

Quick Reference Guide

HP 8719D/20D/22D Network Analyzer



**HEWLETT
PACKARD**

**HP Part No. 08720-90289 Supersedes June 1996
Printed in USA July 1997**

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Maintenance

Clean the cabinet, using a damp cloth only.

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. See the HP 8719D/20D/22D User's Guide for the "Hewlett-Packard Sales and Service Offices" table.

Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

Caution	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the instrument. Do not proceed beyond a caution note until the indicated conditions are fully understood and met.
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Warning	Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.
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Instrument Markings



The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

“CE” The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)

“ISM1-A” This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.

“CSA” The CSA mark is a registered trademark of the Canadian Standards Association.

General Safety Considerations

Warning	This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.
----------------	--

Warning	No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.
----------------	--

Caution	Before switching on this instrument, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed.
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Warning	The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.
----------------	--

Warning	The power cord is connected to internal capacitors that may remain live for 10 seconds after disconnecting the plug from its power supply.
----------------	--

Warning	For continued protection against fire hazard replace line fuse only with same type and rating (F 3A/250V). The use of other fuses or material is prohibited.
----------------	--

Warning	If this instrument is used in a manner not specified by Hewlett-Packard Co., the protection provided by the instrument may be impaired.
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Note

This instrument has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronics Measuring Apparatus, and has been supplied in a safe condition. This instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

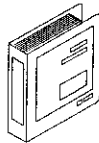
Quick Reference Guide Overview

- Chapter 1, “Analyzer Description and Options,” describes features, functions, and available options.
- Chapter 2, “Making Measurements,” contains step-by-step procedures for making measurements or using particular functions.
- Chapter 3, “Making Mixer Measurements,” contains step-by-step procedures for making calibrated and error-corrected mixer measurements.
- Chapter 4, “Printing, Plotting, and Saving Measurement Results,” contains instructions for saving to disk or the analyzer internal memory, and printing and plotting displayed measurements.
- Chapter 5, “Optimizing Measurement Results,” describes techniques and functions for achieving the best measurement results.
- Chapter 6, “Application and Operation Concepts,” contains explanatory-style information about many applications and analyzer operation.
- Chapter 7, “Specifications and Measurement Uncertainties,” defines the performance capabilities of the analyzer.
- Chapter 8, “Menu Maps,” shows softkey menu relationships.
- Chapter 9, “Key Definitions,” describes all the front panel keys, softkeys, and their corresponding HP-IB commands.
- Chapter 10, “Error Messages,” provides information for interpreting error messages.
- Chapter 11, “Compatible Peripherals,” lists measurement and system accessories, and other applicable equipment compatible with the analyzer. Procedures for configuring the peripherals, and an HP-IB programming overview are also included.
- Chapter 12, “Preset State and Memory Allocation,” contains a discussion of memory allocation, memory storage, instrument state definitions, and preset conditions.
- Chapter 13, “Alphabetic Mnemonics Listing,” provides a description of all HP-IB mnemonics that can be used with the analyzer.

Network Analyzer Documentation Set



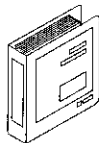
The **Installation and Quick Start Guide** familiarizes you with the network analyzer's front and rear panels, electrical and environmental operating requirements, as well as procedures for installing, configuring, and verifying the operation of the analyzer.



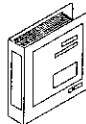
The **User's Guide** shows how to make measurements, explains commonly-used features, and tells you how to get the most performance from your analyzer.



The **Quick Reference Guide** provides a summary of selected user features.



The **Programmer's Guide** provides programming information including an HP-IB programming and command reference as well as programming examples.



The **Service Guide** provides the information needed to adjust, troubleshoot, repair, and verify conformance to published specifications. Available with Option 0BW.

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Analyzer Description

The HP 8719D/20D/22D is a high performance vector network analyzer for laboratory or production measurements of reflection and transmission parameters. It integrates a high resolution synthesized RF source, an S-parameter test set, and a dual channel three-input receiver (four-input receiver, Option 400) to measure and display magnitude, phase, and group delay responses of active and passive RF networks.

Two independent display channels and a large screen color display show the measured results of one or both channels, in rectangular or polar/Smith chart formats.

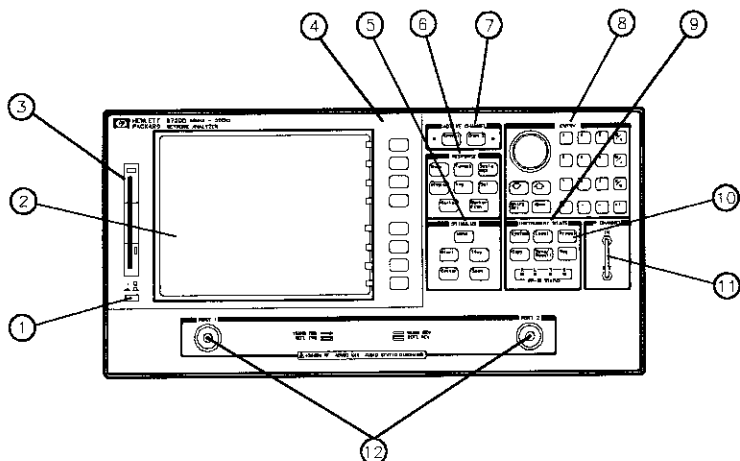
The analyzers have the additional following features:

- Measurement functions selection with front panel keys and softkey menus.
- Direct print or plot output of displayed measurement results, with a time stamp if desired, to a compatible peripheral with a serial, parallel, or HP-IB interface.
- Instrument states storage in internal memory for the following times, or on disk indefinitely.

Temperature at 70 °C	250 days (0.68 year) characteristically
Temperature at 40 °C	1244 days (3.4 years) characteristically
Temperature at 25 °C	10 years characteristically
- Automatic sweep time that selects the minimum sweep time for the given IF bandwidth, number of points, averaging mode, frequency range, and sweep type.
- Built-in service diagnostics are available to simplify troubleshooting procedures.
- Performance improvement and flexibility through trace math, data averaging, trace smoothing, electrical delay, and accuracy enhancement.

- Accuracy enhancement methods that range from normalizing data to complete one or two port vector error correction with up to 1601 measurement points, and TRL*/LRM*.
- “True TRL” measurement capability with Option 400.
- Complete reflection and transmission measurements in a 50 ohm impedance environment.
- Receiver/source frequency offset mode (Option 089) that allows you to set the analyzer’s receiver and source with a fixed frequency offset for mixer test applications.
- Power meter calibration that allows you to use an HP-IB compatible power meter to monitor and correct the analyzer’s output power at each data point.
- Test system automation with the addition of an external controller.
- External keyboard compatibility.
- LIF/DOS disk formats.
- Integration of a high capacity micro-floppy disk drive.
- Internal automation, using test sequencing.
- A general purpose input/output (GPIO) bus that can control eight output bits and read five input bits through test sequencing.

Front Panel Features






pb67d

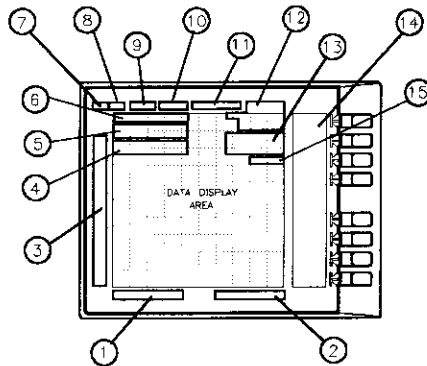
Figure 1-1. HP 8719D/20D/22D Front Panel

1. **LINE switch.** This switch controls ac power to the analyzer. 1 is on, 0 is off.
2. **Display.** This shows the measurement data traces, measurement annotation, and softkey labels. The display is divided into specific information areas, illustrated in Figure 1-2.
3. **Disk drive.** This 3.5 inch drive allows you to store and recall instrument states and measurement results for later analysis.
4. **Softkeys.** These keys provide access to menus that are shown on the display.
5. **STIMULUS function block.** The keys in this block allow you to control the analyzer source's frequency, power, and other stimulus functions.
6. **RESPONSE function block.** The keys in this block allow you to control the measurement and display functions of the active display channel.
7. **ACTIVE CHANNEL keys.** The analyzer has two independent display channels. These keys allow you to select the active

channel. Then any function you enter applies to this active channel.

8. **The ENTRY block.** This block includes the knob, the step   keys, and the number pad. These allow you to enter numerical data and control the markers.
9. **INSTRUMENT STATE function block.** These keys allow you to control channel-independent system functions such as the following:
 - copying, save/recall, and HP-IB controller mode
 - limit testing
 - tuned receiver mode
 - frequency offset mode (option 089)
 - test sequence function
 - time domain transform (option 010)HP-IB STATUS indicators are also included in this block.
10.  **key.** This key returns the instrument to either a known factory preset state, or a user preset state that can be defined.
11. **R CHANNEL connectors.** These connectors allow you to apply an input signal to the analyzer's R channel, for frequency offset mode.
12. **PORT 1 and PORT 2.** These ports output a signal from the source and receive input signals from a device under test.

Analyzer Display



pg64d

Figure 1-2. Analyzer Display (Single Channel, Cartesian Format)

The analyzer display shows various measurement information:

- The grid where the analyzer plots the measurement data.
- The currently selected measurement parameters.
- The measurement data traces.

Figure 1-2 illustrates the locations of the different information labels described below.

1. **Stimulus start value.** This value could be any one of the following:
 - The start frequency of the source in frequency domain measurements
 - The start time in CW mode (0 seconds) or time domain measurements
 - The lower power value in power sweep

When the stimulus is in center/span mode, the center stimulus value is shown in this space.

2. **Stimulus stop Value.** This value could be any one of the following:

- The stop frequency of the source in frequency domain measurements.
- The stop time in time domain measurements or CW sweeps.
- The upper limit of a power sweep.

When the stimulus is in center/span mode, the span is shown in this space.

3. **Status Notations.** This area shows the current status of various functions for the active channel.

The following notations are used:

- Avg = Sweep-to-sweep averaging is on. The averaging count is shown immediately below.
- Cor = Error correction is on.
- C? = Stimulus parameters have changed from the error-corrected state, or interpolated error correction is on.
- C2 = Full two-port error-correction is active and either the power range for each port is different (uncoupled), or the **TESTSET SW HOLD** is activated. You can update all the parameters by pressing **(Menu)** **MEASURE RESTART**.
- Del = Electrical delay has been added or subtracted, or port extensions are active.
- ext = Waiting for an external trigger.
- Ofs = Frequency offset mode is on (option 089 only).
- Of? = Frequency offset mode error (option 089 only), the IF frequency is not within 10 MHz of expected frequency. LO inaccuracy is the most likely cause.
- Gat = Gating is on (time domain option 010 only).
- Hld = Hold sweep.
- man = Waiting for manual trigger.
- PC = Power meter calibration is on.
- PC? = The analyzer's source could not be set to the desired level, following a power meter calibration.

- P? = Source power is unlevelled at start or stop of sweep.
- Pl = Source power has been automatically set to minimum, due to receiver overload.
- PRm = Power range is in manual mode.
- Smo = Trace smoothing is on.
- tsH = Indicates that the test set hold mode is engaged.

That is, a mode of operation is selected which would cause repeated switching of the step attenuator or mechanical transfer switch (Option 007).

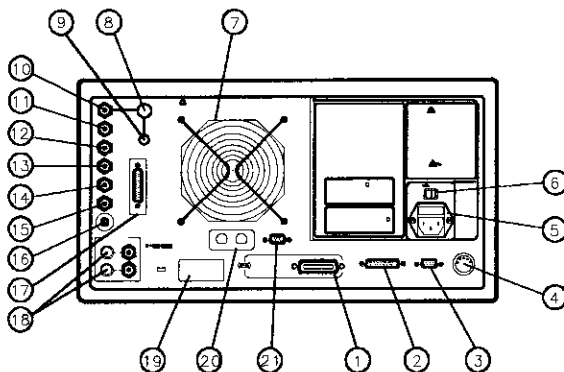
- ↑ = Fast sweep indicator. This symbol is displayed in the status notation block when sweep time is less than 1.0 second. When sweep time is greater than 1.0 second, this symbol moves along the displayed trace.
- * = Source parameters changed: measured data in doubt until a complete fresh sweep has been taken.

4. **Active Entry Area.** This displays the active function and its current value.
5. **Message Area.** This displays prompts or error messages.
6. **Title.** This is a descriptive alpha-numeric string title that you define and enter through an attached keyboard.
7. **Active Channel.** This is the number of the current active channel, selected with the **Chan 1** and **Chan 2** keys. If dual channel is on with an overlaid display, both channel 1 and channel 2 appear in this area.
8. **Measured Input(s).** This shows the S-parameter, input, or ratio of inputs currently measured, as selected using the **Meas** key. Also indicated in this area is the current display memory status.
9. **Format.** This is the display format that you selected using the **Format** key.
10. **Scale/Div.** This is the scale that you selected using the **Scale Ref** key, in units appropriate to the current measurement.
11. **Reference Level.** This value is the reference line in Cartesian formats or the outer circle in polar formats, whichever you selected using the **Scale Ref** key. The reference level is also indicated by a small triangle adjacent to the graticule.

12. **Marker Values.** These are the values of the active marker, in units appropriate to the current measurement.
13. **Marker Stats, Bandwidth.** These are statistical marker values that the analyzer calculates when you access the menus with the **Marker Fctn** key.
14. **Softkey Labels.** These menu labels redefine the function of the softkeys that are located to the right of the analyzer display.
15. **Pass Fail.** During limit testing, the result will be annunciated as PASS if the limits are not exceeded, and FAIL if any points exceed the limits.

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Rear Panel Features and Connectors



pb68d

Figure 1-3. HP 8719D/20D/22D Rear Panel

1. **HP-IB connector.** This allows you to connect the analyzer to an external controller, compatible peripherals, and other instruments for an automated system.
2. **PARALLEL interface.** This connector allows the analyzer to output to a peripheral with a parallel input. Also included, is a general purpose input/output (GPIO) bus that can control eight output bits and read five input bits through test sequencing.
3. **RS-232 interface.** This connector allows the analyzer to output to a peripheral with an RS-232 (serial) input.
4. **KEYBOARD input (DIN).** This connector allows you to connect an external keyboard. This provides a more convenient means to enter a title for storage files, as well as substitute for the analyzer's front panel keyboard. The keyboard must be connected to the analyzer before the power is switched on.
5. **Power cord receptacle, with fuse.**
6. **Line voltage selector switch.**
7. **Fan.**
8. **10 MHZ PRECISION REFERENCE OUTPUT. (Option 1D5)**
9. **10 MHZ REFERENCE ADJUST. (Option 1D5)**

10. **EXTERNAL REFERENCE INPUT connector.** This allows for a frequency reference signal input that can phase lock the analyzer to an external frequency standard for increased frequency accuracy.
11. **AUXILIARY INPUT connector.** This allows for a dc or ac voltage input from an external signal source, such as a detector or function generator, which you can then measure, using the S-parameter menu.
12. **EXTERNAL AM connector.** This allows for an external analog signal input that is applied to the ALC circuitry of the analyzer's source. This input analog signal amplitude modulates the RF output signal.
13. **EXTERNAL TRIGGER connector.** This allows connection of an external negative-going TTL-compatible signal that will trigger a measurement sweep. The trigger can be set to external through softkey functions.
14. **TEST SEQUENCE.** This outputs a TTL signal that can be programmed in a test sequence to be high or low, or pulse (10 μ seconds) high or low at the end of a sweep for robotic part handler interface.
15. **LIMIT TEST.** This outputs a TTL signal of the limit test results as follows:
 - Pass: TTL high
 - Fail: TTL low
16. **MEASURE RESTART.** This allows the connection of an optional foot switch. Using the foot switch will duplicate the key sequence **Meas MEASURE RESTART.**
17. **TEST SET INTERCONNECT.** Not Used
18. **BIAS INPUTS AND FUSES.** These connectors bias devices connected to port 1 and port 2.
19. **Serial number plate.**
20. **RF IN/OUT. (Option 085)** This allows the connection of an optional booster amplifier to increase the output power of the analyzer.
21. **EXTERNAL MONITOR: VGA.**

2

Making Measurements

Principles of Microwave Connector Care

Table 2-1. Connector Care Quick Reference

Handling and Storage	
Do	Do Not
Keep connectors clean Extend sleeve or connector nut Use plastic end-caps during storage	Touch mating plane surfaces Set connectors contact-end down
Visual Inspection	
Do	Do Not
Inspect all connectors carefully Look for metal particles and scratches	Use a damaged connector - ever
Connector Cleaning	
Do	Do Not
Try compressed air first Use isopropyl alcohol Clean connector threads	Use any abrasives Get liquid into plastic support beads
Gaging Connectors	
Do	Do Not
Clean and zero the gage before use Use the correct gage type Use correct end of calibration block Gage all connectors before first use	Use an out-of-spec connector
Making Connections	
Do	Do Not
Align connectors carefully Make preliminary connection lightly Turn only the connector nut Use a torque wrench for final connect	Apply bending force to connection Over tighten preliminary connection Twist or screw any connection Tighten past wrench "break" point

Basic Measurement Sequence and Example

Basic Measurement Sequence

There are five basic steps when you are making a measurement.

1. Connect the device under test and any required test equipment.

Caution	Damage may result to the device under test if it is sensitive to analyzer's default output power level. To avoid damaging a sensitive test device, perform step 2 before step 1.
----------------	--

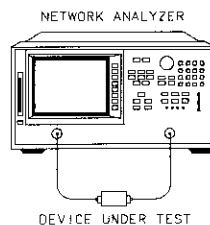
2. Choose the measurement parameters.
3. Perform and apply the appropriate error-correction.
4. Measure the device under test.
5. Output the measurement results.

Basic Measurement Example

This example procedure shows you how to measure the transmission response of a bandpass filter.

Step 1. Connect the device under test and any required test equipment.

1. Make the connections as shown in Figure 2-1.



pb69d

Figure 2-1. Basic Measurement Setup

Step 2. Choose the measurement parameters.

2. Press **[Preset]**.

To set preset to “Factory Preset,” press:

PRESET: FACTORY [Preset].

Setting the Frequency Range.

3. To set the center frequency to 10.24 GHz, press:

[Center] 10.24 [G/n]

4. To set the span to 3 GHz, press:

[Span] 3 [G/n]

Setting the Source Power.

5. To change the power level to -5 dBm, press:

[Menu] POWER -5 [x1]

Setting the Measurement.

6. To change the number of measurement data points to 101, press:

[Menu] NUMBER OF POINTS [↓]

7. To select the transmission measurement, press:

[Meas] Trans:FWD S21 (B/R)

8. To view the data trace, press:

[Scale Ref] AUTOSCALE

Step 3. Perform and apply the appropriate error-correction.

9. Refer to the “Optimizing Measurement Results” chapter for procedures on correcting measurement errors.

10. To save the instrument state and error-correction in the analyzer internal memory, press:

**[Save/Recall] SELECT DISK INTERNAL MEMORY RETURN
SAVE STATE**

Step 4. Measure the device under test.

11. Replace any standard used for error-correction with the device under test.
12. To measure the insertion loss of the bandpass filter, press:

[Marker] 10.24 [G/n].

Step 5. Output the measurement results.

13. To create a hardcopy of the measurement results, press:

Copy **PRINT** (or **PLOT**)

Using the Display Functions

To View Both Measurement Channels

1. To see both channels simultaneously, press:

Display **DUAL CHAN ON**

The analyzer shows channel 1 on the upper half of the display and channel 2 on the lower half of the display. The analyzer also defaults to measuring S_{11} on channel 1 and S_{21} on channel 2.

