement menu, which presents all the possible parameters to be measured on the active channel. These parameters are either one input or a ratio combination of two inputs. An additional menu in the standard instrument or two additional "layered" menus in the Option 001 are required to access all of the possible ratios. The menus are shown in Figure 9.

[DISPLAY]

The **[DISPLAY]** function key presents the display menu, which allows the operator to control the display mode for the active channel. This menu (shown in Figure 10) lets you display (1) the measurement (**[MEAS]**), (2) the trace memory of the active channel (**[MEM]**), or (3) the difference between these (**[MEAS–MEM]**). The **[MEAS–MEM]** display mode is ideal for displaying normalized measurements used in calibration (see **[CAL]**). **[MEAS–M→MEM]** stores the normalized trace in memory.

Also provided in this menu are several other display controls. Display **[HOLD ON]** freezes the active channel trace on the display. **[TRC FMT]** allows reflection data to be displayed in dB or standing wave ratio (SWR). **[MEAS→MEM]** and **[MEAS–M→MEM]** are used to store traces into memory, for storage or for normalization using **[MEAS–MEM]** mode.

[SCALE]

The **[SCALE]** function key activates the scale factor function and presents the scale menu. When scale factor is the active function, use the STEP keys, knob, or keypad to change the scale per division. The only label in the scale menu is the **[AUTOSCALE]** function, which centers the trace on the screen for convenient viewing.

To familiarize yourself with the scale functions:

- Press the **[SCALE]** function key.
- Use the knob and step keys to change the scale factor, and notice how the trace varies.
- Use the keypad in the entry area and press **[1] [0] [dB]** to enter 10 dB/div scale factor.
- Press the **[AUTOSCALE]** soft key to center the trace on-screen.

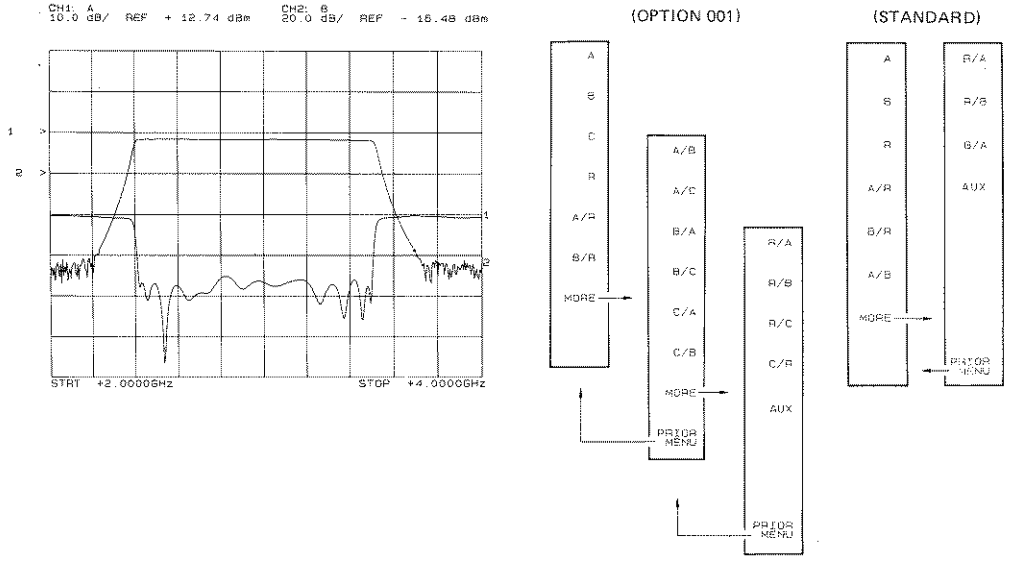


Figure 9. The Measurement Menus

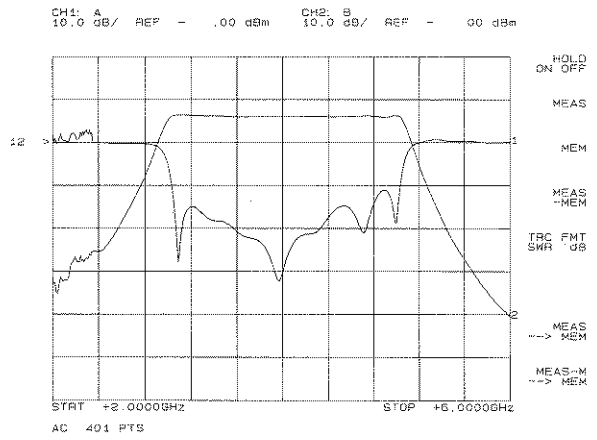


Figure 10. The Display Menu

[REF]

Pressing the **[REF]** function key makes ref level the active function, and presents the reference menu. When ref level is the active function, use the knob, STEP keys, and numeric keypad to enter the reference level. Another function available from the reference menu is **[REF POSN]**, which allows the user to specify which graticule is the reference line. To familiarize yourself with the reference functions:

- Press the **[REF]** function key and use the knob and STEP keys to adjust the reference level.
- Enter a reference level of 0 dBm.
- Press **[REF POSN]** and use the knob and step keys to change the reference line to another graticule.

[CURSOR]

To read the measured value using the HP 8757A measurement cursor, press the **[CURSOR]** function key. This activates the cursor on all displayed channels, and presents the cursor menu, illustrated in Figure 11. Use the knob to move the cursor (+ symbol) to the desired position on the trace. When the cursor is on, the current value of the active channel trace at the cursor position is displayed in the CRT active entry area and the frequency value is displayed centered at the bottom of the grid. The cursor dB or dBm value for all channels is also displayed in the mode labels area above the grid. The cursor value is always displayed with 0.01 dB resolution regardless of the scale per division setting or reference line value.

The value read by the HP 8757A cursor depends upon the measurement and display mode selections. These are accessed by pressing the appropriate FUNCTION key, **[MEAS]** or **[DISPLAY]**. With **[DISPLAY]** **[MEAS]** selected, the cursor value either represents the power difference in dB between the two selected inputs (measured ratio) or the absolute power in dBm at the selected input (measured power). With **[DISPLAY]** **[MEAS–MEM]** selected, the cursor value represents the power difference in dB between the current measurement trace and the stored reference trace (stored by **[MEAS→MEM]**).

Because the cursor always reads the true measured value, it is unnecessary to know the value or position of the reference line in order to determine the value at a point on the trace. Using **[AUTOSCALE]** lets you view the entire measurement trace and see the cursor symbol (+).

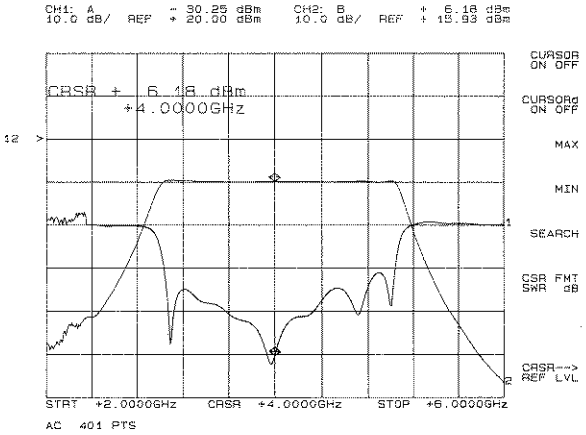


Figure 11. The Cursor Menu

The cursor menu contains several useful cursor functions that can simplify many measurement procedures. For instance, as illustrated in Figure 12, to measure the difference between maximum and minimum values on the trace, use the sequence **[CURSOR]** **[MAX]** **[CURSOR Δ ON]** **[MIN]**. The value displayed in the active entry area is the dB difference between the maximum and minimum trace values.

The cursor **[SEARCH]** function lets you search for a particular value in dBm or dB. Press **[SEARCH]** to bring up the search menu, then set the desired value or leave it as previously set. Then press **[SEARCH LEFT]** or **[SEARCH RIGHT]** to locate the desired value and frequency using linear interpolation between data points. The cursor **[BANDWIDTH]** function determines the N-dB bandwidth for the device under test, where N is the search value.

[FORMAT SWR dB] allows convenient readout of reflection data (cursor only) in SWR (standing wave ratio) rather than dB (return loss) if preferred.

To familiarize yourself with control of the cursor:

- Press CHANNEL **[1]**.
- Press the **[SCALE]** function key, then **[AUTOSCALE]**.
- Press the **[CURSOR]** function key.
- Press **[CURSOR ON OFF]** to switch the cursor on and off. With the cursor on, the + symbol appears on the trace.

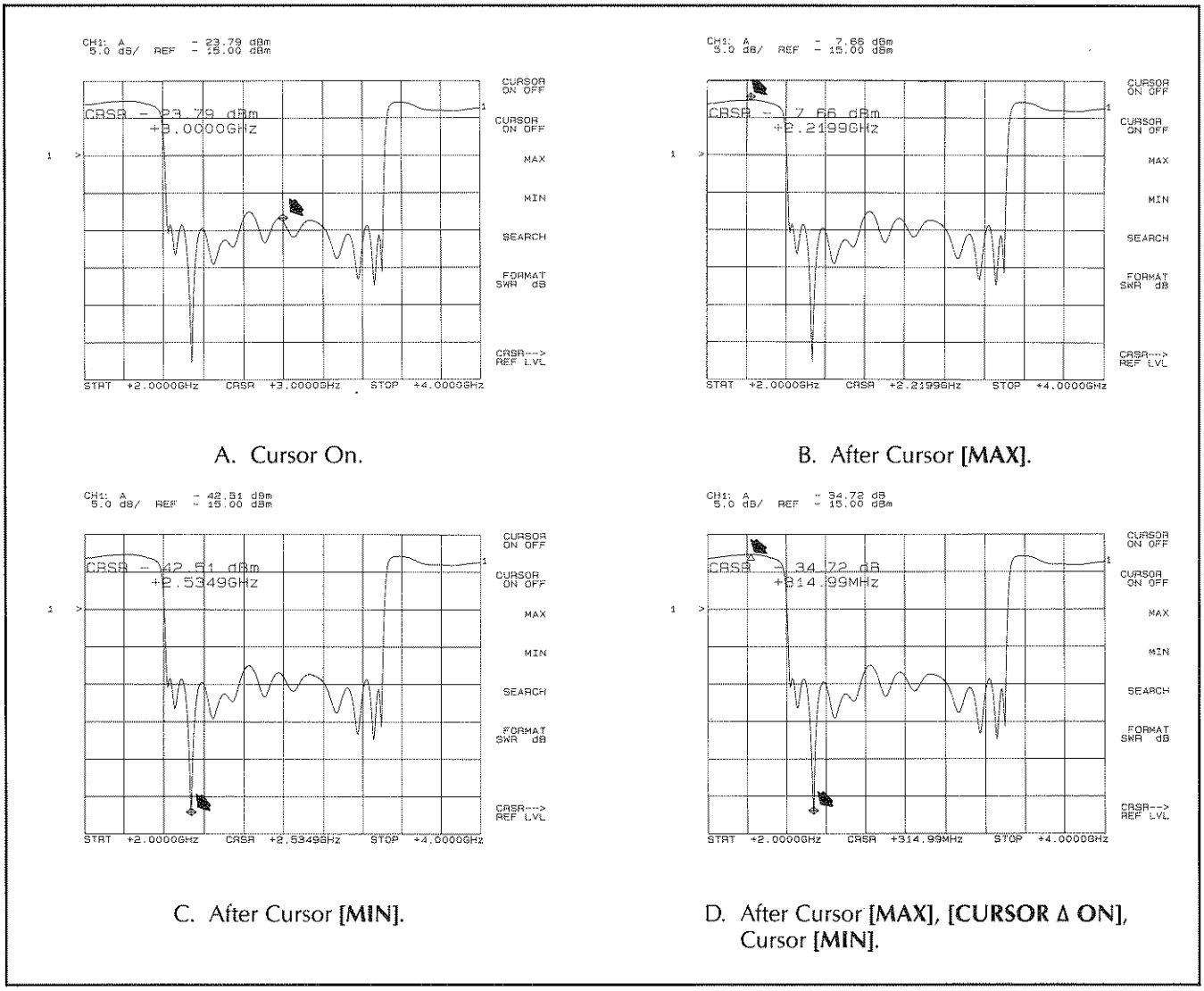


Figure 12. HP 8757A Cursor Modes

Use the knob to move the + to any point on the trace. The magnitude of the cursor is displayed in the mode labels area and its frequency is displayed centered below the grid. The magnitude and frequency of the active channel cursor are also displayed in the active entry area.

- Press **[MAX]**. The + moves to the maximum value of the channel 1 trace.
- Press **[MIN]**. The + moves to the minimum value of the channel 1 trace.
- Press **[CURSOR Δ ON OFF]**. The Δ symbol appears at the + position. The active entry area now displays the magnitude and frequency difference between Δ and +.

Use the knob to move the + to any point on the trace; the Δ position remains unchanged.

- Press **[MAX]** or **[MIN]**. The + moves to the channel 1 maximum or minimum value; the Δ position remains unchanged.
- Press **[CURSOR ΔON OFF]** to turn off the cursor Δ

In addition to the cursor, the HP 8757A can display markers generated by the HP 8350B, as illustrated in Figure 13. Use the source marker selection keys and knob to control these markers. The active HP 8350B marker that corresponds to the blinking HP 8350B marker key is identified by a flag on the marker. With the HP 8757A cursor on, the source markers are shown on the trace but their values are not displayed. With the HP 8757A cursor off, the active source marker value is displayed in the HP 8757A mode labels area, and its frequency in the frequency labels area. All standard HP 8350B marker modes can be used.

[AVG]

The **[AVG]** function key presents the average menu for control of the digital averaging function on the active channel. Averaging computes each data point based on the average value during a specified number of sweeps. This technique improves the accuracy and meaningful resolution of calibration and measurement traces. The number of sweeps over which the trace is averaged is termed the averaging factor.

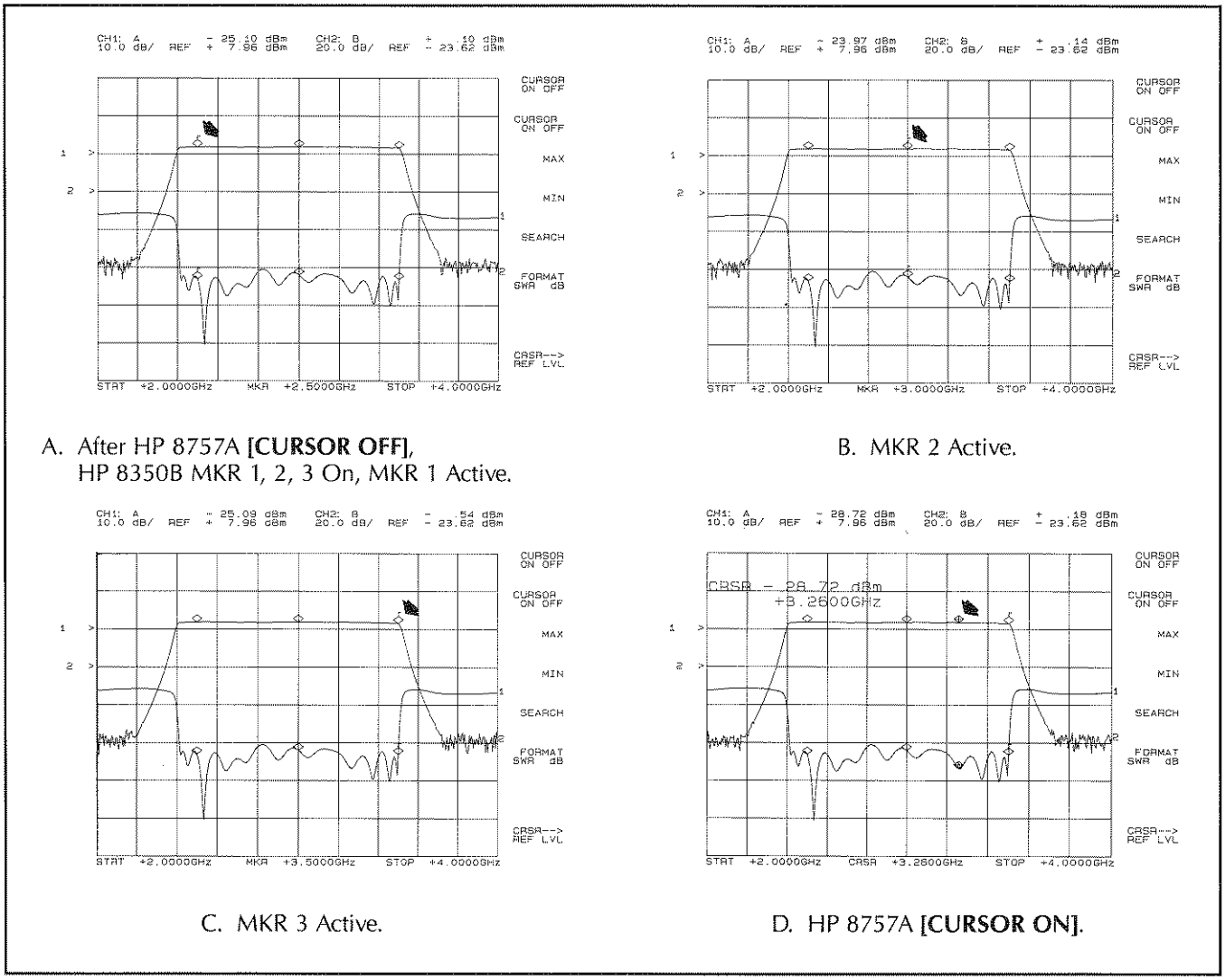


Figure 13. Reading Magnitude and Frequency Using HP 8350B MKR and HP 8757A Cursor

The average menu is shown in Figure 14. The **[RESTART AVERAGE]** key resets averaging and begins the averaging function algorithm again.

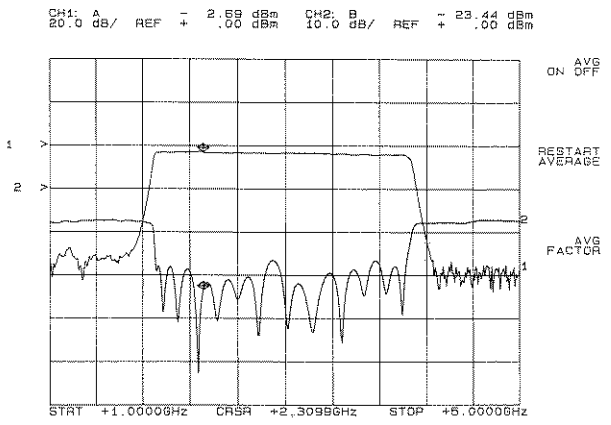


Figure 14. The Average Menu

In usual applications there is no practical value in waiting for more than 2-3n sweeps to produce the final value, where n is the averaging factor. Figure 15 illustrates the effects of averaging on the trace.

To familiarize yourself with control of trace averaging:

- Press CHANNEL **[2]**.
- Press **[AVG]** to present the average menu.
- Press **[AVG ON OFF]** to turn on averaging and to activate the average factor function.
- Use the STEP keys or knob to change the channel 2 average factor.
- Press **[RESTART AVERAGE]** to begin the averaging algorithm again.
- Turn channel 2 averaging off by pressing **[AVG ON OFF]**.

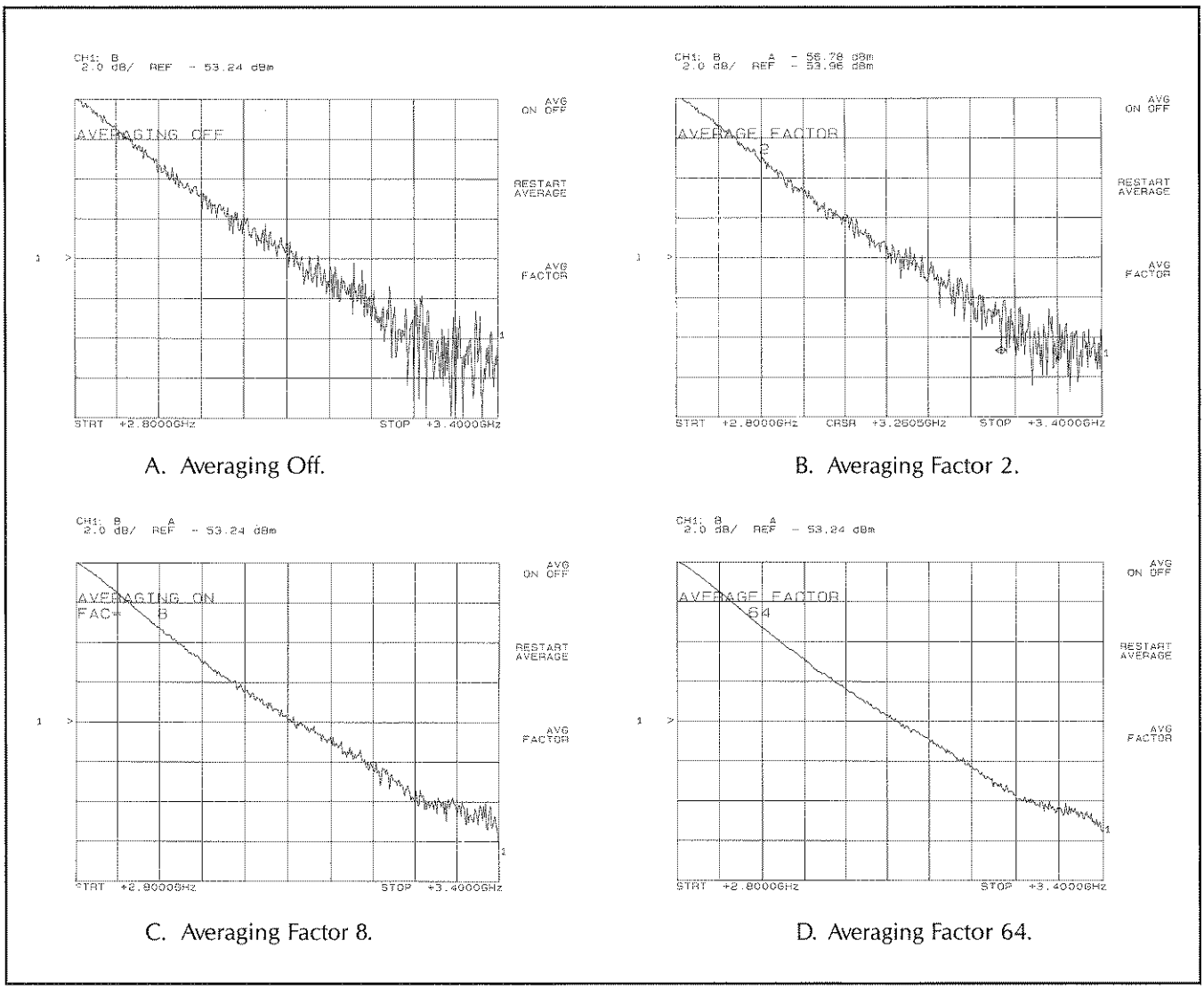
Observe the trace as the averaging factor is changed and averaging is turned on and off. With averaging on the cursor always reads the averaged value.

[CAL]

Scalar network analyzers measure the magnitude response of the device under test relative to the magnitude response of a known standard. In a typical measurement sequence, the standard is connected at the reference plane (the point at which the test device will be connected), then its response is stored. Then the test device is connected and the network analyzer displays the magnitude difference between the response of the standard and the response of the test device. This calibration process is termed normalization. The frequency response of the device under test is normalized to the response of the measurement calibration standard. Thus, frequency response variations of the test setup are automatically removed from the measurement, making it unnecessary to draw calibration lines on the CRT.

Pressing the **[CAL]** function key presents the calibration menu, illustrated in Figure 16. This allows access to several calibration functions. **[MEAS→MEM]** causes the current measurement trace to be stored as the reference trace. This trace is stored with full resolution, regardless of scale and reference settings on the front panel. To view the normalized trace, press the **[DISPLAY]** function key, then **[MEAS–MEM]**. The result is the point by point subtraction of the stored reference trace from the current measurement trace. Each measurement channel has dedicated memory for storage of one reference trace. The reference trace is always stored at full resolution and automatically scaled to the selected scale per division, making it unnecessary to concern yourself with potential scaling errors. In the **[DISPLAY] [MEAS–MEM]** mode, the cursor always reads the normalized value.

Note that the calibration function **[MEAS→MEM]** is also available in the display menu. This provides complete normalization from one menu. Just press **[MEAS→MEM]** then **[MEAS–MEM]** to view the normalized trace.



A. Averaging Off.

B. Averaging Factor 2.

C. Averaging Factor 8.

D. Averaging Factor 64.

Figure 15. Using Averaging to Smooth the Trace

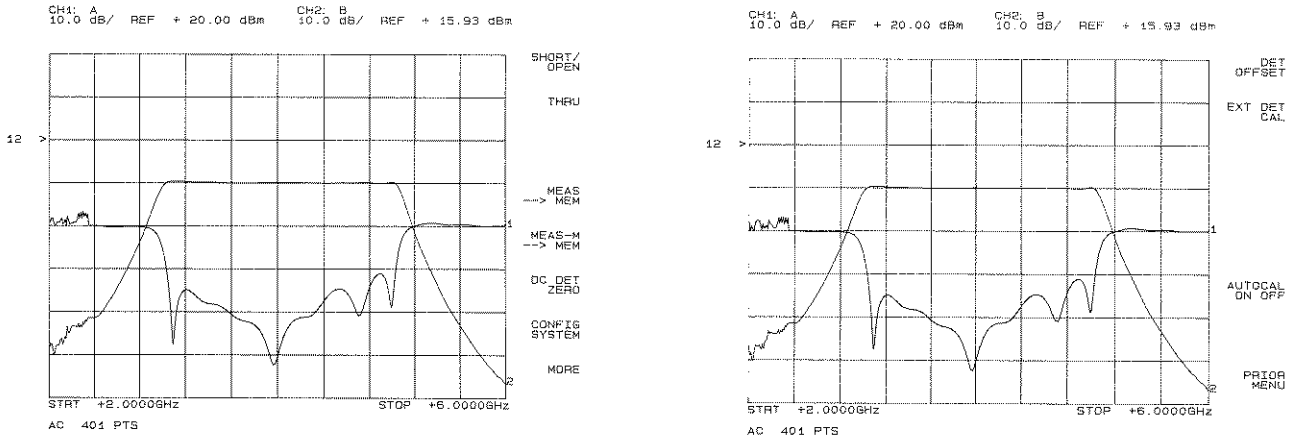


Figure 16. The Calibration Menus

To achieve best accuracy in single channel measurements, do not change the source power level after the reference trace is stored. (For ratio measurements the power level can be changed and the calibration remains valid.) Also, calibrate for measurement using the same adapters and interconnect cables that will be used during measurement. Changing the power level or components in the test setup after the reference trace is stored will result in measurement errors because the reference trace will not represent the frequency response of the altered test setup. If the test setup changes between calibration and measurement, either reconnect the standard and store a new reference trace, or select **[DISPLAY] [MEAS]** to view the uncorrected trace.

Changing the frequency range will also affect the accuracy of the normalized measurement. When the frequency range is increased, the stored reference trace and the measurement trace pertain to different frequency ranges, and the normalization is not valid. When the frequency range is decreased after normalization, the calibration data can be adapted to fit the new frequency range using the "adaptive normalization" feature of the HP 8757A. This function is activated by pressing **[SYSTEM] [ADPT NM ON]**.

To ensure good repeatability the test port and detector port connectors must be clean, in good condition, and properly tightened. If the test setup is not stable during the test and from connection to connection, the actual frequency response of the test setup will not be removed from the measurement of the device under test.

Transmission Calibration

The usual calibration standard for transmission measurements is a "thru" (connect the points at which the test device will be connected). Since the insertion loss between the test port and the detector port should be 0 dB, a convenient reference point is obtained. Making a thru connection with **[DISPLAY] [MEAS]** selected displays the transmission signal path frequency response of the measurement system. If the test device connectors make it impossible to connect the thru and then the test device without switching adapters, switch between detector port adapters with similar insertion and return loss characteristics.

To perform a thru calibration, follow these steps:

- Press the **[DISPLAY]** function key then the **[MEAS]** soft key to see the reference line.
- Press the **[CAL]** function key to bring up the calibration menu.
- Press **[THRU]**, and the prompt "CONNECT THRU. . . STORE WHEN READY" appears in the active entry area.
- Connect the thru (detector to test port), and store by pressing **[STORE THRU]**. The thru trace is stored in the memory of the active channel.

Note: Instead of using the **[THRU]** key, the reference trace can be stored into memory using the **[MEAS→MEM]** key in either the calibration menu or the display menu. However, with the **[THRU]** key you are prompted to make the thru connection.

- Press the **[DISPLAY]** function key, then **[MEAS–MEM]** to display the normalized trace.

Note: No matter what was displayed before calibration is performed, the full resolution calibration data (**[MEAS]**) is stored in memory with **[MEAS→MEM]**, even if **[MEM]** or **[MEAS–MEM]** is displayed.

Reflection Calibration

The usual calibration standard for reflection measurements is a short circuit connected at the reference plane (the point at which the test device will be connected). A short circuit reflects all incident power, so a convenient 0 dB reference line is obtained. Connecting the short circuit at the test port with **[DISPLAY] [MEAS]** selected displays the reflection frequency response of the measurement system. Always calibrate for reflection using the same adapter that will be used for the measurement.

However, using only a short circuit for reflection calibration can cause errors in the calibration routine. Mismatches and leakages in the test setup cause calibration and measurement errors that vary as a function of the reflection and transmission characteristics of the device being measured. For example, connecting a short circuit at the test port produces a trace that includes variations due to losses in the test set as well as variations due to mismatch and bridge directivity effects between the measurement system and the short circuit. Some percentage of the signal reflected by the short circuit is re-reflected by mismatches in the test setup. This causes the power incident at the test port to vary

depending upon interactions between the incident signal and the re-reflected signal. The result of this interaction is that the reference trace does not represent the actual 0 dB reflection signal.

Using proper standards, the short/open average reflection calibration sequence reduces measurement uncertainty for all reflection measurements. By averaging the responses of the short circuit and the shielded open circuit, mismatch and directivity effects are canceled to produce a more accurate reflection frequency response reference trace than if either standard were used alone.

To obtain maximum benefit from this technique, the short circuit and the shielded open circuit must exhibit equal return loss (0 dB), and the phase response of the shielded open must be opposite (180 degrees different) to the short circuit over the entire frequency range of interest. If the standards do not have these characteristics, improvements in measurement calibration accuracy are minimal and, in fact, additional errors may actually be introduced in the reference trace.

To perform a short/open calibration, use the following procedure:

- Press **[SHORT/OPEN]**. Although the short circuit is the best single standard for scalar reflection calibration, the response contains errors due to source match and directivity. These effects on the reflection calibration trace are removed by averaging the response of a short and a shielded open circuit.
- The prompt "CONNECT SHORT. . .STORE WHEN READY" is displayed. Connect a short circuit to the test port.
- Press **[STORE SHORT]**.
- The prompt "CONNECT OPEN. . .STORE WHEN READY" is displayed. Connect a shielded open to the test port.
- Press **[STORE OPEN]**.
- The message "SHORT/OPEN CAL SAVED IN CH1 MEM" is displayed.
- Press the **[DISPLAY]** function key, then **[MEAS–MEM]** to display the normalized trace.

Note: No matter what was displayed before calibration is performed, the full resolution calibration data (**[MEAS]**) is stored in memory with **[SHORT/OPEN]** even if **[MEM]** or **[MEAS–MEM]** is displayed.

This technique produces a more accurate value for reflection signal path frequency response.

[DC DET ZERO] is used for zeroing the HP 85025A/B detectors in DC mode. This zeroing is unnecessary in the AC detection mode (the default mode).

[CONFIG SYSTEM] enables the HP 8757A to poll the detector inputs to determine the type of detector (AC or AC/DC) connected to each input. If a DC detector is connected, a sensitivity resistor and a thermistor internal to the detector are read, and correction factors are generated.

For more information on **[DC DET ZERO]** and **[CONFIG SYSTEM]**, refer to "Using DC Detection."

[MORE] brings up the second CAL menu.

Other calibration functions are also available in the second calibration menu, for example, the detector offset functions. The **[DET OFFSET]**, **[DET A]**, **[DET B]**, **[DET C]** (Option 001), and **[DET R]** keys provide a means to enter detector calibration factors.

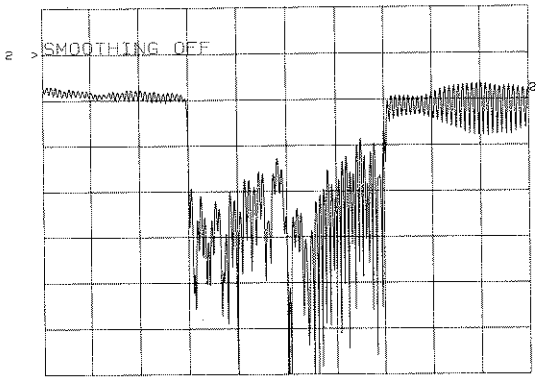
Select the network analyzer input port then enter a dB value using the knob (0.01 dB resolution), the step keys (0.05 dB/step), or the numeric keys (0.01 dB resolution), then press the **[dBm/dB]** units key. This offset is automatically applied to the displayed trace. For most measurements this factor is set at 0.00.

Use the detector offset capability to produce better accuracy in power measurements when appropriate calibration facilities are available. If careful comparison with a power meter shows the power measured by the HP 8757A to be offset by a fixed value over the frequency range of interest, then add or subtract that value to make the measurements agree.

[SPCL]

The **[SPCL]** function key allows access to a menu of special functions for the active channel.

When activated, the **[SMOOTH ON OFF]** function levels out the trace by computing each data point based on the average of nearby data points. The window of data used



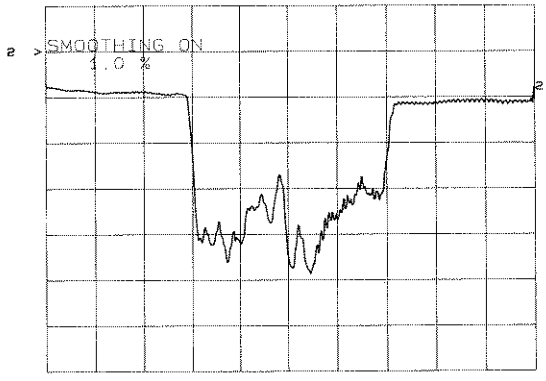


Figure 17. The Effect of Smoothing on the Data

to compute this average determines how much the data will be smoothed. This is adjusted with the **[SMOOTH APERT]** function and the data entry area. Figure 17 illustrates the effect of smoothing on the data.

To activate smoothing on channel 1, follow this procedure:

- Press CHANNEL **[1]**, then **[SPCL]** to bring up the SPCL menu.
- Press **[SMOOTH ON OFF]** to activate smoothing.
- Press **[SMOOTH APERT]**, then use the knob and STEP keys to adjust the data window used by the smoothing algorithm. To enter 2% smoothing, press **[2] [ENT]**.

Smoothing is different from averaging. Averaging computes each data point based on the average value during several sweeps. Smoothing computes each data point based on one sweep, but on the average of a "window" of many data points for the current sweep. The window or smoothing aperture is a percent of the span swept, but less than or equal to 20%.

Another function available from the special functions menu is limit lines. Pressing **[ENTER LIM LNS]** brings up the limits menu, where up to 12 upper or lower limits can be entered as single frequency limits, flat line limits, or sloped line limits. **[LIM LNS ON OFF]** is used to turn the limit line test on or off after entering limits with the limits menu.

INSTRUMENT STATE KEYS

The keys in the INSTRUMENT STATE area of the front panel are used to control system functions that apply not to a single channel but to the entire instrument state.

[SYSTEM]

The **[SYSTEM]** key brings up the system menus, shown in Figure 18. These menus allow access to a variety of functions that are described briefly here. For more detail, refer to Operating Information in the HP 8757A Operating Manual.

The system functions used most are **[PLOT]** and **[PRINT]**, which enable the operator to get a hard copy of measured data from a digital plotter or printer.

The **[PLOT]** soft key brings up the plot menu for more complete plotter control. This menu, shown in Figure 19, lets you plot all **[PLOT ALL]** or part **[PLOT TRACES]**, **[PLOT LABELS]**, **[PLOT GRID]** of the measurement using the default plot parameters or user-defined parameters. **[DEFINE CUSTOM]** presents another menu that allows you to define the parameters to be plotted, and **[PLOT CUSTOM]** is used to draw a plot using the parameters you have defined.

[PRINT] in the system menu brings up the **[PRINT]** menu key. **[PRINT GRAPH]** instructs the HP 2225A ThinkJet printer to draw the grid, labels, trace data, cursor, and markers. The limit lines are not printed.

[PRINT DATA] instructs the printer to output a listing of all displayed data points, both magnitude and frequency. **[PRINT MKRS]** instructs the printer to list just the markers and the cursor if on.

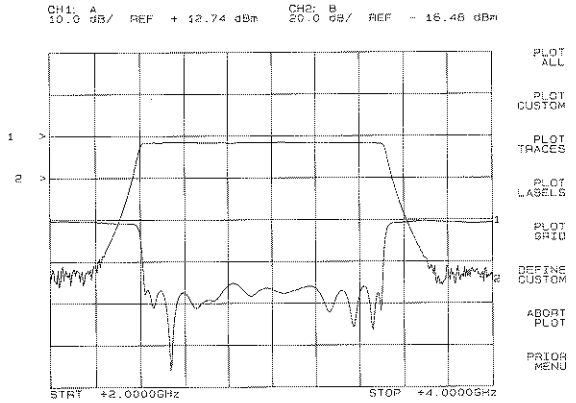
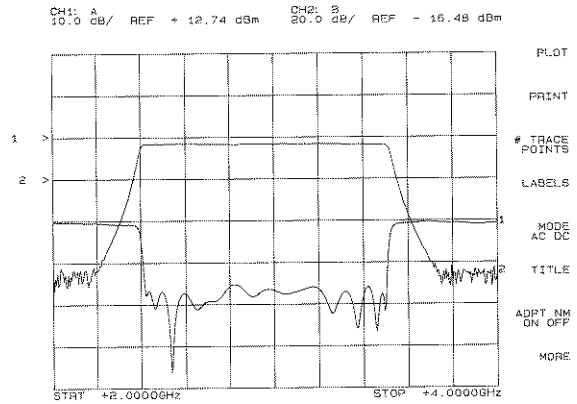


Figure 19. The Plot Menu



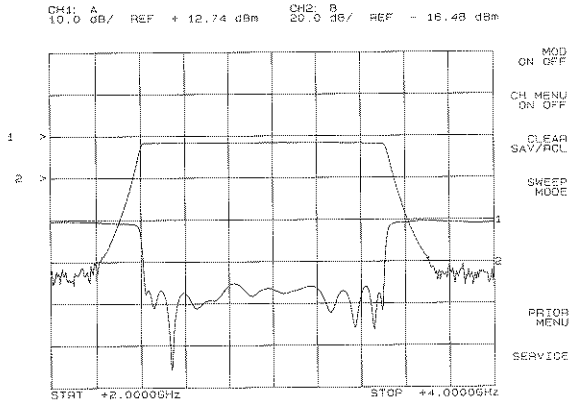


Figure 18. The System Menus

If the message "NO PLOTTER (or PRINTER) AVAILABLE" appears, the plotter (or printer) is off, not connected, or the address is not set to the address expected by the HP 8757A (normally 705 for the plotter and 701 for the printer).

If the message "PLOTTER (or PRINTER) NOT READY" appears, the plotter (or printer) is not ready for plotting (paper not loaded or other error). Correct the problem, then try plotting again. **[ABORT PLOT]** stops the plot and returns the pen.

Pressing **[# TRACE POINTS]** on the system menu presents the # trace points menu, shown in Figure 20. This lets you select the number of data points to be used by the HP 8757A in processing and displaying the data. Selecting fewer points means lower resolution but allows you to use faster sweep times and more traces. This is valuable for making adjustments on the devices. With 1601 point resolution, the sweep time can be as low as 400 ms, but only one trace can be displayed. Table 4 shows the minimum sweep time and the maximum number of traces for each selection in this menu.

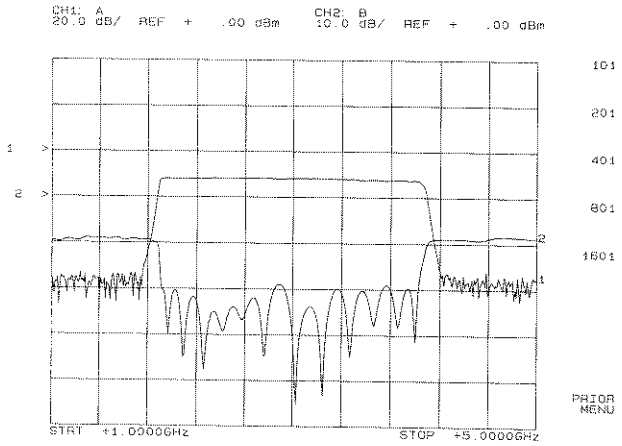


Figure 20. The # Trace Points Menu

Table 4. Minimum Sweep Time/ Maximum Number of Traces

# Points	Minimum Sweep Time (ms)			
	1 Trace	2 Traces	3 Traces	4 Traces
101	40	50	60	70
201	50	75	90	100
401	100	100	150	200
801	200	250	NA	NA
1601	400	NA	NA	NA

Pressing the **[LABELS]** soft key on the system menu presents the labels menu shown in Figure 21. All the labels can be turned off, or just the frequency labels on both the HP 8757A and the compatible HP source. The title can also be turned off and on as desired. If the System Interface is not connected, START and STOP frequency labels can be written by the user.

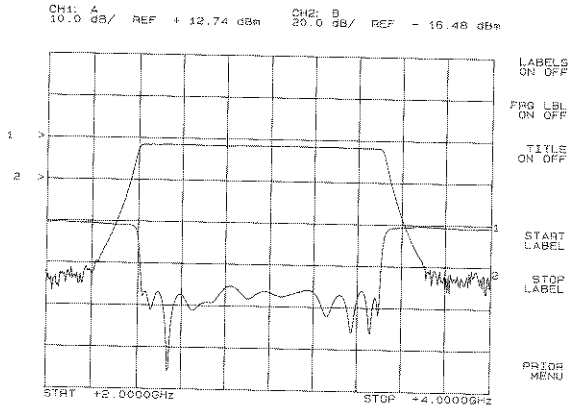


Figure 21. The Labels Menu

Pressing **[TITLE]** on the system menu presents the title menu in the soft key labels area and the character set in the active entry area. By rotating the knob (or by using the **[STP ONE RIGHT]** and **[STP ONE LEFT]** soft keys), a character can be selected and entered by pressing the **[SELECT CHAR]** soft key. The complete title is entered by pressing the **[DONE]** soft key. This title can be turned on and off from the labels menu. When the title is on it is plotted with the data.

The **[MODE AC DC]** key is used to switch between AC and DC detection modes. In AC mode, the detectors detect the envelope of a square wave modulated RF signal. This can be used with either the HP 11664A/E detectors or the HP 85025A/B detectors. DC mode (no modulation) can be used only with the HP 85025A/B detectors. In DC mode, the detector zeroing and control of the source modulation is provided automatically by the HP 8757A. Refer to "Using DC Detection" for more details.

[ADPT NM ON OFF] controls the adaptive normalization feature, which adjusts the calibration data as the frequency range is changed. This makes it possible to narrow in on part of the frequency range without recalibrating.

The **[MORE]** soft key presents another system menu, which allows access to more system functions. **[MOD ON OFF]** controls the 27.778 kHz modulation drive output on the rear panel of the HP 8757A. **[CH MENU ON OFF]** allows the user to disable the channel menu. **[CLEAR SAV/RCL]** allows the user to clear the save/recall registers. **[SWEEP MODE]** presents the sweep mode menu which lets the user specify the type of sweep supplied by a source not compatible with the 8757 System Interface. The **[SERVICE]** key on the second system menu allows access to many servicing functions, detailed in Section VIII of the Service Manual.

[LOCAL]

The **[LOCAL]** instrument state key presents the local menu, shown in Figure 22, which lets the user change the addresses of all the instruments in the system. The recommended addresses are listed in Table 5. When an instrument address is changed using this menu, the HP-IB address on the instrument itself may need to be physically reset.

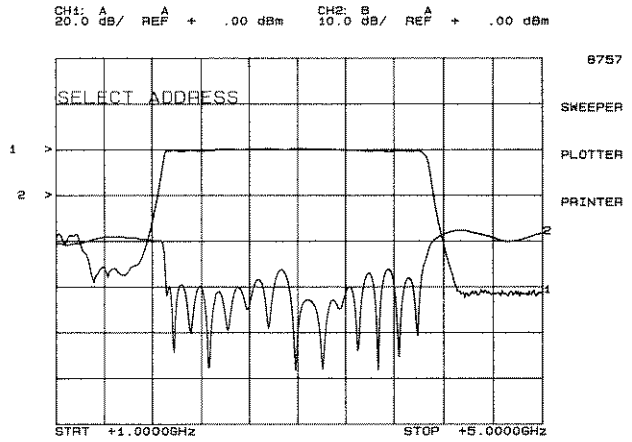


Figure 22. The Local Menu

Table 5. Factory Set Instrument Addresses

Instrument	Address
HP 8757A	16
Sweeper	19
Plotter	05
Printer	01

[SAVE] and [RECALL]

The **[SAVE]** and **[RECALL]** keys are used to save and recall up to nine complete front panel states. If the 8757 System Interface is connected, the front panel state of the sweeper is also saved or recalled. The stored memory for channels 1 and 2 only is saved along with the instrument state in registers 1 through 4 only. This memory trace is stored at 401 points regardless of the number of points selected for the measurement. If a different number of points was selected, the data is adjusted by duplicating points (for 101 or 201 points selected) or taking every second point (for 801) or every fourth point (for 1601).

Registers 1 through 4 only can save title and limit line entries with each instrument state.

The instrument states are stored in non-volatile memory, and will be available even if power goes off, until the registers are either written over or cleared using the **[CLEAR SAV/RCL]** function in the system menu.

[PRESET]

The green **[PRESET]** key returns the instrument to the preset condition shown in Figure 4.

TRANSMISSION MEASUREMENTS

The HP 8757A can measure transmission using any of the four display channels with either a single detector (A, B, C (Option 001), or R) or two detectors in a ratio measurement (A/R, B/R, etc.).

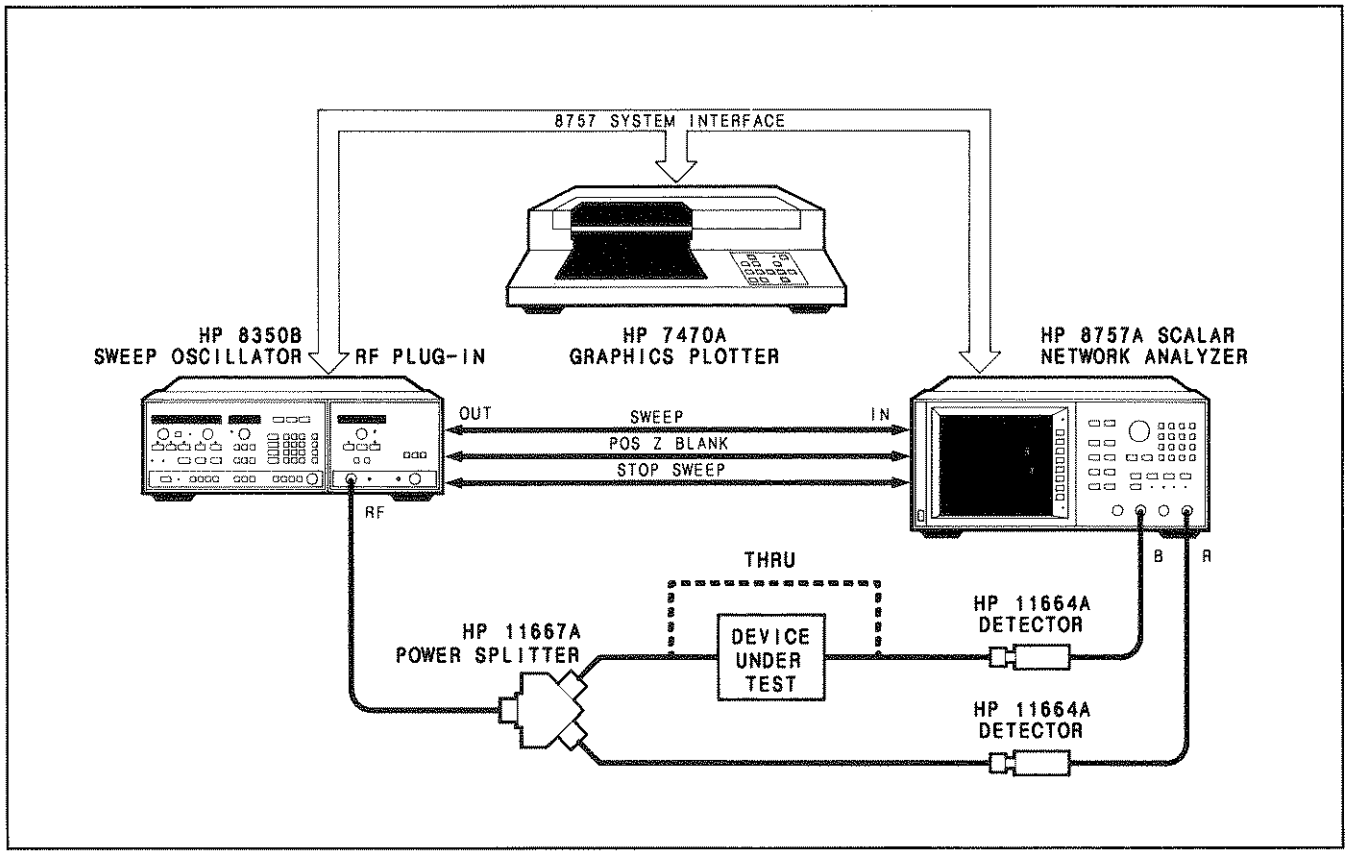


Figure 23. Transmission-Only Ratio Measurement Setup

Transmission Test Setup

The simplest transmission setup is to connect the detector directly to the source output for calibration, then insert the device under test between the source and the detector for measurement. A potential problem when connecting the detector directly to the source output is error due to source power variations caused by source mismatch effects.

Improving Source Match

The setup shown in Figure 23 adds a power splitter and a detector to obtain power for the R (reference) input. Select **[MEAS] [B/R]** to view the response. This ratio technique provides an improvement in effective source match characteristics of the setup by removing stimulus power variations common to both the reference (R) and test (B) inputs. This technique is especially appropriate for measurement of low insertion loss devices and for devices with poor input match . Source match can also be improved by leveling the source externally or by isolating the source with an attenuator or directional bridge.

For most applications (assuming a leveled source, a signal separation device with good source match, and a low reflection test device), this ratio technique is not mandatory to achieve high accuracy. If the source is not leveled, or if a long cable is used to connect the source to the directional bridge, or if the power level varies between calibration and measurement (such as in gain compression tests), the ratio technique must be used.

Insertion Loss or Gain Measurements

This sequence lists the steps for a typical insertion loss or gain measurement.

Calibration:
- Connect instruments as shown in Figure 23.
- Press CHANNEL **[2]** to activate channel 2.
- Press **[MEAS]** then **[B]** or **[B/R]**.
- Press **[DISPLAY]** and select **[MEAS]**.
- Press **[CAL]** then **[THRU]** (soft key).
- Connect thru (connect B detector to test port).
- Press **[STORE THRU]**.
- Press **[DISPLAY]** and select **[MEAS–MEM]**.

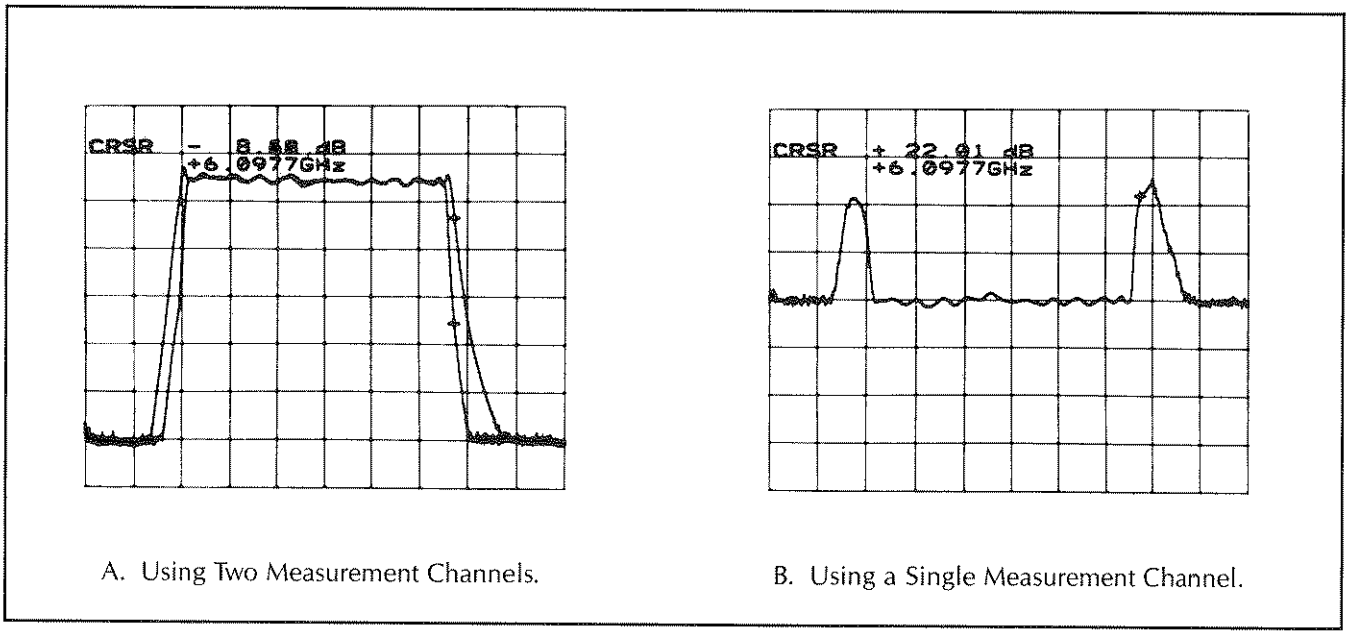
Measurement:
- Connect test device.
- Press **[CURSOR]** and position cursor using the knob.
- Read magnitude and frequency.

Calibration sets a zero dB reference with the thru connection. After the test device is connected, a negative measured value indicates insertion loss; a positive value indicates gain.

Relative Measurements

To measure the difference between two points on the trace, select **[CURSOR ON]**, position the cursor to the first point, then select **[CURSOR Δ ON]**. Moving the cursor to a second point using the knob, cursor **[MAX]**, or cursor **[MIN]** displays the magnitude and frequency difference between the two points. The frequency difference is always displayed as a positive number; the magnitude difference is displayed as positive or negative depending upon whether the second value is greater or less than the first value, respectively.

The following sequence measures the left and right 3 dB frequencies of a filter, using the n-dB search, which interpolates between data points to find the exact −3.00 dB frequencies.



A. Using Two Measurement Channels.

B. Using a Single Measurement Channel.

Figure 24. Matching Devices

Press **[CURSOR]**, then **[MAX]**.

Select **[CURSOR Δ ON]**.

Press **[SEARCH]** (default search value = −3.00 dB)

Press **[SEARCH LEFT]**, then **[PRIOR MENU]**.

Select **[CURSOR Δ OFF]**.

Read left −3 dB frequency.

Select **[CURSOR Δ ON]**.

Press **[SEARCH]** then **[SEARCH RIGHT]** then **[PRIOR MENU]**.

Select **[CURSOR Δ OFF]**.

Read right −3 dB frequency.

The **[BANDWIDTH]** key can be used for a quick reading of the −n dB bandwidth. Note that the **[SEARCH]** and **[BANDWIDTH]** functions interpolate between data points to find the exact n dB values.

Without the **[SEARCH]** and **[BANDWIDTH]** functions, notice that you may not be able to place the cursor exactly on the −3 dB frequency point. Magnitude values are digitized with 0.003 dB resolution for power measurements, and 0.006 dB resolution for ratio or normalized measurements. In all cases the magnitude value is rounded to 0.01 dB resolution for display. Thus, if a frequency sweep of 1000 MHz is digitized at 401 points, the frequency resolution is 1000/401, or about 2.5 MHz per increment. Moving the cursor one increment results in about 2.5 MHz change in the frequency reading. The **[SEARCH]** and **[BANDWIDTH]** functions interpolate between these points to locate the exact −3 dB frequency.

Matching

Matching the transmission characteristics of two test devices using a single measurement channel is a simple procedure using normalization. First connect the standard device, then press **[DISPLAY]**, **[MEAS→MEM]**, **[MEAS–MEM]**. The trace should be a flat line. Now connect the test device. As shown in Figure 24, the trace shows the difference between the standard device and the test device. When the trace is flat, the response of the test device is the same as the response of the standard device.

Using Alternate Sweep

The alternate sweep capability of the HP 8350B and 8340A or 8341A sources is a simple means to display two independent frequency sweeps simultaneously (see Figure 25). The alternate sweep mode described here uses the save and recall functions of the HP 8757A and 8350B to produce a sweep of one frequency width for display as the channel 1 measurement trace, and a different sweep width for display as the channel 2 measurement trace. Use the following sequence to define conditions for alternate sweep.

Press **[PRESET]**.

Press CHANNEL **[1]**, select **[CHAN 2 OFF]**.

Press **[MEAS]** then **[B]**.

Set channel 1 start/stop frequencies on source.

Press **[SAVE] [1]**.

Press CHANNEL **[2]**, select **[CHAN 1 OFF]**.

Set channel 2 start/stop frequencies on source.

Press **[SAVE] [2]**.

Press **[RECALL] [1]**.

On the HP 8350B press **[ALT n] [2]**.

Proceed with the calibration and measurement sequence.

The start, stop, and cursor frequencies for channels 1 and 2 are displayed in the frequency labels area below the grid. Calibrate and adjust each channel separately. The active channel is brighter. To exit the alternate sweep mode, press to extinguish the HP 8350B **[ALT n]** key.

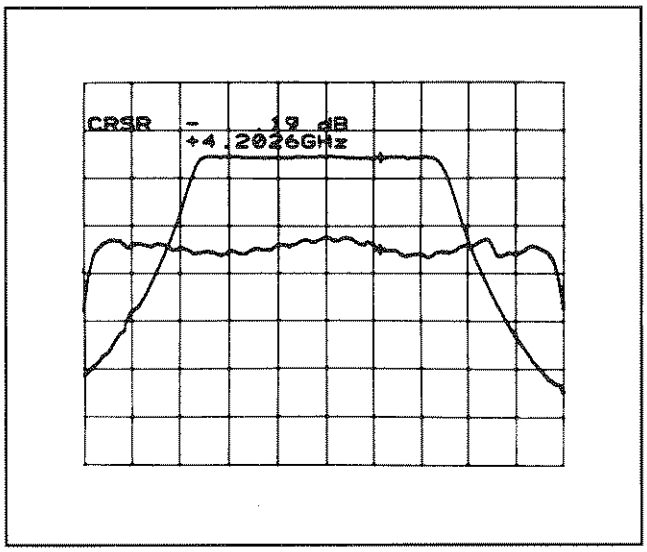


Figure 25. HP 8350B Alternate Sweep

Measuring Active Devices

A typical transmission and reflection measurement on a passive device uses an arbitrary input power level. Stimulus power to the device under test is set so that maximum dynamic range is achieved. For active devices (devices with gain), it is usually necessary to measure the response to varying input levels. This means that a ratio setup must be used to obtain best results. In general, the test setup to measure devices with gain is the same as to measure insertion loss. If the output power of the device under test exceeds +16 dBm, it is necessary to insert an attenuator at the detector input during calibration and measurement.

RF modulation required for the HP 11664 detectors and for the HP 85025 detectors in AC mode is usually provided by internal capabilities of the HP 8350B source. On **[PRESET]** the HP 8757A is set to AC mode (all inputs) and the sweeper output is modulated. For test devices that cannot accept the 27.778 kHz modulation frequency, there are several potential solutions.

Amplifiers with high gain at 27.778 kHz have the potential of saturating on the modulation drive feedthrough. Use the HP 11668A high pass filter inserted between the source and the amplifier to attenuate the 27.778 kHz modulation signal. This device reduces the modulation drive feedthrough from about 8 mV to about 1 mV and helps prevent possible amplifier saturation.

Other types of amplifiers may not tolerate even the attenuated modulation drive feedthrough. These include amplifiers using high-gain internal leveling circuits, types of high power TWT amplifiers operating in saturation, and amplifiers that are subject to self-biasing effects (such as some FET amplifiers). For these devices the test signal at the device input must not be modulated. The DC detection mode of the HP 85025A/B detectors is ideal for these measurements. For further information refer to "Using DC Detection."

Gain Compression

Measurement of gain compression is useful for characterizing the power handling capability of an amplifier. The 1 dB compression point of an amplifier is an indicator of the maximum output power possible before the gain linearity and associated distortion becomes excessive. Gain compression measurements can be made in CW or swept modes; the following example uses the CW mode with power sweep to characterize gain versus input power level.

Connect ratio setup shown in Figure 23.

Connect detector B to measure power at test port.

Connect detector R to the reference arm of the power splitter.

Press CHANNEL **[1]**.

Press **[MEAS] [B/R]**, **[DISPLAY] [MEAS]**.

Press CHANNEL **[2]**.

Press **[MEAS] [B]**, **[DISPLAY] [MEAS]**.

Press CHANNEL **[1]** or **[2]**, then **[CHAN 4]**.

Press **[MEAS] [R]**, **[DISPLAY] [MEAS]**.

HP 8350B:
Press **[SH] [CW]**, set desired frequency.
Set **[POWER LEVEL]** to starting power level.
Set **[POWER SWEEP]** to desired dB/SWP.

Press CHANNEL **[1] [DISPLAY] [MEAS→MEM] [MEAS–MEM]**.
(This calibrates the system frequency).

Connect test port to amplifier input.

Connect detector B to amplifier output.

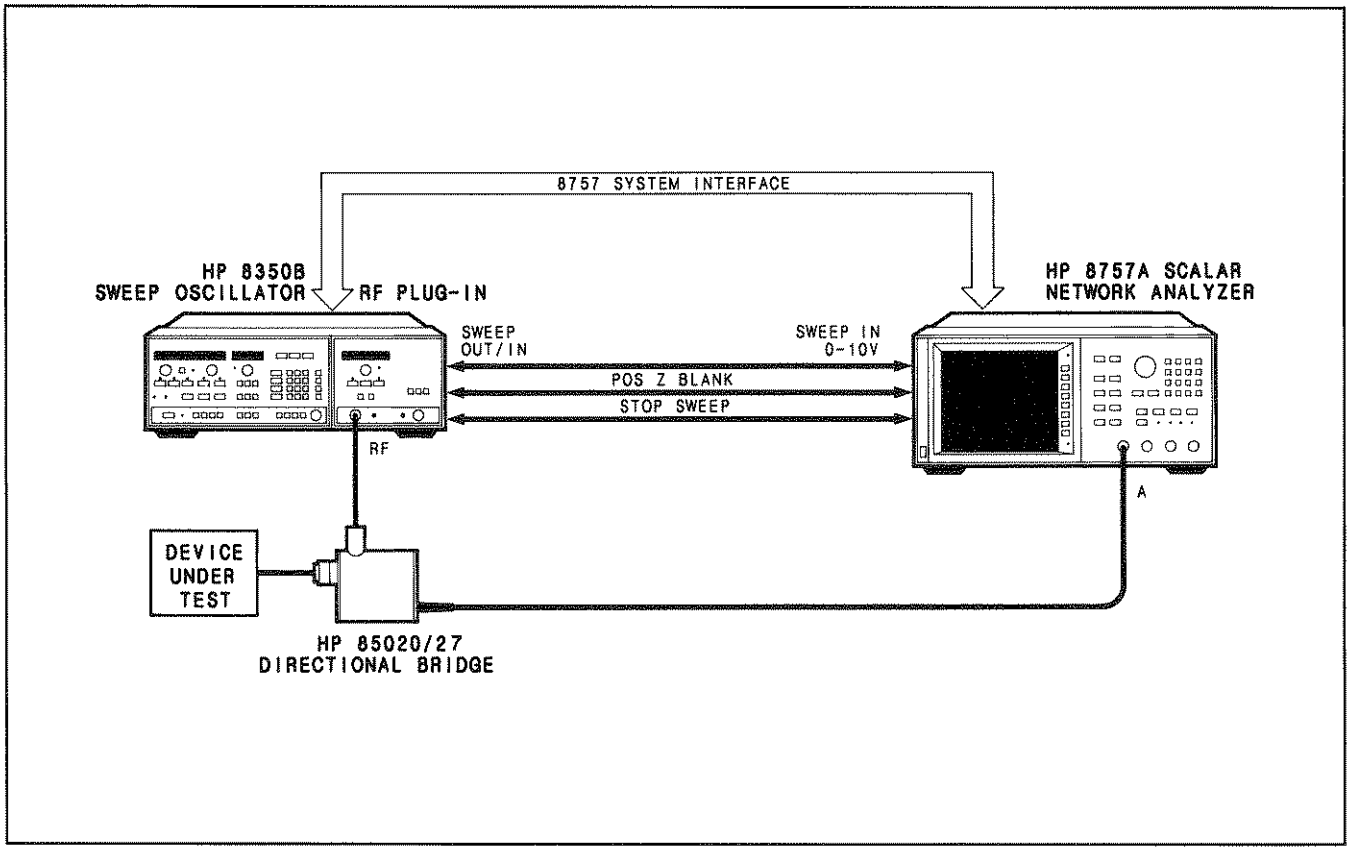


Figure 26. Measurement Setup for Reflection Measurements in AC or DC Mode

Channel 1 displays the amplifier gain response, channel 2 displays output power, and channel 4 displays input power. If the signal level to the amplifier is sufficient to cause compression, the amplifier response will increase, then begin to decrease with increasing power input. Use cursor **[MAX]** and **[CURSOR Δ]** to find the 1 dB compression point.

Swept gain compression measurements can also be made using the alternate sweep function to display small signal gain on one channel and large signal gain on the other. Both measurements are real time.

Non-Insertable Devices

A problem sometimes encountered in evaluating the accuracy of transmission measurements is that of measuring non-insertable devices. A non-insertable device has input and output connectors of types that will not mate. This means that it is necessary to change components in the setup between calibration and measurement. You can use a "bullet" (male-to-male) or "barrel" (female-to-female) adapter to make the thru connection, or you can switch one adapter to make the thru. When the device is measured, the normalized trace will be in error by the difference in frequency response characteristics between the calibration and measurement configurations.

In most situations the worst choice is to use the bullet or barrel during calibration. Better results are obtained by switching between matched adapters. If you are only making transmission measurements it usually does not matter which adapter, the test port or the detector port, is switched to make the thru. If you are also measuring reflection, only the detector port adapter should be switched.

Whatever the test setup, the ideal procedure is to calibrate using the same adapters and cables that will be used for the measurement. If it is necessary to change adapters between calibration and measurement, best accuracy is achieved by switching between detector port adapters having equal insertion and return loss characteristics.

REFLECTION MEASUREMENTS

The HP 8757A can measure reflection using any channel with either a single detector or two detectors in a ratio measurement.

Reflection Test Setup

For typical reflection measurements connect the device under test to the directional bridge test port as shown in Figure 26. The HP 85020 directional bridges use the AC detection mode for detecting the reflected signal. The HP 85027 directional bridges use either AC or DC detection mode. If adapters are required, use the same adapter for calibration and measurement. For ratio measurements, insert a power splitter or coupler at the source for the reference signal (R).

For reflection measurements it is particularly important to use a high quality test port adapter. Since the adapter quality directly affects the system source match and directivity characteristics, the best accuracy solution is to select a directional bridge with the correct test port connector. If you test many different devices with several different connector types, choose the HP 85027A directional bridge with an APC-7 connector, then use the best available adapters.

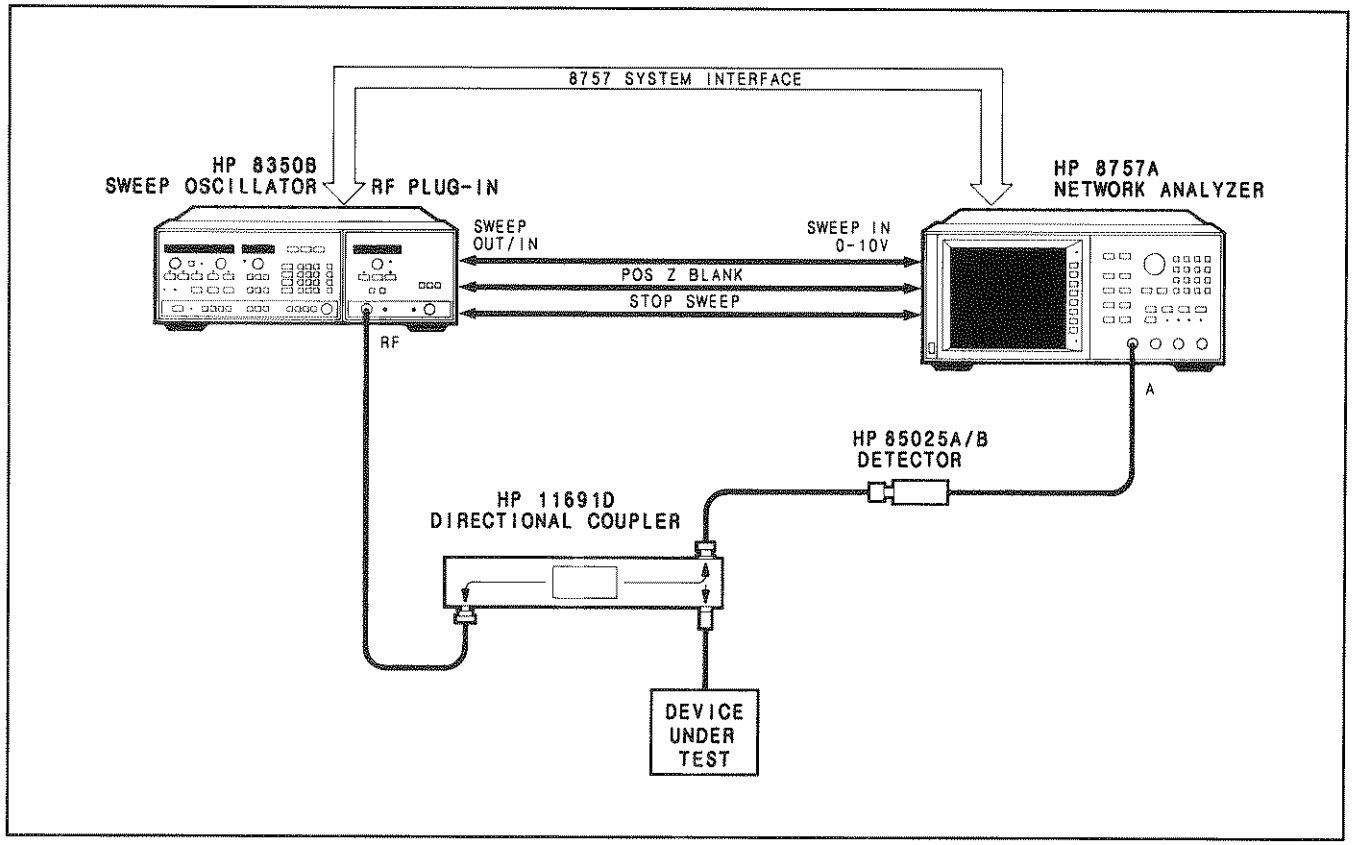


Figure 27. Alternate Measurement Setup for Reflection Measurements Using a Directional Coupler

For testing reflection of low loss two-port devices, best accuracy is achieved by terminating the device output port with a very good 50-ohm termination rather than with a detector. Using a very good termination reduces the effect of output mismatch on the reflection measurement.