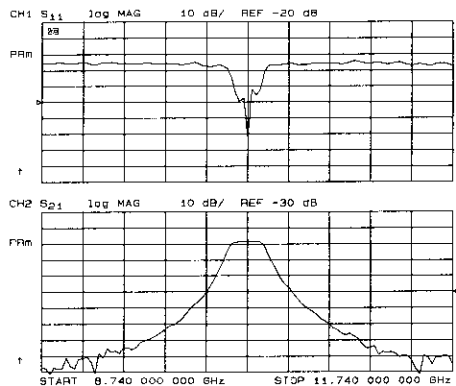


Figure 2-2.
Example of Viewing Both Channels with a Split Display

2. To view both channels on a single graticule, press:

MORE SPLIT DISP OFF

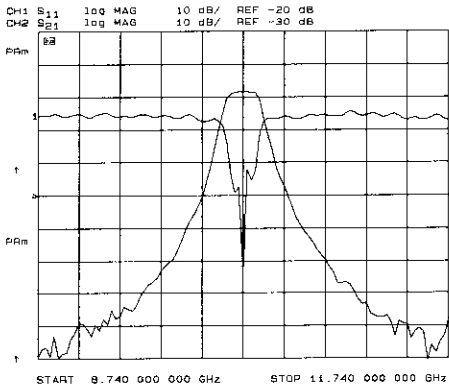


Figure 2-3.
Example of Viewing Both Channels with a Single Graticule

To Save a Data Trace to the Display Memory

Press **Display** **DATA→MEMORY**

To View the Measurement Data and Memory Trace

1. To view a data trace that you have already stored to the active channel memory, press:

Display **MEMORY**

2. To view both the memory trace and the current measurement data trace, press:

Display **DATA and MEMORY**

To Divide Measurement Data by the Memory Trace

1. You must have already stored a data trace to the active channel memory.
2. Press **Display** DATA/MEM.

To Subtract the Memory Trace from the Measurement Data Trace

1. You must have already stored a data trace to the active channel memory.
2. Press **Display** DATA-MEM.

To Ratio Measurements in Channel 1 and 2

1. Press **Menu** COUPLED CH OFF to uncouple the channels.
2. Press **Display** DUAL CHAN ON MORE D2/D1 TO D2 DN.

To Title the Active Channel Display

1. Press **Display** **MORE TITLE** to access the title menu.
2. Press **ERASE TITLE** and enter the title you want for your measurement display.
 - If you have a DIN keyboard attached to the analyzer, type the title you want from the keyboard.
 - If you do not have a DIN keyboard attached to the analyzer, enter the title from the analyzer front panel.
 - a. Turn the front panel knob to move the arrow pointer to the first character of the title.
 - b. Press **SELECT LETTER**.
 - c. Repeat the previous two steps to enter the rest of the characters in your title. You can enter a title that has a maximum of 50 characters.
 - d. Press **DONE** to complete the title entry.

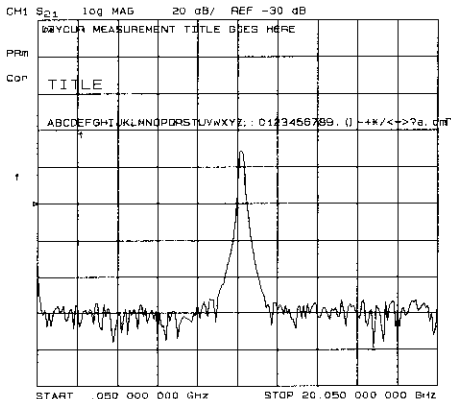


Figure 2-4. Example of a Display Title

To Activate Display Markers

Press **Marker**, then press one or all of the following: **MARKER 1**, **MARKER 2**, **MARKER 3**, **MARKER 4**, **MARKER 5**.

To Use Delta (Δ) Markers

1. Press **Marker** Δ **MODE MENU** Δ **REF=1** to make marker 1 a reference marker.
2. To move marker 1 to any point that you want to reference:
 - ☐ turn the front panel knob
 - OR
 - ☐ enter the frequency value (relative to the reference marker) on the numeric keypad
3. Press **MARKER 2** and move marker 2 to any position that you want to measure in reference to marker 1.

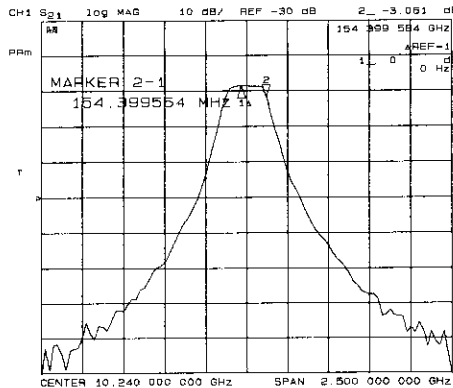


Figure 2-5. Marker 1 as the Reference Marker

To Search for a Specific Amplitude

Searching for the Maximum Amplitude

1. Press **Marker Fctn** **MARKER SEARCH**.
2. Press **SEARCH: MAX** to move the active marker to the maximum point on the measurement trace.

Searching for the Minimum Amplitude

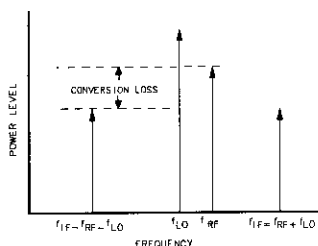
- 1. Press **Marker Fctn** **MARKER SEARCH**.
- 2. Press **SEARCH: MIN** to move the active marker to the minimum point on the measurement trace.

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Making Mixer Measurements (Option 089 Only)

Conversion Loss Using the Frequency Offset Mode

Conversion loss is the measure of efficiency of a mixer. It is the ratio of side-band IF power to RF signal power, and is usually expressed in dB. (Ratioing values in dB amounts to a subtraction of the denominator from the numerator.) The mixer translates the incoming signal, (RF), to a replica, (IF), displaced in frequency by the local oscillator, (LO). Frequency translation is characterized by a loss in signal amplitude and the generation of additional sidebands. For a given translation, two equal output signals are expected, a lower sideband and an upper sideband.



pg594a

Figure 3-1.
An Example Spectrum of RF, LO, and IF Signals Present in a Conversion Loss Measurement

The following procedure describes the swept IF frequency conversion loss measurement of a broadband component mixer.

1. Set the LO source to the desired CW frequency and power level.

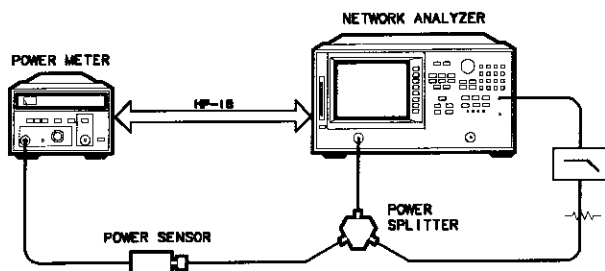
CW frequency = 1000 MHz

Power = 13 dBm

- Set the desired source power to the value which will provide -10 dBm or less to the R-channel input. For the HP 8719D/20D, press:

Menu
POWER PWR RANGE MAN **0** **x1**

- Connect the measurement equipment as shown in Figure 3-2.



pb622d

Figure 3-2. Connections for R Channel and Source Calibration

- From the front panel of the HP 8719D/20D/22D, set the desired receiver frequency and source output power, by pressing:

System INSTRUMENT MODE FREQ OFFS MENU
START **100** **M/μ**
STOP **350** **M/μ**
FREQ OFFS ON

- To view the measurement trace, press:

Meas INPUT PORTS R

- Select the HP 8719D/20D/22D as the system controller:

Local
SYSTEM CONTROLLER

- Set the power meter's address:

SET ADDRESSES
ADDRESS: P MTR/HP IB **##** **x1**

- Select the appropriate power meter by pressing
POWER MTR **[]** until the correct model number is displayed
(HP 436A or HP 438A/437).

9. Press **[Cal]** **PWRMTR CAL LOSS/SENSR LISTS**
CAL FACTOR SENSR A ADD, and enter the correction
factors, as listed on the power sensor. When finished, press **DONE**
DONE.
10. Perform a one sweep power meter calibration over the IF frequency
range at 0 dBm
(-10 dBm, HP 8722D):

```

[Cal]
PWRMTR CAL
ONE SWEEP
[0] [x1] ([-10] [x1], HP 8722D)
TAKE CAL SWEEP
  
```

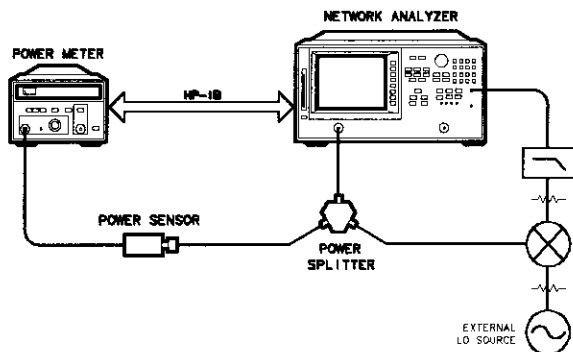
11. To calibrate the R-channel over the IF range, press:

```

[Cal] RECEIVER CAL
TAKE RCVR CAL SWEEP
  
```

Once completed, the display should read 0 dBm (-10 dBm,
HP 8722D).

12. Make the connections as shown in Figure 3-3, for the one-sweep
power meter calibration over the RF range.



pb623a

Figure 3-3.
Connections for a One-Sweep Power Meter Calibration for Mixer
Measurements

13. To set the frequency offset mode LO frequency from the analyzer, press:

```
System
INSTRUMENT MODE
FREQ OFFSET MENU
LO FREQUENCY 1000 M/μ
```

14. To select the converter type and a high-side LO measurement configuration, press:

```
DOWN CONVERTER
RF < LO
```

Notice, in this high-side LO, down conversion configuration, the analyzer's source is actually sweeping backwards, as shown in Figure 3-4. The measurements setup diagram is shown in Figure 3-5.

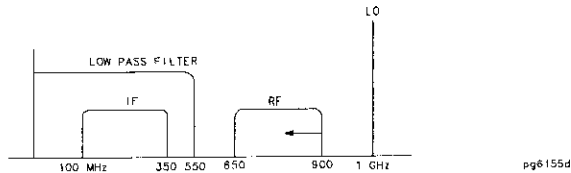
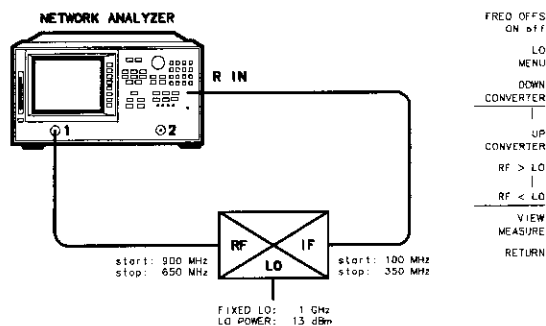


Figure 3-4. Diagram of Measurement Frequencies



pb613d

Figure 3-5. Measurement Setup from Display

15. To view the measurement trace, press:

VIEW MEASURE

16. To perform a one-sweep power meter calibration over the RF frequency range, press:

(Cal) PWRMTR CAL ONE SWEEP (0) (x1) (-10) (x1), HP 8722D)
TAKE CAL SWEEP

The analyzer is now displaying the conversion loss of the mixer, calibrated with power meter accuracy.

17. To view the conversion loss in the best vertical resolution, press:

Scale Ref **AUTOSCALE**

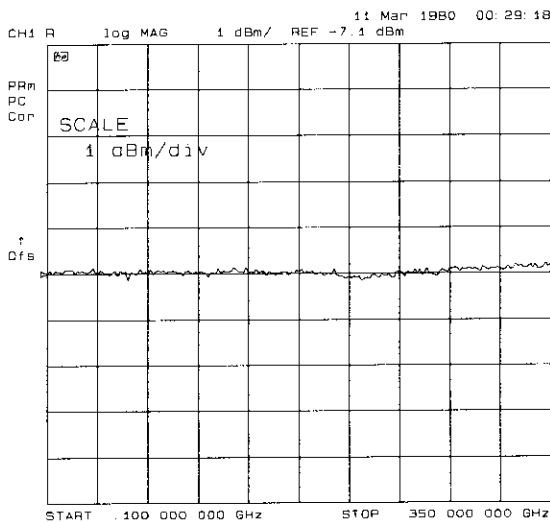


Figure 3-6. Conversion Loss Example Measurement

$$\text{Conversion loss/gain} = \frac{(\text{output power})}{(\text{input power})}$$

In this measurement, you set the input power and measured the output power. Figure 3-6 shows the absolute loss through the mixer versus mixer output frequency. If the mixer under test contained built-in amplification, then the measurement results would have shown conversion gain.

Printing, Plotting, and Saving Measurement Results

Printing or Plotting Your Measurement Results

You can print your measurement results to the following peripherals:

- printers with HP-IB interfaces
- printers with parallel interfaces
- printers with serial interfaces

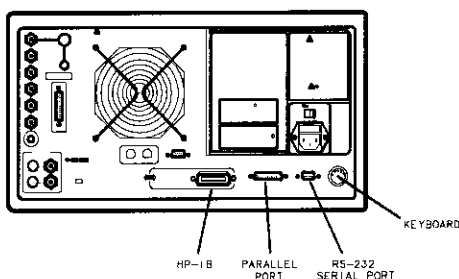
You can plot your measurement results to the following peripherals:

- HPGL compatible printers with HP-IB interfaces
- HPGL compatible printers with parallel interfaces
- plotters with HP-IB interfaces
- plotters with parallel interfaces
- plotters with serial interfaces

Configuring a Print Function

1. Connect the printer to the interface port.

Printer Interface	Recommended Cables
Parallel	HP 92284A
HP-IB	HP 10833A/B/D
Serial	HP 24542G



pb624d

Figure 4-1. Printer Connections to the Analyzer

2. Press **(Local)** **SET ADDRESSES PRINTER PORT PRNTR TYPE** until the correct printer choice appears:
 - ☐ **ThinkJet** (QuietJet)
 - ☐ **DeskJet** (except for HP DeskJet 540 and DeskJet 850C)
 - ☐ **LaserJet**
 - ☐ **PaintJet**
 - ☐ **Epson-P2** (printers that conform to the ESC/P2 printer control language)
 - ☐ **DJ 540** (For use with the HP DeskJet 540 and DeskJet 850C)
3. Select one of the following printer interfaces:
 - Choose **PRNTR PORT HP-IB** if your printer has an HP-IB interface, and then configure the print function as follows:
 - a. Enter the HP-IB address of the printer, followed by **(x1)**.
 - b. Press **(Local)** and **SYSTEM CONTROLLER** if there is no external controller connected to the HP-IB bus.
 - c. Press **(Local)** and **USE PASS CONTROL** if there is an external controller connected to the HP-IB bus.
 - Choose **PARALLEL** if your printer has a parallel (centronics) interface, and then configure the print function as follows:
 - ☐ Press **(Local)** and then select the parallel port interface function by pressing **PARALLEL** until the correct function appears:
 - If you choose **PARALLEL [COPY]**, the parallel port is dedicated for normal copy device use (printers or plotters).

- If you choose **PARALLEL [GPIB]**, the parallel port is dedicated for general purpose I/O, and cannot be used for printing or plotting.
- Choose **SERIAL** if your printer has a serial (RS-232) interface, and then configure the print function as follows:
 - a. Press **PRINTER BAUD RATE** and enter the printer's baud rate, followed by **[x1]**.
 - b. To select the transmission control method that is compatible with your printer, press **XMIT CNTRL** (transmit control - handshaking protocol) until the correct method appears:
 - ☐ If you choose **Non-Xoff**, the handshake method allows the printer to control the data exchange by transmitting control characters to the network analyzer.
 - ☐ If you choose **DTR-DSE**, the handshake method allows the printer to control the data exchange by setting the electrical voltage on one line of the RS-232 serial cable.

Defining a Print Function

Note

The print definition is set to default values whenever the power is cycled. However, you can save the print definition by saving the instrument state.

1. Press **[Copy] DEFINE PRINT**.
2. Press **PRINT**:
 - ☐ Choose **PRINT: MONOCHROME** if you are using a black and white printer, or you want just black and white from a color printer.
 - ☐ Choose **PRINT: COLOR** if you are using a color printer.
3. Press **AUTO-FEED** until the correct choice (ON or OFF) is high-lighted:
 - ☐ Choose **AUTO-FEED ON** if you want to print one measurement per page.
 - ☐ Choose **AUTO-FEED OFF** if you want to print multiple measurements per page.

If You are Using a Color Printer

1. Press **PRINT COLORS**.
2. If you want to modify the print colors, select the print element and then choose an available color.

Note You can set all the print elements to black to create a hardcopy in black and white.

Since the media color is white or clear, you could set a print element to white if you do not want that element to appear on your hardcopy.

To Reset the Printing Parameters to Default Values

1. Press **(Copy) DEFINE PRINT DEFAULT PRINT SETUP**.

Table 4-1. Default Values for Printing Parameters

Printing Parameter	Default
Printer Mode	Monochrome
Auto Feed	ON
Printer Colors	
Channel 1 Data	Magenta
Channel 1 Memory	Green
Channel 2 Data	Blue
Channel 2 Memory	Red
Graticule	Cyan
Warning	Black
Text	Black

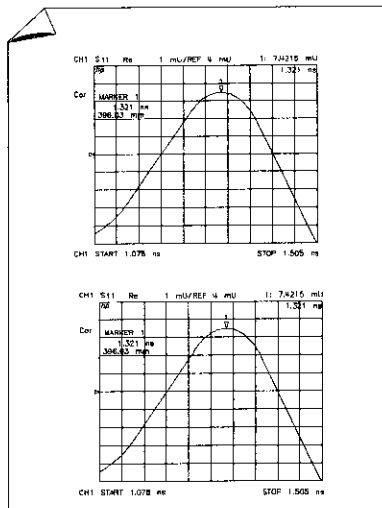
Printing One Measurement Per Page

Press **Copy** **PRINT MONOCHROME**.

- If you defined the **AUTO-FEED OFF**, press **PRINTER FORM FEED** after the message **COPY OUTPUT COMPLETED** appears.

Printing Multiple Measurements Per Page

1. Press **Copy** **DEFINE PRINT** and then press **AUTO-FEED** until the softkey label appears as **AUTO-FEED OFF**.
2. Press **RETURN PRINT MONOCHROME**.
3. Make the next measurement.
4. Press **Copy** **PRINT MONOCHROME**.



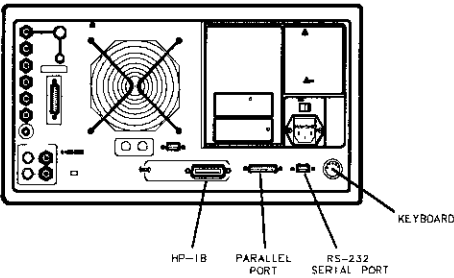
pg5148d

Figure 4-2. Printing Two Measurements

Configuring a Plot Function

1. Connect the peripheral to the interface port.

Peripheral Interface	Recommended Cables
Parallel	HP 92284A
HP-IB	HP 10833A/33B/33D
Serial	HP 24542G



pb624d

Figure 4-3. Peripheral Connections to the Analyzer

If You are Plotting to an HPGL/2 Compatible Printer

2. Press **Local** **SET ADDRESSES PRINTER PORT** and then press **PRNTR TYPE** until the correct printer choice appears:
- ☐ **ThinkJet** (QuietJet)
 - ☐ **DeskJet** (only DeskJet 1200C and DeskJet 1600C)
 - ☐ **LaserJet** (only LaserJet III and IV)
 - ☐ **PaintJet**
 - ☐ **Epson P2** (printers that conform to the ESC/P2 printer control language)

3. Configure the analyzer for one of the following printer interfaces:

- Choose **PRINTER PORT HP-IB** if your printer has an HP-IB interface, and then configure the print function as follows:
 - a. Enter the HP-IB address of the printer (default is 01), followed by **(x1)**.
 - b. Press **(Local)** and **SYSTEM CONTROLLER** if there is no external controller connected to the HP-IB bus.
 - c. Press **(Local)** and **USE PASS CONTROL** if there is an external controller connected to the HP-IB bus.
 - Choose **PARALLEL** if your printer has a parallel (centronics) interface, and then configure the print function as follows:
 - Press **(Local)** and then select the parallel port interface function by pressing **PARALLEL** until the correct function appears:
 - If you choose **PARALLEL [COPY]**, the parallel port is dedicated for normal copy device use (printers or plotters).
 - If you choose **PARALLEL [GPIO]**, the parallel port is dedicated for general purpose I/O, and cannot be used for printing or plotting.
 - Choose **SERIAL** if your printer has a serial (RS-232) interface, and then configure the print function as follows:
 - a. Press **PRINTER BAUD RATE** and enter the printer's baud rate, followed by **(x1)**.
 - b. To select the transmission control method that is compatible with your printer, press **XMIT CTRL** (transmit control - handshaking protocol) until the correct method appears:
 - If you choose **Xon-Xoff**, the handshake method allows the printer to control the data exchange by transmitting control characters to the network analyzer.
 - If you choose **DTR-DSE**, the handshake method allows the printer to control the data exchange by setting the electrical voltage on one line of the RS-232 serial cable.
4. Press **RETURN PLOTTER PORT** and then **PLTR TYPE** until **PLTR TYPE [HPGL PRT]** appears.

If You are Plotting to a Pen Plotter

1. Press **(Local)** **SET ADDRESSES PLOTTER PORT** and then **PLTR TYPE** until **PLTR TYPE [PLOTTER]** appears.
2. Configure the analyzer for one of the following plotter interfaces:
 - Choose **PLTR PORT HP-IB** if your plotter has an HP-IB interface, and then configure the plot function as follows:
 - a. Enter the HP-IB address of the printer (default is 05), followed by **(x1)**.
 - b. Press **(Local)** and **SYSTEM CONTROLLER** if there is no external controller connected to the HP-IB bus.
 - c. Press **(Local)** and **USE PASS CONTROL** if there is an external controller connected to the HP-IB bus.
 - Choose **PARALLEL** if your printer has a parallel (centronics) interface, and then configure the print function as follows:
 - Press **(Local)** and then select the parallel port interface function by pressing **PARALLEL** until the correct function appears:
 - If you choose **PARALLEL [COPY]**, the parallel port is dedicated for normal copy device use (printers or plotters).
 - If you choose **PARALLEL [GPIIO]**, the parallel port is dedicated for general purpose I/O, and cannot be used for printing or plotting.
 - Choose **SERIAL** if your printer has a serial (RS-232) interface, and then configure the print function as follows:
 - a. Press **PRINTER BAUD RATE** and enter the printer's baud rate, followed by **(x1)**.
 - b. To select the transmission control method that is compatible with your printer, press **XMIT CNTRL** (transmit control - handshaking protocol) until the correct method appears:
 - If you choose **Non-Xoff**, the handshake method allows the printer to control the data exchange by transmitting control characters to the network analyzer.
 - If you choose **DTR-DSR**, the handshake method allows the printer to control the data exchange by setting the electrical voltage on one line of the RS-232 serial cable.

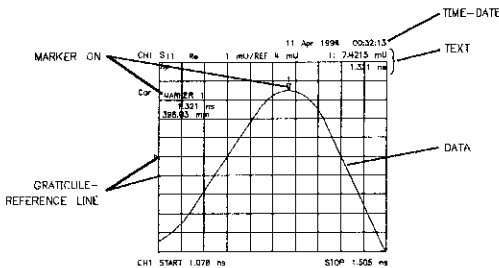
If You are Plotting to a Disk Drive

1. Press **(Local)** **SET ADDRESSES PLOTTER PORT DISK**.
2. Press **(Save/Recall)** **SELECT DISK** and select the disk drive that you will plot to:
 - Choose **INTERNAL DISK** if you will plot to the analyzer internal disk drive.
 - Choose **EXTERNAL DISK** if you will plot to a disk drive that is external to the analyzer. Then configure the disk drive as follows:
 - a. Press **CONFIGURE EXT DISK ADDRESS: DISK** and enter the HP-IB address to the disk drive (default is 00) followed by **(x1)**.
 - b. Press **(Local)** **DISK UNIT NUMBER** and enter the drive where your disk is located, followed by **(x1)**.
 - c. If your storage disk is partitioned, press **VOLUME NUMBER** and enter the volume number where you want to store the instrument state file.

Defining a Plot Function

Note The plot definition is set to default values whenever the power is cycled. However, you can save the plot definition by saving the instrument state.

1. Press **Copy** **DEFINE PLOT**.
2. Choose which of the following measurement display elements that you want to appear on your plot:
 - ☐ Choose **PLOT DATA ON** if you want the measurement data trace to appear on your plot.
 - ☐ Choose **PLOT MEM ON** if you want the displayed memory trace to appear on your plot.
 - ☐ Choose **PLOT GRAT ON** if you want the graticule and the reference line to appear on your plot.
 - ☐ Choose **PLOT TEXT ON** if you want all of the displayed text to appear on your plot. (This does not include the marker values or softkey labels.)
 - ☐ Choose **PLOT MKR ON** if you want the displayed markers, and marker values, to appear on your plot.



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Figure 4-4. Plot Components Available through Definition

3. Press **AUTO-FEED** until the correct choice is high-lighted:
 - ☐ Choose **AUTO-FEED ON** if you want a “page eject” sent to the plotter or HPGL compatible printer after each time you press **PLOT**.

- Choose **AUTO-FEED OFF** if you want multiple plots on the same sheet of paper.
 - 4. Press **MORE** and select the plot element where you want to change the pen number. For example, **PEN_NUM DATA** and then modify the pen number. The pen number selects the color if you are plotting to an HPGL/2 compatible color printer.
- Press **(x1)** after each modification.

Table 4-2.
Default Pen Numbers and Corresponding Colors

Pen Number	Color
0	white
1	cyan
2	magenta
3	blue
4	yellow
5	green
6	red
7	black

Table 4-3. Default Pen Numbers for Plot Elements

Corresponding Key	Plot Element	Chan 1 PenNumbers	Chan 2 Pen Numbers
PEN_NUM DATA	Measurement Data Trace	2	3
PEN_NUM MEMORY	Displayed Memory Trace	5	6
PEN_NUM GRATICULE	Graticule and Reference Line	1	1
PEN_NUM TEXT	Displayed Text	7	7
PEN_NUM MARKER	Displayed Markers and Values	7	7

Note

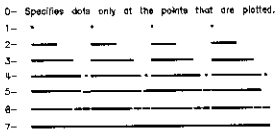
You can set all the pen numbers to black for a plot in black and white.

You must define the pen numbers for each measurement channel (channel 1 and channel 2).

5. Press **MORE** and select each plot element line type that you want to modify.
- Select **LINE TYPE DATA** to modify the line type for the data trace. Then enter the new line type (see Figure 4-5), followed by **(x1)**.
 - Select **LINE TYPE MEMORY** to modify the line type for the memory trace. Then enter the new line type (see Figure 4-5), followed by **(x1)**.

Table 4-4. Default Line Types for Plot Elements

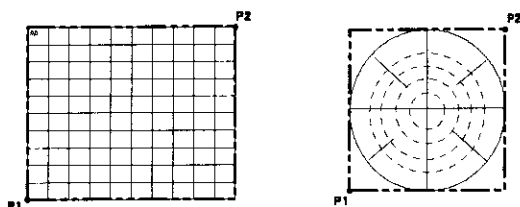
Plot Elements	Channel 1 Line Type Numbers	Channel 2 Line Type Numbers
Data Trace	7	7
Memory Trace	7	7



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Figure 4-5. Line Types Available

6. Press **SCALE PLOT** until the selection appears that you want.
 - Choose **SCALE PLOT [FULL]** if you want the normal scale selection for plotting. This includes space for all display annotations such as marker values and stimulus values. The entire analyzer display fits within the defined boundaries of P1 and P2 on the plotter, while maintaining the exact same aspect ratio as the display.
 - Choose **SCALE PLOT [GRAT]** if you want the outer limits of the graticule to correspond to the defined P1 and P2 scaling point on the plotter. (Intended for plotting on preprinted rectangular or polar forms.



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Figure 4-6.
Locations of P1 and P2 in SCALE PLOT [GRAT] Mode

7. Press **PLOT SPEED** until the plot speed appears that you want.
 - Choose **PLOT SPEED [FAST]** for normal plotting.
 - Choose **PLOT SPEED [SLOW]** for plotting directly on transparencies: the slower speed provides a more consistent line width.

To Reset the Plotting Parameters to Default Values

Press **[Copy]** **DEFINE PLOT MORE MORE**
DEFAULT PLOT SETUP.

Table 4-5. Plotting Parameter Default Values

Plotting Parameter	Default
Select Quadrant	Full page
Auto Feed	ON
Define Plot	All plot elements on
Plot Scale	Full
Plot Speed	Fast
Line Type	7 (solid line)
Pen Numbers: Channel 1	
Data	2
Memory	5
Graticule	1
Text	7
Marker	7
Pen Numbers: Channel 2	
Data	3
Memory	6
Graticule	1
Text	7
Marker	7

Plotting One Measurement Per Page Using a Pen Plotter

1. Define the plot.
2. Press **(Copy) PLOT**.
 - If you defined the **AUTO-FEED OFF**, press **PLOTTER FORM FEED** after the message **COPY OUTPUT COMPLETED** appears.

Plotting Multiple Measurements Per Page Using a Pen Plotter

1. Define the plot.
2. Press **Copy** **SEL QUAD**.
3. Choose the quadrant where you want your displayed measurement to appear on the hardcopy.

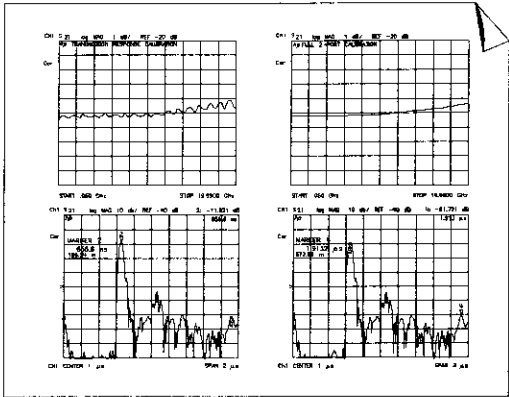


Figure 4-7. Plot Quadrants

4. Press **PLOT**.
5. Make the next measurement.
6. Press **Copy** **SEL QUAD** and choose another quadrant.
7. Repeat the previous three steps until you have captured the results of up to four measurements.

If You are Plotting to an HPGL Compatible Printer

Press **Copy** **PLOT PLOTTER FORM FEED** to print the data the printer has received.

Plotting a Measurement to Disk

The plot files that you generate from the analyzer, contain the HPGL representation of the measurement display. The files will not contain any setup or form-feed commands.

1. Configure the analyzer to plot to disk, as explained in “Configuring a Plot Function” located earlier in this chapter.
2. Press **(Copy)** **PLOT**.

Aborting a Print or Plot Process

1. Press the **(Local)** key to stop all data transfer.
2. If your peripheral is not responding, press **(Local)** again or reset the peripheral.

Saving and Recalling Instrument States

Places Where You Can Save

- analyzer internal memory
- floppy disk using the analyzer's internal disk drive
- floppy disk using an external disk drive
- IBM compatible personal computer using HP-IB mnemonics

What You Can Save to the Analyzer's Internal Memory

You can save instrument states in the analyzer internal memory, along with the following list of analyzer settings. The default filenames are REG<01-31>.

- error-corrections on channels 1 and 2
- displayed memory trace
- print/plot definitions
- measurement setup
 - frequency range
 - number of points
 - sweep time
 - output power
 - sweep type
 - measurement parameter

Note	When the ac line power is switched off, the internal non-volatile memory is retained by a battery. The data retention time with the 3 V, 1.2 Ah battery is as follows:
	Temperature at 70 °C 250 days (0.68 year) characteristically
	Temperature at 40 °C 1244 days (3.4 years) characteristically
	Temperature at 25 °C 10 years characteristically

What You Can Save to a Floppy Disk

You can save an instrument state and/or measurement results to a disk. The default filenames are FILEn, where n gets incremented by one each time a file with a default name is added to the directory. The default filenames for data-only files are DATAnDn (DATAn.Dn for DOS), where the first n is incremented by one each time a file with a default name is added to the directory. The second n is the channel where the measurement was made. When you save a file to disk, you can choose to save some or all of the following:

- all settings listed above for internal memory
- active error-correction for the active channel only
- displayed measurement data trace
- displayed user graphics
- data only
- HPGL plots

What You Can Save to a Computer

Instrument states can be saved to and recalled from an external computer (system controller) using HP-IB mnemonics. For more information about the specific analyzer settings that can be saved, refer to the output commands located in the “Command Reference” chapter of the *HP 8719D/20D/22D Network Analyzer Programmer's Guide*. For an example program, refer to “Saving and Recalling Instruments States” in the “Programming Examples” chapter of the *HP 8719D/20D/22D Network Analyzer Programmer's Guide*.

Saving an Instrument State

1. Press **(Save/Recall)** **SELECT DISK** and select one of the storage devices:
 - **INTERNAL MEMORY**
 - **INTERNAL DISK**
 - **EXTERNAL DISK** and then configure as follows:
 - a. Press **(Local)** **DISK UNIT NUMBER** and enter the drive where your disk is located, followed by **(x1)**.
 - b. If your storage disk is partitioned, press **VOLUME NUMBER** and enter the volume number where you want to store the instrument state file.
 - c. Press **SET ADDRESSES ADDRESS: DISK**.
 - d. Enter the HP-IB address of the peripheral, if the default address is incorrect (default = 00). Follow the entry by pressing **(x1)**.
 - e. Press **(Local)** and select one of the following:
 - Choose **SYSTEM CONTROLLER** to allow the analyzer to control peripherals directly.
 - Choose **TALKER/LISTENER** to allow the computer controller to be involved in all peripheral access operations.
 - Choose **USE PASS CONTROL** to allow yourself to control the analyzer over HP-IB and also allows the analyzer to take or pass control.
2. Press **(Save/Recall)** **SAVE STATE**.

The analyzer saves the state in the next available register, if you are saving to internal memory, or saves the state to disk.

Note

If you have saved enough files that you have used all the default names (FILE00 - FILE31 for disk files, or REG1 - REG31 for memory files), you must do one of the following in order to save more states:

- use another disk
 - rename an existing file to make a default name available
 - re-save a file/register
 - delete an existing file/register
-

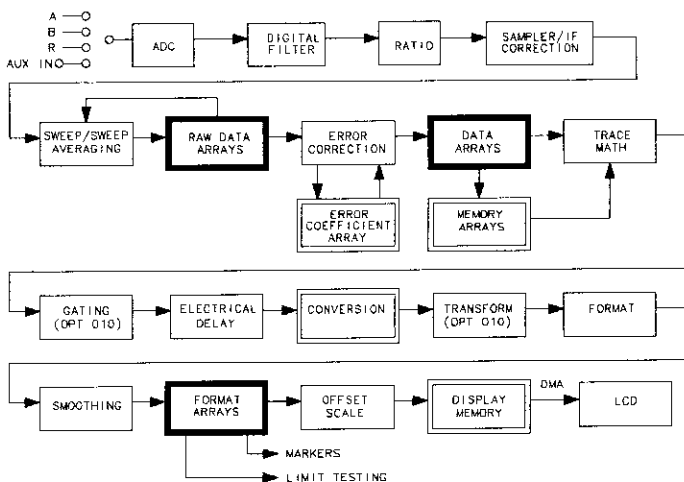
Saving Measurement Results

Instrument states combined with measurements results can only be saved to disk. Files that contain data-only, and the various save options available under the **DEFINE DISK SAVE** key, are also only valid for disk saves.

The analyzer stores data in arrays along the processing flow of numerical data, from IF detection to display. These arrays are points in the flow path where data is accessible, usually via HP-IB. You can choose from three different arrays which vary in modification flexibility when they are recalled.

Define Save	Modification Flexibility During Recall
Raw Data Array	Most
Data Array	Medium
Format Array	Least

You can also save data-only. This is saved to disk with default filenames DATA00D1 to DATA31D1, for channel 1, or DATA00D2 to DATA31D2, for channel 2. However, these files are not instrument states and cannot be recalled.



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Figure 4-8. Data Processing Flow Diagram

1. Press **Save/Recall** **SELECT DISK**.
2. Choose one of the following disk drives:
 - **INTERNAL DISK**
 - **EXTERNAL DISK** (See "Saving an Instrument State," located earlier.)
 - Press **Save/Recall** **DEFINE DISK-SAVE**.
 - Define the save by selecting one of the following choices:
 - ☐ **DATA ARRAY ON**
 - ☐ **RAW ARRAY ON**
 - ☐ **FORMAT ARRAY ON**
 - ☐ **GRAPHICS ON**
 - ☐ **DATA ONLY ON**

Note

Selecting **DATA ONLY ON** will override all of the other save options.

3. Choose the type of format you want:
 - ☐ Choose **SAVE USING BINARY** for all applications except CITIFile, S2P, or CAE applications.
 - ☐ Choose **SAVE USING ASCII** for CITIFile, S2P, and CAE applications or when you want to import the information into a spread sheet format.
4. Press **RETURN SAVE STATE**.

Recalling a File

1. Press **(Save/Recall) SELECT DISK**.
2. Choose from the following storage devices:
 - ☐ **INTERNAL MEMORY**
 - ☐ **INTERNAL DISK**
 - ☐ **EXTERNAL DISK**
3. Press the **(↓) (↑)** keys or the front panel knob to high-light the name of the file that you want to recall.
4. Press **RETURN RECALL STATE**.

Optimizing Measurement Results

Increasing Measurement Accuracy

Connector Repeatability

- inspect the connectors
- clean the connectors
- gauge the connectors
- use correct connection techniques. See Chapter 2, (Table 2-1).

Interconnecting Cables

- inspect for lossy cables
- inspect for damaged cable connectors
- practice good connector care techniques
- minimize cable position changes between error-correction and measurements
- inspect for cables which change magnitude or phase response when flexing

Temperature Drift

During a measurement calibration, the temperature of the calibration devices must be stable and within 23 ± 3 °C.

- use a temperature-controlled environment
- ensure the temperature stability of the calibration devices
- avoid handling the calibration devices unnecessarily during calibration
- ensure the ambient temperature is ± 1 °C of measurement error-correction temperature

Frequency Drift

- override the internal crystal with a high-stability external source, frequency standard, or use the internal frequency standard.

Performance Verification

- perform a measurement verification at least once per year

Reference Plane and Port Extensions

Use the port extension feature to compensate for the phase shift of an extended measurement reference plane, due to such additions as cables, adapters, and fixtures, after completing an error-correction procedure (or when there is no active correction).

Table 5-1.
Differences between PORT EXTENSIONS and ELECTRICAL DELAY

	PORT EXTENSIONS	ELECTRICAL DELAY
Main Effect	The end of a cable becomes the test port plane for all S-parameter measurements.	Compensates for the electrical length of a cable. Set the cable's electrical length x 1 for transmission. Set the cable's electrical length x 2 for reflection
Measurements Affected	All S-parameters.	Only the currently selected S-parameter.
Electrical Compensation	Intelligently compensates for 1 times or 2 times the cable's electrical delay, depending on which S-parameter is computed.	Only compensates for electrical length.

You can activate a port extension by pressing **Cal** MORE PORT EXTENSIONS EXTENSIONS ON. Then enter the delay to the reference plane.

Measurement Error-Correction

Conditions Where Error-Correction is Suggested

- Adapting to a different connector type or impedance.
- Connecting a cable between the test device and an analyzer test port.
- Connecting any attenuator or other such device on the input or output of the test device.