To take full advantage of the reflection measurement dynamic range afforded by the 40 dB directivity of the HP 85027A directional bridge, the RF input level to the directional bridge should be at least +7 dBm.

Reflection measurements can also be made using a directional coupler and detector as shown in Figure 27. The coupler has less loss than the bridge, but typically does not cover such a broad bandwidth.

Return Loss (SWR) Measurements

This sequence lists the steps for a typical return loss measurement. The procedure shows the short/open average reflection calibration technique available using the CAL menu.

Calibration (short/open average):
- Press CHANNEL **[1]** **[MEAS]** then **[A]** (or **[A/R]** for ratio measurement).
- Press **[CAL]** then **[SHORT/OPEN]**.
- Connect short circuit.
- Press **[STORE SHORT]**.
- Connect shielded open circuit.
- Press **[STORE OPEN]**, and the short/open average is stored in calibration memory.
- Press **[DISPLAY]** then **[MEAS–MEM]**.

Measurement:
- Connect test device.
- Press **[CURSOR]** then **[FORMAT SWR dB]** to read the SWR value in the active entry area.

Calibration sets a zero dB reference with the short/open average. After the test device is connected, a negative measured value indicates that the reflected power is less than the incident power.

Short/Open Average Reflection Calibration

The short/open average reflection calibration can improve the accuracy of any reflection measurement if proper standards are used. You can test the standards by performing the short/open calibration then re-measuring the standards and evaluating the results. Figure 28 shows plots of two different sets of short/shielded open circuit pairs after performing the short/open average calibration. Note that in A the traces are symmetrical about the flat reference line; in B the center of the normalized traces is not flat. If the responses are not symmetrical (approximately equal excursions from a flat reference line), then the short and shielded open circuit standards do not exhibit opposite phase response across the frequency range.

Source match (test setup impedance looking back into the test port) can be approximated by measuring the peak-to-peak amplitude of the short/open ripple pattern. Use the equation:

Test Port SWR = 10**x

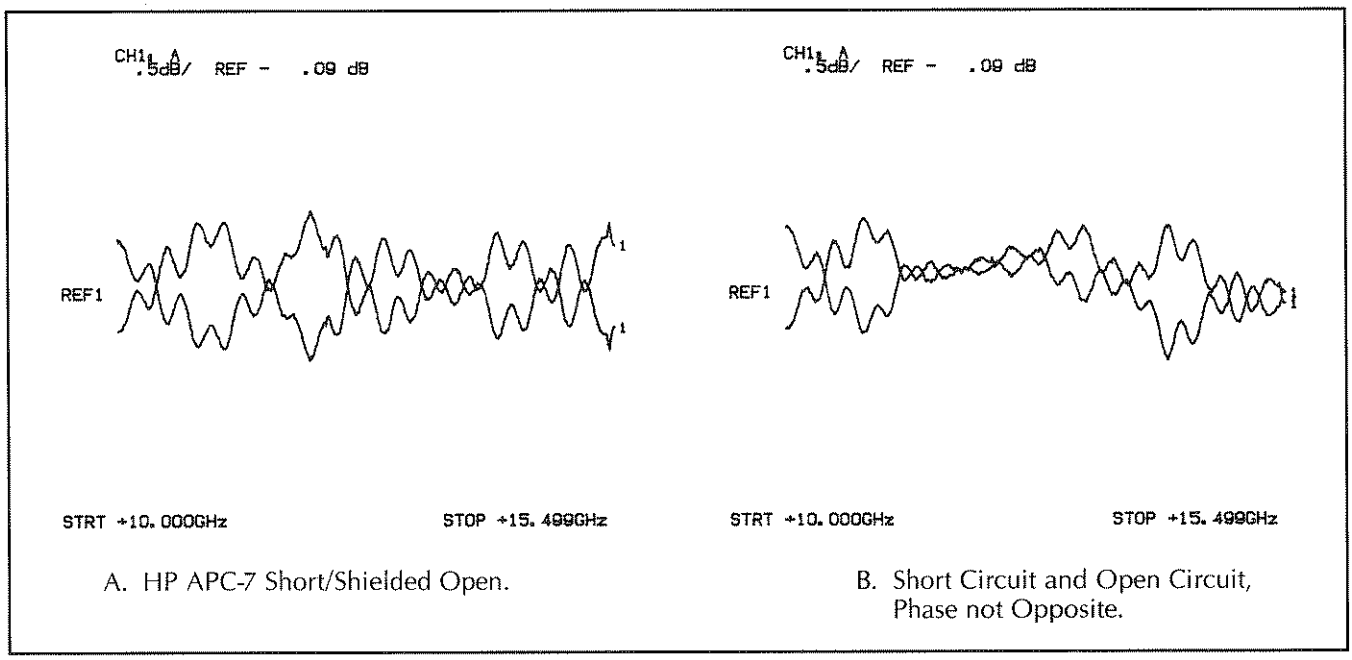
where x = (dB p-p/20). For example, if the p-p difference between the short and open circuit response is 1.6 dB, then

SWR = 10**(1.6/20) = 1.2

To find equivalent test port return loss in dB, use:

Return Loss (dB) = −20 log((SWR−1)/(SWR + 1))

For example, for an observed 1.6 dB peak-to-peak difference between the short and open responses, the test port match is about 1.2 SWR, or about 20 dB return loss.



A. HP APC-7 Short/Shielded Open.

B. Short Circuit and Open Circuit, Phase not Opposite.

Figure 28. Plots of Short and Shielded Open Responses After Short/Open Average Calibration

USING DC DETECTION

With the HP 85025A/B detectors or the HP 85027A/B/C directional bridges, the HP 8757A offers two modes of detection, AC and DC. With AC detection mode, the detector detects the envelope of a square-wave modulated RF signal. DC detection mode allows the detector to respond to unmodulated RF signals. This section describes how to use these detection modes.

Detector Configuration

When the HP 8757A is powered on, it polls all the detector inputs to see which detector type is connected to each input. It can recognize either an AC only detector or bridge (HP 11664 or 85020/85021) or an AC/DC detector (HP 85025A/B). If no detector is connected to an input, an AC only detector is assumed.

If the detector configuration is changed after power-on, the HP 8757A must be reconfigured. To do this, use the following procedure.

- Press **[CAL]** to bring up the calibration menu.
- Press **[CONFIG SYSTEM]**.

When **[CONFIG SYSTEM]** is pressed, the message "READING DETECTOR INPUTS" is displayed in the active entry area, while the HP 8757A reads each input to determine its detector type. If a DC detector is connected, a sensitivity resistor and a thermistor internal to the detector are read. The network analyzer then generates correction factors that are specific to each input port and detector, while the message "CALIBRATING DET INPUT A (B, C, R)" is displayed. Finally the message "CONFIG SYSTEM COMPLETED" is displayed, together with the detector type for each input, as illustrated in Figure 29.

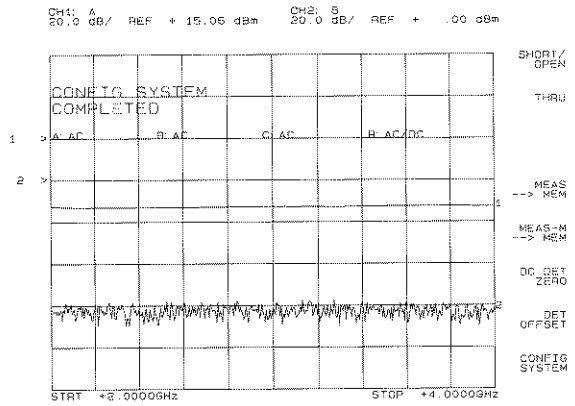


Figure 29. System Configuration Completed

If an AC/DC detector is present, the HP 8757A allows operation in either AC or DC mode. Press **[SYSTEM]** and note that the **[MODE AC DC]** selection enables operation in either mode. (If the system is configured with only AC detectors, it is not possible to switch into DC mode using the **[MODE AC DC]** soft key.)

Press **[CAL]** and note that the label **[DC DET ZERO]** appears. This soft key selection is available only when one or more AC/DC detectors are connected. If an AC/DC detector is added after power-on, the system must be reconfigured using **[CONFIG SYSTEM]**.

DC Detector Zeroing

DC detectors require periodic zeroing to compensate for the effects of DC drift (this is not required for the AC detection mode). Zeroing also eliminates small DC voltages present in the detectors, and establishes the displayed noise floor with no RF signal applied. Pressing **[DC DET ZERO]** in the calibration menu presents the DC detector zero menu, illustrated in Figure 30 (a).

When the detector zero menu appears, the message "SELECT DC DET ZERO" is displayed on the CRT. This is the prompt to choose either automatic or manual zeroing.

Automatic zeroing is used in a setup using the 8757 System Interface, where the HP 8757A controls the detector zeroing. Press **[AUTOZRO]**, and the HP 8757A turns off the RF signal from the source for a short time and automatically zeroes all DC detectors. The calibration menu is then returned to the screen. To have the autozero repeated every five minutes, select **[REPT AZ ON]**. Five minutes is the autozero timer's default value, but the timer can be set anywhere from one to 60 minutes using the **[REPT AZ TIMER]** key and the numeric keypad.

Manual zeroing is used for a setup without the 8757 System Interface, since the network analyzer has no control over the source power. Press **[DC DET ZERO]**, then **[MANUAL]**, and the prompt "REMOVE RF FROM DC DETECTORS" is displayed on the CRT. Disconnect the detectors from the device under test or turn off the RF signal, and press **[CONT]** (see Figure 30 (b)). (Do not disconnect the detectors from the network analyzer as this will cause an incorrect zero. The HP 8757A must read the detector voltage and control circuitry for correct zeroing.) The detectors are zeroed, and the calibration menu is returned to the screen.

Now switch between AC and DC mode. Press **[SYSTEM]**, then **[MODE AC DC]**. Recalibration (thru, short/open) is recommended when switching between AC and DC modes, but is not always required. Typically the variation in response is $<\pm 0.2$ dB when the modulation does not affect the behavior of the device under test.

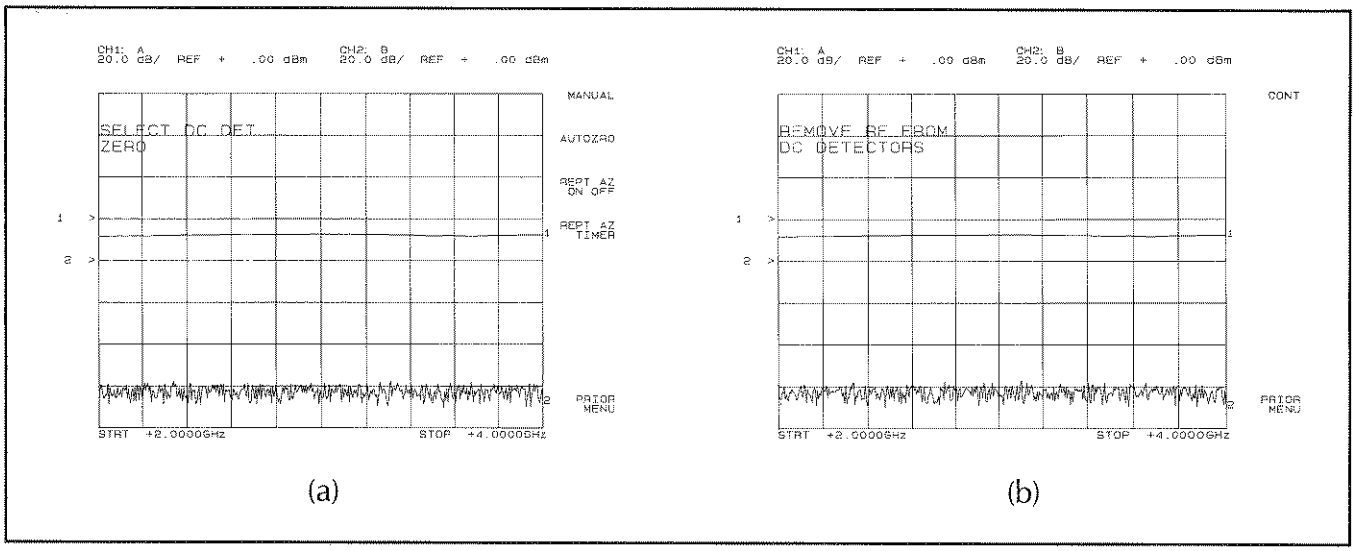


Figure 30. DC Detector Zero Menus

CONTROLS, INDICATORS, AND DISPLAYS SUMMARY

CHANNEL Keys

The CHANNEL keys are used to select the active channel and display the channel menu. They also allow soft key access to channels 3 and 4. The active channel is displayed brighter than the inactive channels.

FUNCTION Keys

The eight function keys are used to activate functions and present menus that apply to the active channel only.

ENTRY Area

Provides the numeric and units keypad, the STEP keys, and the knob to allow operator entry of data to control the measurement and display.

[ENT OFF] clears the active entry area.

[ENT] serves as a terminator for unitless numeric entries.

[dBm/dB] serves as terminator for **[SCALE]**, **[REF LEVEL]**, **[CURSOR]**, **[DET OFFSET]**, and **[REF STEP SIZE]** entries.

[BK SP] allows backspace to delete last digit(s) entered.

INSTRUMENT STATE Area

This area is used to provide information on the instrument state, and control system functions that are not channel specific but apply to the entire instrument state.

[SAVE], when followed by a numeric 1 through 9, saves the current front panel control settings of the HP 8757A and 8350B. An acknowledgment of these keystrokes is shown in the active entry area.

[RECALL], when followed by a numeric 1 through 9, recovers the string stored by **[SAVE]** and sets the HP 8757A and 8350B to that state. An acknowledgment of these keystrokes is shown in the active entry area.

[PRESET] sets the HP 8757A and 8350B (if the 8757 System Interface is connected) to a known state. The following actions take place:

1. HP 8757A self-test, indicated by the clearing of the CRT display. Refer to Section VIII of the HP 8757A Service Manual if an error indication is displayed.
2. The HP 8757A, source, and plotter are set to the preset state listed in Figure 4 of this note.

[LOCAL] returns the HP 8757A to local operation from the remote operation state.

[R], **[L]**, **[T]**, and **[S]** indicators display the HP-IB (not 8757 System Interface) status. Refer to the HP 8757A HP-IB Programming Note (Introductory Operating Guide) for detailed information.

Soft Keys

These keys provide for additional functions of the HP 8757A beyond those of the front panel keys explained above. The soft key menu selections are made by pressing the key immediately to the right of the soft key label.

INPUT/OUTPUT SUMMARY

The A, B, C (Option 001), and R detector inputs each have identical characteristics for connection of the HP 8757A compatible detectors and/or bridges. A is typically used for the connection of a directional bridge for reflection measurements. B is typically used for the connection of a detector for transmission measurements. C is the optional fourth detector input. R is usually used for the reference detector input when making ratio measurements.

The 8757 SYSTEM INTERFACE input/output connector allows control of the HP 8350B sweep oscillator and the HP 7470A plotter using internal HP 8757A firmware and standard HP-IB connectors and protocol.

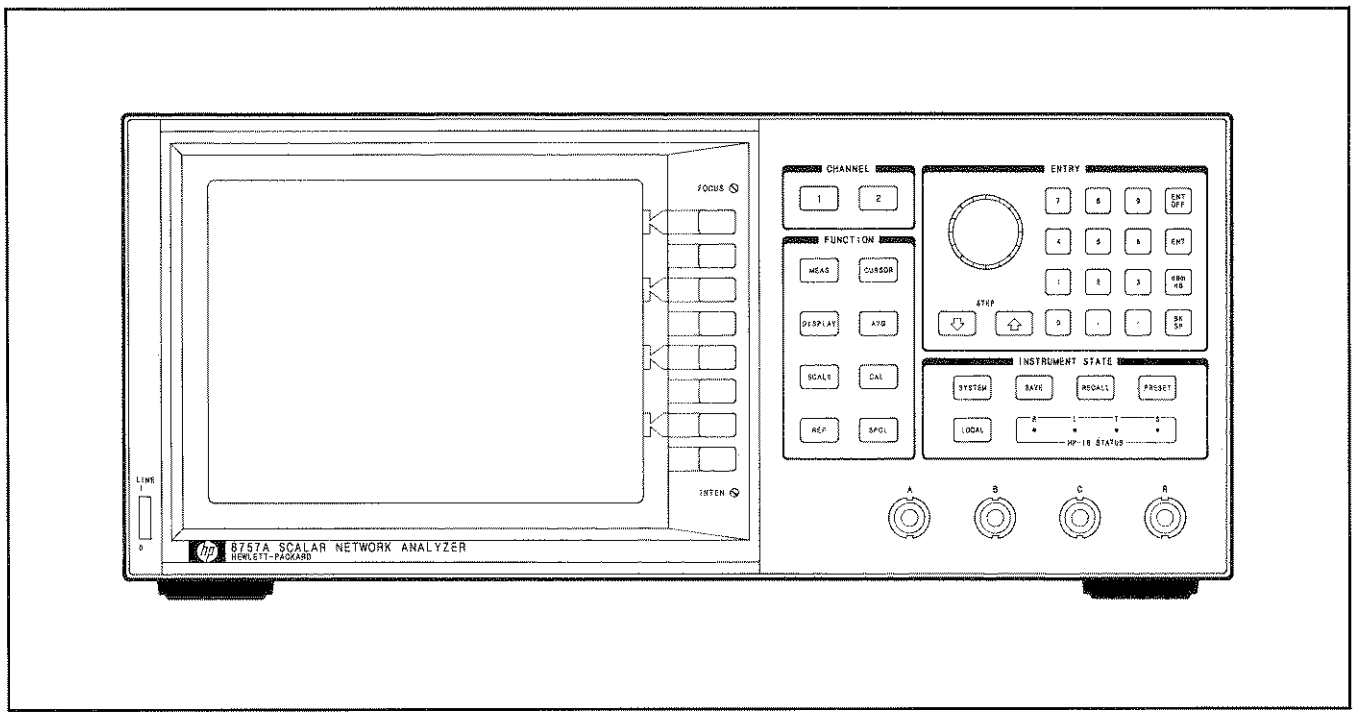


Figure 31. HP 8757A Option 001 Front Panel

The HP INTERFACE BUS input/output connector allows interfacing with other HP-IB instruments or a controller.

The SWEEP IN 0-10V input connector accepts a 0V to 10V sweep signal from a sweep oscillator. It can accept a different sweep ramp using the non-standard sweep mode.

The POS Z BLANK input connector accepts positive 5V retrace and bandswitch blanking and negative intensity marker (z-axis modulation) signals.

The STOP SWEEP output connector provides the interface signal to stop the sweep of the HP 8350B or 8340A controlled over the 8757 System Interface. The HP 8757A also uses this connector to sense when the source has stopped the sweep.

The MODULATOR output connector provides a 27.778 kHz square wave signal, nominally ±6V, for driving external HP 11665B modulators or the external amplitude or pulse modulation input of the HP 8350B sweep oscillator or the HP 8340A or 8341A synthesized sweepers.

The DAC OUT 0-10V connector is provided for future enhancements with later revisions of firmware. It can also be used for troubleshooting purposes, as described in the Service Manual.

The ADC IN connector is provided for display of an external voltage. It can also be used for troubleshooting purposes, as described in the Service Manual.

The CONTROL 1 and CONTROL 2 connectors provide open-collector TTL outputs for driving other peripheral equipment in an HP-IB controlled system. The CONTROL 1 signal is used as an oscilloscope trigger when continuous-loop service-related tests are performed.

The LINE V ±10% input connector accepts primary line voltage to power the instrument. Refer to Section II, Installation, of the Operating Manual for instructions.

MENU STRUCTURE

Figure 33 shows the complete HP 8757A menu structure. The menus are defined by the internal firmware of the HP 8757A.

Figure 32. HP 8757A Rear Panel Connections

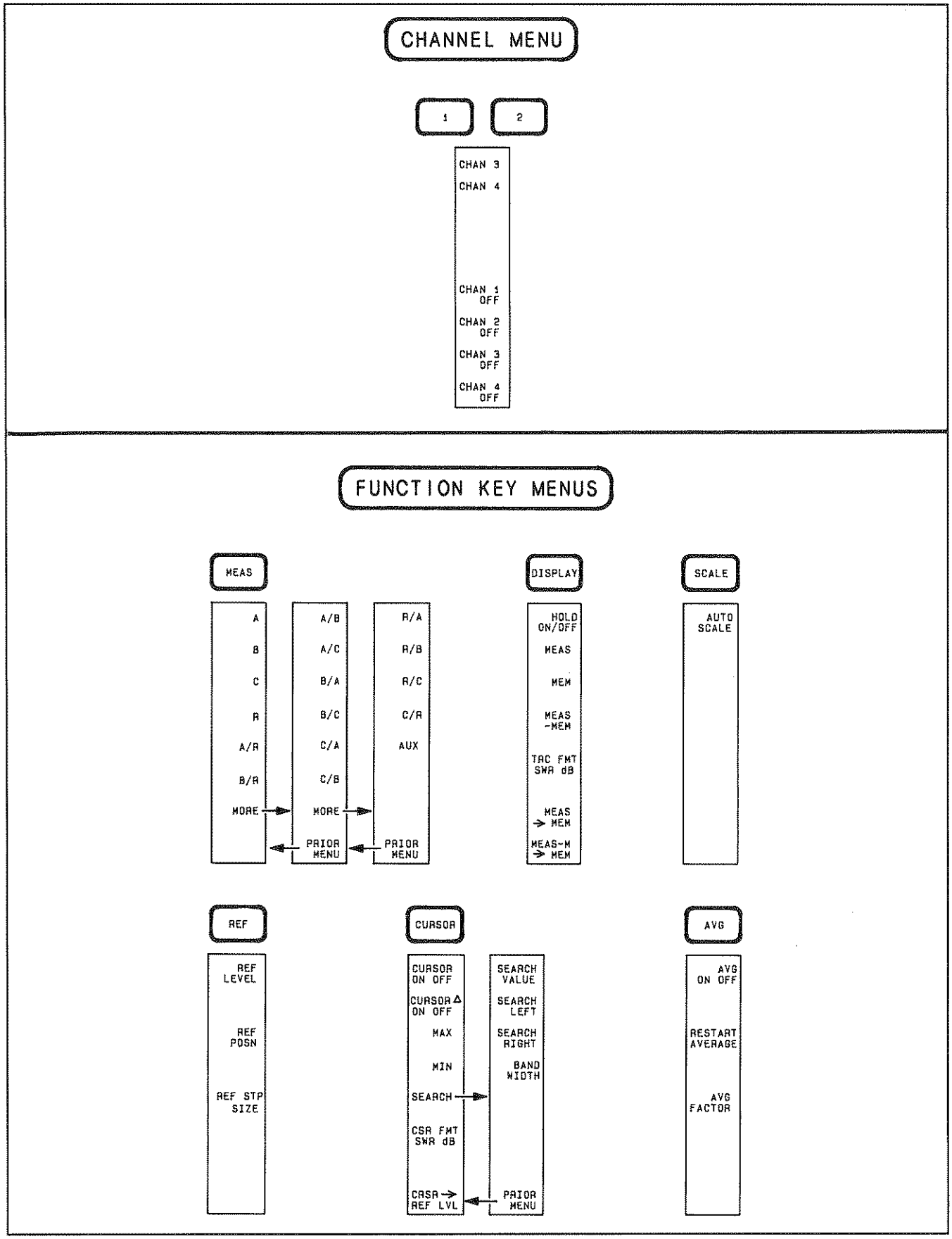


Figure 33. HP 8757A Menu Structure (1 of 3)

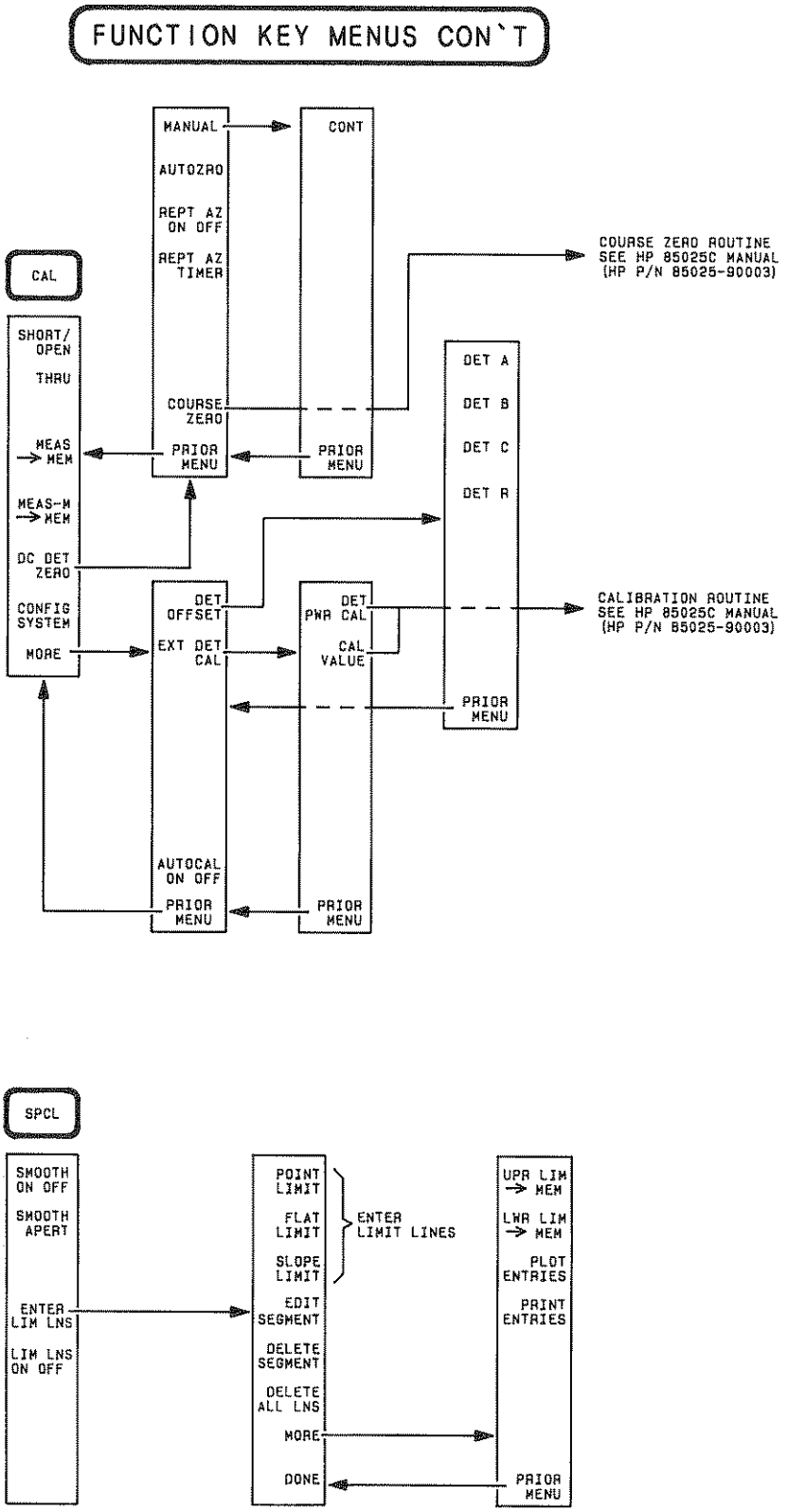


Figure 33. HP 8757A Menu Structure (2 of 3)

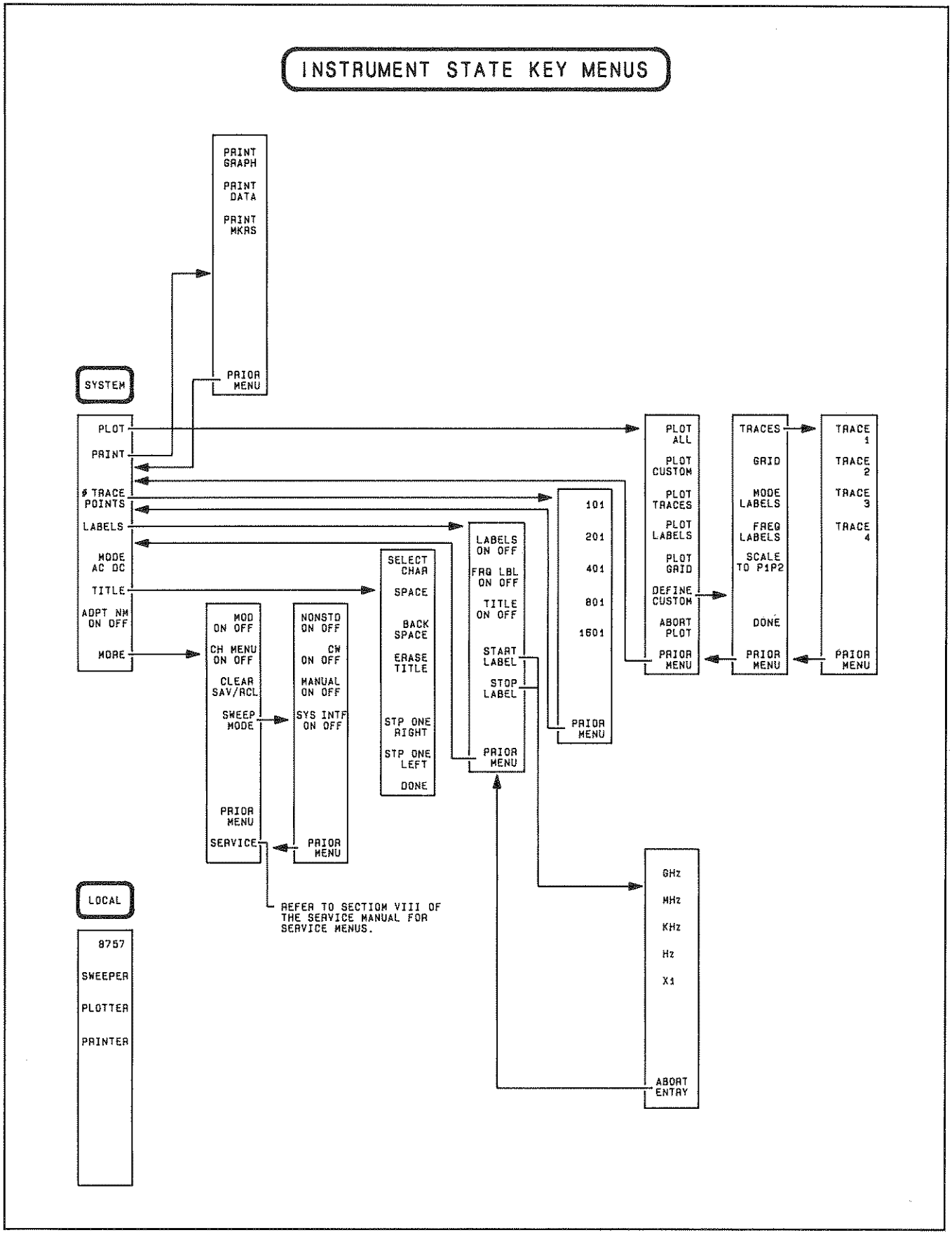


Figure 33. HP 8757A Menu Structure (3 of 3)

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FOR MORE INFORMATION, CALL YOUR LOCAL HP SALES OR SERVICE OFFICE or East (201) 265-5000 ● Midwest (312) 255-9800 ● South (404) 955-1500 ● West (213) 970-7500 or (415) 968-9200 **OR WRITE**, Hewlett-Packard, 1820 Embarcadero, Palo Alto, California 94303. **IN EUROPE, CALL YOUR LOCAL HP SALES OR SERVICE OFFICE OR WRITE**, Hewlett-Packard S.A., 7, rue du Bois-du-Lan Case Postale 365 CH 1217 Meyrin 1-Geneva, Switzerland. **IN JAPAN**, Yokogawa-Hewlett-Packard Ltd., 1-27-15, Yabe Sagamihara City, Kanagawa Prefecture, Japan 229.

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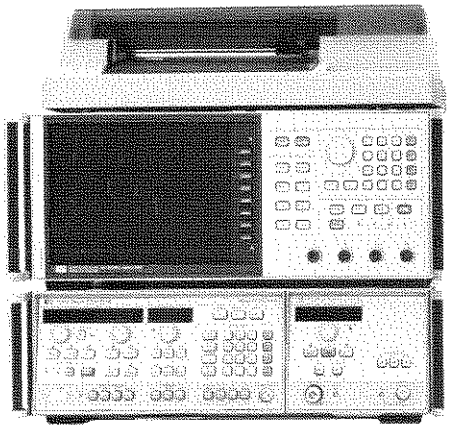
DESIGNED FOR HP-IB SYSTEMS

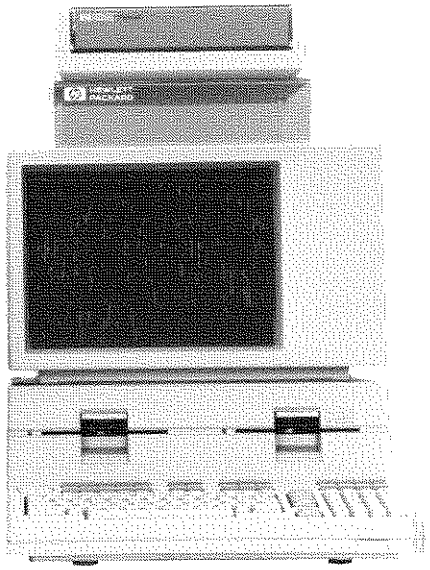
Programming Note

HP 8757A/200-1A
Supersedes: 8757A/200-1

JANUARY 1986

Introductory Operating Guide for the HP 8757A Scalar Network Analyzer with the HP 9000 Series 200 or 300 Desktop Computer (BASIC)





INTRODUCTION

This programming note describes the remote operation of the HP 8757A scalar network analyzer when used with an HP 9000 Series 200 or 300 desktop computer. Included in this guide are several short programs that demonstrate the use of the HP 8757A with HP-IB commands, and a diagram of system connections for remote control.