Table 5-2.
Purpose and Use of Different Error-Correction Procedures

Correction Procedure	Corresponding Measurement	Errors Corrected	Standard Devices
Response	Transmission or reflection measurement when the highest accuracy is not required.	Frequency response	Thru for transmission, open or short for reflection
Response & isolation	Transmission of high insertion loss devices or reflection of high return loss devices. Not as accurate as 1-port or 2-port correction.	Frequency response plus isolation in transmission or directivity in reflection	Same as response plus isolation standard (load)
S_{11} 1-port	Reflection of any one-port device or well terminated two-port device.	Directivity, source match, frequency response.	Short and open and load
S_{22} 1-port	Reflection of any one-port device or well terminated two-port device.	Directivity, source match, frequency response.	Short and open and load
Full 2-port	Transmission or reflection of highest accuracy for two-port devices.	Directivity, source match, load match, isolation, frequency response, forward and reverse.	Short and open and load and thru (2 loads for isolation)
TRL/LRM Option 400	Transmission or reflection when the same level of error correction as full 2-port is required.	Directivity, isolation, source match, load match, frequency response (forward and reverse)	Thru, reflect, line, or line, reflect, match, or thru, reflect, match
TRL*/LRM*	Transmission or reflection when highest accuracy is not required.	Directivity, isolation, frequency response (forward and reverse)	Thru, reflect, line, or line, reflect, match, or thru, reflect, match

Calibration Standards

- use the correct standard model
- inspect the calibration standards
- clean the calibration standards
- gauge the calibration standards
- use correct connection techniques

Table 5-3. Frequency Cutoff Points of Load Standards

Connector Type	Broadband Load (50 MHz to 20 GHz)	
	Lowband Load	Sliding Load
3.5 mm	50 MHz to 3 GHz	3 GHz to 20 GHz
7 mm	50 MHz to 2 GHz	2 GHz to 20 GHz
Type-N	50 MHz to 2 GHz	2 GHz to 20 GHz
2.4 mm	50 MHz to 4 GHz	4 GHz to 20 GHz

Increasing Sweep Speed

To Decrease the Frequency Span

Modify the frequency span to eliminate as many band switches as possible while maintaining measurement integrity. Refer to the following table to identify the analyzer's band switch points:

Table 5-4. Band Switch Points

Band	Frequency Span
1	50 MHz to 110 MHz
2	110 MHz to 230 MHz
3	230 MHz to 470 MHz
4	470 MHz to 698 MHz
5	698 MHz to 1.17 GHz
6	1.17 GHz to 1.878 GHz
7	1.878 GHz to 2.55 GHz
8	2.55 GHz to 4.71 GHz
9	4.71 GHz to 8.256 GHz
10	8.256 GHz to 13.562 GHz
11 (HP 8720D/22D)	13.562 GHz to 20.05 GHz
12 (HP 8722D)	20.05 GHz to 25.0 GHz
13 (HP 8722D)	25.0 GHz to 40.0 GHz

To Set the Auto Sweep Time Mode

- Press **Menu** **SWEEP TIME** **0** **x1**, to re-enter the auto mode.

To Widen the System Bandwidth

1. Press **(Avg)** **IF BW**.
2. Set the IF bandwidth to change the sweep time.

IF BW	Cycle Time (Seconds) ¹	
	Full Span	Narrow Sweep
3700 Hz	.6012	.094
3000 Hz	.6028	.098
1000 Hz	.6044	.134
300 Hz	.6958	.249
100 Hz	1.028	.583
30 Hz	2.427	1.89
10 Hz	6.108	5.56

¹ The listed sweep times correspond to an HP 8720D analyzer being set to a preset state for the full span, and 3 GHz to 4 GHz for the narrow span.

To Reduce the Averaging Factor

1. Press **(Avg)** **AVG FACTOR**.
2. Enter an averaging factor that is less than the value displayed on the analyzer screen and press **(x1)**.

To Reduce the Number of Measurement Points

1. Press **(Menu)** **NUMBER OF POINTS**.
2. Enter a number of points that is less than the value displayed on the analyzer screen and press **(x1)**.

Number of Points	Cycle Time (Seconds) ¹	
	Full Span	
	LIN	LOG
03	333 m	273 m
11	361 m	467 m
21	389 m	536 m
26	416 m	556 m
51	437 m	650 m
101	472 m	833 m
201	540 m	1.19
401	644 m	1.88
801	848 m	3.26
1601	1.23	6.01

¹ The listed sweep times correspond to an HP 8720D analyzer being set to a preset state.

To Set the Sweep Type

1. Press **Menu** **SWEEP TYPE MENU**.
2. Select the sweep type:
 - ☐ Select **LIN FREQ** for the fastest sweep for a given number of fixed points.
 - ☐ Select **LIST FREQ** for the fastest sweep when specific non-linear spaced frequency points are of interest.
 - ☐ Select **LOG FREQ** for the fastest sweep when the frequency points of interest are in the lower part of the frequency span selected.

To View a Single Measurement Channel

1. Press **Display** **DUAL CHAN OFF**.
2. Press **Chan 1** and **Chan 2** to alternately view the two measurement channels.

To Activate Chop Sweep Mode

- Press **[Cal]** MORE CHOP A and B.

Increasing Dynamic Range

To Increase the Test Port Input Power

Press **[Menu]** POWER and enter the new source power level, followed by **[x1]**.

Caution TEST PORT INPUT DAMAGE LEVEL: + 30 dBm

To Reduce the Receiver Noise Floor

Changing System Bandwidth

Each tenfold reduction in IF (receiver) bandwidth lowers the noise floor by 10 dB.

1. Press **[Avg]** IF BW.
2. Enter the bandwidth value that you want, followed by **[x1]**.

Changing Measurement Averaging

1. Press **[Avg]** AVERAGING FACTOR.
2. Enter a value followed by **[x1]**.
3. Press AVERAGING ON.

Reducing Trace Noise

To Activate Averaging

1. Press **[Avg]** AVERAGING FACTOR.
2. Enter a value followed by **[x1]**.
3. Press AVERAGING ON.

To Change System Bandwidth

1. Press **[Avg]** IF BW.
2. Enter the IF bandwidth value that you want, followed by **[x1]**.

Reducing Receiver Crosstalk

To set the alternate sweep, press **[Cal]** MORE ALTERNATE A AND B.

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Application and Operation Concepts

System Operation

Network analyzers measure the reflection and transmission characteristics of devices and networks. A network analyzer test system consists of the following:

- source
- signal-separation devices
- receiver
- display

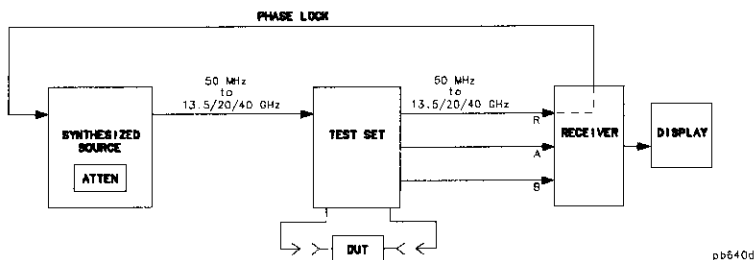
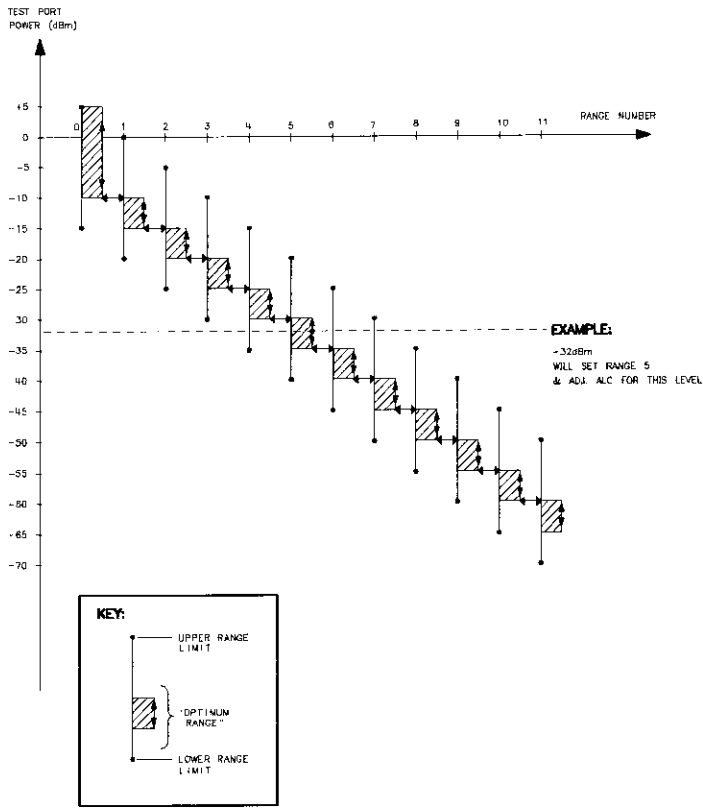


Figure 6-1.
Simplified Block Diagram of the Network Analyzer System

The Power Menu

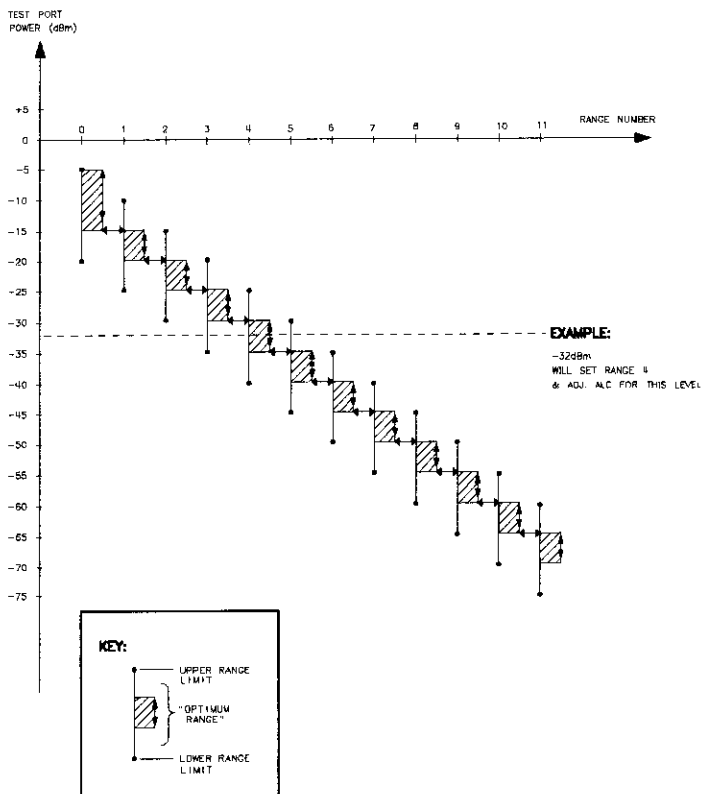
The power menu is used to define and control analyzer power. **PWR RANGE AUTO** *man* allows you to select power ranges automatically or manually.

Note After measurement calibration, you can change the power within a range and still maintain nearly full accuracy.



pb642d

Figure 6-2.
Power Range Transitions in the Automatic Mode (HP 8719D/20D, Standard)



pb8123d

Figure 6-3.
Power Range Transitions in the Automatic Mode (HP 8722D, Standard)

Note The power ranges for instruments equipped with Option 007 will be shifted 5 dB higher.

Power Coupling Options

Channel coupling

`CHAN POWER [COUPLED]` toggles between coupled and uncoupled channel power.

Test port coupling

`PORT POWER [COUPLED]` toggles between coupled and uncoupled test ports.

Channel Stimulus Coupling

`COUPLED CH on OFF` toggles the channel coupling of stimulus values.

In the stimulus coupled mode, the following parameters are coupled:

- frequency
- number of points
- source power
- number of groups
- IF bandwidth
- sweep time
- trigger type
- gating parameters
- sweep type
- power meter calibration

Sweep Time

Minimum Sweep Time

The minimum sweep time is dependent on the following measurement parameters:

- the number of points selected
- IF bandwidth
- sweep-to-sweep averaging in dual channel display mode

- error-correction
- type of sweep

In addition to the previously listed parameters, the actual cycle time of the analyzer is also dependent on the following measurement parameters:

- smoothing
- limit test
- trace math
- marker statistics
- time domain (Option 010 Only)

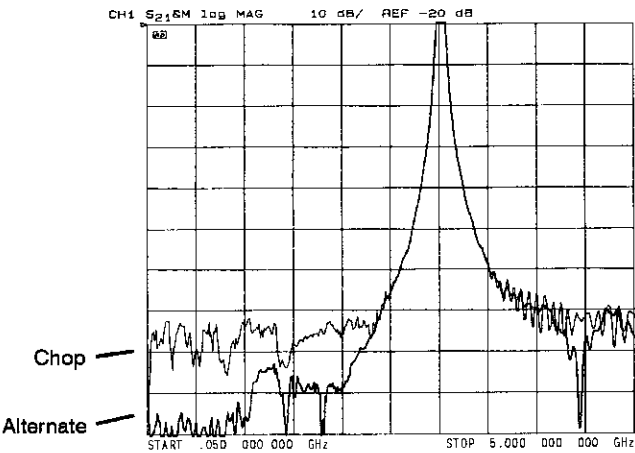
Table 6-1. Minimum Cycle Time (in seconds)

Number of Points	IF Bandwidth						10 Hz
	3700 Hz	3000 Hz	1000 Hz	300 Hz	100 Hz	30 Hz	
11	0.0041 s	0.0055 s	0.012 s	0.037 s	0.108 s	0.359 s	1.14 s
51	0.0191 s	0.0255 s	0.060 s	0.172 s	0.504 s	1.660 s	5.30 s
101	0.0379 s	0.0505 s	0.120 s	0.341 s	0.998 s	3.300 s	10.5 s
201	0.0754 s	0.1005 s	0.239 s	0.679 s	1.990 s	6.600 s	20.9 s
401	0.1504 s	0.2005 s	0.476 s	1.355 s	3.960 s	13.10 s	41.7 s
801	0.3004 s	0.4005 s	0.951 s	2.701 s	7.910 s	26.10 s	83.3 s
1601	0.6004 s	0.8005 s	1.901 s	5.411 s	15.80 s	52.20 s	166.5 s

Alternate and Chop Sweep Modes

ALTERNATE A and B measures only one input per frequency sweep, in order to reduce unwanted signals, such as crosstalk from sampler A to B when measuring B/R. Thus, this mode optimizes the dynamic range for all four S-parameter measurements.

CHOP A and B is the default measurement mode. This mode measures both inputs A and B during each sweep.



pb643d

Figure 6-4. Alternate and Chop Sweeps Overlaid

Understanding S-Parameters

S-parameters (scattering parameters) are a convention used to characterize the way a device modifies signal flow. A brief explanation of the S-parameters of a two-port device is provided here. For additional details refer to Hewlett-Packard Application Notes A/N 95-1 and A/N 154.

S-parameters are always a ratio of two complex (magnitude and phase) quantities. S-parameter notation identifies these quantities using the numbering convention:

S out in

where the first number (out) refers to the test-device port where the signal is emerging and the second number (in) is the test-device port where the signal is incident. For example, the S-parameter S_{21} identifies the measurement as the complex ratio of the signal emerging at the test device's port 2 to the signal incident at the test device's port 1.

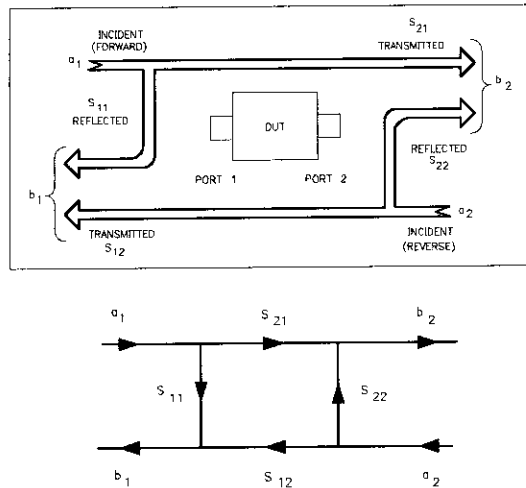


Figure 6-5. S-Parameters of a Two-Port Device

S-parameters are exactly equivalent to the more common description terms below, requiring only that the measurements be taken with all test device ports properly terminated.

S-Parameter	Definition	Test Set Description	Direction
S_{11}	$\frac{b_1}{a_1} \quad a_2 = 0$	Input reflection coefficient	FWD
S_{21}	$\frac{b_2}{a_1} \quad a_2 = 0$	Forward gain	FWD
S_{12}	$\frac{b_1}{a_2} \quad a_1 = 0$	Reverse gain	REV
S_{22}	$\frac{b_2}{a_2} \quad a_1 = 0$	Output reflection coefficient	REV

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Measurement Calibration

Measurement calibration is an accuracy enhancement procedure that effectively removes the system errors that cause uncertainty in measuring a test device. It measures known standard devices, and uses the results of these measurements to characterize the system.

What is Accuracy Enhancement?

A perfect measurement system would have infinite dynamic range, isolation, and directivity characteristics, no impedance mismatches in any part of the test setup, and flat frequency response. In any high frequency measurement there are measurement errors associated with the system that contribute uncertainty to the results. Parts of the measurement setup such as interconnecting cables and signal-separation devices (as well as the analyzer itself) all introduce variations in magnitude and phase that can mask the actual performance of the test device. Vector accuracy enhancement, also known as measurement calibration or error-correction, provides the means to simulate a nearly perfect measurement system.

What Causes Measurement Errors?

Network analysis measurement errors can be separated into systematic, random, and drift errors.

Correctable systematic errors are the repeatable errors that the system can measure. These are errors due to mismatch and leakage in the test setup, isolation between the reference and test signal paths, and system frequency response.

The system cannot measure and correct for the non-repeatable random and drift errors. These errors affect both reflection and transmission measurements. Random errors are measurement variations due to noise and connector repeatability. Drift errors include frequency drift, temperature drift, and other physical changes in the test setup between calibration and measurement.

Time Domain Operation (Option 010)

With Option 010, the analyzer can transform frequency domain data to the time domain or time domain data to the frequency domain.

The analyzer has three frequency-to-time transform modes:

Time domain bandpass mode is designed to measure band-limited devices and is the easiest mode to use. This mode simulates the time domain response of an impulse input.

Time domain low pass step mode simulates the time domain response of a step input. As in a traditional TDR measurement, the distance to the discontinuity in the test device, and the type of discontinuity (resistive, capacitive, inductive) can be determined.

Time domain low pass impulse mode simulates the time domain response of an impulse input (like the bandpass mode). Both low pass modes yield better time domain resolution for a given frequency span than does the bandpass mode. In addition, when using the low pass modes, you can determine the type of discontinuity. However, these modes have certain limitations that are defined in "Time domain low pass," later in this section.

Time Domain Low Pass

This mode is used to simulate a traditional time domain reflectometry (TDR) measurement. It provides information to determine the type of discontinuity (resistive, capacitive, or inductive) that is present.

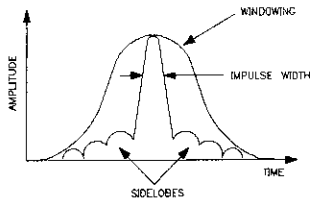
Table 6-2.
Minimum Frequency Ranges for Time Domain Low Pass

Number of Points	Minimum Frequency Range
3	50 MHz to 150 MHz
11	50 MHz to 550 MHz
21	50 MHz to 1.05 GHz
51	50 MHz to 2.55 GHz
101	50 MHz to 5.05 GHz
201	50 MHz to 10.05 GHz
401	50 MHz to 20.05 GHz
801	50 MHz to 40.05 GHz

Time Domain Concepts

Windowing

- **Finite impulse width (or rise time).** Finite impulse width limits the ability to resolve between two closely spaced responses. The effects of the finite impulse width cannot be improved without increasing the frequency span of the measurement (see Table 6-3).



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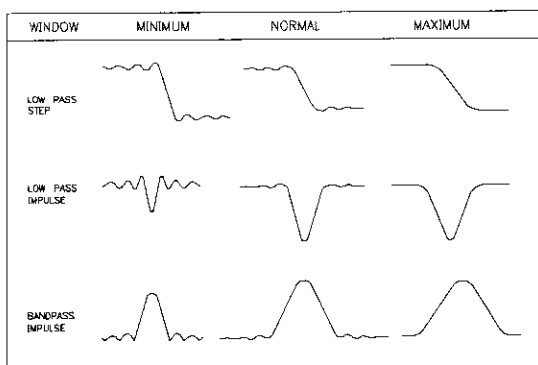
Figure 6-6. Impulse Width, Sidelobes, and Windowing

- **Sidelobes.** The impulse sidelobes limit the dynamic range of the time domain measurement by hiding low-level responses within the sidelobes of higher level responses. The effects of sidelobes can be improved by windowing (see Table 6-3).