The HP 8757A is a fully programmable analyzer capable of making magnitude-only transmission and reflection measurements over the RF and microwave frequency range (10 MHz to 60 GHz). When used with an HP-IB computer, the HP 8757A's front panel may be remotely controlled, along with most soft key functions and some functions accessible only via HP-IB. The HP 8757A exerts control over a sweep oscillator (HP 8350B or HP 8340A/41A), digital plotter (HP 7470A or HP 7475A), and HP 2225A ThinkJet printer, connected to the 8757 SYSTEM INTERFACE.

This note assumes familiarity with local (non-remote) operation of the HP 8757A. If you are unfamiliar with the HP 8757A, refer to the Operating Manual. You should also have some familiarity with the HP 9000 series 200 or 300 computer, particularly HP-IB operation. Throughout the rest of this document, the term "computer" refers to any of these computers.

REFERENCE INFORMATION

For further information on the HP Interface Bus, the HP 8757A, or the HP 9000 series 200 or 300 computer, see the following texts:

- HP 8757A Operating Manual
- Programming Note: Quick Reference Guide for the HP 8757A Scalar Network Analyzer (Literature no. 5954-1508)
- Programming Note: Introductory Operating Guide for the HP 8350B Sweep Oscillator with the HP 9000 Series 200 Computers (BASIC) (Literature no. 5953-8868)
- Programming Note: Quick Reference Guide for the HP 8350B Sweep Oscillator (Literature no. 5953-8866)

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- Programming Note: Introductory Operating Guide for the HP 8340A Synthesized Sweeper with the HP 9000 Series 200 Computers (BASIC) (Literature no. 5952-9337)
- Programming Note: Quick Reference Guide for the HP 8340A Synthesized Sweeper (Literature no. 5953-8877)

HP 9000 Series 200 or 300 Computer:

- BASIC Operating Manual
- BASIC Programming Techniques
- BASIC Language Reference
- BASIC Interfacing Techniques
- BASIC Graphics Techniques

General HP-IB Literature:

- Condensed Description of the Hewlett-Packard Interface Bus (Literature no. 59401-90030)
- Tutorial Description of the Hewlett-Packard Interface Bus (Literature no. 5952-0156)

EQUIPMENT REQUIRED

1 HP 8757A scalar network analyzer

1 HP 8350B sweep oscillator with plug-in or HP 8340A/8341A synthesized sweeper

1 HP 9000 series 200 or 300 computer with BASIC 2.0, 2.1 extensions, 3.0, or 4.0 and at least 64K bytes of free user memory.

1 HP 85021A/B/C directional bridge.

1 HP 11664A/E detector or HP 85025A/B detector. Connector type to match bridge and test device.

1 Shielded open circuit, connector to mate with bridge.

1 Short circuit, connector to mate with bridge.

3 HP 11170C BNC cables, 122 cm. (38 inches). (4 are needed with HP 8340/8341A

2 HP 10833A/B/C/D HP-IB cables

Test device(s)

SET-UP

Connect the instruments as shown in Figure 1. The following procedure sets the HP-IB addresses of the instruments to operate properly with the programs contained in this Guide.

1. Turn on the HP 8350B sweep oscillator. Press **[SHIFT] [LCL]**. The FREQUENCY/TIME display indicates the current HP-IB address of the HP 8350B. If it is other than 19, press **[1] [9] [GHz]** to change the address. The HP 8340A or 8341A synthesized sweeper operates the same, only the address is displayed in the right-hand display area.

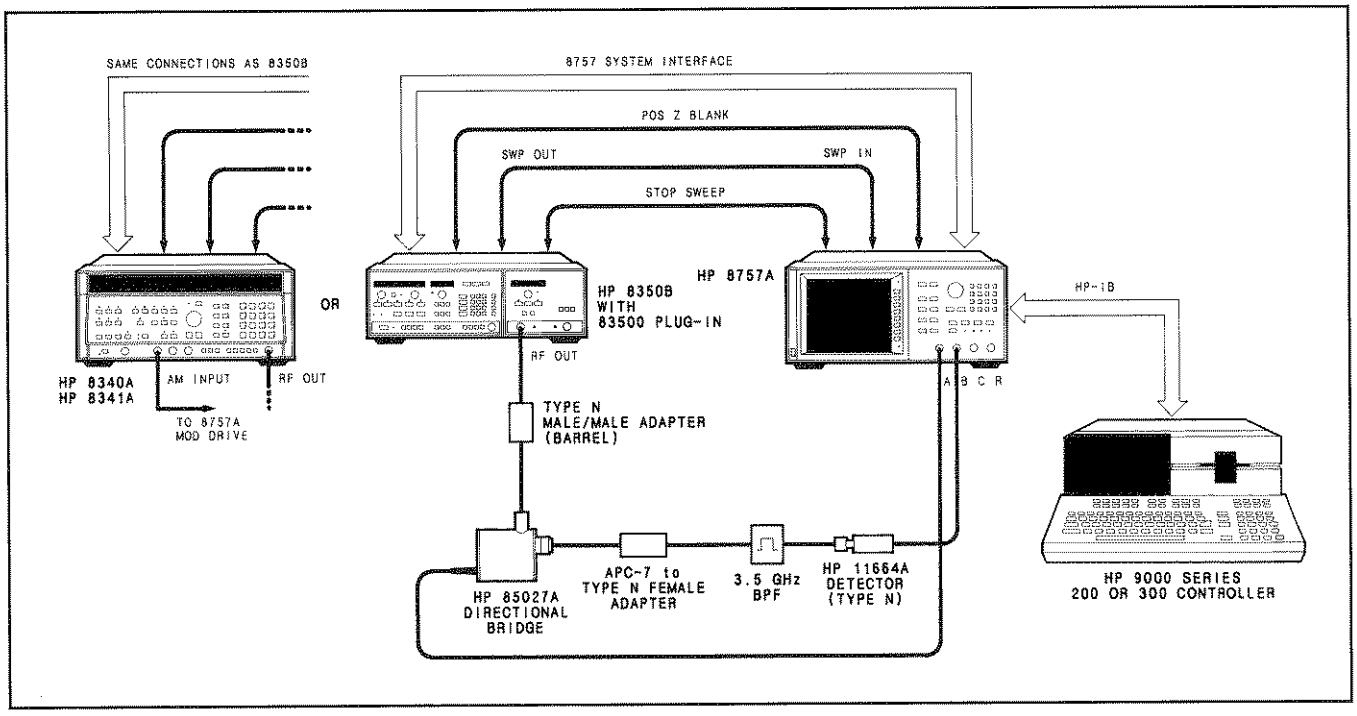

Figure 1. System Connections

2. Turn on the HP 8757A scalar network analyzer. The current HP-IB address is indicated in the active entry area of the CRT. If it is other than 16, press **[LOCAL] [8757] [1] [6] [ENT]** to set the address.

3. Insert the BASIC system disc into the disc drive of the computer and turn it on. After a few seconds, the computer displays: BASIC Ready x.x, where "x.x" is the BASIC version number (2.0, 3.0, etc.). If you are using BASIC 3.0 or 4.0, you will need to also load the following binary (BIN) programs: DISC, CS80, HPIB, GRAPH, ERR, and IO, via the LOAD BIN command.

CHECK OUT PROCEDURE

1. Press **[PRESET]** on the HP 8757A. If the 8757 SYSTEM INTERFACE is properly connected and the address of the sweeper correctly set, both the HP 8757A and the sweeper will perform an instrument preset. Press **[PRESET]** on the sweeper and, again, both the sweeper and the HP 8757A perform an instrument preset. If either instrument detects a failure during instrument preset, that instrument displays the error encountered. Refer to the Operating Manual of the instrument for instructions to help you interpret the error message.

2. To verify the HP-IB connections made between the HP 8757A and the computer, perform the following procedure:

   a. Press **[SHIFT] [PAUSE]** to reset the computer.

   b. Type "REMOTE 716" and **[EXECUTE]***

   The **R** (remote) and **L** (listen) lights in the HP 8757A INSTRUMENT STATE area should go on. The HP 8757A has received its HP-IB listen address.

* On some computers (i.e., the series 300) the **[EXECUTE]** key does not appear; use the **[RETURN]** key instead when instructed to press **[EXECUTE]**.

PROGRAMMING EXAMPLES

In the sections that follow, example programs are used to introduce the HP-IB capabilities of the HP 8757A. Each example program consists of these sections:

1. A description of the functions exercised.
2. The program listing.
3. An explanation of each program line.
4. Detailed instructions for operating the program.

When you finish all of the example programs, you will have a good idea of the power of the HP 8757A when used in an automatic system.

PROGRAM 1: Remote, Local, and Local Lockout

The HP 8757A may be used with the front panel (local operation) or programmed via HP-IB (remote operation). The programmer of the instrument system has control over the operation of all instruments in the system.

When the computer first addresses an instrument, the instrument is placed in a special remote operating mode, called simply "remote" mode. When in remote, the instrument does not respond to its front panel, except for the **[LOCAL]** key. **[LOCAL]**, when pressed, cancels the remote mode and allows the instrument to be used with its front panel.

The computer can also return the instrument to local operation. To do so, the computer sends a special command that forces the instrument to go to local mode.

Occasionally, the programmer of an automatic system needs to prevent the instrument operator from returning the instrument to local operation (via **[LOCAL]**). When the LOCAL LOCKOUT function of the computer is used, the instruments are prevented from exiting remote mode, even when **[LOCAL]** is pressed.

Frequently, the programmer needs to place the instruments connected to the computer into a known state. When preset, the HP 8757A defaults to the conditions shown in Table 1. The "Instrument Preset" function operates the same as the front-panel **[PRESET]** key on the HP 8757A and the HP 8350B. When presetting the HP 8757A and its associated sweeper, only the HP 8757A need be sent the PRESET command. The HP 8757A will preset the sweeper attached to the 8757 SYSTEM INTERFACE.

```
10    ASSIGN @Sna TO 716
20    ABORT 7
30    CLEAR @Sna
40    REMOTE @Sna
50    PAUSE
60    REMOTE @Sna
70    LOCAL LOCKOUT 7
80    PAUSE
90    LOCAL 7
100   PAUSE
110   OUTPUT @Sna;"IP"
120   END
```

EXPLANATION

Line 10 Assign the address of the HP 8757A to an I/O path. This is not required, but it is good programming practice. If you change the address of the instrument later, you only change the address in one place in your program.

Line 20 Abort any HP-IB transfers and reset the computer's HP-IB interface.

Line 30 Clear the HP 8757A's HP-IB interface.

Line 40 Set the HP 8757A and sweeper to "remote" mode.

Line 50 Temporarily stop execution.

Line 60 Set the HP 8757A and sweeper to "remote" mode.

Line 70 Lock out the "local" key of the HP 8757A and sweeper.

Line 80 Temporarily stop execution.

Line 90 Set the HP 8757A and sweeper to "local" mode.

Line 100 Temporarily stop execution.

Line 110 Preset the HP 8757A and sweeper.

Line 120 End program execution.

RUNNING THE PROGRAM

1. Press **[SHIFT]** **[RESET]** on the computer. Type "SCRATCH" and press **[EXECUTE]**. This clears the program memory of the computer.
2. Type in the program.
3. Press **[RUN]** on the computer.
4. When the program stops, the HP 8757A is in remote mode. You can verify this by observing the lights in the INSTRUMENT STATE area of the HP 8757A. The **R** (remote) and **L** (listen) lights should be on. Try pressing any key on the HP 8757A (except **[LOCAL]**). Nothing happens. The sweeper is also in remote mode. Now press **[LOCAL]** and verify that the keys on the HP 8757A are active. Also, notice the **R** light went out when you pressed **[LOCAL]**. The sweeper went into local mode along with the HP 8757A.
5. Press **[CONTINUE]** on the computer. The HP 8757A is again in remote mode. This time, however, the **[LOCAL]** key is locked out. Try pressing **[LOCAL]** and the other keys. None of the keys on the HP 8757A or the sweeper cause any action.
6. Press **[CONTINUE]** on the computer. All instruments on the HP-IB interface are returned to local mode, including the HP 8757A and sweeper. To set only the HP 8757A into local mode, the command "LOCAL 716" can be given from the computer. Verify that the **R** light on the HP 8757A is off and the **REM** light on the sweeper is off.

Table 1. Instrument Preset Conditions

HP 8757A:

Channels 1 and 2 on and the Channel Menu will appear in the soft key label area of the CRT. The following applies to channels 1, 2, 3, and 4.

a. Measure power A, B, C (or B), R, on channels 1, 2, 3, 4.
b Display measurement data in log magnitude format.
c. Scale = 20 dB/div.
d. Reference level 0 dB/dBm for all channels.
e. Reference level step size = 20 dB.
f. Averaging factor = 8 (off).
g. Cursor off.
h. All labels on.
i. Channel 1 as the active channel.
j. Modulation drive on.
k. Number of points = 401.
l. Detector mode set for AC detection.
m. Smoothing set for 5.0% of span (off).
n. Cursor format = log magnitude.
o. Search value = −3 dB.
p. Autocalibration on.
q. Standard sweep mode on.

The following are not changed during a PRESET or "IP" command execution:

a. Reference position.
b. Trace Memory.
c. Save/Recall registers.
d. HP-IB addresses.
e. Request Mask.
f. Limit Lines.
g. Title.
h. Detector offset.
i. User-defined plot.
j. System Interface mode.
k. Repeat Autozero Timer.

SOURCE:

a. Instrument preset.
b. Sweep time set to 200 ms.
c. HP 8350B Square Wave Modulation on.
d. HP 8340/8341 Shift Pulse on; RF Output on.

PLOTTER:

a. Abort plot if in progress.
b. The positions of P1 and P2 are left unchanged.

PRINTER:

a. Abort printout if in progress.

7. Press **[CONTINUE]** on the computer. The HP 8757A and sweeper are both preset. Note that the computer sent the Instrument Preset command only to the HP 8757A. The HP 8757A, in turn, preset the sweeper.

Remember, to Preset both the HP 8757A and the sweeper, you only need to send the Instrument Preset command to the HP 8757A. Do not send Instrument Preset to the sweeper by way of Passthrough mode (discussed in Program 2).

PROGRAM 2: Controlling the Front Panel

All front panel keys and most of the soft keys of the HP 8757A may be programmed remotely via HP-IB. For example, you can program the scale per division, reference level, and reference position for each channel.

```
10    ASSIGN @Sna TO 716
20    ABORT 7
30    CLEAR @Sna
40    OUTPUT @Sna;"IP"
50    PAUSE
60    OUTPUT @Sna;"C1C0C2"
70    PAUSE
80    OUTPUT @Sna;"SD10"
90    PAUSE
100   OUTPUT @Sna;"RL-10"
110   PAUSE
120   OUTPUT @Sna;"RP4"
130   PAUSE
140   OUTPUT @Sna;"IA"
150   PAUSE
160   OUTPUT @Sna;"C0C1 SD5; RP4; RL-5"
170   END
```

EXPLANATION

Line 10 Assign an I/O path to the HP-IB address of the HP 8757A.

Line 20 Abort any transfers and clear the HP-IB interface of the computer.

Line 30 Clear the HP-IB interface of the HP 8757A.

Line 40 Preset the HP 8757A and the sweeper.

Line 50 Temporarily stop execution.

Line 60 Select channel 1 and turn it off. Turn channel 2 on.

Line 70 Temporarily stop execution.

Line 80 Set the scale per division to 10 dB. No terminator (";") is needed because this is the only command in the statement.

Line 90 Temporarily stop execution.

Line 100 Set the reference level to −10 dBm. Again, note the absence of a terminator (";").

Line 110 Temporarily stop execution.

Line 120 Set the reference position line to the center of the screen (graticule 4). No terminator is needed because this is the only command on the line.

Line 130 Temporarily stop execution.

Line 140 Program channel 2 to measure reflection (input "A") instead of transmission (input "B").

Line 150 Temporarily stop execution.

Line 160 Many commands on one line, with terminators. Turn channel 2 off (C2C0) and channel 1 on (C1). Set the scale per division (SD) to 5 dB, the reference position line (RP) to the center of the screen, and the reference level (RL) to −5 dBm.

Line 170 End execution.

RUNNING THE PROGRAM

1. Type "SCRATCH" and press **[EXECUTE]** on the computer. This erases the previous program.
2. Type in this program and press **[RUN]** on the computer.
3. The computer presets the HP 8757A and sweeper and pauses. Note the settings of channel 1 and 2, then press **[CONTINUE]**.
4. Channel 1 is turned off. Channel 2 is now the active channel, as you can see from the brightened annotation on the screen of the HP 8757A. Press **[CONTINUE]**.
5. Channel 2 scale per division is set to 10 dB. It defaulted to 20 dB/div when the HP 8757A was originally preset. Press **[CONTINUE]**.
6. The reference level is set to −10 dBm (it was 0.0 before). Press **[CONTINUE]**.
7. The reference position line is set to the center of the screen (graticule 4). The top of the screen is graticule 8 and the bottom is graticule 0. Press **[CONTINUE]**.
8. Change the measurement to reflection (input "A") instead of transmission (input "B"). At preset, channel 2 defaults to input "B". Press **[CONTINUE]**.
9. In one statement: turn off channel 2, turn on channel 1, set the scale per division to 5 dB, set the reference position line to the center of the screen, and set the reference level to −5 dBm. NOTE: the semicolon (";") terminators are needed after any HP 8757A command that can have a variable length. Extra terminators never hurt, so use them liberally.

PROGRAM 3: Passthrough Mode

In normal operation, the system sweeper and digital plotter are connected to the 8757 SYSTEM INTERFACE. This connection allows the HP 8757A to control and extract information from the other parts of the measurement system. To allow you to control the sweeper and plotter with the computer, the HP 8757A has a built-in "passthrough" command that takes a command from the computer and passes it on to one of the instruments connected to the 8757 SYSTEM INTERFACE.

To initiate "Passthrough" mode, you first tell the HP 8757A which instrument you wish to command by setting the passthrough address. Then, to talk (or listen) to that device, you address the HP 8757A's special Passthrough HP-IB address (which is different from the HP 8757A's HP-IB address). While in the Passthrough mode, the HP 8757A stops updating its CRT screen and does not respond to its front panel (because it's in remote mode). To remove the HP 8757A from Passthrough mode, simply address it via HP-IB. While in Passthrough mode, do not press **[LOCAL]** on the HP 8757A.

The HP 8757A's Passthrough address is calculated from its HP-IB address. If the address of the HP 8757A is even (e.g. 16 decimal) then the Passthrough address is the next larger number (17 decimal). If the address of the HP 8757A is odd (e.g. 15 decimal), then the Passthrough address is the next smaller number (14 decimal). Never set the address of the HP 8757A such that its address conflicts with one of the instruments connected to the 8757 SYSTEM INTERFACE. For instance, if the sweeper is set to 19 decimal, do not set the address of the HP 8757A to 19.

Data can be sent to or received by any instrument on the 8757 SYSTEM INTERFACE via Passthrough mode. LOCAL, REMOTE, and TRIGGER HP-IB messages do not pass through the HP 8757A. Nor can service requests be generated from a Passthrough device, although they can be interrogated!

```
10    PRINTER IS 1
20    ASSIGN @Sna TO 716
30    ASSIGN @Passthru TO 717
40    ABORT 7
50    CLEAR @Sna
60    OUTPUT @Sna;"IP"
70    OUTPUT @Sna;"PT19"
80    OUTPUT @Passthru;"OPFA"
90    ENTER @Passthru;Min_freq
100   Min_freq=Min_freq/1.E+9
110   OUTPUT @Passthru;"OPFB"
120   ENTER @Passthru;Max_freq
130   Max_freq=Max_freq/1.E+9
140   OUTPUT @Sna
150   PRINT "Frequency limits:";Min_freq
;"to";Max_freq;"GHz"
160   INPUT "Start frequency (GHz)?",Sta
rt_freq
170   INPUT "Stop frequency (GHz)?",Stop
_freq
180   OUTPUT @Passthru;"FA";Start_freq;"
GZ FB";Stop_freq;"GZ"
190   OUTPUT @Sna
200   END
```

EXPLANATION

Line 10 Direct printed output to the screen of the computer.

Line 20 Assign an I/O path to the address of the HP 8757A. (This is the HP 8757A's control address).

Line 30 Assign an I/O path to the HP 8757A's Passthrough address. By communicating to this HP-IB address, the computer will control a device connected to the 8757 SYSTEM INTERFACE.

Line 40 Abort any transfers and clear the HP-IB interface of the computer.

Line 50 Clear the HP-IB interface of the HP 8757A.

Line 60 Preset the HP 8757A and sweeper.

Line 70 Tell the HP 8757A which device is controlled through the HP 8757A's Passthrough address. In this case, the sweeper (device 19).

Line 80 Send a command to the sweeper. Command it to output its current start frequency.

Line 90 Read the start frequency from the sweeper.

Line 100 Scale the start frequency to display it in GHz.

Line 110 Command the sweeper to output its current stop frequency.

Line 120 Read the stop frequency from the sweeper.

Line 130 Scale the stop frequency to display it in GHz.

Line 140 Exit Passthrough mode by addressing the HP 8757A.

Line 150 Print the start and stop frequencies.

Line 160 Get start frequency from user.

Line 170 Get stop frequency from user.

Line 180 Set start and stop frequencies of sweeper to those given by the user.

Line 190 Exit Passthrough mode by addressing the HP 8757A.

Line 200 End program execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.
2. Press **[RUN]** on the computer.
3. The computer presets the HP 8757A and the sweeper, reads the start and stop frequency of the sweeper, and displays it on the screen of the computer. At preset, the sweeper defaults to the full frequency range of the plug-in. The values read, then, represent the frequency limits of this plug-in. When the computer stops, it displays the question:

   Start frequency (GHz)?

   Enter a start frequency in the frequency range of the plug-in and press **[CONTINUE]**.
4. The computer displays the question:

   Stop frequency (GHz)?

   Enter a stop frequency in the frequency range of the plug-in (but higher than the start frequency) and press **[CONTINUE]**.
5. The computer sets the start and stop frequency of the sweeper to those given by you. The HP 8757A immediately begins sweeping the frequency range you defined.
6. Try deleting or "commenting out" line 190 in the program. Now, when the program ends, the HP 8757A is displaying the message "DATA PASSTHROUGH EXECUTING" and the display is frozen (not sweeping). To exit passthrough mode, type "OUTPUT 716" and press **[EXECUTE]** on the computer. The HP 8757A displays "DATA PASSTHROUGH COMPLETE" and begins sweeping.

Points to remember: You must address the HP 8757A after using Passthrough mode to return it to normal swept operation. Any command can be sent via passthrough mode to any instrument on the 8757 SYSTEM INTERFACE, and any data can be read. Service Requests and parallel polls do not "pass through" the HP 8757A.

PROGRAM 4: Cursor Operations

To enhance the speed and accuracy of measurements, the HP 8757A contains a built-in cursor that displays the frequency and magnitude of a trace at any given point. To make measurements even more efficient, the cursor may be set to the maximum or minimum point on the trace simply by pressing a "soft key". These cursor functions are available via HP-IB commands.

With a computer, the cursor may be turned on and off, its "position" (0 to n-1, where n is the number of points/trace) set, its value and position read, and set to the maximum or minimum point on the trace. The cursor functions all apply to the "active" channel with the bright annotation; i.e. the channel accessed most recently. In short, you have complete control over cursor operations via HP-IB.

Cursor programming is especially useful for measuring parameters like flatness and maximum power, where you are interested in the highest and lowest point on the trace. For measuring parameters such as 3 dB points and other specific points (not a maximum or minimum), it is more efficient to use either the cursor search functions or to read the entire trace and search for the points you need.

```
10    PRINTER IS 1
20    Start_freq=2
30    Stop_freq=5
40    ASSIGN @Sna TO 716
50    ASSIGN @Passthru TO 717
60    ABORT 7
70    CLEAR @Sna
80    OUTPUT @Sna;"IP"
90    OUTPUT @Sna;"PT19"
100   OUTPUT @Passthru;"FA";Start_freq;"
GZ FB";Stop_freq;"GZ"
110   OUTPUT @Sna;"C2 CXOC"
120   ENTER @Sna;Value,Posn
130   PRINT "Cursor reads ";Value;"dB at
 position";Posn
140   INPUT "Desired cursor position (0.
.400)?",New_posn
150   OUTPUT @Sna;"SC";INT(New_posn+.5)
160   OUTPUT @Sna;"OC"
170   ENTER @Sna;Value,Posn
180   PRINT "Value at position";Posn;"is
 ";Value;"dB."
190   INPUT "Cursor frequency (GHz)?",Cu
r_freq
200   New_posn=400*((Cur_freq-Start_freq
)/(Stop_freq-Start_freq))
210   OUTPUT @Sna;"SC";INT(New_posn+.5)
220   OUTPUT @Sna;"OC"
230   ENTER @Sna;Value,Posn
240   Cur_freq=Start_freq+(Stop_freq-Sta
rt_freq)*(Posn/400)
250   PRINT "Cursor reads ";Value;"dB at
";Cur_freq;"GHz."
260   END
```

EXPLANATION

Line 10 Direct printed output to the screen of the computer.

Line 20 Define the start frequency of the desired sweep in GHz.

Line 30 Define the stop frequency of the desired sweep in GHz.

Line 40 Assign an I/O path to the address of the HP 8757A.

Line 50 Assign an I/O path to the Passthrough address of the HP 8757A.

Line 60 Abort any transfers and clear the HP-IB interface of the computer.

Line 70 Clear the HP-IB interface of the HP 8757A.

Line 80 Preset the HP 8757A and sweeper. This presets the number of points per trace to 401.

Line 90 Tell the HP 8757A which instrument is controlled through the Passthrough address (19 is the sweeper).

Line 100 Command the sweeper to set a start frequency of 2 GHz and a stop frequency of 5 GHz.

Line 110 Set the cursor to the maximum point on channel 2 and command the HP 8757A to output the cursor's value and position.

Line 120 Read the value and position of the cursor.

Line 130 Print the value and position of the cursor on the screen of the computer.

Line 140 Get new cursor position from the user. Input should be between 0 and 400.

Line 150 Set the cursor to the new cursor position chosen by the user. The INT function truncates instead of rounding so add 0.5 to the cursor position before making it an integer.

Line 160 Command the HP 8757A to output the cursor's value and position.

Line 170 Read the value and position of the cursor at its new position.

Line 180 Print the cursor's value and position on the screen of the computer.

Line 190 Get new cursor frequency from the user. Should be within the frequency range of the sweep selected.

Line 200 Calculate the position of the cursor from its frequency and the start and stop frequencies of the current measurement.

Line 210 Set the cursor to the desired position.

Line 220 Command the HP 8757A to output the cursor's value and position.

Line 230 Read the cursor's value and position.

Line 240 Calculate the cursor's actual frequency from its position and the start and stop frequencies of the current measurement. You can easily program other start and stop frequencies by following the example in Program 3.

Line 250 Print the value and actual frequency of the cursor on the screen of the computer.

Line 260 End program execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.

2. Press **[RUN]** on the computer.

3. The computer turns on both channels and sets channel 1 to reflection (input "A") and channel 2 to transmission (input "B"). The cursor is positioned to the maximum point on the channel 2 trace and its value and position are read and displayed. At preset, the number of points per trace is 401.

4. When the computer stops and displays:

   Desired cursor position (0. . .400)?

   Type in a number between 0 and 400 and press **[CONTINUE]**. A position of 0 represents the left side of the HP 8757A's screen (lowest frequency) and 400 represents the right side of the screen (highest frequency). The position is set, and the value and position of the cursor are read and printed on the screen of the computer.

5. When the computer stops and displays:

   Cursor frequency (GHz)?

   Enter a frequency within the current start and stop frequencies of the measurement (0.01 and 20 GHz). The nearest cursor position is calculated and set. The value and position of the cursor are read, and the actual cursor frequency is calculated from the cursor's position. Note: the original desired frequency and the actual cursor frequency are usually different. Because there are only 401 possible cursor positions, some frequencies cannot be set exactly.

To use more points per trace, modify line 80 to be "IP SP801" for 801 points. Then modify the "400" in lines 140, 200, and 240, to "800".

PROGRAM 5: Read a Single Value

In many instances, measurements require that a single value be read at a CW frequency. Particularly when extremely good frequency accuracy and resolution are required.

The HP 8757A is able to read and send a single reading of any measurement channel, via HP-IB, to the computer. The "output value" (OV) command operates on the active channel and causes the HP 8757A to send one reading of measurement data. Even when the HP 8757A is in normalized mode (MEAS–MEM), the OV command sends the measured, not the normalized, data. This command, like the "output data" command in Program 6, can operate with either ASCII or fast binary formats.

```
10    PRINTER IS 1
20    ASSIGN @Sna TO 716
30    ASSIGN @Passthru TO 717
40    ABORT 7
50    CLEAR @Sna
60    OUTPUT @Sna;"IP"
70    OUTPUT @Sna;"PT19"
80    OUTPUT @Sna;"SW0"
90    Freq=2
100   Freq_step=.1
110   OUTPUT @Passthru;"CW";Freq;"GZ SF"
;Freq_step;"GZ"
120   OUTPUT @Sna;"C1IA"
130   FOR I=1 TO 21
140     OUTPUT @Sna;"OV"
150     ENTER @Sna;Value
160     PRINT I;": ",Value;"dB at";Freq;
"GHz"
170     OUTPUT @Passthru;"UP"
180     Freq=Freq+Freq_step
190   NEXT I
200   OUTPUT @Passthru;"FA2GZ FB4GZ"
210   OUTPUT @Sna;"SW1"
220   END
```

EXPLANATION

Line 10 Direct printed output to the screen of the computer.

Line 20 Assign an I/O path to the address of the HP 8757A.

Line 30 Assign an I/O path to the Passthrough of the HP 8757A.

Line 40 Abort any transfers and clear the HP-IB interface of the computer.

Line 50 Clear the HP-IB interface of the HP 8757A.

Line 60 Preset the HP 8757A and sweeper.

Line 70 Tell the HP 8757A which instrument is controlled through the Passthrough address (19 is the sweeper).

Line 80 Put the HP 8757A in "non-swept" mode. This step is necessary when you wish to read single values. After receiving this command, the HP 8757A stops updating its display.

Line 90 Define a start frequency for further measurements (in GHz).

Line 100 Define a frequency increment (in GHz).

Line 110 Put the sweeper into CW mode at the start frequency and set its frequency "step size" to that of the frequency increment.

Line 120 Command the HP 8757A to measure reflection (input "A") on channel 1. This statement also causes the HP 8757A to exit Passthrough mode.

Line 130 Make 21 measurements, at equally-spaced CW frequencies.

Line 140 Command the HP 8757A to send the current reading of channel 1 (the active channel) to the computer. The reading is taken immediately.

Line 150 Read the value. In this instance, no format has been defined so the default format of ASCII is in effect.

Line 160 Print the measurement number, the reading and the frequency on the screen of the computer.

Line 170 Command the sweeper to increment the CW frequency by the "step size" set earlier (line 100). This is a very fast way of setting a series of equally-spaced frequencies.

Line 180 Increment the variable that contains the current frequency. This variable is only used for printing the current frequency at each iteration of the loop.

Line 190 End of the loop.

Line 200 Command the sweeper to sweep from 2 to 4 GHz. The sweeper exits CW mode and returns to start/stop mode.

Line 210 Command the HP 8757A to return to swept mode. The HP 8757A again updates the trace information on the display. This command also exits Passthrough mode.

Line 220 End program execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.
2. Press **[RUN]** on the computer.
3. The sweeper frequency is set immediately to 2 GHz and the computer begins reading reflection (input "A") of the HP 8757A and printing the measurements. After 21 readings, the program ends.

PROGRAM 6: Trace Transfer

One feature that sets the HP 8757A apart is its ability to transfer an entire measurement trace to a computer at very high speed. A complete, high-resolution (0.01 dB), 401-point measurement can be sent to the computer in 35 milliseconds (binary format) or 800 milliseconds (ASCII format). Of course, transfer time will be less for fewer points/trace, and greater for more points/trace.

The HP 8757A gives you complete flexibility when reading measurement traces via HP-IB. You may read from the active channel and you may read the stored memory trace, the current measurement trace, or the normalized trace (measurement—memory). In addition, the memory trace may be written back to the HP 8757A, allowing you to save and restore calibrations traces via HP-IB.

With Trace Transfer measurements, some frequency resolution is traded off for measurement speed. The number of points per trace can be programmed to control the resolution across the frequency range being swept. If you are measuring a device that changes very rapidly with frequency, it is possible to miss very narrowband responses that occur between measurement points if the resolution is low. For these cases, the measurement should be made at a higher resolution. The Trace Transfer method of measurement is much faster than CW point-by-point measurements.

```
10    ASSIGN @Sna TO 716
20    ASSIGN @Fast_sna TO 716;FORMAT OFF
30    ABORT 7
40    CLEAR @Sna
50    OUTPUT @Sna;"IP"
60    DIM Ascii_dat(0:400)
70    INTEGER Bin_dat(0:400)
80    OUTPUT @Sna;"C1IA C2IB"
90    WAIT 1
100   OUTPUT @Sna;"FD0 C10D"
110   ENTER @Sna;Ascii_dat(*)
120   OUTPUT @Sna;"C1WM";Ascii_dat(*)
130   PAUSE
140   OUTPUT @Sna;"FD1 C20D"
150   ENTER @Fast_sna;Bin_dat(*)
160   OUTPUT @Sna USING "#,K";"C2WM"
170   OUTPUT @Fast_sna;Bin_dat(*)
180   PAUSE
190   FOR I=0 TO 400
200     Bin_dat(I)=(I MOD 100)
210   NEXT I
220   OUTPUT @Sna;"C2C0 C1MY"
230   OUTPUT @Sna USING "#,K";"FD1 WM"
240   OUTPUT @Fast_sna;Bin_dat(*)
250   OUTPUT @Sna;"AS"
260   END
```

EXPLANATION

Line 10 Assign an I/O path to the address of the HP 8757A.

Line 20 Assign another I/O path to the address of the HP 8757A, to be used for fast binary transfers.

Line 30 Abort any transfers and clear the HP-IB interface of the computer.

Line 40 Clear the HP-IB interface of the HP 8757A.

Line 50 Preset the HP 8757A and the sweeper. This sets the number of points/trace to 401.

Line 60 Dimension an array to hold a trace in ASCII format. Array is 401 elements (0 to 400, inclusive).

Line 70 Dimension an array to hold a trace in binary format. It, too, is 401 elements.

Line 80 Set channel 1 to input "A" (reflection) and channel 2 to input "B" (transmission).

Line 90 Wait for the sweeper to sweep a few times, to insure the traces contain valid data. When you command the HP 8757A to output a trace, it obeys immediately.

Line 100 Set the format to ASCII and command the HP 8757A to output the channel 1 measurement trace data.

Line 110 Read the measurement trace. Note the use of (*) to designate the entire array.

Line 120 Write the measured trace back to the trace memory of channel 1. Reading the measurement trace and storing it into the memory trace is equivalent to executing the MEAS→MEM function (HP-IB command SM).

Line 130 Temporarily stop program execution.

Line 140 Set the format to binary and command the HP 8757A to output its channel 2 measurement trace.

Line 150 Enter the measurement trace through the I/O path that suspends formatting. This technique is useful for reading data from the HP 8757A at the highest possible speed.