To select a window, press **System** **TRANSFORM MENU WINDOW**. A menu is presented that allows the selection of three window types (see Table 6-3).

Table 6-3.
Impulse Width, Sidelobe Level, and Windowing Values

Window Type	Impulse Sidelobe Level	Low Pass Impulse Width (50%)	Step Sidelobe Level	Step Rise Time (10 - 90%)
Minimum	-13 dB	0.60/Freq Span	-21 dB	0.45/Freq Span
Normal	-44 dB	0.98/Freq Span	-60 dB	0.99/Freq Span
Maximum	-75 dB	1.39/Freq Span	-70 dB	1.48/Freq Span
NOTE: The bandpass mode simulates an impulse stimulus. Bandpass impulse width is twice that of low pass impulse width. The bandpass impulse sidelobe levels are the same as low pass impulse sidelobe levels.				



pb564d

Figure 6-7.

The Effects of Windowing on the Time Domain Responses of a Short Circuit

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Range

In the time domain, range is defined as the length in time that a measurement can be made without encountering a repetition of the response, called aliasing. A time domain response repeats at regular intervals because the frequency domain data is taken at discrete frequency points, rather than continuously over the frequency band.

$$\text{Measurement range} = \frac{1}{\Delta F}$$

where ΔF is the spacing between frequency data points

$$\text{Measurement range} = \frac{(\text{number of points} - 1)}{\text{frequency span}(Hz)}$$

example:

$$\text{Measurement} = 201 \text{ points}$$

$$1 \text{ MHz to } 2.001 \text{ GHz}$$

$$\text{Range} = \frac{1}{\Delta F} \text{ or } \frac{(\text{number of points} - 1)}{\text{frequency span}}$$

$$= \frac{1}{(10 \times 10^6)} \text{ or } \frac{(201 - 1)}{(2 \times 10^9)}$$

$$= 100 \times 10^{-9} \text{ seconds}$$

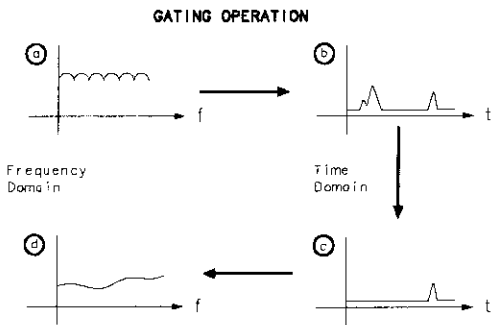
$$\text{Electrical length} = \text{range} \times \text{the speed of light } (3 \times 10^8 \text{ m/s})$$

$$= (100 \times 10^{-9} \text{ s}) \times (3 \times 10^8 \text{ m/s})$$

$$= 30 \text{ meters}$$

Gating

Gating provides the flexibility of selectively removing time domain responses. The remaining time domain responses can then be transformed back to the frequency domain.



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Figure 6-8. Sequence of Steps in Gating Operation

Selecting gate shape. The four gate shapes available are listed in Table 6-4. Each gate has different passband flatness, cutoff rate, and sidelobe levels.

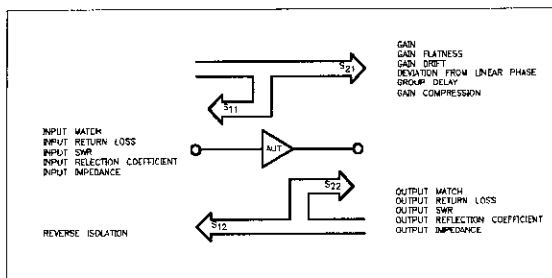
Table 6-4. Gate Characteristics

Gate Shape	Passband Ripple	Sidelobe Levels	Cutoff Time	Minimum Gate Span
Gate Span Minimum	± 0.10 dB	-48 dB	1.4/Freq Span	2.8/Freq Span
Normal	± 0.01 dB	-68 dB	2.8/Freq Span	5.6/Freq Span
Wide	± 0.01 dB	-57 dB	4.4/Freq Span	8.8/Freq Span
Maximum	± 0.01 dB	-70 dB	12.7/Freq Span	25.4/Freq Span

Amplifier Testing

Amplifier Parameters

The HP 8719D/20D/22D allows you to measure the transmission and reflection characteristics of many amplifiers and active devices.

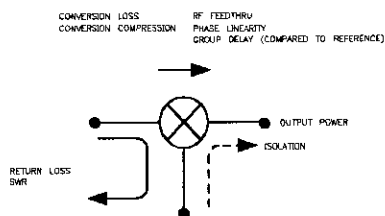


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Figure 6-9. Amplifier Parameters

Mixer Testing

Mixer Parameters That You Can Measure



pb6118a

Figure 6-10. Mixer Parameters

- Transmission characteristics include conversion loss, conversion compression, group delay, and RF feedthru.
- Reflection characteristics include return loss, SWR and complex impedance.
- Output power.
- Other parameters of concern are isolation terms, including LO to RF isolation and LO to IF isolation.

Up-Conversion and Down-Conversion Definition

When you choose between $RF < LO$ and $RF > LO$ in the frequency offset menus, the analyzer determines which direction the internal source must sweep in order to achieve the requested IF frequency.

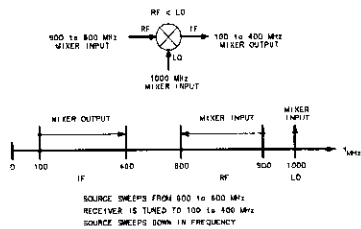
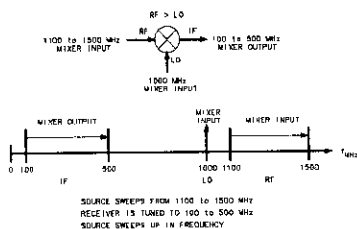
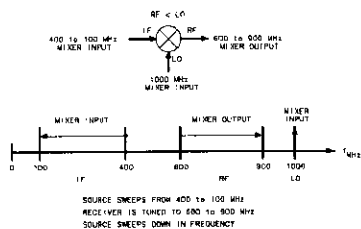
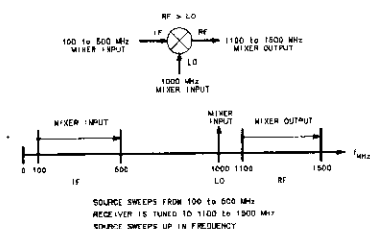


Figure 6-11. Examples of Up Converters and Down Converters

Specifications and Measurement Uncertainties

Table 7-1. Instrument Specifications

SPECIFICATIONS AND CHARACTERISTICS		
Description	Specification	Code
FREQUENCY CHARACTERISTICS		
Range		
HP 8719D	0.05 to 13.51 GHz	S-1
HP 8720D	0.05 to 20.05 GHz	S-1
HP 8722D	0.05 to 40 GHz	S-1
Accuracy		
(at 23 °C ±3 °C)	±10 ppm	S-1
Stability		
0 ° to 55 °C	±7.5 ppm	C
Option 1D5	±0.05 ppm	C
per year (aging)	±3 ppm	C
Option 1D5	±0.5 ppm	C
Resolution	1 Hz	S-3
POWER CHARACTERISTICS		
Power Range		
HP 8719D (Std., Opts. 007, 085, 400)	75 dB	C
HP 8720D (Std., Opts. 007, 085, 400)	75 dB	C
HP 8722D (Std., Opts. 085, 400: 0.05 to 20 GHz)	70 dB	C
HP 8722D (Std., Opts. 085, 400: 20 to 40 GHz)	65 dB	C
HP 8722D (Opt. 007: 0.05 to 20 GHz)	70 dB	C
HP 8722D (Opt. 007: 20 to 40 GHz)	65 dB	C

Table 7-1. Instrument Specifications (continued)

SPECIFICATIONS AND CHARACTERISTICS		
Description	Specification	Code
POWER CHARACTERISTICS (CONT'D)		
Maximum Output Power		
HP 8719D/20D (Std., Opts. 085, 400)	+5 dBm	C
HP 8719D/20D (Opt. 007)	+10 dBm	C
HP 8722D (Std., Opts. 085, 400: 0.05 to 20 GHz)	-5 dBm	C
HP 8722D (Std., Opts. 085, 400: 20 to 40 GHz)	-10 dBm	C
HP 8722D (Opt. 007: 0.05 to 20 GHz)	0 dBm	C
HP 8722D (Opt. 007: 20 to 40 GHz)	-5 dBm	C
Resolution	0.01 dB	S-3
Flatness (@ 5 dB below maximum output power)		
HP 8719D/20D	± 2 dB	S-1
HP 8722D	± 3 dB	S-1
Power Sweep Range		
HP 8719D	20 dB	S-3
HP 8720D	20 dB	S-3
HP 8722D	15 dB	S-3
Power Linearity		
Test Reference Power:		
-5 dBm for HP 8719D/8720D (Std., Opts. 085, 400)		
0 dBm for HP 8719D/8720D (Opt. 007)		
-10 dBm for HP 8722D (Std., Opts. 085, 400)		
-5 dBm for HP 8722D (Opt. 007)		
± 5 dB from reference	± 0.35 dB	S-1
-10 dB from reference	± 0.6 dB	S-1
+10 dB* from reference	± 1.0 dB	S-1
* Does not apply to HP 8722D.		

Table 7-1. Instrument Specifications (continued)

SPECIFICATIONS AND CHARACTERISTICS		
Description	Specification	Code
SYSTEM CHARACTERISTICS		
Dynamic Range [†]		
HP 8719D/20D (Std., Opts. 085, 400)		
0.05-20 GHz	100 dB [#]	S-1
HP 8719D/20D (Opt. 007)		
0.05-20 GHz	105 dB [△]	S-1
HP 8722D (Std. [‡] , Opts. 085, 400)		
0.05-2 GHz	93 dB [§]	S-1
2-8 GHz	93 dB	S-1
8-20 GHz	91 dB	S-1
20-40 GHz	80 dB [◇]	S-1
HP 8722D (Opt. 007)		
0.05-2 GHz	98 dB [⊙]	S-1
2-8 GHz	98 dB	S-1
8-20 GHz	96 dB	S-1
20-40 GHz	85 dB [◇]	S-1
[†] The dynamic range specifications apply to transmission measurements using 10 Hz IF BW and response and isolation correction or full 2-port correction. Dynamic range is limited by the maximum test port power and the receiver's noise floor. Noise floor is statistically specified at a level 3σ (three standard deviations) above the mean of the noise trace over frequency.		
[‡] With HP 85133E flexible cable on test port.		
[◇] 3 dB less for Option 085 or Option 012.		
[§] Rolls off below 840 MHz to 67 dB at 50 MHz.		
[⊙] Rolls off below 840 MHz to 72 dB at 50 MHz.		
[#] Rolls off below 840 MHz to 77 dB at 50 MHz.		
[△] Rolls off below 840 MHz to 82 dB at 50 MHz.		

Table 7-1. Instrument Specifications (continued)

SPECIFICATIONS AND CHARACTERISTICS			
Description		Specification	Code
SYSTEM CHARACTERISTICS (CONT'D)			
Compression*			
0.05-0.5 GHz		20 dBm	C
0.5-2 GHz		16 dBm	C
2-8 GHz		15 dBm	C
8-20 GHz		8 dBm	C
20-40 GHz		3 dBm	C
Maximum Input Level			
Damage level (test port)		30 dBm	C
Reference (R) Input Level (Opt. 089)			
Maximum			
HP 8719D/20D		-7 dBm	C
HP 8722D		-12 dBm	C
Minimum			
HP 8719D/20D/22D		-34 dBm	C
High Level Trace Noise†			
Magnitude (zero-peak)			
0.05-13.5 GHz		.03 dB	C
13.5-20 GHz		.04 dB	C
20-40 GHz		.15 dB	C
Phase (zero-peak)			
0.05-13.5 GHz		0.3° dB	C
13.5-20 GHz		0.4° dB	C
20-40 GHz		1.5° dB	C
* Input power level that causes 0.1 dB compression in the receiver.			
† Trace noise is defined as variation of a high signal level trace due to noise. The value given represents a noise variation that is three standard deviations away from the trace's mean value as measured in a 3 kHz IF bandwidth in the fast sweep mode (STEP SWP OFF).			

Front Panel Connectors

Connector Types

HP 8719D/8720D.....	3.5-mm precision
HP 8722D.....	2.4-mm precision
Impedance.....	50-ohms (nominal)

Environmental Characteristics

Operating Conditions

Operating Temperature.....	0 ° to 55 °C
Calibration Temperature.....	23°C±3°C
Error-Corrected Temperature Range	±1 °C of calibration temperature
Humidity.....	5% to 95% at 40 °C (non-condensing)
Altitude.....	0 to 4500 meters (15,000 feet)

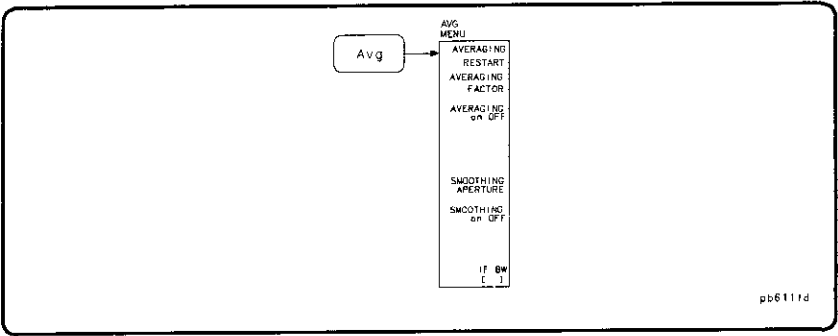
Non-Operating Storage Conditions

Temperature.....	−40 °C to +70 °C
Humidity.....	0 to 90% relative at +65 °C (non-condensing)
Altitude.....	0 to 15,240 meters (50,000 feet)

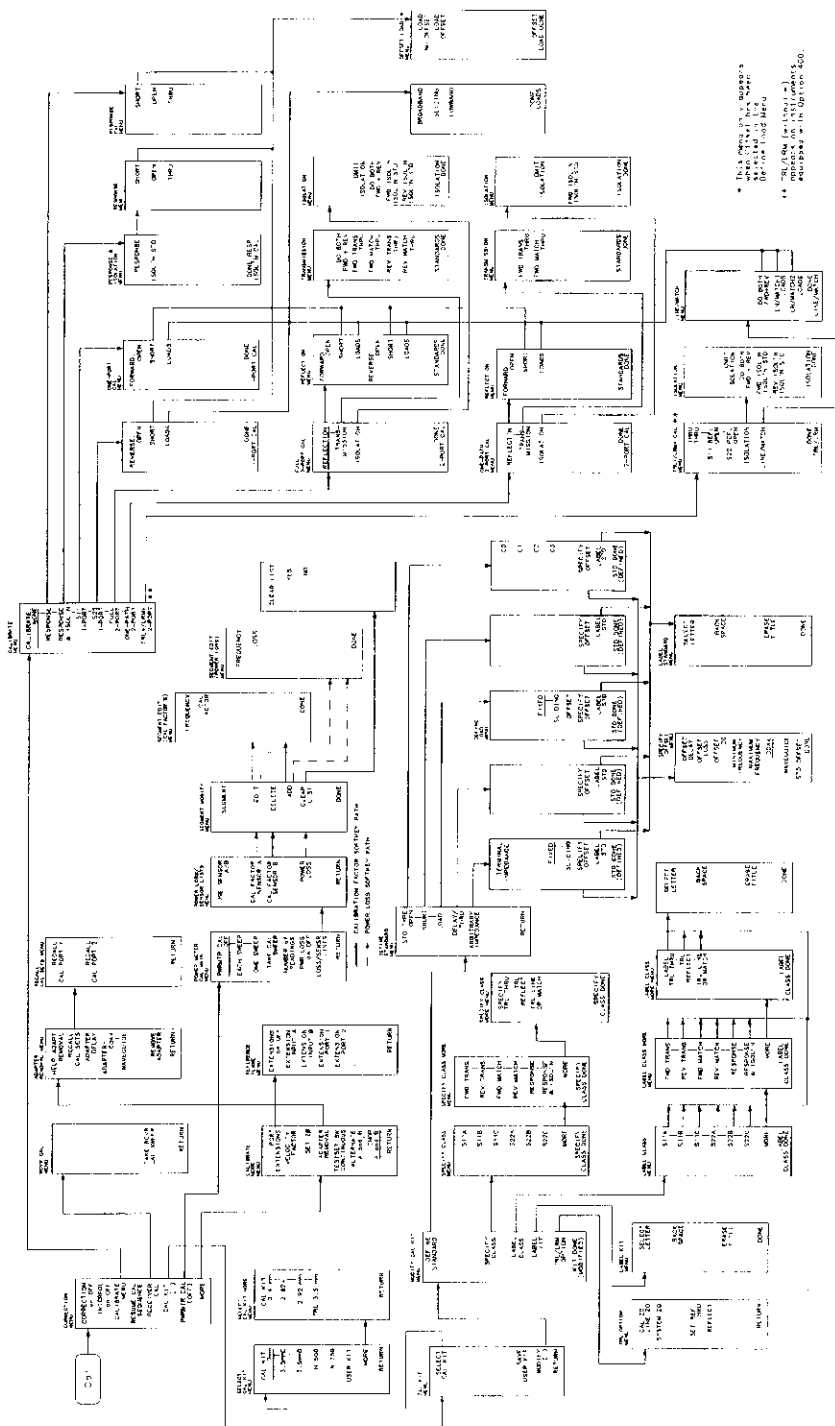
Menu Maps

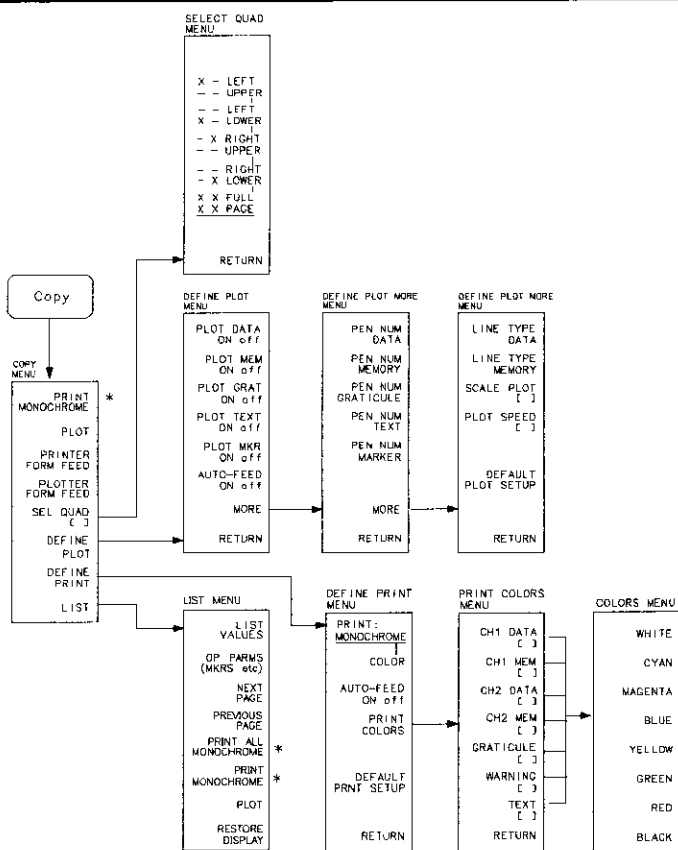
This chapter contains menu maps arranged in the following order:

- Avg
- Cal
- Copy
- Display
- Format
- Local
- Marker
- Marker Fctn
- Meas
- Menu
- Save/Recall
- Preset
- Scale Ref
- Seq
- System



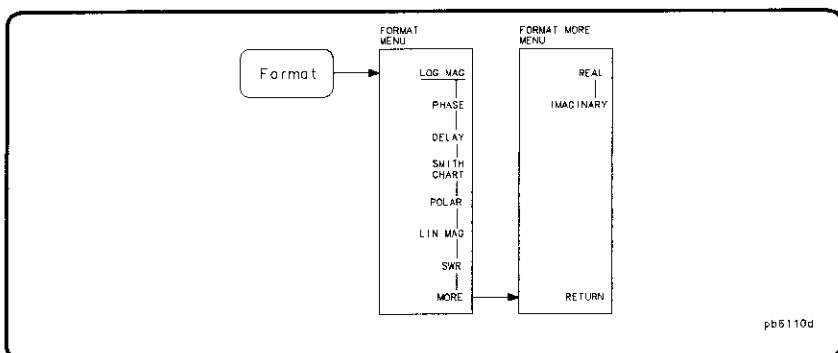
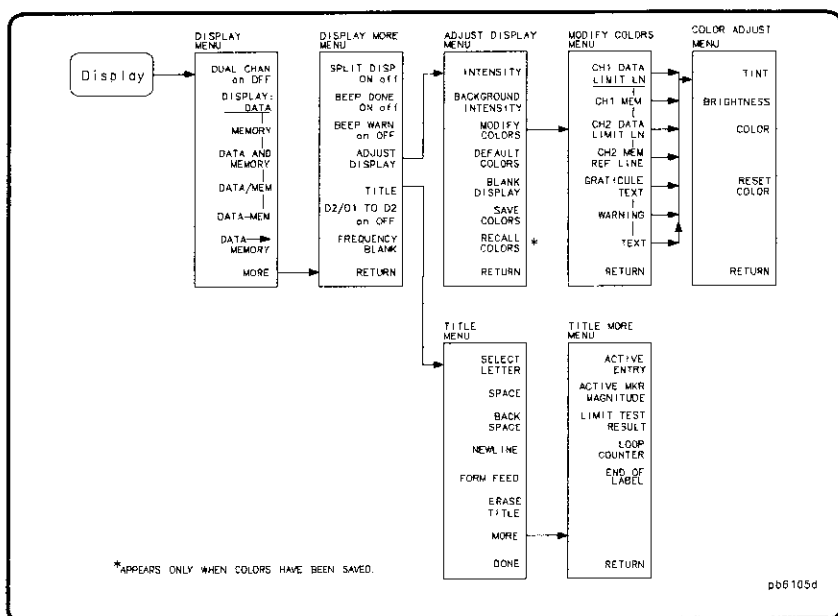
4
5
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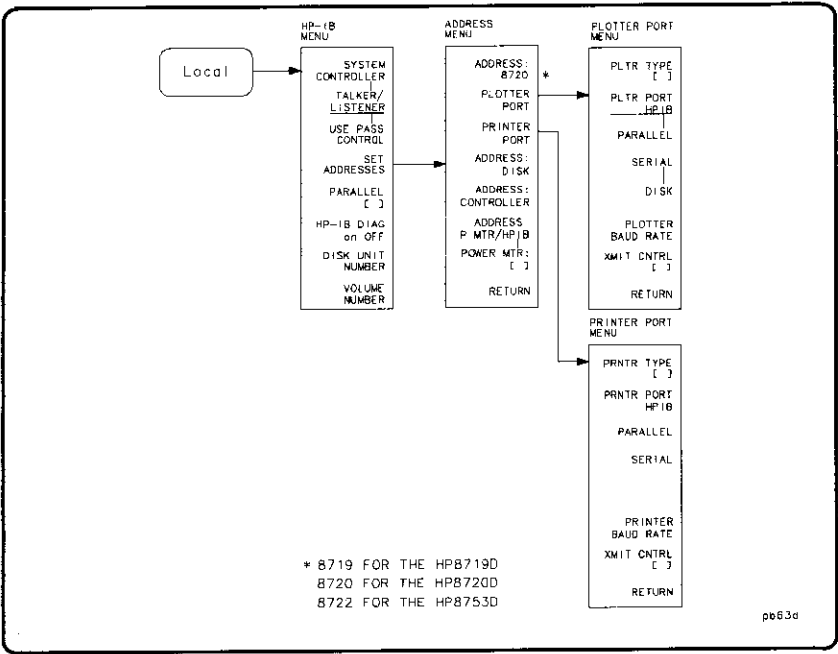


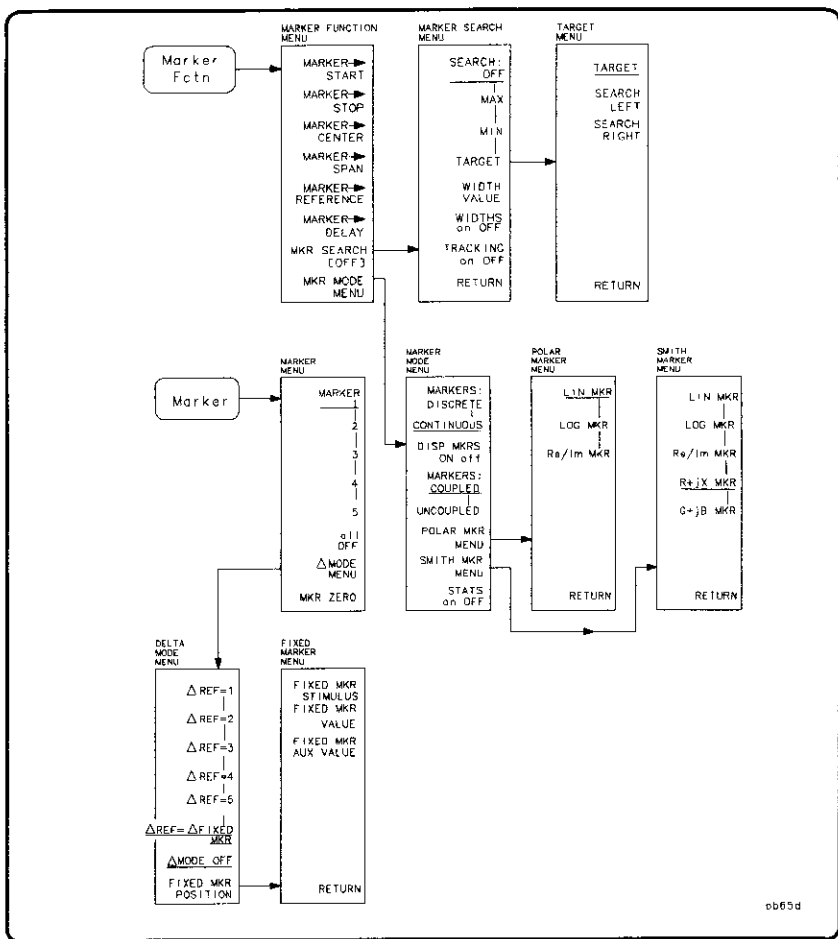


* THIS KEY LABEL CHANGES BETWEEN PRINT MONOCHROME AND PRINT COLOR, DEPENDING ON THE SETTING OF THE PRINT: MONOCHROME/COLOR KEY SELECTION IN THE DEFINE PRINT MENU.

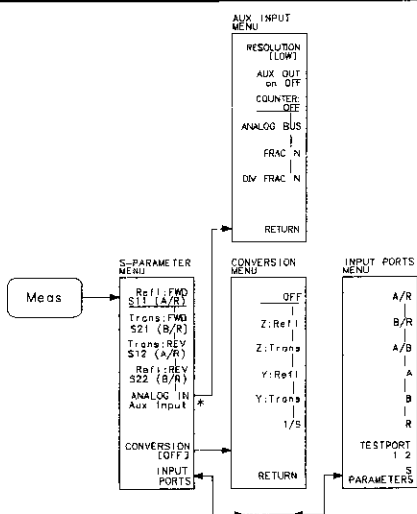
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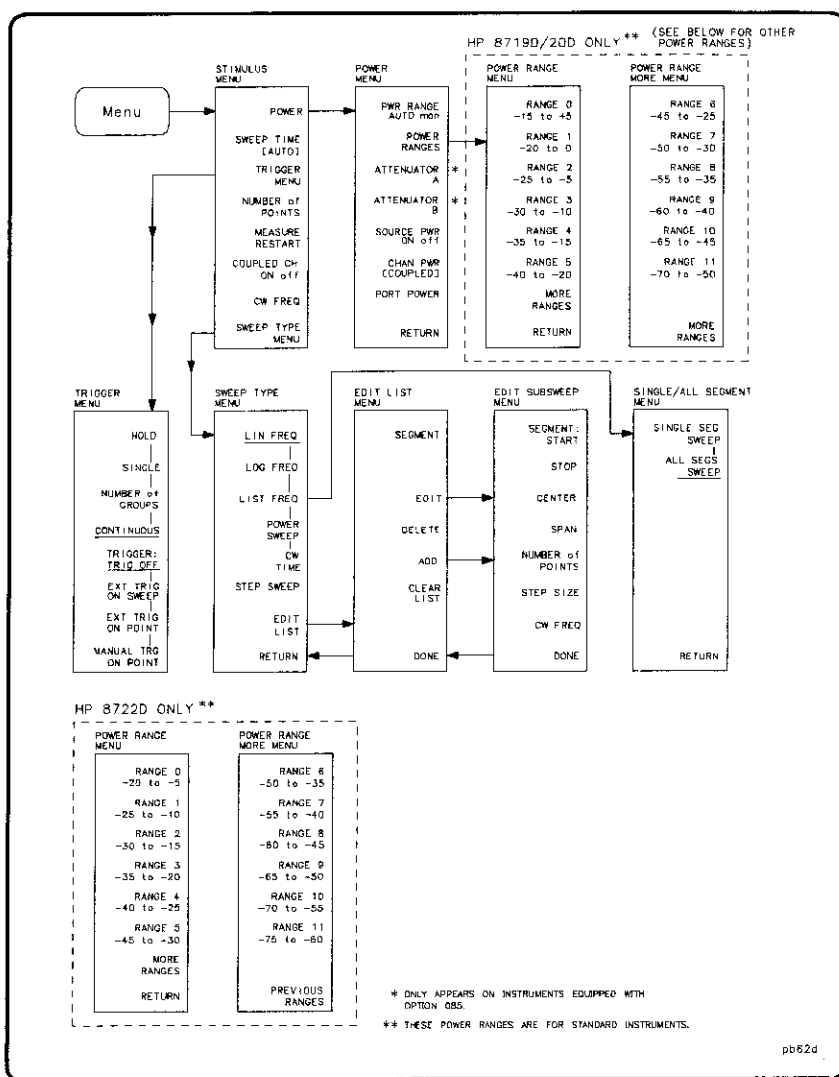


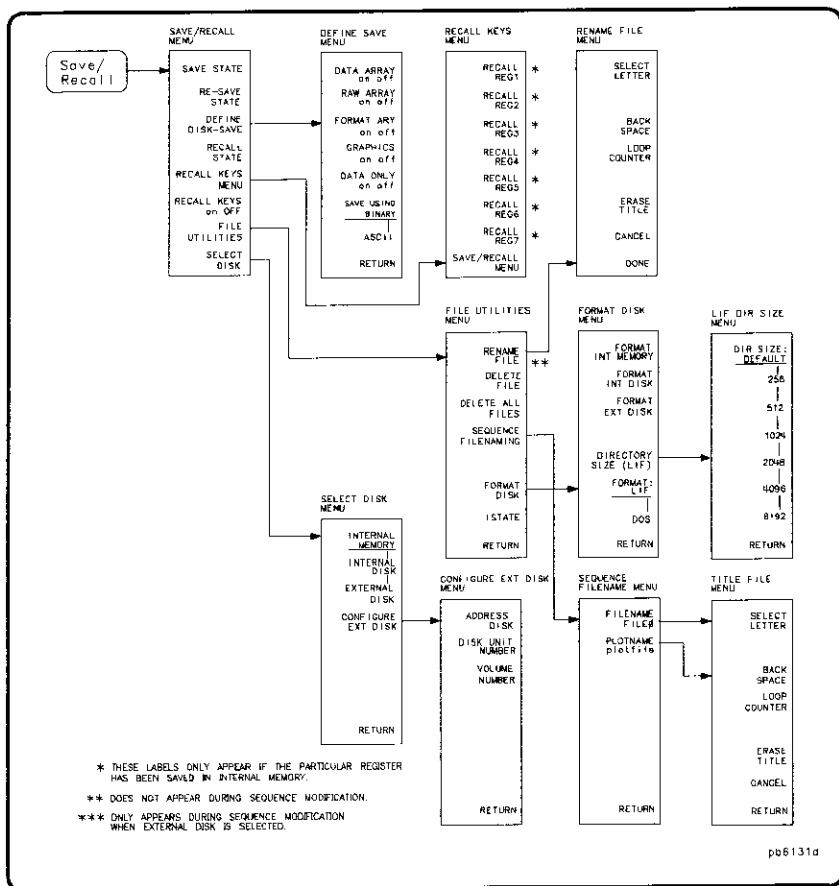
0605d

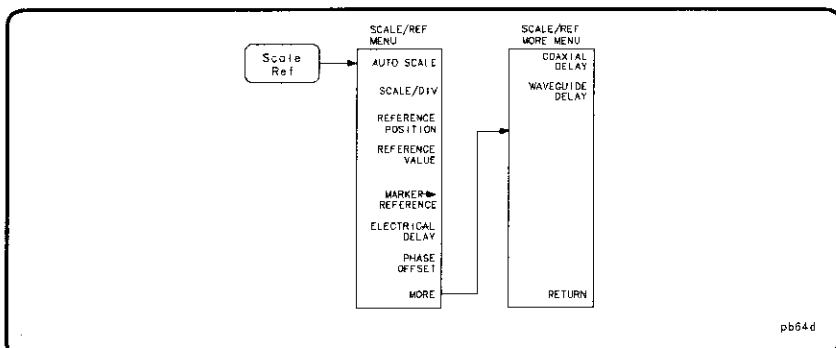
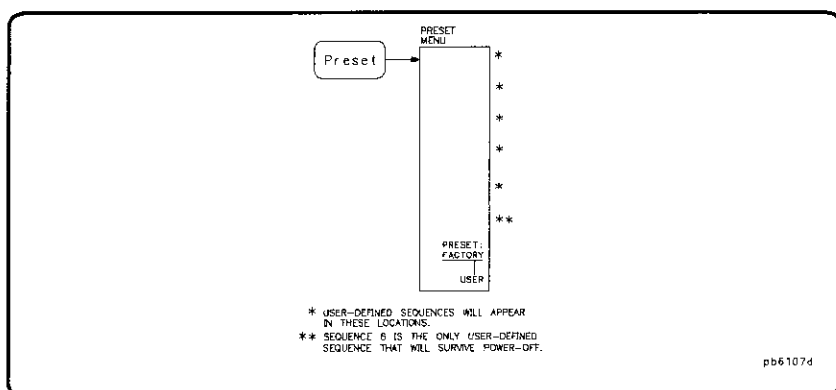


* AUX INPUT MENU APPEARS ONLY WHEN THE ANALOG BUS on OFF (SERVICE MENU KEY UNDER THE SYSTEM HARDKEY) IS TURNED TO ON.

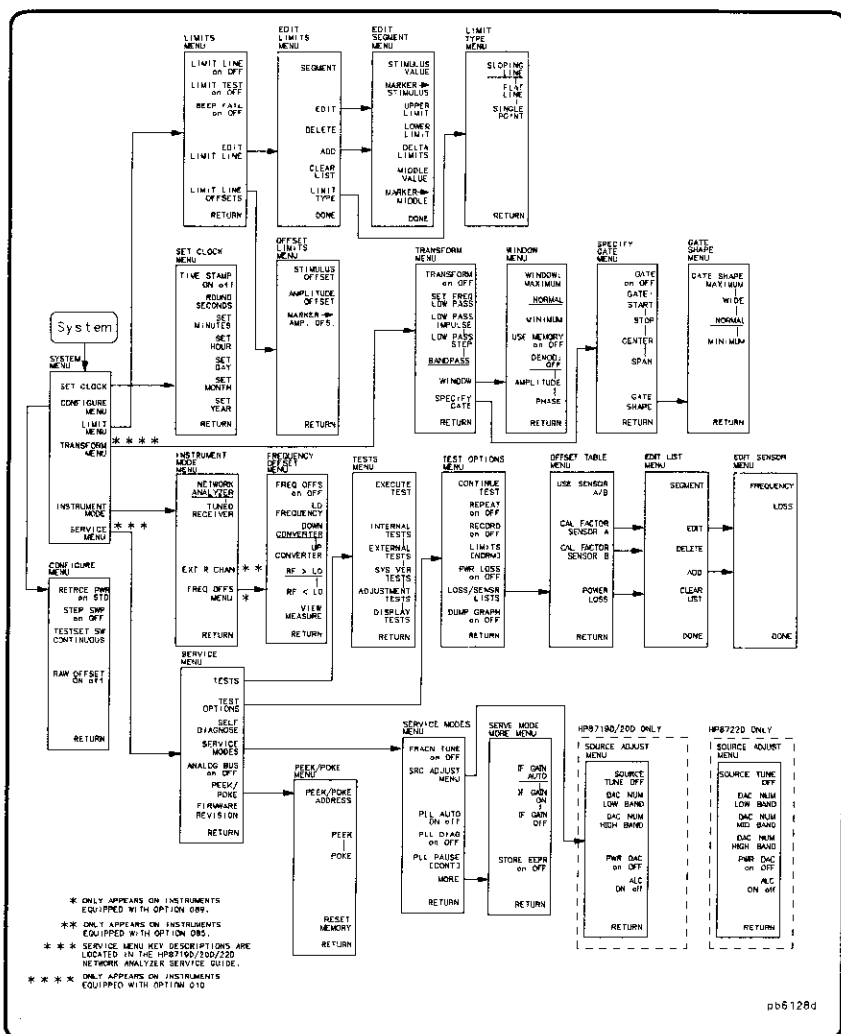
pb5 109d







8-12 Menu Maps



Key Definitions

Softkey Locations

The following table lists the softkey functions alphabetically, and the corresponding front-panel access key. This table is useful in determining which front-panel key leads to a specific softkey.