Line 160 Command the HP 8757A to accept the trace into its channel 2 memory. Note the suppression of the normal carriage return/line feed sequence by the "#,K" format. If the cr/lf isn't suppressed, the HP 8757A assumes the first data point is null.

Line 170 Send the trace to the HP 8757A, again through the I/O path that suspends formatting.

Line 180 Temporarily stop program execution.

Line 190 Set up a loop for all 401 measurement points read from the HP 8757A.

Line 200 Calculate some arbitrary function and fill the binary data array. This function has no particular meaning, but represents some special calibration data (such as an open/short average).

Line 210 End of the loop.

Line 220 Turn off channel 2 and command channel 1 to display the trace memory data.

Line 230 Set the format to binary (redundant, but good practice) and command the HP 8757A to accept the following trace to channel 1 memory. Again, suppress the cr/lf sequence at the end of the line.

Line 240 Write the trace to the memory through the I/O path that suspends formatting.

Line 250 Command the HP 8757A to "autoscale" the current display, which is the memory trace just written.

Line 260 End program execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.

2. Press **[RUN]** on the computer.

3. Watching the screen of the HP 8757A, you will see it display "DATA DUMP TO HP-IB" when it begins sending trace data to the computer, and "DATA DUMP TO TRACE MEMORY" when the computer sends the data back. The transfer takes about 800 milliseconds each way (ASCII transfer).

4. Watching the screen of the HP 8757A, press **[CONTINUE]** on the computer. The computer again reads and writes a trace of data, and the HP 8757A displays the same messages. Don't blink, the transfer takes about 35 milliseconds each way (binary format).

5. Press **[CONTINUE]** on the computer. The computer calculates an arbitrary function and sends it to a trace memory of the HP 8757A, where it is autoscaled and displayed. This function (a sawtooth pattern) has no significance. It represents a special calibration trace, such as an open/short average. With a computer, the HP 8757A measurement system may be calibrated over several different frequency ranges and changed from one to another very quickly, without re-calibration.

When writing memory traces in ASCII format, be sure to set the HP 8757A to ratio or single-input measurements before sending the trace. If you wish to transfer a higher resolution trace, modify line 50 to be "IP SP801" for 801 points. Then modify the "400" in lines 60, 70, and 190 to "800".

PROGRAM 7: Using the "Take Sweep" Command

To make measurements as quickly and efficiently as possible, it is often necessary to synchronize the sweeper with the actions of the HP 8757A. The "Take Sweep" command gives the HP 8757A the ability to command the sweeper to make a specified number of complete sweeps (1 to 255). This command is especially useful when using the "Trace Transfer" method of reading data from the HP 8757A.

Using the Take Sweep command is straightforward. First, the HP 8757A is placed in "Non-Swept" mode (SW0 command). Then the Take Sweep command is given with the number of sweeps desired (TSd command). At the end of the specified number of sweeps, the HP 8757A informs the computer of the completion of this operation by setting a bit in its Status Byte.

The computer can detect this event in two ways: 1) monitor the Status Byte continuously until the bit is set (called "polling"), or 2) let the HP 8757A generate a Service Request (SRQ) and interrupt the computer. Table 2 is a diagram of the Status Bytes of the HP 8757A. It shows all of the bits that can be used to either monitor or interrupt the computer. In this program bit 4 (decimal value 16) is used to signal "Operation Complete"; i.e. all of the sweeps specified by the Take Sweep command have been completed.

When you follow the Take Sweep command with an output statement (such as "Output Data" OD), the data is sent immediately not after the instructed number of sweeps. The two approaches mentioned overcome this by letting us get the data sent at the end of the specified number of sweeps not immediately. A third approach is to use the "Sweep Hold" mode (SW2 command) instead of the Non-swept mode (SW0 command). In this mode the HP 8757A will prevent any HP-IB operations until the completion of the Take Sweep command.

```
10    DIM Ascii_dat(0:400)
20    ASSIGN @Sna TO 716
30    ASSIGN @Passthru TO 717
40    ABORT 7
50    CLEAR @Sna
60    OUTPUT @Sna;"IP"
70    OUTPUT @Sna;"PT19"
80    OUTPUT @Passthru;"ST250MS"
90    OUTPUT @Sna;"C2C0 IB"
100   OUTPUT @Sna;"SW0 CS RM16"
110   OUTPUT @Sna;"TS10"
120   Stat=SPOLL(@Sna)
130   IF BIT(Stat,4)=0 THEN 120
140   OUTPUT @Sna;"C10D"
150   ENTER @Sna;Ascii_dat(*)
160   OUTPUT @Sna;"SW1"
170   PAUSE
180   OUTPUT @Sna;"SW0 CS RM16"
190   ON INTR 7 GOTO Srq_recv
200   ENABLE INTR 7;2
210   OUTPUT @Sna;"TS10"
220   GOTO 220
230 Srq_recv:  !
240   Stat=SPOLL(@Sna)
250   OUTPUT @Sna;"RM0"
260   OUTPUT @Sna;"C10D"
270   ENTER @Sna;Ascii_dat(*)
280   OUTPUT @Sna;"SW1"
290   END
```

EXPLANATION

Line 10 Dimension an array large enough to hold a trace of data (401 points).

Line 20 Assign an I/O path to the address of the HP 8757A.

Table 2: HP 8757A Status Byte Descriptions

STATUS BYTE (#1)								
Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Decimal Value	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Function	N/A	Request Service (SRQ)	SRQ on HP-IB Syntax Error	SRQ on Operation Complete (Sweep, Plot, or Print)	SRQ on Soft Key Only Pressed	SRQ on Change in Extended Status Byte	SRQ on Numeric Entry Completed (HP-IB or Front Panel)	SRQ on Any Front Panel Key Pressed
EXTENDED STATUS BYTE (#2)								
Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Decimal Value	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Function	N/A	SRQ on Detector Uncal	SRQ on Power-on or Preset	SRQ on Limit Test Failed	SRQ on Action Requested not possible	SRQ on Knob activity	SRQ on Low Battery Voltage	SRQ on Self Test Failure

Line 30 Assign an I/O path to the Passthrough address of the HP 8757A.

Line 40 Abort any transfers and clear the HP-IB interface of the computer.

Line 50 Clear the HP-IB interface of the HP 8757A.

Line 60 Preset the HP 8757A and sweeper.

Line 70 Tell the HP 8757A which device is controlled through the Passthrough address. Address 19 belongs to the sweeper.

Line 80 Set the sweeper to 250 milliseconds per sweep.

Line 90 Turn off channel 2 of the HP 8757A and select transmission (input "B") for display on channel 1.

Line 100 Put the HP 8757A into Non-Swept mode. Clear the status register of the HP 8757A. Set the Request Mask to 16 (bit 4) so that the HP 8757A will set bit 4 (Operation Complete) at the completion of the Take Sweep command. Table 2 has a description of all bits in the Status Bytes.

Line 110 Command the HP 8757A to take 10 sweeps.

Line 120 Wait for the 10 sweeps to be completed by reading the HP 8757A Status Byte.

Line 130 Test the Status Byte to see if bit 4 is set. If it is, then 10 sweeps have been completed. If bit 4 is not set, then continue to read and test the Status Byte until it is set.

Line 140 Command the HP 8757A to output the channel 1 trace data.

Line 150 Read the trace data.

Line 160 Return the HP 8757A to Swept mode. The display now updates continuously.

Line 170 Temporarily stop program execution.

Line 180 Put the HP 8757A into Non-Swept mode. Clear the status register of the HP 8757A. Set the Request Mask to 16 (bit 4, Operation Complete) so that the HP 8757A will send the computer a Service Request (SRQ) at the completion of the Take Sweep command. This is the same as in line 100 except we will look for interrupts this time.

Line 190 Define the routine to be executed when the SRQ is received from the HP 8757A. The label "Srq_recv" is equivalent to line 230.

Line 200 Turn interrupts on in the computer. Specifically, allow an HP-IB Service Request to interrupt the computer. See the BASIC Language Reference of the computer for more detail about HP-IB programming.

Line 210 Command the HP 8757A to take 10 sweeps.

Line 220 Wait for the SRQ from the HP 8757A by putting the computer into a tight loop. If a PAUSE statement were used, the computer would not respond to interrupts.

Line 230 The computer begins execution here after receiving the SRQ from the HP 8757A.

Line 240 Read the Status Byte of the HP 8757A. This action clears the SRQ flag of the HP 8757A.

Line 250 Disable interrupt generation from the HP 8757A.

Line 260 Command the HP 8757A to output the channel 1 data trace.

Line 270 Read the channel 1 trace.

Line 280 Return the HP 8757A to Swept mode. The HP 8757A display begins updating continuously.

Line 290 End of execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.

2. Press **[RUN]** on the computer.

3. The computer first presets the HP 8757A and sweeper. It then sets the sweeper to 250 milliseconds per sweep and sets the HP 8757A to display transmission on channel 1.

4. The computer commands the HP 8757A to take 10 sweeps and polls the HP 8757A Status Byte to determine when they were completed. The computer reads a trace from the HP 8757A. Just before the trace is sent, you should see the display "freeze" as the Take Sweep command is completed.

5. Press **[CONTINUE]**, and the computer again tells the HP 8757A to take 10 sweeps, only this time the computer receives an interrupt after the last sweep. The computer sits in a loop (line 220) and waits until the HP 8757A signals completion of the Take Sweep command. In this segment of the program, you should not see the display "freeze" at all. Immediately after it receives the interrupt, the computer puts the HP 8757A back into Swept mode. This method of sensing the end of a Take Sweep command via an interrupt is more efficient time-wise than the polling method used above because the computer can be doing something else during the 10 sweeps.

To use the Sweep Hold mode, modify line 100 to "SW2" and delete lines 120 and 130. The program will wait at line 140 until the 10 sweeps are completed. Whenever practical, use the Service Request interrupt to sense the end of a Take Sweep command. In fact, you can use the time to do plotting or printing of data, instead of sitting in a loop. Service Requests are also useful for other events, as demonstrated by the next program.

PROGRAM 8: Programming the Soft Keys

The HP 8757A has eight screen-labeled "soft keys" that make measurements faster and easier for users. Under HP-IB control, you can re-label the soft keys with any annotation and sense when they are pressed.

Use the soft keys to branch to special measurement programs. By making full use of the soft keys, your automatic system may not need a normal computer keyboard at all, making it easy to use as a manual instrument.

```
10    PRINTER IS 1
20    ASSIGN @Sna TO 716
30    ABORT 7
40    CLEAR @Sna
50    OUTPUT @Sna;"IP"
60    OUTPUT @Sna;"CS RM8"
70    ON INTR 7 GOTO Srq_recv
80    OUTPUT @Sna;"WK1 CAL 1"
90    OUTPUT @Sna;"WK2 TEST 1"
100   OUTPUT @Sna;"WK3 CAL 2"
110   OUTPUT @Sna;"WK4 TEST 2"
120   OUTPUT @Sna;"WK8 ABORT"
130 Wait_srq:  !
140   ENABLE INTR 7;2
150   GOTO 150
160 Srq_recv:  !
170   Stat=SPOLL(@Sna)
180   OUTPUT @Sna;"OK"
190   ENTER @Sna;Key_code
200   SELECT Key_code
210     CASE =32
220       PRINT "Calibration #1"
230     CASE =8
240       PRINT "Test #1"
250     CASE =0
260       PRINT "Calibration #2"
270     CASE =16
280       PRINT "Test #2"
290     CASE =41
300       PRINT "Abort measurement"
310     CASE ELSE
320       PRINT "*** undefined ***"
330   END SELECT
340   GOTO Wait_srq
350   END
```

EXPLANATION

Line 10 Direct output to the screen of the computer.

Line 20 Assign an I/O channel to the address of the HP 8757A.

Line 30 Abort any transfers and clear the HP-IB interface of the computer.

Line 40 Clear the HP-IB interface of the HP 8757A.

Line 50 Preset the HP 8757A and sweeper.

Line 60 Set the Request Mask to interrupt the computer whenever a soft key is pressed (bit 3). See Table 2 for the description of the Status Bytes.

Line 70 Define the line that the computer will go to whenever it receives an interrupt.

Line 80 Label soft key 1 with "CAL 1". Soft key 1 is the soft key at the top of the screen.

Line 90 Label soft key 2 with "TEST 1".

Line 100 Label soft key 3 with "CAL 2".

Line 110 Label soft key 4 with "TEST 2".

Line 120 Label soft key 8 with "ABORT".

Line 130 Line label for routine that waits for an interrupt.

Line 140 Turn on the SRQ interrupts in the computer.

Line 150 Wait for the interrupt in a tight loop. If PAUSE were used, the interrupts would not be active.

Line 160 Line label for the routine that services the interrupts.

Line 170 Serial poll the HP 8757A. Reading the Status Byte of the HP 8757A clears the SRQ. The "Clear Status" (CS) command could also be used.

Line 180 Command the HP 8757A to output the key code of the last key pressed.

Line 190 Read the key code.

Line 200 Multi-way branch on key code value.

Line 210 If the key code is 32, then soft key 1 was pressed.

Line 220 Print an appropriate message.

Line 230 If the key code is 8, then soft key 2 was pressed.

Line 240 Print an appropriate message.

Line 250 If the key code is 0, then soft key 3 was pressed.

Line 260 Print an appropriate message.

Line 270 If the key code is 16, then soft key 4 was pressed.

Line 280 Print an appropriate message.

Line 290 If the key code is 41, then soft key 8 was pressed.

Line 300 Print an appropriate message.

Line 310 If the key code doesn't match any of the preceding codes, another key was pressed. In this case, the key code has to be for soft key 5, 6, or 7 (key codes 14, 38, or 40) since these are the only other keys that can interrupt the computer.

Line 320 Print an appropriate message.

Line 330 End of the multi-way branch.

Line 340 Re-enter the progarm at the "Wait_srq" label. At that point, the interrupts are re-enabled and the computer waits for another SRQ.

Line 350 End program execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.
2. Press **[RUN]** on the computer.
3. After the computer presets the HP 8757A and the sweeper, it writes the soft key labels on the screen of the HP 8757A. When the first key label is written, the HP 8757A labels it and blanks the other soft key labels. Since all labels except soft keys 5, 6, and 7 are given new labels, soft keys 5, 6, and 7 remain blank.
4. Press any key of the HP 8757A. Pressing a soft key causes a message to be printed on the screen of the computer. Note that soft keys 5, 6, and 7 generate an interrupt, even though they weren't labeled. No other keys of the HP 8757A generate an interrupt, because of the SRQ mask specified. Because the HP 8757A is in "Remote" mode, nothing is changed by pressing its keys.

In this example, the Service Request mask was set to interrupt the computer whenever a soft key was pressed. Another bit in the mask causes an interrupt to be generated when any key is pressed.

Because the HP 8757A was left in Remote mode, it didn't respond to any keys pressed on its front panel. In some applications it is useful to put the HP 8757A into "Local" operation, so that it can be controlled from the front panel and still generate interrupts whenever a key is pressed.

PROGRAM 9: CRT Graphics

For applications requiring diagrams, drawing, or limit lines, the CRT screen of the HP 8757A may be written to as if it were an HP plotter. By defining the HP 8757A as the plot device used by the computer, you can even use the special plotting statements built into the computer, such as MOVE, DRAW, PEN, AXES, VIEWPORT, etc.

This program draws a connections diagram for a hypothetical test system measuring an amplifier. It will blank the analyzer's standard display containing the graticule, annotation, and soft keys so that we have a blank screen. Figure 2 shows what the CRT should look like when the program is done. Since the program involves drawing many lines, it will use the BASIC data statement to more efficiently store where to draw lines.

For easy-to-use fast graphics, the graphics memory of the HP 8757A is divided into seven "pages" of 500 words. One vector requires two words. Each of the pages may be selected to receive data and turned on and off independently.

You can keep different drawings in each of the graphics memory pages and simply turn on the drawing you need by turning on the appropriate page. Each page may also be erased independently.

To use the graphics capability of the HP 8757A, first define the Passthrough address to be one less than the HP 8757A's control address. If the HP 8757A's address is 16, its graphics address is 15. To the computer, the screen of the HP 8757A looks like a plotter connected to the 8757 SYSTEM INTERFACE.

```
10    ASSIGN @Sna TO 716
20    ASSIGN @Passthru TO 717
30    ABORT 7
40    CLEAR @Sna
50    OUTPUT @Sna;"IP BL5 PT15"
60    GINIT
70    PLOTTER IS 717,"HPGL"
80    WINDOW 0,2698,0,2047
90    OUTPUT @Passthru;"EP; GP1"
100   PEN 3
110   GRID 100,100
120   PEN 1
130   RESTORE Graphix
140   REPEAT
150     READ Pen_mode$,X,Y
160     SELECT Pen_mode$
170       CASE "D"
180         DRAW X,Y
190       CASE "M"
200         MOVE X,Y
210     END SELECT
220   UNTIL Pen_mode$="E"
230   MOVE 600,1600
240   OUTPUT @Passthru USING "K";"SI0.28
,0.34;LBCONNECTION DIAGRAM";CHR$(3)
250   MOVE 1200,250
260   LABEL "DUT"
270 Graphix:
280   DATA "M",300,800,"D",1100,800,"D",
1100,1100,"D",300,1100
290   DATA "D",300,800,"M",800,800,"D",8
00,1100
300   DATA "M",1500,800,"D",2300,800,"D"
,2300,1200,"D",1500,1200
310   DATA "D",1500,800,"M",1950,800,"D"
,1950,1200
320   DATA "M",875,850,"D",875,500,"D",1
200,500
330   DATA "M",1400,500,"D",2050,500,"D"
,2050,850
340   DATA "M",1200,400,"D",1400,500,"D"
,1200,600,"D",1200,400
350   DATA "E",0,0
360   END
```

EXPLANATION

Line 10 Assign an I/O path to the address of the HP 8757A.

Line 20 Assign an I/O path to the Passthrough address of the HP 8757A.

Line 30 Abort any transfers and clear the HP-IB interface of the computer.

Line 40 Clear the HP-IB interface of the HP 8757A.

Line 50 Preset the HP 8757A and blank the CRT display. Define the CRT graphics as the target of Passthrough commands. Graphics address is always one less than the HP 8757A's HP-IB address.

Line 60 Initialize the graphics. This sets a default line type, scale, and clipping limits in the computer.

Line 70 Define the HP 8757A CRT screen as the plot device and tell the computer that it is an HP-GL (Hewlett-Packard Graphics Language) device.

Line 80 Scale the plotting area to the entire CRT screen. The numbers are the corners of the CRT, as described in the HP 8757A Operating Manual.

Line 90 Erase all graphics pages. Turn graphics page 1 on to ensure that the graphics start in it.

Line 100 Select to plot with pen 3, the lowest intensity for the HP 8757A CRT.

Line 110 Plot a grid on the CRT. These are 100 by 100 squares, giving you an indication of where the X and Y coordinates are on the CRT.

Line 120 Select to plot with pen 1, the brightest intensity for the HP 8757A CRT.

Line 130 Define where to start looking for data. Here we've indicated that the data starts at the line label "Graphix", which is line 270. This ensures that we always start at the right data statement.

Line 140 Define the beginning of a loop.

Line 150 Read three items from the data statement. Pen__mode$ is a one character string indicating whether we should move ("M"), draw ("D"), or end ("E") the plotting. X and Y are the coordinates to plot to.

Line 160 Multi-way branch on the Pen__mode$ value.

Line 170 If Pen__mode$ is "D", then we want to draw.

Line 180 Draw to coordinates X, Y.

Line 190 If Pen__mode$ is "M", then we want to move.

Line 200 Move to coordinates X, Y.

Line 210 End of multi-way branch.

Line 220 End of the repeat loop. Repeat lines 150 through 210 again if Pen__mode$ isn't "E". If it was, then we are done plotting the data in the data statements.

Line 230 Move the pen to title our display.

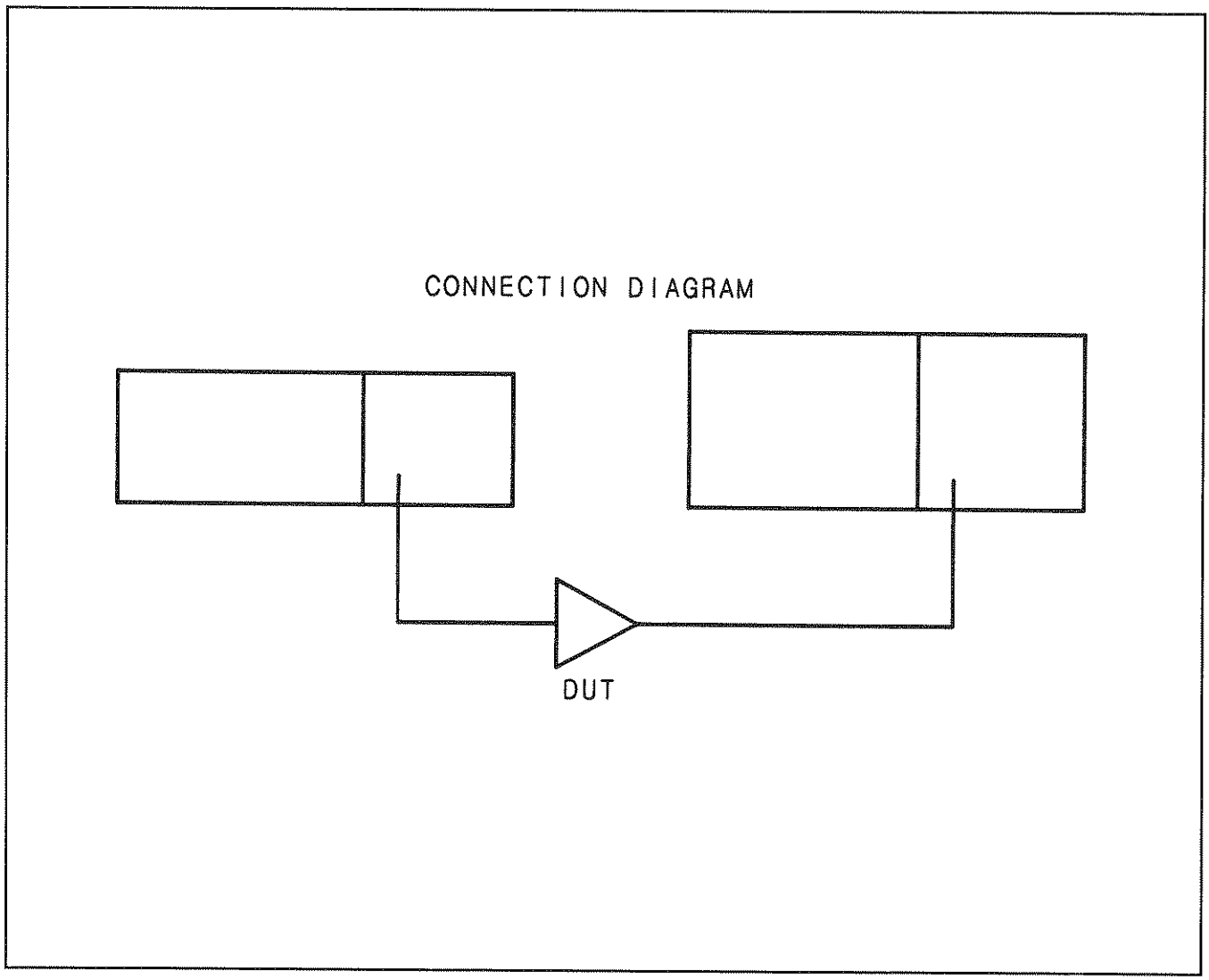

Figure 2. The CRT Graphics Display

Line 240 Title the display with the label "CONNECTION DIAGRAM". This shows one way to label the HP 8757A display by using its internal character set. To do this, we must first specify which set to use via the "SI" command. This specifies the width and height respectively of each character and is similar to the computer's CSIZE instruction. We indicate what the label is with the "LB" command and follow it with the label. We must terminate the label with an "End-of-text" (ETX) character — a byte equal to binary 3.

Line 250 Move the pen to label our device under test (DUT).

Line 260 Label the DUT using the computer's LABEL statement. Notice the difference between this label and the one generated in line 240. First, the intensity is less. Second, the characters look more round and smoother. This is because the computer generates each character by plotting several small strokes, more than the HP 8757A's internal CRT does for its characters. This means that you will also use much more graphics memory than with the internal character set.

Line 270 Define the start of the data statements containing our plotting information for all of the lines on the CRT. While these may be less legible than lots of MOVE's and DRAW's, it is more efficient programming wise.

Line 280 This data statement draws the outline of the sweeper.

Line 290 This data statement draws the plug-in in the sweeper.

Line 300 This data statement draws the outline of the analyzer.

Line 310 This data statement draws the CRT of the analyzer.

Line 320 This data statement draws the connections from the sweeper to the DUT.

Line 330 This data statement draws the connections from the DUT to the analyzer.

Line 340 This data statement draws the DUT — an amplifier.

Line 350 This data statement indicates the end of our plotting. The X and Y values are needed here only to keep the read statement in line 150 happy.

Line 360 End program execution.

RUNNING THE PROGRAM

1. Clear the program memory of the computer and type in the program.
2. Press **[RUN]** on the computer.
3. After the HP 8757A and sweeper are preset, the CRT will be blanked. First a grid is plotted on the CRT. While this isn't necessary for our connection diagram, it does give you a good indication of where the X and Y coordinates are on the analyzer's CRT.
4. All of the lines are plotted on the HP 8757A's CRT. These are just a sequence of MOVE's and DRAW's as specified by the data statements. If brighter lines are desired, draw each line twice.
5. Finally the labeling is added. The label "CONNECTION DIAGRAM" is done using the HP 8757A CRT's internal character set. The "DUT" label was done using the computer's character set. The key differences are that while using the computer's LABEL statement is easier, it also takes a lot more graphics memory than the internal character set. This can become very important if you have several labels and/or want to have several hookup diagrams.

In this example, only graphics page 1 was used. You can independently control up to 7 separate pages of graphics information. If you write too much information into one page, it overflows into the next page.

When the graphics page is selected, the "pointer" to where the first location of memory that receives information is reset to the beginning of the page. Thus, as information is written into the page the old information is destroyed. If we were plotting a line, this would appear as a new trace overwriting an old one.

PROGRAM 10: Learning the Instrument State

Being able to save a specific instrument state is helpful when it is needed several times in a test or measurement procedure. The user could save the instrument state by manually logging the important analyzer and sweeper parameters, such as start/stop frequency, sweep time, number of trace points, scale per division, display format, etc., then reinput them at the appropriate time. A somewhat simpler approach is to save the instrument state in one of the internal save/recall registers of the analyzer/sweeper combination, then recall it when needed.

The HP-IB user has two additional options with the Interrogate function and the Learn String. With the Output Interrogated Parameter function ("OP"), you can selectively interrogate the values of all functions that have numeric values, such as frequency, number of trace points, etc. This function operates the same way in both the HP 8757A analyzer and the sweeper. It is illustrated in Program 3 where the sweeper start and stop frequencies are interrogated in lines 80 through 130.

A more thorough approach is to use the Learn String functions of the HP 8757A analyzer and sweeper. The Learn String describes the present instrument state and is similar to what one of the internal save/recall registers retains. For the HP 8757A, the Learn String also includes all of the global parameters but does not include limit line information. Once an instrument state is learned, the HP 8757A and sweeper states can be restored at any later time. The following program demonstrates how to both learn and restore the instrument states of the HP 8757A and the HP 8350B

sweeper by using their Learn String functions. If using the HP 8340A or 8341A synthesized sweepers, perform the modification described later.

```
10    OPTION BASE 1
20    DIM Lswpr$[90],Lsna$[150]
30    ASSIGN @Sna TO 716
40    ASSIGN @Passthru TO 717
50    ABORT 7
60    CLEAR @Sna
70    OUTPUT @Sna;"PT19;"
80    LOCAL @Sna
90    INPUT "SET UP SYSTEM, PRESS CONT
INUE",A$
100   OUTPUT @Sna;"OL"
110   ENTER @Sna USING "#,150A";Lsna$
120   OUTPUT @Passthru;"OL"
130   ENTER @Passthru USING "#,90A";Ls
wpr$
140   OUTPUT @Sna;"IP"
150   INPUT "TO RESTORE SETUP, PRESS
CONTINUE",A$
160   OUTPUT @Sna USING "2A,150A";"IL"
,Lsna$
170   OUTPUT @Passthru USING "2A,90A";
"IL",Lswpr$
180   OUTPUT @Sna
190   LOCAL @Sna
200   END
```

EXPLANATION

Line 10 Define the first element of any array to be at index number 1.

Line 20 Dimension two strings large enough to hold the learn strings of the sweeper (90 bytes) and the HP 8757A (150 bytes).

Line 30 Assign an I/O path to the HP 8757A address.

Line 40 Assign an I/O path to the HP 8757A Passthrough address.

Line 50 Abort any transfers and clear the computer HP-IB interface.

Line 60 Clear the HP 8757A HP-IB interface.

Line 70 Tell the HP 8757A which device is controlled through the Passthrough address. Address 19 belongs to the sweeper.

Line 80 Set the HP 8757A and sweeper to "local" mode.

Line 90 Prompt the user to set up the system and wait for the CONTINUE key press.

Line 100 Program the HP 8757A to output its Learn String.

Line 110 Read the HP 8757A Learn String into the string Lsna$. Notice the "#,150A" format. The HP 8757A Learn String is 150 contiguous binary bytes that does not end with a cr/lf (since these could actually be part of the learn string information). The computer must read all 150 bytes and this form ensures that it will.

Line 120 Program the sweeper to output its Learn String.

Line 130 Read the sweeper Learn String into the string Lswpr$. Notice the "#,90A" format. As in line 110, the computer must read the entire Learn String. For the HP 8350B sweeper, it is 90 bytes long.

Line 140 Preset the HP 8757A and sweeper to clear the instrument states.

Line 150 Prompt the user and wait for the CONTINUE key press.

Line 160 Program the HP 8757A to accept its Learn String, then send the Learn String. Notice that the "2A,150A" format ensures that the "IL" command and the 150 bytes of the Learn String are sent contiguously. The HP 8757A expects the Learn String to start immediately after the "IL" command.

Line 170 Program the sweeper to accept its Learn String, then send the Learn String. Notice the "2A,90A" format. As in line 160, this ensures that the Learn String is sent properly.

Line 180 Readdress the HP 8757A to exit Passthrough mode and continue sweeping.

Line 190 Set the HP 8757A and sweeper to "local" mode.

Line 200 End of execution.

RUNNING THE PROGRAM

1. Clear the computer program memory and type in the program.
2. Press **[RUN]** on the computer.
3. When the computer stops and displays:
   SETUP SYSTEM, THEN CONTINUE
   Adjust the HP 8757A and sweeper to a preferred instrument state, then press the **[CONTINUE]** key on the computer.
4. The computer will save the Learn Strings of both the HP 8757A and the sweeper. After completing this, the HP 8757A and sweeper will be preset to destroy your original instrument state.
5. When the computer stops and displays:
   TO RESTORE SETUP, PRESS CONTINUE
   Press the **[CONTINUE]** key. The computer will restore your original instrument state via the two Learn Strings. Verify on the HP 8757A and the sweeper displays that your state has been restored.

This example is designed to work with the HP 8350B sweeper, which has a Learn String of 90 bytes. The program can be easily modified to work with the HP 8340A and 8341A synthesized sweepers, which have Learn Strings 123 bytes in length. To do this, change the "90" in lines 20, 130, and 170 to "123." Now the program will output and input the appropriate Learn String.

Table 3: Alphabetical Listing of HP 8757A Programming Commands (1 of 3)

CODE	ACTION
A0	Averaging off
AB	A/B ratio measurement
AC	A/C ratio measurement*
AFd	Averaging On and Factor d
ANm	Adaptive Normalization on/off
AR	A/R ratio measurement
AS	Autoscale
AZm	Auto Zero repeat on/off of the DC detectors
AZ2	Auto Zero the DC detectors once
BA	B/A ratio measurement
BC	B/C ratio measurement*
BL0	Restore CRT to normal mode
BL1	Blank frequency labels
BL2	Blank all labels
BL3	Blank active channel trace
BL4	Blank softkey labels
BL5	Blank all (except user CRT graphics)
BL6	Blank title
BL7	Blank mode labels
BL8	Blank the active entry area
BL9	Blank the limit lines
BR	B/R ratio measurement
BW	Display the search bandwidth on the CRT
C0	Channel off
C1	Channel 1 on/active
C2	Channel 2 on/active
C3	Channel 3 on/active
C4	Channel 4 on/active
CA	C/A ratio measurement*
CB	C/B ratio measurement*
CDm	Cursor Delta on/off
CL	Perform system configuration calibration of detectors and channels
CN	Cursor to minimum
CR	C/R ratio measurement*
CS	Clear Status bytes
CTm	Auto System Calibration on/off†
CUm	Cursor on/off
CWm	CW mode on/off
CX	Cursor to maximum
DAd	Detector A Offset set to d
DBd	Detector B Offset set to d
DCd	Detector C Offset set to d*
DHm	Display Hold on/off of the active channel trace.
DM0	All inputs set to DC detection
DM1	All inputs set to AC detection
DN	Step down (decrement)
DRd	Detector R Offset set to d
DS0	Display trace data in log magnitude format†
DS1	Display trace data in Standing Wave Ratio (SWR) format†
ER0	Erase all save/recall registers
FA	Graticule start label
FB	Graticule stop label
FD0	Format Data ASCII
FD1	Format Data binary

Table 3: Alphabetical Listing of HP 8757A Programming Commands (2 of 3)

CODE	ACTION
FD2	Format Data Extended ASCII†
FR0	Display cursor data in log magnitude format
FR1	Display cursor data in SWR format
IA	Input A absolute power measurement
IB	Input B absolute power measurement
IC	Input C absolute power measurement*
ILs	Input Learn string
IP	Instrument Preset
IR	Input R absolute power measurement
IX	External ADC Input ("AUX") voltage measurement‡
LE	Erase limit lines for active channel**
LFs	Enter limit test flat line data**
LL	Store lower limit line into memory**
LPs	Enter limit test point data**
LSs	Enter limit test sloped line data**
LTm	Limit line test on/off**
LU	Store upper limit line into memory**
M–	Display normalized data (measurement–memory)
MDm	Modulation on/off
ME	Display Measurement data
MM	Display the Channel Menu (main menu)
MN	Display normalized data (same as M-)
MR	Marker (or cursor) to reference line
MSm	Manual sweep mode on/off
MU0	Display the Measurement Menu
MU1	Display the Display Menu
MU2	Display the Scale Menu
MU3	Display the Reference Menu
MU4	Display the Cursor Menu
MU5	Display the Average Menu
MU6	Display the Calibration Menu
MU7	Display the Special Menu
MU8	Display the System Menu
MY	Display Memory data
MZ	Manual calibration of DC detectors
NSm	Non-standard sweep mode on/off
OC	Output Cursor value
OD	Output Trace data
OI	Output Identity
OK	Output Keycode of last key pressed
OL	Output Learn string
OM	Output Memory data
ON	Output Normalized (measurement–memory) data
OPxx	Output Interrogated Parameter value xx = AF, BW, DA, DB, DC, DR, RL, RP, SD, SL, SO, SP, SR, SS, ST
OR	Output Rotary Knob value (−32768 ≤ value ≤+32767)
OS	Output Status bytes
OT1m	Control Output #1 on/off
OT2m	Control Output #2 on/off
OV	Output CW value
P1	Plot channel 1 trace on external plotter
P2	Plot channel 2 trace on external plotter
P3	Plot channel 3 trace on external plotter
P4	Plot channel 4 trace on external plotter

Table 3: Alphabetical Listing of HP 8757A Programming Commands (3 of 3)

CODE	ACTION
PA	Plot all on external plotter
PBm	System Interface control on/off
PC	Plot labels on external plotter
PD	Plot custom plot on external plotter
PG	Plot grid on external plotter
PR1	Print all graphics to external printer
PR2	Print tabular trace data to external printer†
PR3	Print tabular marker/cursor data to external printer†
PTd	Pass Through address set to d
R1	R/A ratio measurement
R2	R/B ratio measurement
R3	R/C ratio measurement*
RCn	Recall register n
RLd	Reference Level set to d
RMd	Service Request Mask set to d
RPq	Reference Position set to vertical division q
RS	Restart averaging
SCd	Set Cursor to horizontal position d
SDd	Scale per division set to d
SKq	Select Soft Key q: q = 1 to 8
SL	Cursor Search Left
SM	Store Measurement into memory
SN	Store Normalized data (measurement–memory) into memory
SOd	Smoothing set to d % of frequency span
SPd	Number of Points set to d: d = 101, 201, 401, 801, 1601
SR	Cursor Search Right
SSd	Cursor search value set to d
STd	Reference level step size set to d
SUd	Specify custom plot according to d
SVn	Save register n
SW0	Non-swept mode. Non-swept operation
SW1	Swept mode. Normal swept operation
SW2	Sweep Hold mode. Non-swept mode with HP-IB bus hold off until completion of TSd
TSd	Take d Sweeps, then hold display
UP	Step up (increment)
WKs	Write soft key label
WMs	Write to channel memory
WTs	Write Title, s is an ASCII string of up to 50 characters
XAs	External Detector Cal Value for detector A†
XBs	External Detector Cal Value for detector B†
XCs	External Detector Cal Value for detector C†
XRs	External Detector Cal Value for detector R†

* Valid only for HP 8757A Option 001 (C detector).
** Limit line functions valid only for channels 1 or 2.
† Functions new in Revision 2.0.