Table 9-1. Softkey Locations

Softkey	Front-Panel Access Key
Δ MODE MENU	Marker
Δ MODE OFF	Marker
Δ REF = 1	Marker
Δ REF = 2	Marker
Δ REF = 3	Marker
Δ REF = 4	Marker
Δ REF = 5	Marker
Δ REF = Δ FIXED MKR	Marker
I/S	Meas
A	Meas
A/B	Meas
A/R	Meas
ACTIVE ENTRY	Display
ACTIVE MRK MAGNITUDE	Display
ADAPTER: COAX	Cal
ADAPTER: DELAY	Cal
ADAPTER: REMOVAL	Cal
ADAPTER: WAVEGUIDE	Cal
ADDRESS: 8720	Local
ADDRESS: CONTROLLER	Local
ADDRESS: DISK	Local
ADDRESS: DISK	Save/Recall
ADDRESS: P MTR/HP1B	Local
ADJUST DISPLAY	Display
ALL OFF	Marker
ALL SEGS SWEEP	Menu
ALTERNATE A and B	Cal
AMPLITUDE	System

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
AMPLITUDE OFFSET	System
ANALOG IN Aux Input	Meas
ARBITRARY IMPEDANCE	Cal
ASCII	Save/Recall
ASSERT SRQ	Seq
ATTENUATOR A	Menu
ATTENUATOR B	Menu
AUTO FEED on OFF	Copy
AUTO SCALE	Scale Ref
AVERAGING FACTOR	Avg
AVERAGING on OFF	Avg
AVERAGING RESTART	Avg
B	Meas
B/R	Meas
BACKGROUND INTENSITY	Display
BANDPASS	System
BEEP DONE ON off	Display
BEEP FAIL on OFF	System
BEEP WARN on OFF	Display
BLANK DISPLAY	Display
BRIGHTNESS	Display
BROADBAND	Cal
C0	Cal
C1	Cal
C2	Cal
C8	Cal
CAL FACTOR	Cal
CAL FACTOR SENSOR A	Cal

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
CAL FACTOR SENSOR B	Cal
CAL KIT [1]	Cal
CAL KIT: 2.4mm	Cal
CAL KIT: 2.92*	Cal
CAL KIT: 2.92mm	Cal
CAL KIT: 3.5mmC	Cal
CAL KIT: 3.5mmD	Cal
CAL KIT: TRL 3.5mm	Cal
CAL KIT: 7mm	Cal
CAL KIT: N 50 Ω	Cal
CAL KIT: N 75 Ω	Cal
CAL KIT: USER KIT	Cal
CAL Z0: LINE Z0	Cal
CAL Z0: SYSTEM Z0	Cal
CALIBRATE MENU	Cal
CALIBRATE: NONE	Cal
CH1 DATA [1]	Copy
CH1 DATA LIMIT LN	Display
CH1 MEM	Display
CH1 MEM [1]	Copy
CH2 DATA [1]	Copy
CH2 DATA LIMIT LN	Display
CH2 MEM [1]	Copy
CH2 MEM REF LINE	Display
CHAN PWR [COUPLED]	Menu
CHAN PWR [UNCOUPLD]	Menu
CHOP A and B	Cal
CLEAR BIT	Seq

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
CLEAR LIST	Menu
CLEAR SEQUENCE	Seq
COAX	Cal
COAXIAL DELAY	Scale Ref
COLOR	Display
CONFIGURE	System
CONFIGURE EXTERNAL DISK	Save/Recall
CONTINUE SEQUENCE	Seq
CONTINUOUS	Menu
CONVERSION []	Meas
CORRECTION on OFF	Cal
COUPLED CH on OFF	Menu
CW FREQ	Menu
CW TIME	Menu
D2/D1 to D2 on OFF	Display
DATA and MEMORY	Display
DATA ARRAY on OFF	Save/Recall
DATA/MEM	Display
DATA - MEM	Display
DATA → MEMORY	Display
DATA ONLY on OFF	Save/Recall
DECISION MAKING	Seq
DECR LOOP COUNTER	Seq
DEFAULT COLORS	Display
DEFAULT PLOT SETUP	Copy
DEFAULT PRINT SETUP	Copy
DEFINE DISK-SAVE	Save/Recall
DEFINE PLOT	Copy

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
DEFINE PRINT	Copy
DEFINE STANDARD	Cal
DELAY	Format
DELAY/THRU	Cal
DELETE FILE	Save/Recall
DELTA LIMITS	System
DEMOD: AMPLITUDE	System
DEMOD: OFF	System
DEMOD: PHASE	System
DIRECTORY SIZE (LIF)	Save/Recall
DISK UNIT NUMBER	Local
DISK UNIT NUMBER	Save/Recall
DISPLAY: DATA	Display
DISP MKRS ON/off	Marker
DO BOTH FWD + REV	Cal
DO SEQUENCE	Seq
DONE 1-PORT CAL	Cal
DONE 2-PORT CAL	Cal
DONE RESPONSE	Cal
DONE RESP ISOL'N CAL	Cal
DONE SEQ MODIFY	Seq
DONE TRL/LRM	Cal
DOWN CONVERTER	System
DUAL CHAN on/OFF	Display
DUPLICATE SEQUENCE	Seq
EACH SWEEP	Cal
EDIT LIMIT LINE	System
EDIT LIST	Menu

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
ELECTRICAL DELAY	Scale Ref
EMIT BEEP	Seq
END OF LABEL	Display
END SWEEP HIGH PULSE	Seq
END SWEEP LOW PULSE	Seq
ERASE TITLE	Cal
ERASE TITLE	Display
ERASE TITLE	Save/Recall
EXT R CHAN	System
EXT SOURCE AUTO	System
EXT SOURCE MANUAL	System
EXT TRIG ON POINT	Menu
EXT TRIG ON SWEEP	Menu
EXTENSION INPUT A	Cal
EXTENSION INPUT B	Cal
EXTENSION PORT 1	Cal
EXTENSION PORT 2	Cal
EXTENSIONS on OFF	Cal
EXTERNAL DISK	Save/Recall
FILENAME FILE0	Save/Recall
FILE UTILITES	Save/Recall
FIXED	Cal
FIXED MKR AUX VALUE	Marker
FIXED MKR POSITION	Marker
FIXED MKR STIMULUS	Marker
FIXED MKR VALUE	Marker
FLAT LINE	System
FORM FEED	Display

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
FORMAT:ARY on OFF	Save/Recall
FORMAT:DISK	Save/Recall
FORMAT:DDS	Save/Recall
FORMAT:LIF	Save/Recall
FORMAT:EXT:DISK	Save/Recall
FORMAT:INT:DISK	Save/Recall
FORMAT:INT:MEMORY	Save/Recall
FREQ:OFFS:MENU	System
FREQ:OFFS on OFF	System
FREQUENCY	Cal
FREQUENCY:BLANK	Display
FULL:2-PORT	Cal
FULL:PAGE	Copy
FWD:ISOL'N:ISOL'N:STD	Cal
FWD:MATCH	Cal
FWD:MATCH:THRU	Cal
FWD:TRANS	Cal
FWD:TRANS:THRU	Cal
G+JB:MKR	Marker
GATE: CENTER	System
GATE: SPAN	System
GATE: START	System
GATE: STOP	System
GATE on OFF	System
GATE: SHAPE	System
GATE: SHAPE: MAXIMUM	System
GATE: SHAPE: MINIMUM	System
GATE: SHAPE: NORMAL	System

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
GOSUB SEQUENCE	Seq
GRAPHICS on OFF	Save/Recall
GRATICULE []	Copy
GRATICULE TEXT	Display
HELP ADAPT REMOVAL	Cal
HOLD	Menu
HP-IB DIAG on off	Local
IF BW []	Avg
IF LIMIT TEST FAIL	Seq
IF LIMIT TEST PASS	Seq
IF LOOP COUNTER = 0	Seq
IF LOOP < > COUNTER 0	Seq
IMAGINARY	Format
INCR LOOP COUNTER	Seq
INIT DISK? YES	Save/Recall
INITIALIZE DISK	Save/Recall
INPUT PORTS	Meas
INSTRUMENT MODE	System
INTENSITY	Display
INTERNAL DISK	Save/Recall
INTERNAL MEMORY	Save/Recall
INTERPOL on OFF	Cal
ISOLATION	Cal
ISOLATION DONE	Cal
ISOL'N STD	Cal
ISTATE CONTENTS	Save/Recall
KIT DONE (MODIFIED)	Cal
LABEL CLASS	Cal

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
LABEL CLASS DONE	Cal
LABEL KIT	Cal
LABEL STD	Cal
LEFT LOWER	Copy
LEFT UPPER	Copy
LIMIT LINE OFFSETS	System
LIMIT LINE on OFF	System
LIMIT MENU	System
LIMIT TEST on OFF	System
LIMIT TEST RESULT	Display
LIMIT TYPE	System
LIN FREQ	Menu
LIN MAG	Format
LIN MKR	Marker
LIST FREQ	Menu
LINE/MATCH	Cal
LINE TYPE DATA	Copy
LINE TYPE MEMORY	Copy
LIST	Copy
LN/MATCH 1	Cal
LN/MATCH 2	Cal
LO FREQUENCY	System
LOAD	Cal
LOAD NO OFFSET	Cal
LOAD OFFSET	Cal
LOAD SEQ FROM DISK	Seq
LOG FREQ	Menu
LOG MAG	Format

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
LOG MKR	Marker
LOOP COUNTER	Seq
LOOP COUNTER	Display
LOOP COUNTER	Save/Recall
LOSS	Cal
LOSS/SENSR LISTS	Cal
LOWER LIMIT	System
LOW BAND	Cal
LOW PASS IMPULSE	System
LOW PASS STEP	System
MANUAL TRG ON POINT	Menu
MARKER → AMP. DFS.	System
MARKER → CENTER	Marker Fctn
MARKER → CN	Seq
MARKER → DELAY	Marker Fctn
MARKER → DELAY	Scale Ref
MARKER → MIDDLE	System
MARKER → REFERENCE	Marker Fctn
MARKER → REFERENCE	Scale Ref
MARKER → SPAN	Marker Fctn
MARKER → START	Marker Fctn
MARKER → STIMULUS	System
MARKER → STOP	Marker Fctn
MARKER 1	Marker
MARKER 2	Marker
MARKER 3	Marker
MARKER 4	Marker
MARKER 5	Marker

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
MARKER: ALL OFF	Marker
MARKER MODE MENU	Marker
MARKERS: CONTINUOUS	Marker
MARKERS: COUPLED	Marker
MARKERS: DISCRETE	Marker
MARKERS: UNCOUPLED	Marker
MAX	Marker Fctn
MAXIMUM FREQUENCY	Cal
MEASURE RESTART	Menu
MEMORY	Display
MIDDLE VALUE	System
MIN	Marker Fctn
MINIMUM	System
MINIMUM FREQUENCY	Cal
MKR SEARCH []	Marker Fctn
MKR ZERO	Marker
MODIFY []	Cal
MODIFY COLORS	Display
NETWORK ANALYZER	System
NEW SEQ/MODIFY SEQ	Seq
NEWLINE	Display
NEXT PAGE	Copy
NORMAL	System
NUMBER OF GROUPS	Menu
NUMBER OF POINTS	Menu
NUMBER OF READINGS	Cal
OFFSET	Cal
OFFSET DELAY	Cal

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
OFFSET LOADS DONE	Cal
OFFSET LOSS	Cal
OFFSET Z0	Cal
OMIT ISOLATION	Cal
ONE-PATH 2-PORT	Cal
ONE SWEEP	Cal
OPEN	Cal
OP PARMS (MKRS etc)	Copy
P MTR/HPIB TO TITLE	Seq
PARALL IN BIT NUMBER	Seq
PARALL IN IF BIT H	Seq
PARALL IN IF BIT L	Seq
PARALLEL	Local
PARALLEL []	Local
PARALLEL OUT ALL	Seq
PAUSE TO SELECT	Seq
PEN NUM DATA	Copy
PEN NUM GRATICULE	Copy
PEN NUM MARKER	Copy
PEN NUM MEMORY	Copy
PEN NUM TEXT	Copy
PERIPHERAL HPIB ADDR	Seq
PHASE	Format
PHASE	System
PHASE OFFSET	Scale Ref
PLOT	Copy
PLOT DATA ON off	Copy
PLOT GRAT ON off	Copy

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
PLOT MEM ON/off	Copy
PLOT MKR ON/off	Copy
PLOT NAME PLOTFILE	Save/Recall
PLOT SPEED []	Copy
PLOT TEXT ON/off	Copy
PLOTTER BAUD RATE	Local
PLOTTER FORM FEED	Copy
PLOTTER PORT	Local
PLTR PORT: DISK	Local
PLTR PORT: HP1B	Local
PLTR PORT: PARALLEL	Local
PLTR PORT: SERIAL	Local
PLTR TYPE []	Local
POLAR	Format
POLAR MKR MENU	Marker
PORT EXTENSIONS	Cal
PORT PWR [COUPLED]	Menu
PORT PWR [UNCOUPLD]	Menu
POWER	Menu
POWER LOSS	Cal
POWER MTR []	Local
POWER RANGES	Menu
POWER SWEEP	Menu
PRESET: FACTORY	Preset
PRESET: USER	Preset
PREVIOUS PAGE	Copy
PRINT: COLOR	Copy
PRINT COLORS	Copy

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
PRINT: MONOCHROME	Copy
PRINT MONOCHROME	Copy
PRINT SEQUENCE	Seq
PRINTER BAUD RATE	Local
PRINTER FORM FEED	Copy
PRINTER PORT	Local
PRNTR PORT: HP/IB	Local
PRNTR PORT: PARALLEL	Local
PRNTR PORT: SERIAL	Local
PRNTR TYPE []	Local
PURGE SEQUENCES	Seq
PWR LOSS on OFF	Cal
PWR RANGE AUTO man	Cal
PWRMTR CAL []	Cal
PWRMTR CAL [OFF]	Cal
R	Meas
R+XX MKR	Marker
RANGE 0 XX TO XX	Menu
RANGE 1 XX TO XX	Menu
RANGE 2 XX TO XX	Menu
RANGE 3 XX TO XX	Menu
RANGE 4 XX TO XX	Menu
RANGE 5 XX TO XX	Menu
RANGE 6 XX TO XX	Menu
RANGE 7 XX TO XX	Menu
RANGE 8 XX TO XX	Menu
RANGE 9 XX TO XX	Menu
RANGE 10 XX TO XX	Menu
RANGE 11 XX TO XX	Menu

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
RAW ARRAY on OFF	Save/Recall
RAW OFFSET On Off	System
Re/Im MKR	Marker
REAL	Format
RECALL CAL PORT 1	Cal
RECALL CAL PORT 2	Cal
RECALL CAL SETS	Cal
RECALL COLORS	Display
RECALL KEYS on OFF	Save/Recall
RECALL REG1	Save/Recall
RECALL REG2	Save/Recall
RECALL REG3	Save/Recall
RECALL REG4	Save/Recall
RECALL REG5	Save/Recall
RECALL REG6	Save/Recall
RECALL REG7	Save/Recall
RECALL STATE	Save/Recall
RECEIVER CAL	Cal
REFERENCE POSITION	Scale Ref
REFERENCE VALUE	Scale Ref
Ref1: FWD S11 (A/R)	Meas
Ref1: REV S22 (B/R)	Meas
REFLECT AND LINE	Cal
REFLECTION	Cal
REMOVE ADAPTER	Cal
RE-SAVE STATE	Save/Recall
RESET COLOR	Display
RESPONSE	Cal

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
RESPONSE & ISOL'N	Cal
RESUME CAL SEQUENCE	Cal
RETRCE PWR on STD	System
REV ISOL'N ISOL'N STD	Cal
REV MATCH	Cal
REV MATCH THRU	Cal
REV TRANS	Cal
REV TRANS THRU	Cal
RF > LO	System
RF < LO	System
RIGHT LOWER	Copy
RIGHT UPPER	Copy
ROUND SECONDS	System
S PARAMETERS	Meas
S11 1-PORT	Cal
S11A	Cal
S11B	Cal
S11C	Cal
S11 REFL SHORT	Cal
S22 1-PORT	Cal
S22A	Cal
S22B	Cal
S22C	Cal
S22 REFL SHORT	Cal
SAVE COLORS	Display
SAVE USER KIT	Cal
SAVE USING BINARY	Save/Recall
SCALE/DIV	Scale Ref

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
SCALE PLOT []	Copy
SEARCH LEFT	Marker Fctn
SEARCH RIGHT	Marker Fctn
SEARCH: MAX	Marker Fctn
SEARCH: MIN	Marker Fctn
SEARCH: OFF	Marker Fctn
SECOND	System
SEGMENT	Cal
SEGMENT	System
SEGMENT: CENTER	Menu
SEGMENT: SPAN	Menu
SEGMENT: START	Menu
SEGMENT: STOP	Menu
SEL QUAD []	Copy
SEQUENCE 1 SEQ1	Seq
SEQUENCE 2 SEQ2	Seq
SEQUENCE 3 SEQ3	Seq
SEQUENCE 4 SEQ4	Seq
SEQUENCE 5 SEQ5	Seq
SEQUENCE 6 SEQ6	Seq
SEQUENCE FILENAMING	Save/Recall
SET ADDRESSES	Local
SET BIT	Seq
SET CLOCK	System
SET DAY	System
SET FREQ LOW PASS	System
SET HOUR	System
SET MINUTES	System

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
SET MONTH	System
SET REF: THRU	System
SET REF: REFLECT	System
SET YEAR	System
SET Z0	Cal
SHORT	Cal
SINGLE	Menu
SINGLE POINT	System
SINGLE SEG SWEEP	Menu
SLIDING	Cal
SLOPING LINE	System
SMITH CHART	Format
SMITH MKR MENU	Marker
SMOOTHING APERTURE	Avg
SMOOTHING on OFF	Avg
SOURCE PWR ON off	Menu
SPAN	Menu
SPAN	System
SPECIAL FUNCTIONS	Seq
SPECIFY CLASS	Cal
SPECIFY GATE	System
SPECIFY OFFSET	Cal
SPLIT DISP on OFF	Display
STANDARDS DONE	Cal
STATS on OFF	Marker Fctn
STD DONE (MODIFIED)	Cal
STD OFFSET DONE	Cal
STD TYPE:	Cal
STEP SIZE	Menu

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
STIMULUS VALUE	System
STIMULUS OFFSET	System
STORE SEQ TO DISK	Seq
STP SWP on OFF	System
SWEEP	System
SWEEP TIME [1]	Menu
SWEEP TYPE MENU	Menu
SWR	Format
SYSTEM CONTROLLER	Local
TAKE CAL SWEEP	Cal
TAKE RCVR CAL SWEEP	Cal
TALKER/LISTENER	Local
TARGET	Marker Fctn
TERMINAL IMPEDANCE	Cal
TEST PORT 1 2	Meas
TESTSET I/O FWD	Seq
TESTSET I/O REV	Seq
TEST SET SW XXXX	Cal System
TEXT	Display
TEXT [1]	Copy
THRU	Cal
THRU THRU	Cal
TIME STAMP ON off	System
TINT	Display
TITLE	Display
TITLE SEQUENCE	Seq
TITLE TO MEMORY	Seq

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
TITLE TO P MTR/HPIB	Seq
TITLE TO PERIPHERAL	Seq
TITLE TO PRNTR/HPIB	Seq
TRACKING on OFF	Marker Fctn
TRANS DONE	Cal
TRANS: FWD S21 (B/R)	Meas
TRANS: REV S12 (B/R)	Meas
TRANSFORM MENU	System
TRANSFORM on OFF	System
TRANSMISSION	Cal
TRIGGER MENU	Menu
TRIGGER: TRIG OFF	Menu
TRL*/LRM* 2-PORT	Cal
TRL/LRM 2-PORT (Option 400)	Cal
TRL/LRM OPTION	Cal
TTL I/O	Seq
TTL OUT HIGH	Seq
TTL OUT LOW	Seq
TUNED RECEIVER	System
UNCOUPLED	Marker
UP CONVERTER	System
UPPER LIMIT	System
USE MEMORY on OFF	System
USE PASS CONTROL	Local
USER	Preset
USER KIT	Cal
USE SENSOR A / B	Cal
VELOCITY FACTOR	Cal

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
VIEW MEASURE	System
VOLUME NUMBER	Local
VOLUME NUMBER	Save/Recall
WAIT x	Seq
WARNING	Display
WARNING [1-3]	Copy
WAVEGUIDE	Cal
WAVEGUIDE DELAY	Scale Ref
WIDE	System
WIDTH VALUE	Marker Fctn
WIDTHS on OFF	Marker Fctn
WINDOW	System
WINDOW: MAXIMUM	System
WINDOW: MINIMUM	System
WINDOW: NORMAL	System
XMIT CNTRL [1-3]	Local
Y: Ref1	Meas
Y: Trans	Meas
Z: Ref1	Meas
Z: Trans	Meas

Error Messages

Error Messages in Alphabetical Order

This chapter contains an alphabetical listing of all error messages to help you interpret any error messages that may be displayed on the analyzer, or transmitted by the instrument over HP-IB.