NOTES

n = decimal integer 1 to 9
d = variable length numeric
m = 0 for off
= 1 for on
q = unique value
s = ASCII or binary string

FOR MORE INFORMATION, CALL YOUR LOCAL HP SALES OR SERVICE OFFICE or East (201) 265-5000 ● Midwest (312) 255-9800 ● South (404) 955-1500 ● West (213) 970-7500 or (415) 968-9200 **OR WRITE**, Hewlett-Packard, 1820 Embarcadero, Palo Alto, California 94303. **IN EUROPE, CALL YOUR LOCAL HP SALES OR SERVICE OFFICE OR WRITE**, Hewlett-Packard S.A., 7, rue du Bois-du-Lan Case Postale 365 CH 1217 Meyrin 1-Geneva, Switzerland. **IN JAPAN**, Yokogawa-Hewlett-Packard Ltd., 1-27-15, Yabe Sagamihara City, Kanagawa Prefecture, Japan 229.

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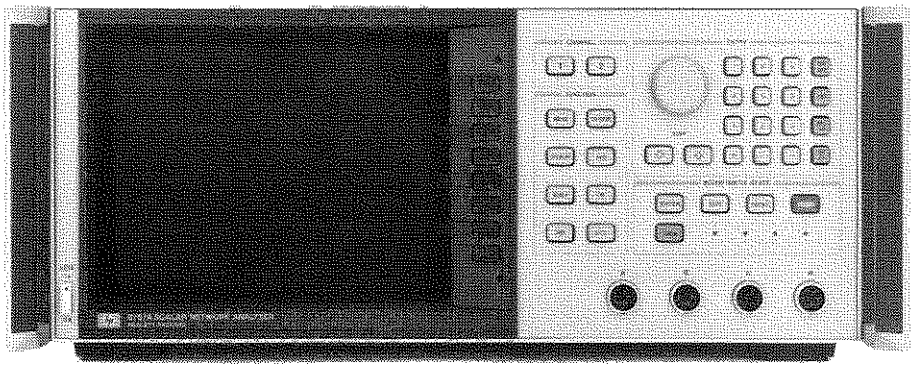
DESIGNED FOR HP-IB SYSTEMS

Programming Note

8757A/0000-2A
Supersedes: 8757A/0000-2

NOVEMBER 1985

Quick Reference Guide for the HP 8757A Scalar Network Analyzer



INTRODUCTION

This programming note is a reference guide for the remote operation of the HP 8757A scalar network analyzer with firmware revision 2.0 or greater. This note is intended for use by those familiar with HP-IB programming and the basic functions of the HP 8757A. For complete information, refer to Operating Information and the Introductory Operating Guide, contained in the HP 8757A Operating Manual.

NOTE

Remote operation of the HP 8757A applies to operation with the HP Interface Bus (HP-IB) connector on the rear panel of the HP 8757A. Do not connect an HP-IB controller to the 8757 SYSTEM INTERFACE connector; HP-IB control of the instruments connected to this port is described in the Pass Through described later.

HP-IB CAPABILITIES

The following codes describe the HP-IB electrical capabilities of the HP 8757A, using IEEE Std 488-1978 mnemonics (HP-IB, GP-IB, IEEE 488, and IEC-625 are all electrically equivalent). Briefly, the mnemonics translate as follows:

SH1: Source Handshake, complete capability.

AH1: Acceptor Handshake, complete capability.

T6: Talker, capable of basic talker, serial poll, and unaddress if MLA.

TE0: Talker, Extended address; no capability.

L4: Listener, capable of basic listener, and unaddress if MTA.

LE0: Listener, Extended address; no capability.

SR1: Service Request, complete capability.

RL1: Remote Local, complete capability.

PP0: Parallel Poll, no capability.

DC1: Device Clear, complete capability.

DT0: Device Trigger, no capability.

C0: Controller, no capability.

E1: Electrical specification indicating open collector outputs.

These codes are completely explained in the IEEE Std 488-1978 document, published by the Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, New York 11017.

HEWLETT PACKARD

INPUT DATA

The HP 8757A scalar network analyzer accepts specific programming commands for selecting front panel key functions, most soft key functions and special HP-IB only functions. The line switch and HP-IB address setting are not programmable. The HP 8757A can pass through HP-IB commands to a compatible HP swept source, HP graphics plotter, and/or HP ThinkJet printer, connected to the 8757 SYSTEM INTERFACE. In addition, some HP Graphics Language (HP-GL) commands may be passed through to the CRT.

Programming data consists of a string of ASCII coded characters composed of one or more of the following control fields:

- Select channel
- Measure power/ratio
- Display measured data/memory
- Select scale
- Select reference value/position
- Select averaging
- Cursor functions
- Plot functions
- HP-GL graphics commands
- Instrument state/registers
- Special HP-IB only functions

Input Syntax

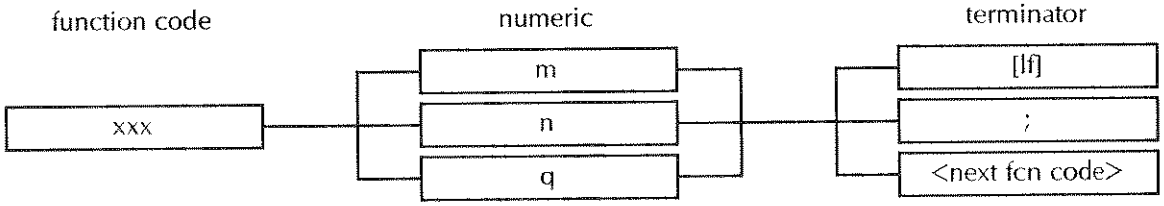
The HP 8757A responds to program commands in the order in which they are received. The commands may be sent as upper or lower case ASCII characters, and must be sent without any intervening alphanumeric characters or digits (spaces are ignored).

There are two input command terminators which may be universally applied to all HP 8757A input commands: a line feed ([lf]) or a semicolon (";"). It is recommended that all input programming commands be terminated with either a line feed or a semicolon. However, there are alternate choices in the use of terminators. Listed below in the syntax diagrams are all of the possible terminators that may be used with the various input commands.

Input Syntax #1: Function Code

Example: "C1 IA;ME[lf]"
Select channel 1 (C1), measure the power at the A detector (IA), display the measured data (ME) on the CRT. Terminators are not actually required on these commands; they are used for convenience only.

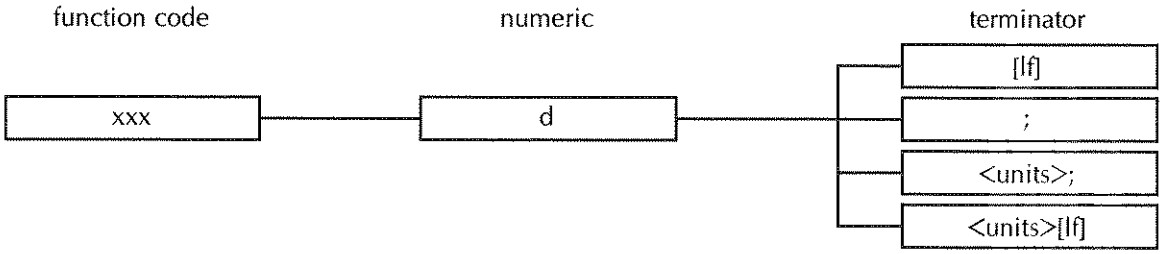
Input Syntax #2: Function Code followed by a Single Digit Numeric



where: m = 0 function off
= 1 function on
n = decimal integer 1 through 9
q = value unique to the particular function and explained under command description

Example: "MD1;RP4 SV9[lf]"
Turn the square wave modulation on (MD1), set the reference position to the 4th graticule (RP4), and then save the front panel setting into register 9 (SV9). Terminators are not actually required on these commands; they are used for convenience only.

Input Syntax #3: Function Code followed by a Variable Length Numeric

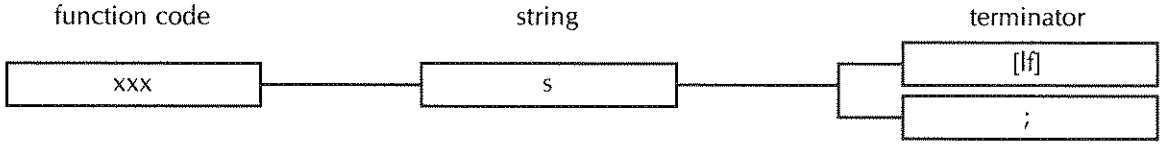


where: d = Variable length parameter, including sign, decimal point, and exponent if desired. The general format is ±D.DDDDDE±DD. Resolution or range of d is explained under the particular command description. When the value of d does not correspond to the function's resolution or range, d will be rounded and assigned the closest allowable value.

<units> = DB for dB/dBm, SWR for SWR, V for Volts, or null for other cases.

Example: "AF64;RL-10DB;SD0.5DB[lf]"
Set the averaging factor to 64 (AF64), set the reference level to −10 dB (RL-10), and set the scale per division to 0.5 dB (SD0.5).

Input Syntax #4: Function Code followed by a String of Bytes or Characters



where: s = An ASCII string of characters or a sequence of 8-bit binary bytes, the length of which is unique to the particular function and is explained under the command description.

Example: "WK1 TEST1;WT PASSBAND INSERTION LOSS[lf]"
Write soft key 1 with label 'TEST1' (WK1 TEST1), and write a title onto the CRT which says 'PASSBAND INSERTION LOSS' (WT PASSBAND INSERTION LOSS).

Valid Characters

Programming commands may be sent as upper or lower case ASCII characters. Spaces, unnecessary signs (+,−), leading zeros, carriage returns ([cr]) and unnecessary terminators are ignored by the HP 8757A. The parity bit (the eighth bit, MSB) of all ASCII coded characters will be ignored.

Any alphanumeric sequence which is not a recognized HP 8757A command will be noted on the CRT in the ACTIVE ENTRY AREA as "UNKNOWN CMD- " followed by the last one or two characters received by the HP 8757A over HP-IB. The HP 8757A will not lock out further HP-IB traffic, and will execute any subsequent valid command. Further, a syntax error service request (SRQ) will be output if that SRQ bit has been enabled in the Request Mask (see SERVICE REQUEST & STATUS BYTES below). If there are many errors in the alphanumeric sequence, only the last error is displayed in the active function area.

Programming Data

See Table 1, Function Select Commands, for Input Programming Codes.

Commands associated with the C detector are valid only for HP 8757A's that include Option 001 (C detector). If a command associated with the C detector is sent to a standard HP 8757A (not Option 001), it will be treated as an unknown command.

Instrument Preset

A self test is first performed when the PRESET key is pressed or when the "IP" command is received by the HP 8757A. This is followed by presetting the HP 8757A and the instruments connected to the 8757 SYSTEM INTERFACE. All functions are turned off, then the following is set:

1. Channels 1 and 2 on and the channel menu will appear in the soft key label area of the CRT. The following applies to channels 1, 2, 3, and 4.
   a. Measure power A, B, C (or B), R, on channels 1, 2, 3, 4.
   b. Display measurement data in log magnitude format.
   c. Scale = 20 dB/div.
   d. Reference level 0 dB/dBm for all channels.
   e. Reference level step size = 20 dB.
   f. Averaging factor = 8 (off).
   g. Cursor off.
   h. All labels on.
   i. Channel 1 as the active channel.
   j. Modulation drive on.
   k. Number of points = 401.
   l. Detector mode set for AC detection.
   m. Smoothing set for 5.0% of span (off).
   n. Cursor format = log magnitude.
   o. Search value = −3 dB.
   p. Autocalibration on.
   q. Standard sweep mode on.

The following are not changed during a PRESET or "IP" command execution.

a. Reference position.
b. Trace memory.
c. Save/recall registers.
d. HP-IB addresses.
e. Request mask.
f. Limit lines.
g. Title.
h. Detector offset.
i. User-defined plot.
j. System Interface mode.
k. Repeat Auto Zero Timer value.

2. If a compatible HP-IB sweep oscillator is connected to the 8757 SYSTEM INTERFACE, the following actions are performed:
   a. Instrument preset.
   b. Sweep time set to 200 ms.
   c. HP 8350B square wave modulation on.
   d. HP 8340/41 SHIFT pulse on; RF output on.
3. If a compatible HP-IB plotter is connected to the 8757 SYSTEM INTERFACE, the following actions are performed:
   a. Abort plot if in progress.
   b. The position of P1 and P2 are left unchanged.
4. If a compatible HP-IB printer is connected to the 8757 SYSTEM INTERFACE, the following actions are performed:
   a. Aborts printout if in progress.

Pass Through

Programming commands and data may be sent to HP instruments connected to the 8757 SYSTEM INTERFACE and/or the HP 8757A CRT. This is accomplished by first sending the pass through command "PTd", where d is the decimal address of the device being addressed. Subsequent addressing of the 8757 SYSTEM INTERFACE address will pass through commands to the selected device. The "PTd" command may be sent at any time to the analyzer's address. The default addresses for pass through commands are as follows:

8757 Analyzer	16 decimal
8757 SYSTEM INTERFACE	17 decimal
8757 CRT	15 decimal
HP Source	19 decimal
HP Plotter	05 decimal
HP Printer	01 decimal

An explanation of how to pass through commands to HP instruments connected to the 8757 SYSTEM INTERFACE and the CRT is provided in the following sections.

8757 System Interface

This rear panel connector is physically similar to the HP-IB port, but is specifically used to control the following HP instruments:

Sources

HP 8350B Sweep Oscillator
HP 8340A Synthesized Sweeper
HP 8341A Synthesized Sweeper

Plotters

HP 7470A Two-pen Graphics Plotter
HP 7475A Six-pen Graphics Plotter
HP 7550A Eight-pen Graphics Plotter

Printers

HP 2225A ThinkJet Printer

The transfer of commands and data is performed by first sending a Pass Through command "PTd" to the HP 8757A, where d is the decimal address of the desired device. Subsequent addressing of the 8757 SYSTEM INTERFACE will pass through commands to the instrument selected.

The address of the 8757 SYSTEM INTERFACE is determined by complementing the least significant bit of the current HP 8757A address. For example, since the HP 8757A default address is 16 decimal = 10000 binary, the default 8757 SYSTEM INTERFACE address is 17 decimal = 10001 binary. As another example, if the HP 8757A address is set to 7 decimal = 111 binary, then the 8757 SYSTEM INTERFACE address becomes 6 decimal = 110 binary.

An example of how to pass through commands to the HP source with address 19 decimal using the HP 8757A default address (16 decimal) is:

1. Address device 16 (the HP-IB port on the HP 8757A) and send the command "PT19;".
2. Address device 17 (the 8757 SYSTEM INTERFACE) and send commands to the HP source.
3. Address device 16. This returns the HP 8757A to its normal HP-IB operation.

An example of how to pass through commands to the HP plotter with address 05 decimal using the HP 8757A default address (16 decimal) is:

1. Address device 16 (the HP-IB port on the HP 8757A) and send the command "PT05;".
2. Address device 17 (the 8757 SYSTEM INTERFACE) and send commands to the HP plotter.
3. Address device 16. This returns the HP 8757A to its normal HP-IB operation.

CRT Graphics

The CRT screen of the HP 8757A may be used as if it were an external HP-IB graphics plotter. By defining the HP 8757A CRT as the plot device used by the computer, the operator may pass through graphics commands which will plot graphics on the CRT.

The graphics commands are mostly a subset of the Hewlett-Packard Graphics Language (HP-GL), shown in Table 4. The HP 8757A graphics characters used for labeling are shown in Table 5, HP 8757A Modified ASCII Code Conversion Table. These modified ASCII characters are available only when using the "LB" command explicitly; many desktop computer plotter commands use different characters sets.

The address of the CRT is the HP 8757A address minus 1. The default address of the HP 8757A is 16 decimal, thus the default address of the CRT is 15 decimal.

An example of how to pass through commands to the CRT with address 15 decimal using the HP 8757A default address (16 decimal) is:

1. Address device 16 (the HP-IB port of the HP 8757A) and send the command "PT15;".
2. Address device 17 (the 8757 SYSTEM INTERFACE) and send graphics commands to the CRT.
3. Address device 16. This returns the HP 8757A to its normal HP-IB operation.

OUTPUT DATA

The HP 8757A has several output modes that allow the user to learn or interrogate the instrument state and to output data. The following output modes are available.

- Learn String
- Interrogate Function
- Status
- Error
- Data
- Identity

The program codes and syntax to enable each function are shown in Table 3.

Learn String

Selected with the "OL" program code, the HP 8757A outputs a Learn String of 150 bytes in length. This binary data string completely describes the present instrument state (excluding the storage registers, trace memory, title, limit line data, and source settings) of the HP 8757A. This information is packed and encoded for minimal storage requirements thereby making data analysis difficult. When stored in an ASCII character data string, the Learn String can later be input to the HP 8757A to restore that instrument state by using the Input Learn String command. The length of the Learn String is fixed at 150 bytes.

Interrogate Function

Selected with the "OP" program code followed immediately by the program code for the function to be interrogated. The HP 8757A will output the present value for the function that was selected to be interrogated. The units of the output value will be the same as the units available for setting the value if it can be set. The functions valid for interrogation are: AF, BW, DA, DB, DC, DR, RL, RP, SD, SL, SO, SP, SR, SS, and ST.

Status

Selected with the "OS" program code, the HP 8757A will output 2 sequential 8-bit bytes giving the present instrument status. The first status byte is equivalent to the Status Byte of the Serial Poll, the second status byte is an Extended Status Byte which provides additional information. See Table 6 for a description of each Status Byte. The Status Bytes are cleared upon execution of either a Serial Poll, Device Clear (DCL), Selective Device Clear (SDC), PRESET, or sending the "CS" or "OS" commands.

Error

Selected with the "OE1" or "OE2" program codes, the HP 8757A will output one 8-bit byte giving the present status of display channels 1 or 2, respectively. This allows the user to determine which channel has failed the specified limit test if limit lines were enabled.

Data

The HP 8757A outputs data from the designated display channel in one of three formats: ASCII formatted data, Extended ASCII formatted data, and binary formatted data. The two ASCII formats are the more general purpose formats and are easier to interpret the output values. Binary formatted data provides faster data transfer rates and is usually the choice when transfer speed is a major concern. The data format is selected by using the "FD0," "FD1" and the "FD2" commands. The data format must be selected before a data transfer is attempted.

Identity

Selected with the "OI" program code, the HP 8757A will output a message which identifies it from other scalar network analyzers. Both the model number and the software revision are provided. This is helpful in system applications where software is written to run on more than one scalar network analyzer.

TRIGGER

The HP 8757A does not respond to the Group Execute Trigger (GET) message.

CLEAR

The Device Clear (DCL) and Selective Device Clear (SDC) messages clear all status bytes, the Request Mask, the HP-IB of the HP 8757A, and the 8757 SYSTEM INTERFACE.

REMOTE/LOCAL

The HP 8757A goes to Remote when the Remote Enable (REN) line on the interface is low (true) and it receives its Listen Address. In remote, all front panel functions are disabled except the LINE switch and the LOCAL key. The LOCAL key can be disabled via the Local Lockout (LLO) command. The state of the REN line is also sensed by the 8757 SYSTEM INTERFACE. An instrument on the 8757 SYSTEM INTERFACE designated as the pass through instrument (with the "PTd" command) is placed in remote or local depending on the state of the REN line. When the HP 8757A is placed in Local Lockout, the HP-IB Source is also placed in Local Lockout.

The HP 8757A goes to Local when it recieves the Go To Local (GTL) command or when the REN line goes high (false). It will also return to local when the LOCAL key is pressed unless the Local Lockout (LLO) command has been executed.

SERVICE REQUEST

The HP 8757A can initiate a Service Request (SRQ) whenever one of the following conditions exist:

- HP-IB command syntax error
- End of operation (sweep or plot completed)
- Self Test failed
- Any front panel key pressed
- Numeric entry completed (HP-IB or front panel)
- Soft key only pressed
- Battery voltage low
- Rotary knob activity
- Requested action not possible
- Limit test failed

Further information can be obtained by executing a Serial Poll or by executing the Output Status "OS" command. A Serial Poll operation consists of sending the HP 8757A its Talk Address, sending the Serial Poll Enable (SPE) command, reading the Status Byte on the bus, and sending the Serial Poll Disable (SPD) command. The SRQ is cleared only by executing either a Serial Poll, Device Clear (DCL), Selective Device Clear (SDC), PRESET, or sending the "CS" or "OS" commands.

The Request Mask function "RMd" is used to specify a particular set of conditions for initiating a Service Request (SRQ). The mask value is determined by summing the decimal values of each selected function/condition that is desired. If a bit in the Request Mask is set to zero, that bit in the status byte will be masked and an SRQ cannot be initiated. For example, the command "RM41" indicates an SRQ can be initiated by the functions of bits #0, 3 and 5. The default value of the Request Mask at power-on is '00000000' or 0 decimal (no SRQ's are initiated).

STATUS BYTE

The HP 8757A responds to a Serial Poll by sending the Status Byte (#1). Both the Status Byte (#1) and the Extended Status Byte (#2) are obtained by sending the Output Status "OS" command and by immediately reading the two byte values, respectively. The Status Bytes of the HP 8757A are described in Table 6.

When bit #6 (Request Service) of the Status Byte (#1) is true (one), an SRQ has occurred. See **SERVICE REQUEST** for the conditions causing a Service Request. Bit #2 of the Status Byte (#1) indicates whether a change has occurred in the Extended Status Byte (#2). If bit #2 is true, then the Extended Status Byte (#2) should be accessed via the Output Status "OS" command to determine the cause of the status change. All other bits (7, 5, 4, 3, 1, 0) of the Status Byte (#1) indicate the present status of the noted function. The bits are true (one) if and only if the associated function/condition is true.

STATUS BIT

The HP 8757A does not respond to a Parallel Poll.

CONTROLLER CAPABILITIES

The HP 8757A does not have the ability to take or pass control.

ABORT

The HP 8757A responds to the ABORT message (Interface Clear Line, IFC true) by stopping all Listener or Talker functions.

SELF-TEST

A self-test is performed at power-up and whenever the Instrument Preset "IP" command is received by the HP 8757A. This self-test routine includes a brief but thorough check that key parts of the instrument are functioning. At the conclusion of the self-test, the HP 8757A will be placed in its PRESET condition. The operator can check the outcome of the self-test by reading bit 0 of the Extended Status Byte (#2) or by checking the front panel of the HP 8757A. For details on checking the front panel after the self-test, refer to Operating Information.

ADDRESS ASSIGNMENT INFORMATION

The HP-IB address for the HP 8757A is set at the factory to decimal 16. The current address may be determined by pressing the **LOCAL** key on the front panel, then selecting the **8757** soft key, and observing the ACTIVE ENTRY AREA of the CRT. It may be changed, if desired, by entering the digits, range **01** to **29** decimal, followed by **ENT**, using the keypad. Avoid the use of address 21 (most HP-IB controllers use this address) and any address used on the 8757 SYSTEM INTERFACE (i.e., 8757 CRT, HP source, HP plotter, HP printer).

The new address is retained in non-volatile memory until changed by the operator. However, should battery power to the non-volatile memory be interrupted, the HP-IB address will default to 16 decimal.

The default addresses associated with the HP 8757A are summarized below:

16 decimal	HP 8757A
17 decimal	8757 SYSTEM INTERFACE
15 decimal	8757 CRT
19 decimal	HP Source
05 decimal	HP Plotter
01 decimal	HP Printer

Table 1. Function Select Commands (1 of 5)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Channel Selection	C1	1	Channel 1 on and the active channel.
	C2	1	Channel 2 on and the active channel.
	C3	1	Channel 3 on and the active channel.
	C4	1	Channel 4 on and the active channel.
	C0	1	Turns the currently active channel off.
Measure Power/Voltage	IA	1	Input A absolute power measurement.
	IB	1	Input B absolute power measurement.
	IC	1	Input C absolute power measurement.*
	IR	1	Input R absolute power measurement.
	IX	1	External ADC Input ("AUX") voltage measurement.
Measure Ratio	AB	1	A/B ratio measurement.
	AC	1	A/C ratio measurement.*
	AR	1	A/R ratio measurement.
	BA	1	B/A ratio measurement.
	BC	1	B/C ratio measurement.*
	BR	1	B/R ratio measurement.
	CA	1	C/A ratio measurement.*
	CB	1	C/B ratio measurement.*
	CR	1	C/R ratio measurement.*
	R1	1	R/A ratio measurement.
	R2	1	R/B ratio measurement.
	R3	1	R/C ratio measurement.*
Display Trace Data	ME	1	Display measurement data.
	MY	1	Display memory data.
	M- or MN	1	Display normalized data (measurement — memory).
	DHm	2	Display hold on/off of the active trace.
	SM	1	Store measurement data into memory.
	SN	1	Store normalized data (measurement — memory) into memory.
	DS0	1	Display trace data in a log magnitude format.
	DS1	1	Display trace data in a Standing Wave Ratio (SWR) format.
Scale	AS	1	Autoscale the trace on the CRT.
	SDd	3	Set scale per division to d; where d is for dB, dBm: 20, 10, 5, 2, 1, 0.5, 0.2, or 0.1 for SWR: 10, 4, 2, 1, 0.4, 0.2, 0.1, 0.04, or 0.02 for Volts: 5, 2.5, 1, 0.5, 0.25, 0.1, 0.05, or 0.025
Reference Level	MR	1	Marker = Reference Level. Moves the cursor (or active marker if no cursor) and trace to the reference line.
	RLd	3	Set Reference Level to d; d must be in the range of: ratio measurement: +90 to −90 dB normalized measurement: +90 to −90 dB power measurement: +20 to −70 dBm SWR measurement: 1.0 to 37.0 SWR voltage measurement: +10 to −10 V normalized voltage measurement: +20 to −20 V
	STd	3	Set Reference Level Step size to d; where d is for dB, dBm: 0 to 60 dB for SWR: 1 to 37 SWR for Volts: 0 to 10 V

* Valid only for HP 8757A Option 001 (C detector)

Table 1. Function Select Commands (2 of 5)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Reference Position	RPq	2	Set Reference Position; q has a value from 0 to 8 corresponding to the major horizontal graticule lines: 8 = top graticule line 4 = center graticule line 0 = bottom graticule line
Cursor	CUm	2	Cursor on/off.
	CDm	2	Cursor Delta on/off.
	CX	1	Cursor to maximum for the active channel.
	CN	1	Cursor to minimum for the active channel.
	SSd	3	Set cursor search value to the amplitude value of d; d must be in the range of: ratio measurement: +60 to −60 dB normalized measurement: +60 to −60 dB power measurement: +20 to −60 dBm Maximum resolution of d is 0.01 dB or dBm. Cursor search functions are not allowed in SWR or Voltage display modes.
	SL	1	Cursor Search Left for the search value. Cursor will search left to the first frequency point (or interpolated point which equals the search value). If the value cannot be found, the message "SEARCH VALUE NOT FOUND" will appear in the ACTIVE ENTRY AREA.
	SR	1	Cursor Search Right for the search value. Cursor will search right to the first frequency point (or interpolated point which equals the search value). If the value cannot be found, the message "SEARCH VALUE NOT FOUND" will appear in the ACTIVE ENTRY AREA.
	BW	1	Cursor search for bandwidth representing the search value. If the value cannot be found, the message "BANDWIDTH VALUE NOT FOUND" will appear in the ACTIVE ENTRY AREA.
Cursor Format	FR0	1	Display cursor data in a log magnitude format.
	FR1	1	Display cursor data in a Standing Wave Ratio (SWR) format.
Averaging	A0	1	Averaging off.
	AFd	3	Averaging on and factor set to d; d is 0 (enables previous factor), 1, 2, 4, 8, 16, 32, 64, 128, or 256.
	RS	1	Restart averaging process on the next sweep.
DC Detector Zero	MZ	1	Manual zero of the DC detectors. The operator must turn the source RF power off before sending this command.
	AZm	2	Auto Zero Repeat on/off of the DC detectors. The source RF power is automatically turned off at an interval determined by the Repeat Auto Zero Timer and the DC zero is performed each time.**
	AZ2	1	Auto Zero of the DC detectors. The source RF power is automatically turned off and the DC zero is performed once.**
	ZTd	3	Repeat Auto Zero Timer interval set to d; d is a decimal integer from 1 to 60 minutes.
Smoothing	SOd	3	Set Smoothing to d % of span; d must be in the range of 0.0 to 20.0%, with a maximum resolution of 0.1%. When d is set to 0, this is equivalent to smoothing off.
Step	UP	1	Step up; increment the active parameter.
	DN	1	Step down; decrement the active parameter.
Plot	PA	1	Plot All; plots entire display (except user graphics) on an external plotter.
	P1	1	Plot channel 1 trace.
	P2	1	Plot channel 2 trace.

** This command is valid only when the operator is using a source which is connected to the 8757 SYSTEM INTERFACE.

Table 1. Function Select Commands (3 of 5)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Plot (Cont'd)	P3	1	Plot channel 3 trace.
	P4	1	Plot channel 4 trace.
	PC	1	Plot only labels on an external plotter.
	PG	1	Plot only the grid on an external plotter.
	SUd	3	Specify custom plot; d is an ASCII character representing one byte. Each bit of this byte specifies what is to be plotted. If a bit is set to 1, that item will be plotted, else it will not be plotted. bit # (LSB) — action: 0 Scale Trace (P1 and P2 define grid size); 1 Trace 1; 2 Trace 2; 3 Trace 3 bit # — action: 4 Trace 4; 5 Grid; 6 Mode Labels; 7 (MSB) Frequency Labels
	PD	1	Plot custom plot on an external plotter.
Print	PR1	1	Print entire graphics display (except user graphics) on external graphics printer.
	PR2	1	Print tabular trace data on external printer.
	PR3	1	Print tabular marker/cursor data on external printer.
Limit Lines	LE	1	Erase limit lines for active channel (only channels 1 and 2 are valid).
	LPs	4	Limit is a single point specified by s. The string s includes the segment number (1 to 12), the x-axis value, the upper limit value, and the lower limit value in the following format: "LP [seg. no.], [x-value] [x-units], [upper limit] [y-units], [lower limit] [y-units];" where [x-value] is a frequency or value determined by the start/stop labels. [x-units] is "GZ" for GHz, "MZ" for MHz, "KZ" for kHz, "HZ" for Hz, or blank for no units. [y-units] is "DB" for dB/dBm, "SWR" for SWR, or "V" for volts. Entering no value for an upper or lower limit value means do not test this limit. An example is: "LP 1, 2.5 GZ, 1.5 DB, –1 DB;"
	LFs	4	Limit is a flat line specified by s. The string s includes the segment number (1 to 12), the start x-axis value, upper limit value, lower limit value, and stop x-axis value in the following format: "LF [seg. no.], [x-start] [x-units], [upper limit] [y-units], [lower limit] [y-units], [x-stop] [x-units];" where [x-value], [x-units], and [y-units] are described above. An example is: "LF 2, 750 MZ, –30 DB, –32 DB, 850 MZ;"
	LSs	4	Limit is a sloped line specified by s. The string s includes the segment number (1 to 12), the start x-axis value, start upper limit value, start lower limit value, the stop x-axis value, the stop upper limit value, and the stop lower limit value in the following format: "LS [seg. no.], [x-start] [x-units], [upper limit] [y-units], [lower limit] [y-units], [x-stop] [x-units], [upper limit] [y-units], [lower limit] [y-units];" where [x-value], [x-units], and [y-units] are described above. An example is: "LS 4, 1 GZ, –3 DB, –4 DB, 3 GZ, 0 DB, –1 DB;"
	LTm	2	Limit Line test on/off. If on, limit test status is designated by the CRT PASS/FAIL message and status bytes.
	LL	1	Store lower limit line into memory.
	LU	1	Store upper limit line into memory.

Table 1: Function Select Commands (4 of 5)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Graticule Start/Stop Labels	FAs	4	Start value for labeling x-axis graticule and entry of limit lines when System Interface control is off or no source is connected to the 8757 SYSTEM INTERFACE. s is a string in the following format: "FA [value] [x-units];" where [x-units] is "GZ" for GHz, "MZ" for MHz, "KZ" for kHz, "HZ" for Hz, or blank for no units. An example is: "FA 6.55 GZ;"
	FBs	4	Stop value for labeling x-axis graticule and entry of limit lines when System Interface control is off or no source is connected to the 8757 SYSTEM INTERFACE. s is a string in the following format: "FB [value] [x-units];" where [x-units] is described above.
Number of Trace Points	SPd	3	Set the Number of Points displayed on the horizontal axis to d; d is 101, 201, 401, 801, or 1601. If source is connected to the 8757 SYSTEM INTERFACE, the source sweep time may change if increasing the number of points.
Detector Offsets	DAd	3	Set Detector A offset to d; d must be in the range of +60 to −60 dB with a maximum resolution of 0.01 dB.
	DBd	3	Set Detector B offset to d; d must be in the range of +60 to −60 dB with a maximum resolution of 0.01 dB.
	DCd	3	Set Detector C offset to d; d must be in the range of +60 to −60 dB with a maximum resolution of 0.01 dB.*
	DRd	3	Set Detector R offset to d; d must be in the range of +60 to −60 dB with a maximum resolution of 0.01 dB.
External Detector Calibration	XAd	3	Enter external cal value for the specific detector input. d is the code number in the format of [DDDDDD;], read from the front panel after performing a calibration. Note: XCd is valid only for HP 8757A Option 001 (C detector).
	XBd	3	
	XCd	3	
	XRd	3	
Detector Mode	DM0	1	Set Detector mode of all inputs for DC detection.
	DM1	1	Set Detector mode of all inputs for AC detection.
Adaptive Normalization	ANm	2	Adaptive Normalization on /off.
System Calibration	CL	1	Perform system configuration calibration of the detectors and channels.
	CTm	2	Auto System Calibration on/off. Performs a system calibration at an interval of every five minutes.
Sweep Mode	NSm	2	Non-standard sweep on/off. Allows the HP 8757A to track any sweep ramp in the range of 0 to 10 V, increasing in sweep voltage.
	CWm	2	CW mode (single point) on/off.**
	MSm	2	Manual sweep mode on/off.**
	PBm	2	System Interface control on/off.

* Valid only for HP 8757A Option 001 (C detector)

** If source is connected to the 8757 SYSTEM INTERFACE and the interface control is on, the source is also set to this mode.

Table 1. Function Select Commands (5 of 5)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Modulation	MDm	2	Rear panel square wave modulation output on/off.
Save/Recall Registers	SVn	2	Save front panel settings in register n; n from 1 to 9. Note that registers 1 to 4 also retain title, channels 1 and 2 limit line information, and channels 1 and 2 trace memories.
	RCn	2	Recall front panel settings from register n; n from 1 to 9.
	ER0	1	Erase all save/recall registers.
Instrument Preset	IP	1	Presets the HP 8757A and the instruments connected to the 8757 SYSTEM INTERFACE.
Front Panel Menus/ Soft Keys	MM	1	Display the Channel Menu.
	MU0	1	Display the Measurement Menu.
	MU1	1	Display the Display Menu.
	MU2	1	Display the Scale Menu.
	MU3	1	Display the Reference Menu.
	MU4	1	Display the Cursor Menu.
	MU5	1	Display the Average Menu.
	MU6	1	Display the Calibration Menu.
	MU7	1	Display the Special Menu.
	MU8	1	Display the System Menu.
	SKq	2	Select Soft Key q; q is from 1 to 8. Does the equivalent of manually pressing the soft key.

Table 2. HP-IB Only Functions (1 of 2)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Display Blanking	BL0	1	No blanking; restore CRT to normal mode.
	BL1	1	Blank only the frequency labels.
	BL2	1	Blank all labels on the CRT.
	BL3	1	Blank only the active channel trace.
	BL4	1	Blank only the soft key labels.
	BL5	1	Blank all of the CRT except user graphics.
	BL6	1	Blank only the user title.
	BL7	1	Blank only the mode labels.
	BL8	1	Blank only the active entry area.
	BL9	1	Blank only the limit lines.
Status Bytes	CS	1	Clear Status bytes #1 and #2.
	RMd	3	Set Request Mask of status byte #1 to d; d is decimal integer from 0 to 255.
Format Data	FD0	1	Format Data ASCII; all successive data transfers are made in an ASCII format. Data is transferred in [±DD.DDD] format where D is an ASCII digit.
	FD2	1	Format Data Extended ASCII; all successive data transfers are made in an extended ASCII format. Data are transferred in [±DDD.DDD] format where D is an ASCII digit.
	FD1	1	Format Data Binary; all successive data transfers are made in a binary format. Two bytes are transferred, the value of which is scaled between the limits shown below:

	decimal value	ratio meas.	power meas.	normalized ratio meas.	normalized power meas.	SWR meas.	voltage meas.
V0=	0	−90 dB	−70 dBm	−180 dB	−90 dB	1.0	−10 V
	16384	0 dB	−25 dBm	0 dB	0 dB	19.0	0 V
V1=	32767	+90 dB	+20 dBm	+180 dB	+90 dB	37.0	+10 V

Binary data can be unscaled using the following equation:

$$\text{real value} = \left[\text{binary value} \times \frac{(V1-V0)}{32767}\right] + V0$$

Pass Through Address	PTd	3	Set the Pass Through address of an instrument connected to the 8757 SYSTEM INTERFACE; d is a two digit ASCII integer which represents the HP-IB address of the instrument to be programmed.
Cursor Position	SCd	3	Set Cursor position to d; d is a decimal integer which represents a horizontal position on the CRT with a range of values shown below:

No. of trace points	range of d
101	0 to 100
201	0 to 200
401	0 to 400
801	0 to 800
1601	0 to 1600

Control Outputs	OT1m	2	Rear panel control output #1 on/off.
	OT2m	2	Rear panel control output #2 on/off.

Table 2. HP-IB Only Functions (2 of 2)

ACTION	HP-IB COMMAND	SYNTAX	DESCRIPTION
Sweep Mode	SW0	1	Non-swept mode. Sweep off; hold trace data on the CRT.
	SW1	1	Swept mode. Sweep on; continuously track sweep ramp voltage and update trace data on the CRT.
	SW2	1	Sweep Hold mode. Sweep off; hold HP-IB bus activity until completion of TSd number of sweeps.
	TSd	3	Take d Sweeps, then hold trace data on the CRT. The HP 8757A must be in the Non-Swept (SW0) or Sweep Hold (SW2) modes before executing. d is a decimal integer from 1 to 255. For certain operating modes, such as Alternate Sweep on, Averaging on, or Smoothing on, it is recommended that 2 successive sweeps be taken for accurate data.
Learn String	ILs	4	Input learn string; s is string of 150 binary bytes that were output by the output learn string command.
Write Soft Key Label	WKs	4	Write soft key label for a particular soft key. s is an ASCII string; the first character is the soft key number (range 1 to 8) followed by the label. The label can be sent in the following forms: one word label: "[ASCII label] [term]" two word label: "[ASCII label], [ASCII label] [term]" where [ASCII label] is ≤ 7 characters and [term] is a valid teminator.
Write Title	WTs	4	Write Title to the CRT; s is an ASCII string of up to 50 characters.
Write To Trace Memory	WMs	4	Write to the channel memory. Data is transferred from the computer to the channel memory of the analyzer. Several parameters must be properly set before the transfer is made: • data format must be set using the FDm command • the desired channel memory is selected by making that channel the active channel. • the number of points transferred must equal the present number of points/trace.

Table 3. Output Modes (1 of 2)

ACTION	HP-IB COMMAND	DESCRIPTION	FORMAT
Output Learn String	OL	Outputs binary data string 150 bytes long which completely describes instrument state. Can be stored in ASCII character string and later input to restore that instrument state.	150 [B] [EOI]
Output Interrogated Parameter Value	OPxx	Outputs the present numeric value of the function selected. xx is the function code to interrogate (AF, BW, DA, DB, DC, DR, RL, RP, SD, SL, SO, SP, SR, SS, ST).	[±D.DDDDDE±DD] [lf]
Output Cursor Value	OC	Outputs cursor or cursor Δ amplitude and horizontal position. Format set by "FD0", "FD1" or "FD2" command.	ASCII Data: [±DD.DDD],[DDD] [lf] Extended ASCII: [±DDD.DDD], [DDD] [lf] Binary Data: [BB] [BB] [EOI]
Output Measurement Data	OD	Output measurement data; no. of data points is the same as the no. of points/trace. Format set by "FD0", "FD1" or "FD2" command.	ASCII Data: (n–1) [±DD.DDD,] [±DD.DDD] [lf] Extended ASCII: (n–1) [±DDD.DDD,] [±DDD.DDD] [lf] Binary Data: n [BB] [EOI] n = no. of points per trace.
Output Memory Data	OM	Output memory data; no. of data points is the same as the no. of points/trace. Format set by "FD0", "FD1" or "FD2" command.	ASCII Data: (n–1) [±DD.DDD,] [±DD.DDD] [lf] Extended ASCII: (n–1) [±DDD.DDD,] [±DDD.DDD] [lf] Binary Data: n[BB] [EOI] n = no. of points per trace.
Output Normalized Data	ON	Output normalized data (measurement–memory); no. or data points is the same as the no. of points/trace. Format set by "FD0", "FD1" or "FD2" command.	ASCII Data: (n–1) [±DD.DDD,] [±DD.DDD] [lf] Extended ASCII: (n–1) [±DDD.DDD,] [±DDD.DDD] [lf] Binary Data: n[BB] [EOI] n = no. of points per trace.
Output CW Value	OV	Output CW value; Non-swept mode (SW0 or SW2) must be set. Format set by "FD0", "FD1" or "FD2" command.	ASCII Data: [±DD.DDD] [lf] Extended ASCII: [±DDD.DDD] [lf] Binary Data: [BB] [EOI]

Table 3. Output Modes (2 of 2)

ACTION	HP-IB COMMAND	DESCRIPTION	FORMAT
Output Error Status	OE1 OE2	Outputs error status of display channel 1 or 2. One byte is output, where each bit indicates:	[B] [EOI]

Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
Function	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Out of Limits

Output Keycode	OK	Outputs keycode for the last front panel key pressed. Refer to Table 7 for keycodes.	[DD] [lf]
Output Knob Value	OR	Output Knob value; the value is between −32768 and +32767. It is reset to 0 after. Negative value = counterclockwise rotation, positive value = clockwise rotation.	[BB] [EOI]
Output Status Bytes	OS	Output 2 bytes, the Status Byte (#1) and the Extended Status Byte (#2). Both bytes are then cleared.	[BB] [EOI]
Output Identity	OI	Outputs the HP 8757A identity string and the firmware revision number xx.x (i.e., 02.0 for revision 2.0)	"8757A REVxx.x" [cr] [lf]

NOTES:

D = ASCII digit
B = 8-bit byte
, = comma
EOI = End or Identity HP-iB line true
cr = carriage return
lf = line feed

Table 4. CRT Graphics Commands (1 of 2)

HP-GL SUBSET	
NOTE **All Graphics Commands must be terminated with a semicolon ";"** **or a "[linefeed]" (the character [carriage return] is ignored).**	
HP-IB COMMAND	**COMMAND DESCRIPTION**
DF	Default; sets default values. ("DI 1,0; LT 1; SI 0.14,0.17;")
DI run, rise	Absolute Character Direction; run, rise allowable values are: 1, 0 = 0 degrees (default) 0, 1 = 90 degrees −1, 0 = 180 degrees 0, −1 = 270 degrees
LB [text] [ETX]	Label text. Character set is shown in Table 5, HP 8757A Modified ASCII Character Set. Before labeling text, move the pen to the appropriate (x,y) coordinate using the PU and PA commands. The text will be plotted with the lower left corner of the first character starting at the existing pen position. The pen stops at the lower left corner of the next character space.
LTy,z	Line Type; the y = pattern number 1 to 4; z = pattern length which is ignored. For y = 0 or 1 = solid line 2 = short dashes 3 = long dashes
OP	Output the current P1 and P2 positions. (P1 = 0,0; P2 = 2698,2047) The graphics display units (GDU's) define the plotting area on the CRT. The coordinates of the full plotting area are (0,0) for lower left, (2698,2047) for upper right. The coordinates for the trace graticule are (198,150) for lower left, (2307,1814) for upper right.
PA x1, y1 (,x2, y2, ..., ..., xN, yN)	Plot Absolute; x and y are integers and are in Graphics Display Units (GDU's). Moves the pen to the specified (x,y) coordinates. Both the x and y coordinates must be specified. Any number of coordinate pairs can be specified when separated by commas. Use of the PD and PU commands determines whether a line is drawn or the pen is just moved. If an (x,y) coordinate is specified outside of the plotting area, only that portion of the line within the plotting area is drawn.
PD	Pen Down.
PU	Pen Up.
SI w, h	Absolute Character Size; w = width; h = height. Values allowed are: 0.14, 0.17 Smallest size (Mode labels, softkey labels) 0.21, 0.25 (Active Entry Area) 0.28, 0.34 0.35, 0.42 Largest size
SP n	Select pen; n = 0 to 4; 0 Pen up (Beam off) 1 Brightest Intensity 2 3 4 Lowest Intensity

Table 4. CRT Graphics Commands (2 of 2)

NON HP-GL COMMANDS		
The following HP-GL commands will be accepted but their functions are not implemented and no error will be noted: IM (Input SRQ Mask), IP (Input P1 and P2), IW (Input Window), OC (Output Current Position), OE (Output Error, PG (Output Page), SL (Character Slant), and SR (Size Relative for characters).		
	HP-IB COMMAND	**COMMAND DESCRIPTION**
Erase Page	EPn	Erase Page n, where n = 1 to 7; if no n value is given, all pages are erased.
Select Graphics Page On/Off	GPn,m	Turn graphics page n (1 to 7) on/off (m = 1 or 0). Each page may use up to 500 16 bit words. GP without parameters selects and turns on page 1. Also resets pointer to start of page.

Table 5. HP 8757A Modified ASCII Character Set

HP 8757A MODIFIED ASCII CODE CONVERSION TABLE

Note: These characters are output only when the LB command is used directly.

		MOST SIGNIFICANT CHARACTER							
		0	1	2	3	4	5	6	7
LEAST SIGNIFICANT CHARACTER	0		centered *	SP	0	@	P	`	p
	1	HP logo	centered o	!	1	A	Q	a	q
	2	β	↑	"	2	B	R	b	r
	3		←	#	3	C	S	c	s
	4	upper-half tic	↓	$	4	D	T	d	t
	5	lower-half tic	→	%	5	E	U	e	u
	6	left-half tic	√	&	6	F	V	f	v
	7	right-half tic	π	'	7	G	W	g	w
	8	back space	Δ	(	8	H	X	h	x
	9	½ shift down	μ	)	9	I	Y	i	y
	A	line feed	° (degree)	*	:	J	Z	j	z
	B	inv. line feed	Ω	+	;	K	[	k	{
	C	½ shift up	ϱ	,	<	L	\	l	:
	D	carriage return	Γ	-	=	M	]	m	}
	E	horizontal tic	θ	.	>	N	^	n	□
	F	vertical tic	λ	/	?	O	—	o	►

EXAMPLES:

HP logo = 01
A = 41
i = 69
√ = 16
► = 7F
line feed = 0A

Table 6. HP 8757A Status Byte Descriptions

STATUS BYTE (#1)								
Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Decimal Value	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Function	N/A	Request Service (SRQ)	SRQ on HP-IB Syntax Error	SRQ on Operation Complete (Sweep, Plot or Print)	SRQ on Soft Key Only Pressed	SRQ on Change in Extended Status Byte	SRQ on Numeric Entry Completed (HP-IB or Front Panel)	SRQ on Any Front Panel Key Pressed
EXTENDED STATUS BYTE (#2)								
Bit #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Decimal Value	**128**	**64**	**32**	**16**	**8**	**4**	**2**	**1**
Function	N/A	SRQ on Detector Uncal	SRQ on Front Panel Preset or Power-on	SRQ on Limit Test Failed	SRQ on Action Requested not possible	SRQ on Knob activity	SRQ on Low Battery Voltage	SRQ on Self Test Failure

Table 7. Front Panel Keycodes (Values are in decimal)

SOFT KEYS
Soft key 1 (top) = 32
Soft key 2 = 8
Soft key 3 = 0
Soft key 4 = 16
Soft key 5 = 14
Soft key 6 = 38
Soft key 7 = 40
Soft key 8 (bottom) = 41

CHANNEL
Channel 1 = 42
Channel 2 = 43

FUNCTION
Measurement = 44
Display = 45
Scale = 52
Reference = 46
Cursor = 47
Averaging = 48
Calibration = 49
Special = 50

ENTRY
Step down = 22
Step up = 6
0 Key = 20
1 Key = 4
2 Key = 3
3 Key = 7
4 Key = 12
5 Key = 11
6 Key = 15
7 Key = 36
8 Key = 35
9 Key = 39
. Key = 19
- Key = 23
Entry off = 9
Enter = 1
dBm/dB = 33
Back Space = 17

INSTRUMENT STATE
System = 51
Save = 28
Recall = 26
Local = 29

Table 8. Alphabetical Listing of HP 8757A Programming Commands (1 of 3)

CODE	ACTION
A0	Averaging off
AB	A/B ratio measurement
AC	A/C ratio measurement*
AFd	Averaging On and Factor d
ANm	Adaptive Normalization on/off
AR	A/R ratio measurement
AS	Autoscale
AZm	Auto Zero repeat on/off of the DC detectors
AZ2	Auto Zero the DC detectors once
BA	B/A ratio measurement
BC	B/C ratio measurement*
BL0	Restore CRT to normal mode
BL1	Blank frequency labels
BL2	Blank all labels
BL3	Blank active channel trace
BL4	Blank softkey labels
BL5	Blank all (except user CRT graphics)
BL6	Blank title
BL7	Blank mode labels
BL8	Blank the active entry area
BL9	Blank the limit lines
BR	B/R ratio measurement
BW	Display the search bandwidth on the CRT
C0	Channel off
C1	Channel 1 on/active
C2	Channel 2 on/active
C3	Channel 3 on/active
C4	Channel 4 on/active
CA	C/A ratio measurement*
CB	C/B ratio measurement*
CDm	Cursor Delta on/off
CL	Perform system configuration calibration of detectors and channels
CN	Cursor to minimum
CR	C/R ratio measurement*
CS	Clear Status bytes
CTm	Auto System Calibration on/off†
CUm	Cursor on/off
CWm	CW mode on/off
CX	Cursor to maximum
DAd	Detector A Offset set to d
DBd	Detector B Offset set to d
DCd	Detector C Offset set to d*
DHm	Display Hold on/off of the active channel trace.
DM0	All inputs set to DC detection
DM1	All inputs set to AC detection
DN	Step down (decrement)
DRd	Detector R Offset set to d
DS0	Display trace data in log magnitude format†
DS1	Display trace data in Standing Wave Ratio (SWR) format†
ER0	Erase all save/recall registers
FA	Graticule start label
FB	Graticule stop label
FD0	Format Data ASCII
FD1	Format Data binary

Table 8. Alphabetical Listing of HP 8757A Programming Commands (2 of 3)

CODE	ACTION
FD2	Format Data Extended ASCII†
FR0	Display cursor data in log magnitude format
FR1	Display cursor data in SWR format
IA	Input A absolute power measurement
IB	Input B absolute power measurement
IC	Input C absolute power measurement*
ILs	Input Learn string
IP	Instrument Preset
IR	Input R absolute power measurement
IX	External ADC Input ("AUX") voltage measurement†
LE	Erase limit lines for active channel**
LFs	Enter limit test flat line data**
LL	Store lower limit line into memory**
LPs	Enter limit test point data**
LSs	Enter limit test sloped line data**
LTm	Limit line test on/off**
LU	Store upper limit line into memory**
M–	Display normalized data (measurement–memory)
MDm	Modulation on/off
ME	Display Measurement data
MM	Display the Channel Menu (main menu)
MN	Display normalized data (same as M-)
MR	Marker (or cursor) to reference line
MSm	Manual sweep mode on/off
MU0	Display the Measurement Menu
MU1	Display the Display Menu
MU2	Display the Scale Menu
MU3	Display the Reference Menu
MU4	Display the Cursor Menu
MU5	Display the Average Menu
MU6	Display the Calibration Menu
MU7	Display the Special Menu
MU8	Display the System Menu
MY	Display Memory data
MZ	Manual zero of DC detectors
NSm	Non-standard sweep mode on/off
OC	Output Cursor value
OD	Output Trace data
OI	Output Identity
OK	Output Keycode of last key pressed
OL	Output Learn string
OM	Output Memory data
ON	Output Normalized (measurement–memory) data
OPxx	Output Interrogated Parameter value xx = AF, BW, DA, DB, DC, DR, RL, RP, SD, SL, SO, SP, SR, SS, ST
OR	Output Rotary Knob value (−32768 ⩽ value ⩽+32767)
OS	Output Status bytes
OT1m	Control Output #1 on/off
OT2m	Control Output #2 on/off
OV	Output CW value
P1	Plot channel 1 trace on external plotter
P2	Plot channel 2 trace on external plotter
P3	Plot channel 3 trace on external plotter
P4	Plot channel 4 trace on external plotter

Table 8. Alphabetical Listing of HP 8757A Programming Commands (3 of 3)

CODE	ACTION
PA	Plot all on external plotter
PBm	System Interface control on/off
PC	Plot labels on external plotter
PD	Plot custom plot on external plotter
PG	Plot grid on external plotter
PR1	Print all graphics to external printer
PR2	Print tabular trace data to external printer†
PR3	Print tabular marker/cursor data to external printer†
PTd	Pass Through address set to d
R1	R/A ratio measurement
R2	R/B ratio measurement
R3	R/C ratio measurement*
RCn	Recall register n
RLd	Reference Level set to d
RMd	Service Request Mask set to d
RPq	Reference Position set to vertical division q
RS	Restart averaging
SCd	Set Cursor to horizontal position d
SDd	Scale per division set to d
SKq	Select Soft Key q: q = 1 to 8
SL	Cursor Search Left
SM	Store Measurement into memory
SN	Store Normalized data (measurement–memory) into memory
SOd	Smoothing set to d % of frequency span
SPd	Number of Points set to d: d = 101, 201, 401, 801, 1601
SR	Cursor Search Right
SSd	Cursor search value set to d
STd	Reference level step size set to d
SUd	Specify custom plot according to d
SVn	Save register n
SW0	Non-swept mode. Non-swept operation
SW1	Swept mode. Normal swept operation
SW2	Sweep Hold mode. Non-swept mode with HP-IB bus hold off until completion of TSd
TSd	Take d Sweeps, then hold display
UP	Step up (increment)
WKs	Write soft key label
WMs	Write to channel memory
WTs	Write Title, s is an ASCII string of up to 50 characters
XAd	External Detector Cal Value for detector A set to d†
XBd	External Detector Cal Value for detector B set to d†
XCd	External Detector Cal Value for detector C set to d†*
XRd	External Detector Cal Value for detector R set to d†
ZTd	Repeat Auto Zero Timer interval set to d†

* Valid only for HP 8757A Option 001 (C detector).
** Limit line functions valid only for channels 1 or 2.
† Functions new in Revision 2.0.

NOTES

n = decimal integer 1 to 9
d = variable length numeric
m = 0 for off
= 1 for on
q = unique value
s = ASCII or binary string

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For more information, call your local HP Sales Office or nearest Regional Office: **Eastern** (201) 265-5000; **Midwestern** (312) 255-9800; **Southern** (404) 955-1500; **Western** (213) 970-7500; **Canadian** (416) 678-9430. Ask the operator for instrument sales. Or write Hewlett-Packard, 1501 Page Mill Road, Palo Alto, CA 94304. **In Europe**: Hewlett-Packard S.A., 7, rue du Bois-du-Lan, P.O. Box, CH 1217 Meyrin 2, Geneva, Switzerland. **In Japan**: Yokogawa-Hewlett-Packard Ltd., 29-21, Takaido-Higashi 3-chome, Suginami-ku, Tokyo 168.

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APPENDIX A
IN CASE OF DIFFICULTY

INTRODUCTION

This appendix explains what to do when a problem is encountered using the HP 8757A. It presents suggestions for minor problems that do not involve defects in the internal circuitry. The information provided here is divided into three main topics: manual operation problems, system operation problems, and inaccurate operation.

MANUAL OPERATION

Line Power Problems

If the power switch is turned on but all front panel LEDs are off and the fan is not operating, suspect a power problem.

- Make sure the line cord is properly connected.
- Check that the correct line voltage is selected at the rear panel power line module. The voltage selection PC board must be correctly installed. Refer to Section II for installation instructions.
- Make sure the correct fuse is installed in the fuse holder of the power line module. The required fuse rating for each line voltage is indicated in Table 2-1 and below the power line module on the rear panel of the HP 8757A.

Instrument Problems

After verifying that there is power to the instrument, look for internal instrument power problems.

- Check the internal fuses on the power supply assembly A12, especially the ±15V supply fuses A12F1-A12F4.
- Pay particular attention to the fuses in the A14 display assembly, because if the display is not operating the main troubleshooting features of the HP 8757A are not available.

Error Codes

When the front panel **[PRESET]** key is pressed, the HP 8757A performs a series of self-tests before establishing the preset conditions. If any of these tests fails, an error code from 0 to 15 is displayed in binary form with lighted LEDs. This error code appears in two places: on the front panel in the instrument state area, using the LEDs labeled R, L, T, and S; and on the A3 CPU assembly using the four LEDs near the top left corner of the board. In some cases, an error message is also displayed on the CRT. The most reliable failure indication is the LED display on the CPU assembly, since the front panel LEDs will not light in the event of a front panel failure. Table A-1 provides a list of error codes with the tests performed and most probable cause of failure.

SYSTEM OPERATION

If the HP 8757A is configured as a system controller with a sweeper, a plotter, and a printer, problems may occur in the configuration itself rather than in a specific instrument.

General

- Press **[PRESET]** on each instrument. This may correct the problem.
- Make sure that none of the devices (sweeper, plotter, or printer) is preventing proper system operation. Disconnect each instrument and see if the problem is solved.
- Make sure the filters are not clogged. All instrument filters should be cleaned regularly, once a month or more often. A clogged filter will cause overheating and consequent degradation of performance.
- If the system cannot be controlled from the HP 8757A front panel, cycle the power on the HP 8757A.
- Be sure that the source is compatible with the HP 8757A. Compatible sources are the HP 8350B sweep oscillator (serial prefix 2448A/J/U and above), used with an HP 83500-series RF plug-in, and the HP 8340A and 8341A synthesized sweepers. The HP 8350B can also be used with an HP 86200-series RF plug-in with 11869A adapter, though some of these plug-ins require an external modulator for AC compatibility with the HP 8757A.

  The HP 8350A sweep oscillator is manually compatible with the HP 8757A. However, it cannot be controlled by the HP 8757A through the 8757 System Interface private bus. Retrofit kits are available from Hewlett-Packard to update the HP 8350A for interface performance comparable to the HP 8350B.

Table A-1. Summary of Error Codes

LED Reading 8-4-2-1	Error Code	Test Description/Explanation	Probable Cause of Failure
1-1-1-1	15	Microprocessor kernel	A3U22, A3U42, A3U21 (CPU)
1-1-1-0	14	ROM checksum has started	A3U27, A3U4
1-1-0-1	13	ROM A checksum	A3U27, A3U4
1-1-0-0	12	ROM B checksum	A3U28, A3U5
1-0-1-1	11	ROM C checksum	A3U29, A3U6
1-0-1-0	10	RAM A (MSB)	A3U2
1-0-0-1	9	RAM A (LSB)	A3U25
1-0-0-0	8	RAM B (MSB)	A3U3
0-1-1-1	7	RAM B (LSB)	A3U26
0-1-1-0	6	RAM checksum failure	A3U2, A3U3, A3U25, A3U26
0-1-0-1	5	Instrument bus test	A3U41, 38, 39, A6, A11
0-1-0-0	4	CRT interface bus test	A14, W8
0-0-1-1	3	Unexpected interrupt	A4, A6, A2, A3U44, A3U8
0-0-1-0	2	Other self-test failure	As indicated on CRT
0-0-0-1	1	Unexpected key pressed	A1, A2U10
0-0-0-0	0	Pretest pass	—

HP-IB Connections and Addresses

If the instrument addresses are not set correctly, or if the HP-IB cables are not connected properly, a system malfunction may occur.

- Verify that the HP-IB cables are functional.
- Make sure that the sweep oscillator, plotter, and printer HP-IB cables are connected to the 8757 SYSTEM INTERFACE connector, not the HP INTERFACE BUS connector.
- Check that the HP-IB address of each instrument is set correctly and that no two instruments are set to the same address. To check the expected address for each instrument in the system, press **[LOCAL]**. Then press the soft keys **[8757]**, **[SWEEPER]**, **[PLOTTER]**, and **[PRINTER]**, and the expected addresses will be displayed on the CRT. Check the address settings on the instruments and verify that they correspond to the expected addresses.

  If the addresses do not agree, change the expected address using the local menu. Alternatively, the HP-IB address on the instrument itself can be physically reset.

Other Cable Connections

For most uses, the following connections must be made between the network analyzer and the sweeper. Other connections may be necessary for different applications.

- Connect the STOP SWEEP of the HP 8757A to the STOP SWEEP of the source.
- Connect the POS Z BLANK of the HP 8757A to the POS Z BLANK of the source.
- Connect the SWEEP IN 0-10V of the HP 8757A to the SWEEP OUT/IN of the source.

INACCURATE OPERATION

If the HP 8757A is functional but you are in doubt about the accuracy of the measurements, the problem may be with calibration or with the modulation frequency of the input signals.

Calibration

- Make sure the system is correctly configured for the detectors connected. The system must be reconfigured whenever a detector is replaced or exchanged. Press **[CAL]** then **[CONFIG SYSTEM]** to enable the HP 8757A to poll the detector inputs to determine the types of detectors connected and to calibrate each input.
- If you are using DC detection, make sure the detectors are zeroed to compensate for the effects of DC drift. Press **[CAL]**, then **[DC DET ZERO]**, and select either manual or automatic zeroing.
- Make sure the correct value of detector offset, if any, is entered. Press **[CAL]**, then **[DET OFFSET]**, and verify or change the offset values for each detector input. Note that **[PRESET]** does not reset the offset values to zero.
- For further information on calibration procedures, refer to "Calibration Menus" in the Operating Information section.

Modulation Frequency

- If you are using AC detection, verify that the modulation frequency of the input signals to the detectors is 27.778 kHz ±20 Hz.

If a problem is encountered that is not solved using any of the suggestions described here, refer to Section VIII of the HP 8757A Service Manual.

MISCELLANEOUS PROBLEMS

The following paragraphs provide additional information for using features that may cause confusion.

Alternate Sweep

The alternate sweep feature is provided by the compatible HP sweeper and the HP 8757A to allow two successive sweeps of different frequency ranges and/or power levels to be displayed simultaneously on the CRT with the proper frequency annotation. Alternate sweep is defined by the sweeper, not the HP 8757A. It is composed of two distinct sweeps: the active front panel sweeper settings, and the specified recall register sweeper settings. As far as the HP 8757A is concerned, its front panel settings are not changing. This is an important distinction, because there can be confusion about what is displayed during alternate sweep.

The following is an example of the **WRONG** way to run alternate sweep. People often try to do it this way, with confusing results: Set up the first frequency range on the sweeper and the channel 1 settings on the network analyzer, then save them in register 1 of either instrument. Then set up the alternate frequency range on the sweeper and the channel 2 settings on the network analyzer, and save them in register 2. On the sweeper, recall register 1 and alternate with register 2 (press **[RECALL] [1] [ALT] [2]**). The sweeper will display the frequency range of register 1, but the network analyzer settings may not be what you expected at all. The reason this does not work is that the recall register has saved front panel settings for BOTH network analyzer channels. This means that only the FREQUENCY information of the alternate channel is displayed. Frequency information is the only valid thing recalled from the first stored setting.

The **CORRECT** way to perform an alternate sweep is to store the register settings in reverse order. Always make the alternate register (in this case register 2) the one you save first, and use it to save frequency information only. Then set BOTH network analyzer channels and store them in the recall register (in this case 1), together with the second frequency range. Then press **[RECALL] [1] [ALT] [2]** to yield the desired display.

Because it is the sweeper that defines the alternate sweep settings, not the network analyzer, there are a few other limitations. Alternate sweep is defined as alternating between two SWEPT states: it does not work with a manual sweep or a CW frequency (except swept CW). In addition, it is not possible to alternate between AC and DC detection modes. Also, the active front panel settings of the sweeper will be the active, highlighted trace on the network analyzer. When you change active channels on the analyzer, the sweeper settings will also change.

Number of Trace Points and Trace Memory

The number of channels that can be displayed is limited by the number of trace points selected. All four channels can be displayed when 101, 201, or 401 points are selected. With 801 trace points, only channels 1 and 2 are available. With 1601 trace points, only channel 1 is available.

The channel trace memories for channels that are turned off may be destroyed when you select 801 or 1601 trace points. When you select fewer trace points (401 or less), it is advisable to restore the trace memory for channels 2, 3, and 4.

Autozero of DC Detectors

When the HP 8757A is in DC detection mode, it must periodically zero its AC/DC detectors to maintain accurate low-level measurements. When using a compatible HP source connected to the 8757 System Interface, you can select the autozero function and let the HP 8757A control the source power off/on sequence required. However, in order to preserve the front panel settings of the source, the HP 8757A must use save/recall register 9 on both the source and the network analyzer. Register 9 is accessed each time an autozero is performed, whether it is forced by the operator or the autozero repeat function is enabled. Therefore register 9 should not be used for storing other information.

Save/Recall Registers

The save/recall registers store most of the front panel settings, with a few exceptions. Some of the system menu functions are not stored because they apply to every instrument state, rather than to a specific channel.

The following information is stored in the save/recall registers:

- The channel status (which channel is active, and which other channels are on)
- For all four channels:
  - Measurement selected (A, B/R, etc.)
  - Display mode (MEAS, MEMORY, etc.)
  - Averaging on/off status
  - Averaging factor
  - Reference level for each display mode
  - Reference position
  - Scale per division
  - Smoothing on/off status
  - Smoothing factor
- Detection mode (AC or DC)
- Number of trace points selected

- Internal modulation on/off status
- Cursor on/off status
- Cursor delta on/off status
- Cursor position
- Cursor delta position
- Cursor SWR/dB status
- Adaptive normalization on/off status
- Limit line on/off status for channels 1 and 2
- Non-standard sweep on/off status

Registers 1 to 4 also save the following:

- Trace memory at 401 points for channels 1 and 2
- Limit line entries for channels 1 and 2
- Title

The following information applies to the entire instrument rather than the individual channels, and is not saved:

- System Interface on/off status
- Labels on/off status
- Title on/off status
- Frequency labels on/off status
- Repeat autozero on/off status

System Interface On/Off

The 8757 System Interface allows the HP 8757A to control the source, plotter, and printer. This is necessary to provide frequency annotation from the HP source, hard copy plots on the plotter, and hard copy printouts from the HP ThinkJet printer. The System Interface, sometimes called the private bus, should be "on" in most applications. To verify that it is on, press **[SYSTEM] [MORE] [SWEEP MODE]**. The **[SYSINTF]** soft key must have **[ON]** highlighted. If not, press this key to turn it on. When **[SYSINTF OFF]** is highlighted, the HP 8757A has no control nor knowledge of the existence of any HP-IB instrument connected to this interface.

The HP-IB addresses of the source, plotter, and printer are critical. It is important that no two instruments connected to the System Interface have the same address. If you inadvertently connect an HP-IB instrument to the System Interface that has the same address as the source, plotter, or printer, the HP 8757A may operate improperly. It may freeze operation until the offending instrument is removed from the system interface. To see what addresses the HP 8757A is expecting, press **[LOCAL]**, and compare the displayed addresses with the addresses set on the HP-IB switches of the individual instruments. If the addresses do not match, press the appropriate soft key **[SWEEPER]**, **[PLOTTER]**, or **[PRINTER]**, and enter the right address. Alternatively, you can physically change the address on the individual instrument.

When the System Interface is "off" the HP 8757A relinquishes control of the source, plotter, and printer. This allows another instrument, for instance, the HP 8970A noise figure meter, to control the source if you do not want to reconnect the HP-IB cables.

When the System Interface is "off", some of the system functions of the HP 8757A are not possible. These include the following:

- Autozero of DC detectors
- Alternate sweep
- Start/stop/cursor frequency annotation
- System save/recall and preset
- System CW and manual sweep modes
- Hard copy plot and print
- Adaptive normalization

If you try to plot or print with the System Interface turned off, the HP 8757A will perform an instrument preset after a few seconds.

Measurement-Memory/Memory

This function can only be used with ratio measurements.

Cursor Search

It is useful to understand how the search functions differ from the normal cursor operation. The normal cursor is updated with every sweep to reflect the present amplitude response at the cursor frequency. In search left, search right, and/or bandwidth modes, the trace is put into "hold" mode after the first search, and the trace freezes on the CRT. This makes it possible to inspect the trace without it changing.

There are two ways to exit search mode and return to the normal cursor mode. One is to press the **[PRIOR MENU] [CURSOR OFF] [CURSOR ON]** soft keys. The other is to press the front panel **[CURSOR]** key.

Cursor SWR and Delta SWR

In cursor SWR display mode, the cursor reads out the SWR equivalent to the return loss value. This function can be performed on any ratio or normalized trace, but it has meaning only in a reflection measurement. Similarly, in cursor Δ mode with cursor SWR enabled, the resulting display of Δ SWR is undefined.

SECTION IV
PERFORMANCE TESTS

INTRODUCTION

The procedures in this section test the electrical performance of the HP 8757A scalar network analyzer using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section III under Operator's Check. Measurement results depend on calibration constants stored within the instrument using the HP 11613A calibrator. The HP 11613A, used with an HP 9000 series 200 or 300 computer and HP BASIC language, calibrates the loggers independently of any detectors by injecting a 27.778 kHz square wave modulated signal at different power levels. The HP 11613A is supplied with a calibration constant program stored on a 3.5 inch disc and a 5.25 inch disc. For instructions on performing the calibration constant loading procedure, refer to the Operating and Service Manual for the HP 11613A calibrator.

The performance test procedures must be performed in the sequence given, since some procedures rely on satisfactory test results in foregoing steps. If a test measurement is slightly out of tolerance, go to Section V and perform the adjustment procedures. If a function fails to operate, refer to the information titled "In Case of Difficulty" in Section III, or to the troubleshooting information in Section VIII.

EQUIPMENT REQUIRED

Equipment required for testing the HP 8757A, as well as for adjustments and troubleshooting, is listed in Table 4-1. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended models.

TEST RECORD

Results of the performance tests may be recorded in the Performance Test Record at the end of this section. The Performance Test Record lists all of the tested specifications and their acceptable limits, with columns for recording actual measurements before and after calibration. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after adjustments or repairs.

Table 4-1. Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	0—10V SWEEP OUT ramp Positive Z-axis blanking HP-IB programmable Interface to HP 8757A	HP 8350B or HP 8340A or HP 8341A	P,A,T
RF Plug-In (with HP 8350B)	Compatible with sweep oscillator Frequency range: includes 50 MHz Leveled power output: ≥13 dBm at 50 MHz	HP 83592B	P,A,T
Detector	No substitute**	HP 11664A/E	P,A,T
Calibrator	No substitute	HP 11613A	P,A,T
12 dB Step Attenuator	1 dB steps Type-N(f) connectors Calibration data at 50 MHz to 0.01 dB resolution	HP 355C Opt. 001 + Opt. H88	P,A,T
120 dB Step Attenuator	10 dB steps Type-N(f) connectors Calibration data at 50 MHz to 0.01 dB resolution	HP 355D Opt. 001 + Opt. H88	P,A,T
Oscilloscope	Dual channel Bandwidth: ≥100 MHz	HP 1740A	P,T
Oscilloscope Probes (3)	10:1 divider	HP 10041A	T
Universal Counter	Frequency range: ≥30 kHz Frequency resolution: ≤1 Hz Time Interval resolution: ≤100 ns	HP 5316A	P,T
Digital Voltmeter	Accuracy: ≤0.03% Resolution: ≤0.1 mV Input impedance (dc): ≥10 MΩ	HP 3456A	A,T
Power Meter	HP-IB programmable	HP 436A	A,T
Power Sensor	Frequency range: includes 50 MHz Compatible with power meter	HP 8484A	A,T
50 MHz Bandpass Filter		HP P/N 08757-80027	P
Signature Multimeter	Signature analyzer clock frequency: ≥10 MHz	HP 5005A/B	T
Logic Probe	TTL compatible Data rate: ≥16 MHz	HP 545A or HP 10525T	T
Logic Pulser	TTL compatible	HP 546A or HP 10526T	T
Current Tracer	TTL compatible Compatible with logic pulser	HP 547A	T
Service Kit	No substitute	HP P/N 08757-60048	T

*P = performance tests, A = adjustments, T = troubleshooting

**Serial number 25000 or above for the HP 11664A

4-1. SELF TEST

SPECIFICATION

Digital circuitry within the HP 8757A functions properly.

DESCRIPTION

The HP 8757A is PRESET to initiate a built-in self test routine. The self test checks that major parts of the analog and digital circuitry are working properly. The self test results are displayed on the CRT.

PROCEDURE

1. Connect the HP 8757A to line power and turn the LINE switch on.

2. Press **[PRESET]** to run the self test. The self test takes approximately one second to run. If the test runs successfully and passes, the graticule and top-level soft key menu will appear on the display. If the self test fails, an error message will be displayed. Record the results (pass or error message) in the Performance Test Record.

3. If the self test fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

4-2. DYNAMIC RANGE

SPECIFICATIONS

With HP 11664A/E detector: +16 to −60 dBm
With HP 11664D detector: +10 to −50 dBm
With HP 85025A/B detector (25°C ±5°C):
AC mode +16 to −55 dBm
DC mode +16 to −50 dBm

DESCRIPTION

A signal source is connected to the HP 8757A through an HP 11664A or 11664E detector. A signal square-wave modulated at 27.778 kHz is applied, to test the greatest response range and the noise floor of the HP 8757A with the detector.

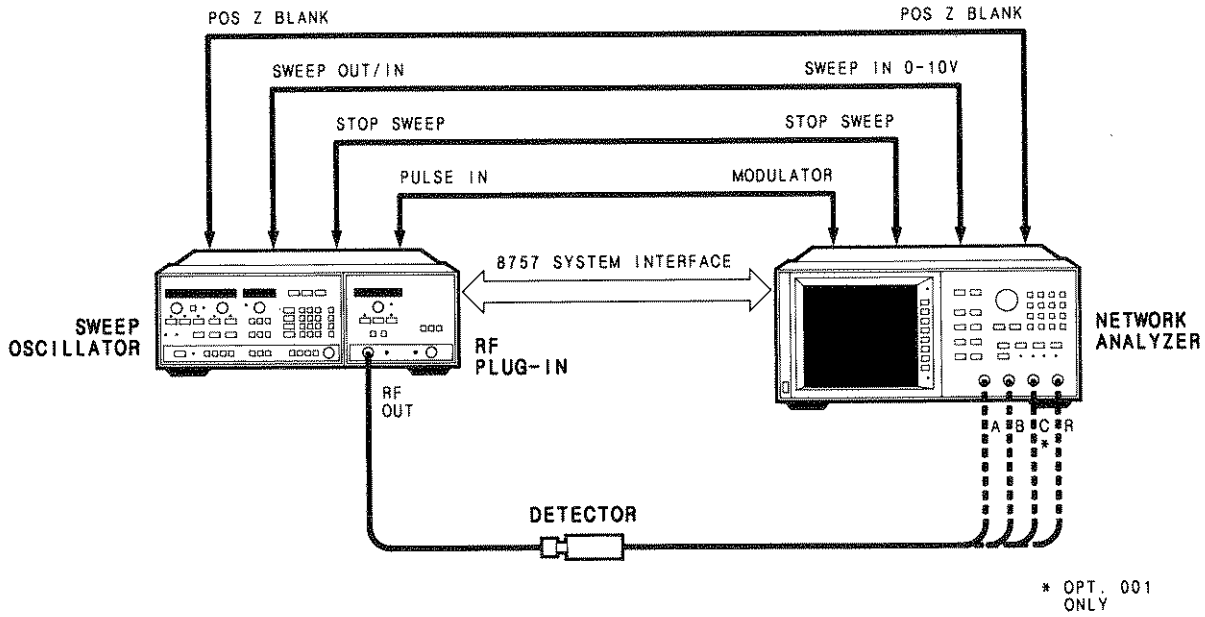


Figure 4-1. Dynamic Range Test Setup

EQUIPMENT

Sweep Oscillator Mainframe ..... HP 8350B
RF Plug-In ..... HP 83592B*
Detector ..... HP 11664A/E

* Any RF Plug-In with output power capabilities of +16 dBm at 50 MHz can be substituted.

PROCEDURE

1. Connect the equipment as shown in Figure 4-1, with the detector connected to the A input of the HP 8757A. On the HP 8757A, press **[PRESET]** to preset both the HP 8757A and 8350B. The HP 8757A is preset automatically to channel 1 and input A.

4-2. DYNAMIC RANGE (cont'd)

2. On the HP 8350B, press **[CW] [50] [MHz]**. Press **[⊔⊓ MOD]** to turn off the internal square-wave modulation. On the HP 8757A press the **[AVG]** key, and verify that the default averaging factor of 8 is displayed on the CRT.

3. On the HP 8757A, press **[CURSOR]** and a cursor will appear at the center of the trace. Note the cursor value displayed on the CRT. Adjust the output power of the RF plug-in until the cursor value on the CRT reads +16 dBm or greater. (Some RF plug-ins may not be capable of outputting +16 dBm at 50 MHz. If necessary use an amplifier or perform the test at a different frequency.) Record the cursor value in the Performance Test Record, step 3.

4. Disconnect the detector input from the RF plug-in. Allow the trace to settle. Note the new cursor value displayed. This value should be −60 dBm or lower. Record the cursor value in the Performance Test Record, step 4.

5. Disconnect the detector from the A input and connect it to the B input. Reconnect the detector input to the RF plug-in. On the HP 8757A press the **[MEAS]** key and then the **[B]** soft key.

6. Allow the trace to settle. Note the cursor reading. If necessary, adjust the output power of the RF plug-in until the cursor value reads +16 dBm or greater. Record the cursor value in the Performance Test Record, step 6.

7. Disconnect the detector input from the RF plug-in and allow the trace to settle. Record the displayed cursor value in the Performance Test Record, step 7.

8. If the instrument is not an Option 001 proceed to step 10. If the instrument is an Option 001, disconnect the detector from input B and connect it to input C. Reconnect the detector input to the RF plug-in.

9. On the HP 8757A press the **[C]** soft key. Repeat steps 6 and 7 and record the high and low cursor values in the Performance Test Record, step 9.

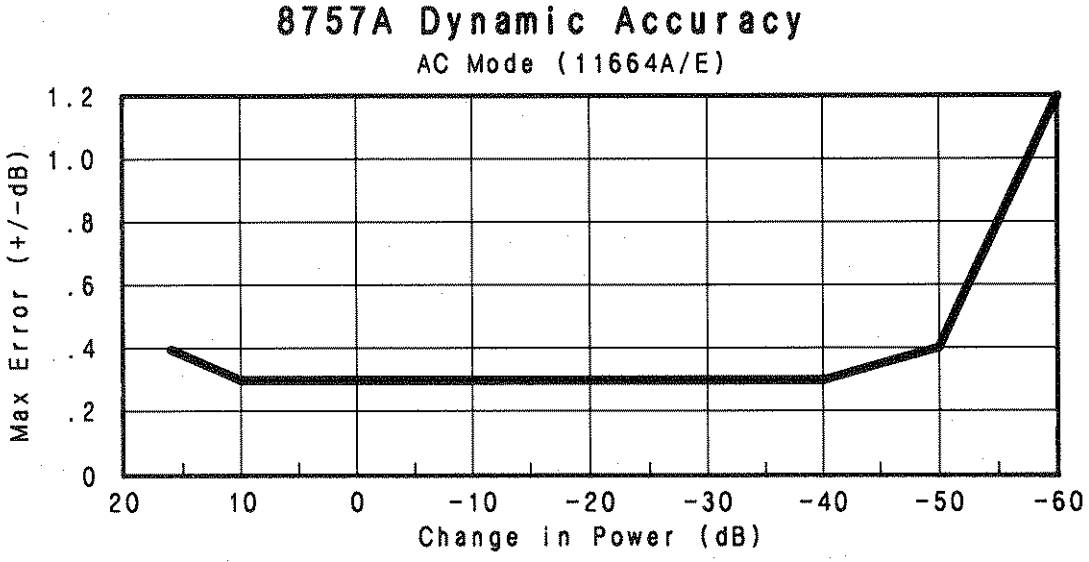
10. Disconnect the detector and connect it to input R. Reconnect the detector input to the RF plug-in. On the HP 8757A press the **[R]** soft key. Repeat steps 6 and 7 and record the high and low cursor values in the Performance Test Record, step 10.

11. If any part of the dynamic range test fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

4-3. DYNAMIC POWER ACCURACY

SPECIFICATION

The dynamic accuracy of the HP 8757A (with the specified HP 11664A/E detector) is graphed in Figure 4-2 below.



Note 1: Measured at 50 MHz, referenced at 0 dBm.

Note 2: For ≤20 dB change of power within +10 to −40 dBm the specification is ±(0.1 dB +0.01 dB/dB).

Figure 4-2. Dynamic Accuracy Specification

NOTE

Meeting AC dynamic accuracy specifications verifies DC absolute accuracy when the detectors are properly calibrated.

DESCRIPTION

The recommended method for checking dynamic amplitude accuracy is to use the HP 11613A calibrator. Alternatively, use calibrated step attenuators to check the dynamic amplitude accuracy of the HP 8757A at 50 MHz from +10 dBm to −60 dBm. For power levels from +10 dBm to +16 dBm, use an external amplifier capable of outputting at least +20 dBm or use the HP 11613A calibrator.

EQUIPMENT

Sweep Oscillator Mainframe	HP 8350A/B
RF Plug-In	HP 83592B*
Calibrated 12 dB Step Attenuator (1 dB steps)	HP 355C Option 001/H88
Calibrated 120 dB Step Attenuator (10 dB steps)	HP 355D Option 001/H88
50 MHz Bandpass Filter	HP P/N 08757-80027
3 dB Pad	HP 8491B
Detector	HP 11664A (S/N 25000 or above) or HP 11664E

*Serial prefix 2410 or higher

4-3. DYNAMIC POWER ACCURACY (cont'd)

NOTE

Calibrated attenuation is used in the dynamic accuracy calculations below. Calibrated step attenuators include a calibration report at 50 MHz to improve measurement accuracy. The report lists the actual attenuation of each step at one frequency of interest. The calibration report may be ordered with the step attenuators when purchased or performed as a service afterwards.

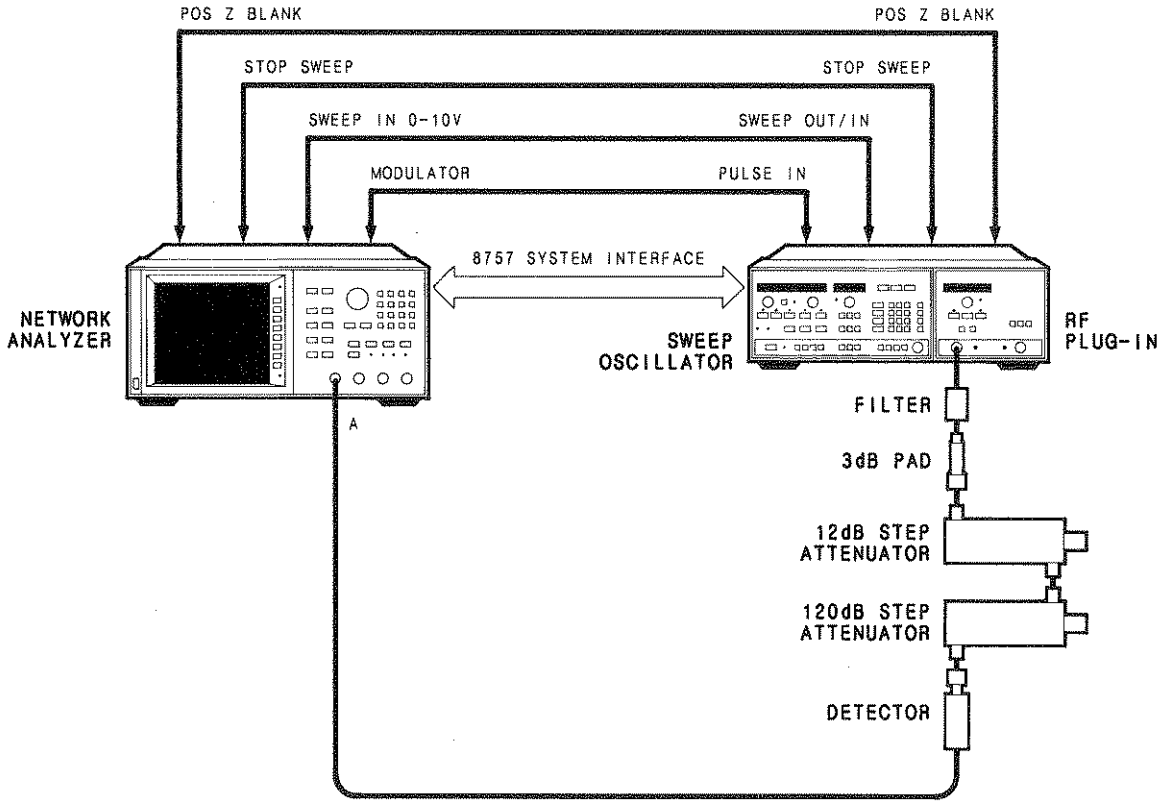


Figure 4-3. Dynamic Power Accuracy Test Setup

PROCEDURE

1. Set up the equipment, as shown in Figure 4-3, with the detector connected to input A. Allow 30 minutes warm-up time.

2. For each of the power levels specified in column 1 of the Performance Test Record, calculate the calibrated power level from the calibration report data as follows:

   Calibrated power level =(+10 dBm) minus (120 dB step attenuator calibrated attenuation) minus (12 dB step attenuator calibrated attenuation).

   Enter these values in the Calibrated Power Level column (#6) on the Performance Test Record.

3. Set the 120 dB attenuator to 10 dB and set the 12 dB attenuator to 0 dB.

4. Set the HP 8350B to generate 50 MHz CW without internal modulation by pressing **[INSTR PRESET] [CW] [5] [0] [MHz]**. Press **[⊔⊓ MOD]** to turn off internal modulation. External modulation is used to ensure accurate modulation characteristics.

4-3. DYNAMIC POWER ACCURACY (cont'd)

5. Activate the cursor of the HP 8757A by pressing **[CURSOR]**. Then rotate the POWER knob on the RF plug-in to set the cursor value (CRSR) to +10 dB minus (calibrated attenuation at 10 dB attenuation).

NOTE

The internal power level resolution of the RF plug-in is better than the 0.1 dB of displayed resolution. Make this adjustment slowly and carefully. Do not change this setting for the remainder of the procedure.

6. Note and record on the Performance Test Record the cursor value displayed on the CRT.

7. Set both attenuators to 0 dB attenuation.

8. Calculate the dynamic accuracy error as follows:

   Dynamic accuracy error = (cursor value) minus (calibrated power level)

   Include and preserve signs in this calculation. Enter this value in the Dynamic ACC Error (dBm) column (#8) of the Performance Test Record.

9. Set the attenuator(s) for the next Nominal PWR LVL (dBm).

NOTE

For power levels of −40 dBm and below use the averaging factor specified on the Performance Test Record to reduce trace noise. Set the attenuator(s) for the desired power level. Press [AVG] [AVG FACTOR] [↑] or [↓] as required for the appropriate averaging factor. Press [AVERAGE ON OFF] to turn on averaging. Press cursor, and when the trace settles, note in the MEAS PWR LVL column (#7) the CRSR value displayed on the CRT. Press [AVG ON OFF] to turn off the averaging factor before resetting the attenuator(s).

10. Repeat steps 6, 7, 8 and 9 for each power level listed on the Performance Test Record.

11. Set the 120 dB attenuator to 10 dB attenuation and the 12 dB attenuator to 0 dB attenuation. If the displayed cursor value is not within 0.02 dB of the value recorded in step 6, repeat steps 5 through 10.

12. Connect the detector to input B.

13. Measure input B by pressing **[MEAS] [B]**. Repeat steps 5 through 11.

14. If the instrument if an Option 001, connect the detector to input C, measure and record the data as above.

15. Connect the detector to input R, measure and record the data as above.

16. If the HP 8757A fails the dynamic accuracy test, refer to "In Case of Difficulty" in Section III or to Section VIII of the Service Manual.

4-4. MODULATOR DRIVE

SPECIFICATION

The modulator drive provides ≥±2.2V into 50 ohms. The frequency accuracy is 27.778 ±0.012 kHz and symmetry is 50/50 ±1%.

DESCRIPTION

The amplitude of the modulator drive (into 50 ohms) is checked with an oscilloscope. The frequency and symmetry of the modulator drive are measured with a universal counter.

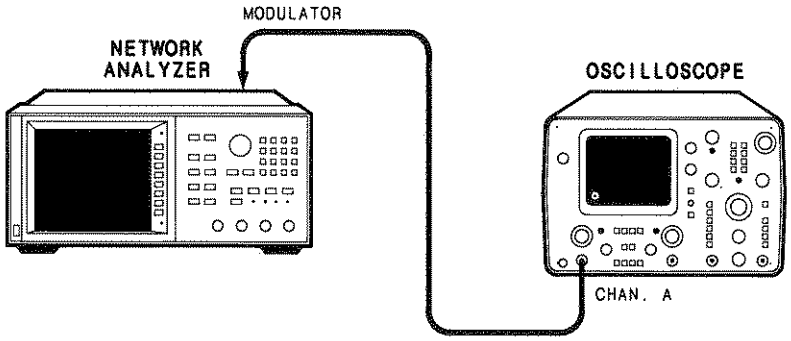


Figure 4-4. Modulator Drive Test Setup

EQUIPMENT

Oscilloscope*	HP 1740A
Universal Counter	HP 5316A
2 Adapters, BNC tee (m)(f)(f)	HP P/N 1250-0781
50 ohm Load	HP 11593A

***NOTE**

The HP 1740A oscilloscope's 50 ohm input will dissipate 5 Vrms. If another oscilloscope is used, its 50 ohm input must be able to dissipate 3 Vrms or about 200 mW. If not, use the oscilloscope's high impedance input and externally terminate the input with a BNC tee and 50 ohm load.

Voltage Amplitude

1. Connect the HP 8757A to the oscilloscope as shown in Figure 4-4.
2. Press HP 8757A **[PRESET]** to turn on the modulation.
3. Set the oscilloscope functions as follows: DISPLAY A, TRIGGER A, CHAN A VOLTS/DIV set at 1, TIME/DIV set at 5μs, TRIGGERING AUTO, HORIZONTAL DISPLAY MODE MAIN. Set all other buttons out.
4. Set oscilloscope input to GND, adjust POSN to vertically center the trace, then reset input to 50 OHM.
5. Adjust the oscilloscope TRIGGER LEVEL for a stable display.

6. Both positive and negative portions of the square wave should exceed 2.2V in absolute magnitude. Record the smaller value on the Performance Test Record, step 6.

Frequency Accuracy and Symmetry

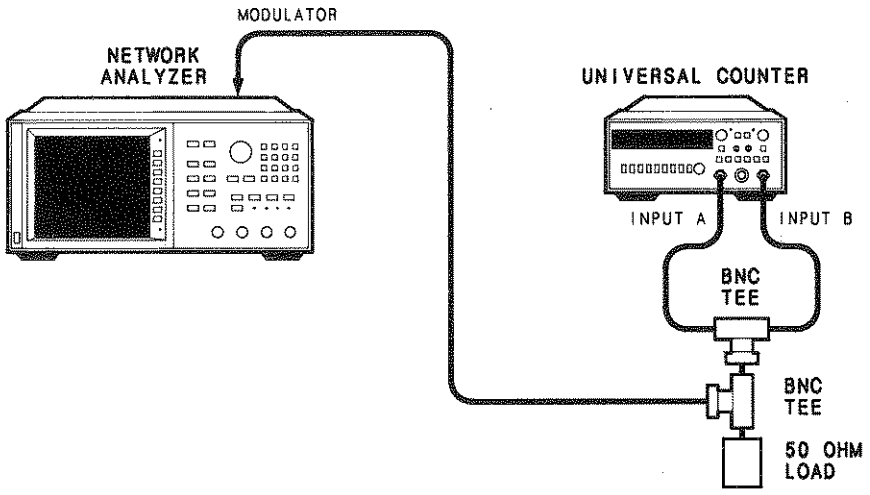


Figure 4-5. Frequency Accuracy and Symmetry Test Setup

7. Turn the universal counter ON. Set all other keys out.

8. With the universal counter inputs disconnected, rotate the channel A LEVEL/SENS knob CCW until the TRIGGER LEVEL LED lights. Rotate the knob CW until the LED just extinguishes. Repeat this procedure for channel B. This sets the trigger levels to 0.0V. Once set, do not readjust these two knobs.

9. Connect the equipment as shown in Figure 4-5.

10. Set channel A at RISING EDGE and channel B at FALLING EDGE. This sets channel A to trigger on the rising edge, B on the falling edge.

11. Press FREQ A to measure the modulation frequency. Record this frequency on the Performance Test Record, step 11.

12. Set the FREQ/PERIOD key (blue) to PERIOD and select T1 AVG A to B to measure the positive half cycle. Record this value on the Performance Test Record, step 12.

13. Reset channel A to trigger on the falling edge and B on the rising edge to measure the negative half cycle. Record this value on the Performance Test Record, step 13.

14. The symmetry specification is verified when the test limits of steps 12 and 13 are met.

15. If the HP 8757A fails one or more parts of the modulator drive test, refer to "In Case of Difficulty" in Section III or to Section VIII of the Service Manual.

4-5. HP INTERFACE BUS AND 8757 SYSTEM INTERFACE

SPECIFICATION

NOTE

The following diagnostic test verifies the hardware associated with the HP interface bus and 8757 system interface. These have no electrical specifications or performance standards other than IEEE Standard 488-1978.

The HP interface bus (HP-IB) and 8757 system interface operate according to IEEE Standard 488-1978. They allow bi-directional communication with other instruments and/or controllers.

DESCRIPTION

The HP interface bus and 8757 system interface connectors are connected together with an HP-IB cable. Internal diagnostic routines check the ability of both ports to send and accept data. This procedure also serves as an operator's check of the remote mode.

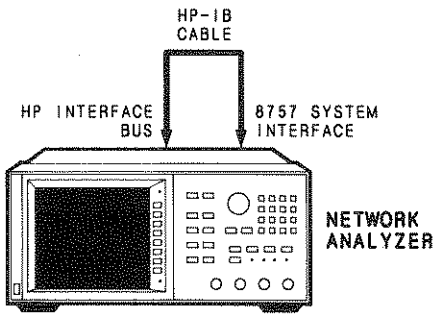


Figure 4-6. HP Interface Bus and 8757 System Interface Test Setup

EQUIPMENT

HP-IB Cable ..... HP 10833A/B/C/D

PROCEDURE

1. Connect the HP-IB cable between the rear panel HP INTERFACE BUS and 8757 SYSTEM INTERFACE ports as shown in Figure 4-6.

2. Press **[PRESET]**.

3. Press **[SYSTEM]**, then soft keys **[MORE] [SERVICE] [A6 HPIB INSTBUS] [HPIB TESTS]**. Then press **[HPIB TALK]** to run the first diagnostic test. In this test, the HP interface bus sends test data to the 8757 system interface, acting as talker. If the test passes, the CRT displays "HPIB TALK PASS"; other messages indicate the test failed. Record the results on the Performance Test Record, step 3.

4. Press **[HPIB LISTEN]** to run the second diagnostic test. In this test, the HP interface bus port accepts test data from the 8757 system interface, acting as listener. If the test passes, the CRT displays "HPIB LISTEN PASS"; other messages indicate the test failed. Record the results on the Performance Test Record, step 4.

5. Press **[PRESET]** or **[EXIT SERVICE]** to exit the diagnostic test, and disconnect the HP-IB cable.

6. If either of the tests fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

4-6. DETECTOR CONTROL CIRCUITRY

SPECIFICATION

The HP 8757A has the capability to determine which type of detector is connected to each of the three inputs (four in Option 001). In addition, it can also determine some of the characteristics of each detector, as well as its temperature if the detector has this capability. This test verifies the operation of the detector control circuitry.

DESCRIPTION

Instrument **[PRESET]** verifies most of the detector control circuitry. To completely verify the control circuitry at each of the inputs, the sense resistor (1.0k ohms) must be measured. This is done by measuring the voltage drop across the resistor when an HP 11664 detector is connected to the input (1.0k ohms to ground).

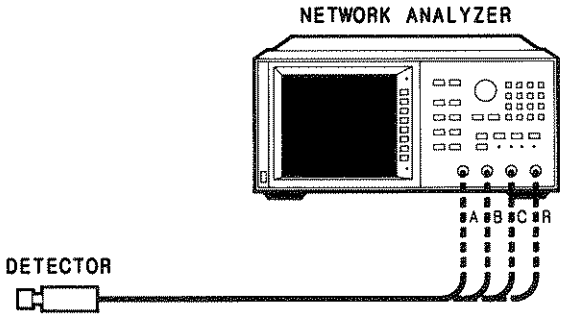


Figure 4-7. Detector Control Circuitry Test Setup

EQUIPMENT

Detector . . . . . HP 11664A (S/N 25000 or above) or HP 11664E

PROCEDURE

1. On the HP 8757A, press **[PRESET]**. If the instrument passes **[PRESET]**, most of the detector control circuitry is verified, with the exception of the sense resistors for each input.

2. Press the **[SYSTEM]** key. Then press soft keys **[MORE]** and **[SERVICE]**.

3. Press soft keys **[A4 ADC]** and **[MORE]**.

4. Press soft keys **[CHANNEL VOLTS]**, **[CHANV DET DAC]**, **[MODE 1]** and **[DET DAC MAX]**. The CRT displays the DRIVE and SENSE voltages for each of the inputs.

5. Connect the detector to input A of the HP 8757A as illustrated in Figure 4-7.

4-6. DETECTOR CONTROL CIRCUITRY (cont'd)

6. Note the CHAN A SENSE and DRIVE voltages displayed. With the detector connected to the input, the SENSE voltage should drop to one half of the DRIVE voltage ±3%. Record the results as pass or fail in the Performance Test Record, step 6.

7. Repeat steps 5 and 6 for the B, C (Option 001), and R inputs. Record the results as pass or fail in the Performance Test Record, step 7.

8. If the detector control circuitry test fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

PERFORMANCE TEST RECORD (1 of 5)

Test	Lower Limit	Test Result (Before Cal)	Test Result (After Cal)	Upper Limit
4-1. Self Test				
2. Press **[PRESET]**	PASS	_____	_____	
4-2. Dynamic Range				
3. RF ON (A)	+16 dBm	_____	_____	—
4. RF OFF (A)	—	_____	_____	−60 dBm
6. RF ON (B)	+16 dBm	_____	_____	—
7. RF OFF (B)	—	_____	_____	−60 dBm
9. RF ON (C) (Opt 001)	+16 dBm	_____	_____	—
RF OFF (C) (Opt 001)	—	_____	_____	−60 dBm
10. RF ON (R)	+16 dBm	_____	_____	—
RF OFF (R)	—	_____	_____	−60 dBm

4-3. Dynamic Accuracy

See remaining pages of Performance Test Record.

	Lower Limit	Test Result	Upper Limit
4-4. Modulator Drive			
6. Absolute magnitude	2.2V	_____	—
11. Modulation frequency	27.766 kHz	_____	27.790 kHz
12. Positive half cycle	17.65 μs	_____	18.35 μs
13. Negative half cycle	17.65 μs	_____	18.35 μs
4-5. HP Interface Bus and 8757 System Interface			
3. HPIB TALK	PASS	_____	—
4. HPIB LISTEN	PASS	_____	—

4-6. Detector Control Circuitry	Test Result	Limit
6. CHAN A SENSE	_____	1/2 CHAN A DRIVE V ±3%
7. CHAN B SENSE	_____	1/2 CHAN B DRIVE V ±3%
CHAN C SENSE (Opt 001)	_____	1/2 CHAN C DRIVE V ±3%
CHAN R SENSE	_____	1/2 CHAN R DRIVE V ±3%

PERFORMANCE TEST RECORD (2 of 5)

A Input (Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)

1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTEN Setting (dB)	3. Nominal 12 dB ATTEN Setting (dB)	4.* CAL ATTEN (120 dB ATTN)	5.* CAL ATTEN 12 dB ATTN)	6.* CAL PWR LVL (dBm) (10 dBm — CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit (Absolute Value)
0	+10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
−3	10	3						0.13
−6	10	6						0.16
−10	20	0						0.20
−13	20	3						0.23
−16	20	6						0.26
−20	30	0						0.30
−25	30	5						0.30
−30	40	0						0.30
−35	40	5						0.30
−40	50 (16)	0						0.30
−45	50 (32)	5						0.35
−50	60 (64)	0						0.40
−55	60 (64)	5						0.80
−60	70 (64)	0						1.20

*Record on B Input, C Input (if Option 001) and R Input Performance Test Record.

PERFORMANCE TEST RECORD (3 of 5)

B Input (Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)

1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTEN Setting (dB)	3. Nominal 12 dB ATTEN Setting (dB)	4.* CAL ATTEN (120 dB ATTN)	5.* CAL ATTEN 12 dB ATTN)	6.* CAL PWR LVL (dBm) (10 dBm — CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit (Absolute Value)
0	+10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
−3	10	3						0.13
−6	10	6						0.16
−10	20	0						0.20
−13	20	3						0.23
−16	20	6						0.26
−20	30	0						0.30
−25	30	5						0.30
−30	40	0						0.30
−35	40	5						0.30
−40	50 (16)	0						0.30
−45	50 (32)	5						0.35
−50	60 (64)	0						0.40
−55	60 (64)	5						0.80
−60	70 (64)	0						1.20

PERFORMANCE TEST RECORD (4 of 5)

C Input (Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)

1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTEN Setting (dB)	3. Nominal 12 dB ATTEN Setting (dB)	4.* CAL ATTEN (120 dB ATTN)	5.* CAL ATTEN 12 dB ATTN)	6.* CAL PWR LVL (dBm) (10 dBm — CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit (Absolute Value)
0	+10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
−3	10	3						0.13
−6	10	6						0.16
−10	20	0						0.20
−13	20	3						0.23
−16	20	6						0.26
−20	30	0						0.30
−25	30	5						0.30
−30	40	0						0.30
−35	40	5						0.30
−40	50 (16)	0						0.30
−45	50 (32)	5						0.35
−50	60 (64)	0						0.40
−55	60 (64)	5						0.80
−60	70 (64)	0						1.20

PERFORMANCE TEST RECORD (5 of 5)

R Input (Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)

1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTEN Setting (dB)	3. Nominal 12 dB ATTEN Setting (dB)	4.* CAL ATTEN (120 dB ATTN)	5.* CAL ATTEN (12 dB ATTN)	6.* CAL PWR LVL (dBm) (10 dBm — CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit
0	+10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
−3	10	3						0.13
−6	10	6						0.16
−10	20	0						0.20
−13	20	3						0.20
−16	20	6						0.20
−20	30	0						0.20
−25	30	5						0.20
−30	40	0						0.20
−35	40	5						0.20
−40	50 (16)	0						0.20
−45	50 (32)	5						0.30
−50	60 (64)	0						0.40
−55	60 (64)	5						0.80
−60	70 (64)	0						1.20