ABORTING COPY OUTPUT

Information Message	This message is displayed briefly if you have pressed (Local) to abort a copy operation. If the message is not subsequently replaced by error message number 25, PRINT ABORTED, the copy device may be hung. Press (Local) once more to exit the abort process and verify the status of the copy device. At this point, the copy device will probably have an error condition which must be fixed. (For example: out of paper or paper jam.)
---------------------	--

ADDITIONAL STANDARDS NEEDED

Error Number	Error correction for the selected calibration class cannot be computed until you have measured all the necessary standards.
68	

ADDRESSED TO TALK WITH NOTHING TO SAY

Error Number 31	You have sent a read command to the analyzer (such as ENTER 716) without first requesting data with an appropriate output command (such as OUTPDATA). The analyzer has no data in the output queue to satisfy the request.
--------------------	--

AIR FLOW RESTRICTED: CHECK FAN FILTER

Error Number 20	Something is restricting the air flow into the analyzer. Check for any debris and clean or replace the fan filter.
--------------------	--

ALL REGISTERS HAVE BEEN USED

Error Number 200	You have used all of the available registers; you can store no more instrument states even though you may still have sufficient memory. There are 31 registers available, plus the present instrument state.
---------------------	--

ANALOG INPUT OVERLOAD

Error Number 60	The power level of the analog input is too high. Reduce the power level of the analog input source.
--------------------	---

ANOTHER SYSTEM CONTROLLER ON HP-IB BUS

Error Number 37	You must remove the active controller from the bus or the controller must relinquish the bus before the analyzer can assume the system controller mode.
--------------------	---

ASCII: MISSING 'BEGIN' STATEMENT

Error Number	The citifile you just downloaded over the HP-IB or via disk was not properly organized. The analyzer is unable to read the "BEGIN" statement.
193	

ASCII: MISSING 'CITIFILE' STATEMENT

Error Number	The citifile you just downloaded over the HP-IB or via disk was not properly organized. The analyzer is unable to read the "CITIFILE" statement.
194	

ASCII: MISSING 'DATA' STATEMENT

Error Number	The citifile you just downloaded over the HP-IB or via disk was not properly organized. The analyzer is unable to read the "DATA" statement.
195	

ASCII: MISSING 'VAR' STATEMENT

Error Number	The citifile you just downloaded over the HP-IB or via disk was not properly organized. The analyzer is unable to read the "VAR" statement.
196	

AVERAGING INVALID ON NON-RATIO MEASURE

Error Number	You cannot use sweep-to-sweep averaging in single-input measurements. Sweep-sweep averaging is valid only for ratioed measurements (A/R, B/R, A/B, and S-parameters). You can use noise reduction techniques, such as narrower IF bandwidth, for single input measurements.
13	

BAD FREQ FOR HARMONIC OR FREQ OFFSET

Error Number	You turned on time domain or recalled a calibration
181	that resulted in start and stop frequencies that are beyond the allowable limits.

BATTERY FAILED. STATE MEMORY CLEARED

Error Number	The battery protection of the non-volatile CMOS
183	memory has failed. The CMOS memory has been cleared. Refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for battery replacement instructions. See Chapter 12, "Preset State and Memory Allocation," for more information about the CMOS memory.

BATTERY LOW! STORE SAVE REGS TO DISK

Error Number	The battery protection of the non-volatile CMOS
184	memory is in danger of failing. If this occurs, all of the instrument state registers stored in CMOS memory will be lost. Save these states to a disk and refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for battery replacement instructions. See Chapter 12, "Preset State and Memory Allocation," for more information about the CMOS memory.

BLOCK INPUT ERROR

Error Number	The analyzer did not receive a complete data
34	transmission. This is usually caused by an interruption of the bus transaction. Clear by pressing the Local key or aborting the I/O process at the controller.

BLOCK INPUT LENGTH ERROR

Error Number	The length of the header received by the analyzer did not agree with the size of the internal array block. Refer to the <i>HP 8719D/20D/22D Network Analyzer Programmer's Guide</i> for instructions on using analyzer input commands.
35	

CALIBRATION ABORTED

Error Number	You have changed the active channel during a calibration so the calibration in progress was terminated. Make sure the appropriate channel is active and restart the calibration.
74	

CALIBRATION REQUIRED

Error Number	A calibration set could not be found that matched the current stimulus state or measurement parameter. You will have to perform a new calibration.
63	

CANNOT FORMAT DOS DISKS ON THIS DRIVE

Error Number	You have attempted to initialize a floppy disk to DOS format on an external disk drive that does not support writing to all 80 tracks of the double density and high density disks. The older single-sided disks had only 66 tracks and some disk drives were limited to accessing that number of tracks. To format the disk, either choose another external disk drive or use the analyzer's internal disk drive.
185	

CANNOT MODIFY FACTORY PRESET

- | | |
|---------------------|--|
| Error Number
199 | You have attempted to rename, delete, or otherwise alter the factory preset state. The factory preset state is permanently stored in CMOS memory and cannot be altered. If your intent was to create a user preset state, you must create a new instrument state, save it, and then rename it to "UPRESET". Refer to Chapter 12, "Preset State and Memory Allocation," for more detailed instructions. |
|---------------------|--|

CANNOT READ/WRITE HFS FILE SYSTEM

- | | |
|---------------------|---|
| Error Number
203 | The disk is being accessed by the analyzer and is found to contain an HFS (hierarchical file system) or files nested within subdirectories. The analyzer does not support HFS. Replace the disk medium with a LIF or DOS formatted disk that does not contain files nested within subdirectories. |
|---------------------|---|

CAN'T STORE/LOAD SEQUENCE, INSUFFICIENT MEMORY

- | | |
|---------------------|---|
| Error Number
127 | Your sequence transfer to or from a disk could not be completed due to insufficient memory. |
|---------------------|---|

CAUTION: POWER OUT MAY BE UNLEVELED

- | | |
|---------------------|---|
| Error Number
179 | There is either a hardware failure in the source or you have attempted to set the power level too high. The analyzer allows the output power to be set higher or lower than the specified available power range. However, these output powers may be unleveled or unavailable. Check to see if the power level you set is within specifications. If it is, refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for troubleshooting. |
|---------------------|---|

CH1 (CH2) TARGET VALUE NOT FOUND

Error Number 159	Your target value for the marker search function does not exist on the current data trace.
----------------------------	--

CONTINUOUS SWITCHING NOT ALLOWED

Error Number 10	Your current measurement requires different power ranges on channel 1 and channel 2. To protect the attenuator from undue mechanical wear, test set hold will be activated.
---------------------------	---

In instruments equipped with Option 007, test set hold will be activated if the mechanical transfer switch is required to switch continuously (for example, if channel 1 is set to measure S_{11} and channel 2 is set to measure S_{22}).

The "tsH" (test set hold) indicator in the left margin of the display indicates that the inactive channel has been put in the sweep hold mode.

COPY: device not responding; copy aborted

Error Number 170	The printer or plotter is not accepting data. Verify the cable connections, HP-IB addresses, and otherwise ensure that the copy device is ready.
----------------------------	--

COPY OUTPUT COMPLETED

Information Message	The analyzer has completed outputting data to the printer or plotter. The analyzer can now accept another copy command.
----------------------------	---

CORRECTION AND DOMAIN RESET

Error Number 65	When you change the frequency range, sweep type, or number of points, error-correction is switched off and the time domain transform is recalculated, without error-correction. You can either correct the frequency range, sweep type, or number of points to match the calibration, or perform a new calibration. Then perform a new time domain transform.
--------------------	---

CORRECTION CONSTANTS NOT STORED

Error Number 3	A store operation to the EEPROM was not successful. You must change the position of the jumper on the A9 CPU assembly. Refer to the "A9 CC Jumper Position Procedure" in the "Adjustments and Correction Constants" chapter of the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> .
-------------------	---

CORRECTION TURNED OFF

Error Number 66	Critical parameters in your current instrument state do not match the parameters for the calibration set, therefore correction has been turned off. The critical instrument state parameters are sweep type, start frequency, frequency span, and number of points.
--------------------	---

CURRENT PARAMETER NOT IN CAL SET

Error Number 64	Correction is not valid for your selected measurement parameter. Either change the measurement parameters or perform a new calibration.
--------------------	---

D2/D1 INVALID WITH SINGLE CHANNEL

Error Number 130	You can only make a D2/D1 measurement if both channels are on.
----------------------------	---

D2/D1 INVALID: CH1 CH2 NUM PTS DIFFERENT

Error Number 152	You can only make a D2/D1 measurement if both channels have the same number of points.
----------------------------	---

DEADLOCK

Error Number 111	A fatal firmware error occurred before instrument preset completed. Call your local Hewlett-Packard sales and service office.
----------------------------	--

DEMODULATION NOT VALID

Error Number 17	Demodulation was selected when the analyzer was not in CW time mode. Select demodulation only after putting the analyzer into CW time mode.
---------------------------	--

DEVICE: not on, not connect, wrong addr

Error Number 119	The device at the selected address cannot be accessed by the analyzer. Verify that the device is switched on, and check the HP-IB connection between the analyzer and the device. Ensure that the device address recognized by the analyzer matches the HP-IB address set on the device itself.
----------------------------	--

DIRECTORY FULL

Error Number	There is no room left in the directory to add files.
188	Either delete files or get a new disk.

DISK HARDWARE PROBLEM

Error Number	The disk drive is not responding correctly. Refer to the
39	<i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for
	troubleshooting information. If using an external disk
	drive, refer to the disk drive operating manual.

DISK IS WRITE PROTECTED

Error Number	The store operation cannot write to a write-protected
48	disk. Slide the write-protect tab over the write-protect
	opening in order to write data on the disk.

DISK MEDIUM NOT INITIALIZED

Error Number	You must initialize the disk before it can be used.
40	

DISK MESSAGE LENGTH ERROR

Error Number	The analyzer and the external disk drive aren't
190	communicating properly. Check the HP-IB connection
	and then try substituting another disk drive to isolate
	the problem instrument.

DISK: not on, not connected, wrong addr's

Error Number	The disk cannot be accessed by the analyzer. Verify power to the disk drive, and check the HP-IB connection between the analyzer and the disk drive. Ensure that the disk drive address recognized by the analyzer matches the HP-IB address set on the disk drive itself.
38	

DISK READ/WRITE ERROR

Error Number	There may be a problem with your disk. Try a new floppy disk. If a new floppy disk does not eliminate the error, suspect hardware problems.
189	

DISK WEAR - REPLACE DISK SOON

Error Number	Cumulative use of the disk is approaching the maximum. Copy files as necessary using an external controller. If no controller is available, load instrument states from the old disk and store them to a newly initialized disk using the save/recall features of the analyzer. Discard the old disk.
49	

DOMAIN RESET

Error Number	Time domain calculations were reset due to a change in the frequency range, sweep type, or number of points. Perform a new time domain transform on the new state.
67	

DOS NAME LIMITED TO 8 CHARS + 3 CHAR EXTENSION

- Error Number 180 A DOS file name must meet the following criteria:
- minimum of 1 character
 - format is filename.ext
 - maximum of 8 characters in the filename
 - maximum of 3 characters in the extension field (optional)
 - a dot separates the filename from the extension field (the dot is not part of the name on the disk)

DUPLICATING TO THIS SEQUENCE NOT ALLOWED

- Error Number 125 A sequence cannot be duplicated to itself.

EXCEEDED 7 STANDARDS PER CLASS

- Error Number 72 When modifying calibration kits, you can define a maximum of seven standards for any class.

EXTERNAL SOURCE MODE REQUIRES CW TIME

- Error Number 148 An external source can only be phase locked and measured in the CW time sweep mode.

EXT SOURCE NOT READY FOR TRIGGER

Error Number 191	There is a hardware problem with the HP 8625A external source. Verify the connections between the analyzer and the external source. If the connections are correct, refer to the source operating manual.
----------------------------	---

EXT SRC: NOT ON/CONNECTED OR WRONG ADDR

Error Number 162	The analyzer is unable to communicate with the external source. Check the connections and the HP-IB address on the source.
----------------------------	--

FILE NOT COMPATIBLE WITH INSTRUMENT

Information Message	You cannot recall user graphics that had been saved on an earlier model of analyzer with a monochrome display. These files cannot be used with the HP 8719D/20D/22D.
----------------------------	--

FILE NOT FOUND

Error Number 192	The requested file was not found on the current disk medium.
----------------------------	--

FILE NOT FOUND OR WRONG TYPE

Error Number 197	During a resave operation, either the file was not found or the type of file was not an instrument state file.
----------------------------	--

FIRST CHARACTER MUST BE A LETTER

Error Number 42	The first character of a disk file title or an internal save register title must be an alpha character.
--------------------	---

FORMAT NOT VALID FOR MEASUREMENT

Error Number 75	Conversion measurements (Z or Y reflection and transmission) are not valid with Smith chart and SWR formats.
--------------------	--

FORMATTING DATA

Information Message	The list information is being processed for a list data output to a copy device and stored in the copy spool buffer. During this time, the analyzer's resources are dedicated to this task (which takes less than a few seconds.)
------------------------	---

FREQ OFFSET ONLY VALID IN NETWORK ANALYZER MODE

Error Number 140	You can only make frequency offset measurements in the network analyzer mode.
---------------------	---

FREQS CANNOT BE CHANGED, TOO MANY POINTS

Error Number 204	The number of points selected for setting the low pass transform frequencies is too high. Reduce the number of points so that the low pass criteria is met.
---------------------	---

FUNCTION NOT AVAILABLE

Error Number 202	The function you requested over HP-IB is not available on the current instrument.
---------------------	---

FUNCTION NOT VALID

Error Number	The function you requested is incompatible with the
14	current instrument state.

FUNCTION NOT VALID DURING MOD SEQUENCE

Error Number	You cannot perform sequencing operations while a
131	sequence is being modified.

FUNCTION NOT VALID FOR INTERNAL MEMORY

Error Number	The function you selected only works with disk files.
201	

FUNCTION ONLY VALID DURING MOD SEQUENCE

Error Number	You can only use the <code>GOSUB SEQUENCE</code> capability
164	when you are building a sequence. Attempting to use
	this softkey at any other time returns an error message
	and no action is taken.

HP 8720 SOURCE PARAMETERS CHANGED

Error Number	Some of the stimulus parameters of the instrument
61	state have been changed, because you have turned
	correction on. A calibration set for the current
	measurement parameter was found and activated. The
	instrument state was updated to match the stimulus
	parameters of the calibration state.

This message also appears when you have turned on harmonic mode or frequency offset and the present frequency range cannot be used with one of these modes.

HP-IB COPY IN PROGRESS, ABORT WITH LOCAL

Error Number 169	An HP-IB copy was already in progress when you requested the HP-IB for another function. To abort the first copy, press Local , otherwise the HP-IB is unavailable until the first copy is completed.
---------------------	--

ILLEGAL UNIT OR VOLUME NUMBER

Error Number 46	The disk unit or volume number set in the analyzer is not valid. Refer to the disk drive operating manual.
--------------------	--

INIT DISK removes all data from disk

Information Message	Continuing with the initialize operation will <i>destroy</i> any data currently on the disk.
------------------------	--

INITIALIZATION FAILED

Error Number 47	The disk initialization failed, probably because the disk is damaged.
--------------------	---

INSTRUMENT STATE MEMORY CLEARED

Error Number 56	All instrument state registers have been cleared from memory along with any saved calibration data, memory traces, and calibration kit definitions. Additionally, all user-settable selections (such as HP-IB addresses) are set to their defaults.
--------------------	---

INSUFFICIENT MEMORY

Error Number	Your last front panel or HP-IB request could not be implemented due to insufficient memory space. In some cases, this is a fatal error from which you can escape only by presetting the instrument.
51	

INSUFFICIENT MEMORY FOR PRINT/PLOT

Error Number	There is not enough memory available for the print or plot function. Increase the available memory by changing or eliminating a memory-intensive operation such as reducing the number of points in the sweep.
168	

INSUFFICIENT MEMORY, PWR MTR CAL OFF

Error Number	There is not enough memory space for the power meter calibration array. Increase the available memory by clearing one or more save/recall registers, or by reducing the number of points.
154	

INVALID KEY

Error Number	You pressed an undefined softkey.
2	

LIST MODE OFF: INVALID WITH LO FREQ

Error Number	List mode has been turned off in the frequency offset mode because it is incompatible with your selected LO frequency.
182	

LIST TABLE EMPTY

Error Number 9	The frequency list is empty. To implement list frequency mode, add segments to the list table.
-------------------	--

LOG SWEEP REQUIRES 2 OCTAVE MINIMUM SPAN

Error Number 150	A logarithmic sweep is only valid if the stop frequency is greater than four times the start frequency. For frequency spans of less than two octaves, the sweep type automatically reverts to linear sweep.
---------------------	---

LOW PASS: FREQ LIMITS CHANGED

Information Message	The frequency domain data points must be harmonically related from dc to the stop frequency. That is, $\text{stop} = n \times \text{start}$, where n = number of points. If this condition is not true when a low pass mode (step or impulse) is selected and transform is turned on, the analyzer resets the start and stop frequencies. The stop frequency is set close to the entered stop frequency, and the start frequency is set equal to stop/n .
------------------------	---

MEMORY FOR CURRENT SEQUENCE IS FULL

Error Number 132	All the memory in the sequence you are modifying is filled with instrument commands.
---------------------	--

MORE SLIDES NEEDED

Error Number 71	When you use a sliding load (in a user-defined calibration kit), you must set at least three slide positions to complete the calibration.
--------------------	---

NO CALIBRATION CURRENTLY IN PROGRESS

Error Number **The RESUME CAL SEQUENCE softkey is not valid**
69 unless a calibration is already in progress. Start a new
 calibration.

NO DISK MEDIUM IN DRIVE

Error Number **You have no disk in the current disk unit. Insert a disk,**
41 or check the disk unit number stored in the analyzer.

NO FAIL FOUND

Service Error **The self-diagnose function of the instrument operates**
Number 114 on an internal test failure. At this time, no failure has
 been detected.

NO FILE(S) FOUND ON DISK

Error Number **No files of the type created by an analyzer store**
45 operation were found on the disk or the disk drive is
 empty. If you requested a specific file title, that file was
 not found on the disk.

NO IF FOUND: CHECK R INPUT LEVEL

Error Number **The first IF signal was not detected during pretune.**
5 Check the front panel R channel jumper. If there is no
 visible problem with the jumper, refer to the
 HP 8719D/20D/22D Network Analyzer Service Guide
 for troubleshooting.

NO LIMIT LINES DISPLAYED

Error Number 144	You can turn limit lines on but they cannot be displayed on polar or Smith chart display formats.
---------------------	---

NO MARKER DELTA -SPAN NOT SET

Error Number 15	You must turn the delta marker mode on, with at least two markers displayed, in order to use the MARKER → SPAN softkey function.
--------------------	---

NO MEMORY AVAILABLE FOR INTERPOLATION

Error Number 123	You cannot perform interpolated error correction due to insufficient memory.
---------------------	--

NO MEMORY AVAILABLE FOR SEQUENCING

Error Number 126	You cannot modify the sequence due to insufficient memory.
---------------------	--

NO SPACE FOR NEW CAL. CLEAR REGISTERS

Error Number 70	You cannot store a calibration set due to insufficient memory. You can free more memory by clearing a saved instrument state from an internal register (which may also delete an associated calibration set, if all the instrument states using the calibration kit have been deleted.) You can store the saved instrument state and calibration set to a disk before clearing them. After deleting the instrument states, press Preset to run the memory packer.
--------------------	--

NOT ALLOWED DURING POWER METER CAL

Error Number	When the analyzer is performing a power meter calibration, the HP-IB bus is unavailable for other functions such as printing or plotting.
198	

NOT ENOUGH SPACE ON DISK FOR STORE

Error Number	The store operation will overflow the available disk space. Insert a new disk or purge files to create free disk space.
44	

NO VALID MEMORY TRACE

Error Number	If you are going to display or otherwise use a memory trace, you must first store a data trace to memory.
54	

NO VALID STATE IN REGISTER

Error Number	You have requested the analyzer, over HP-IB (or by sequencing), to load an instrument state from an <i>empty</i> internal register.
55	

ONLY LETTERS AND NUMBERS ARE ALLOWED

Error Number	You can only use alpha-numeric characters (and underscores) in disk file titles or internal save register titles. Other symbols are not allowed, except for the "underscore" symbol.
43	

OPTIONAL FUNCTION; NOT INSTALLED

- | | |
|-------------------|---|
| Error Number
1 | The function you requested requires a capability provided by an option to the standard analyzer. That option is not currently installed. (Refer to Chapter 1 for a description of the available options.) |
|-------------------|---|

PARALLEL PORT NOT AVAILABLE FOR GPIO

- | | |
|---------------------|---|
| Error Number
165 | You have defined the parallel port as COPY for sequencing in the HP-IB menu. To access the parallel port for general purpose I/O (GPIO), set the selection to [GPIO]. |
|---------------------|---|

PARALLEL PORT NOT AVAILABLE FOR COPY

- | | |
|---------------------|--|
| Error Number
167 | You have defined the parallel port as general purpose I/O (GPIO) for sequencing. The definition was made under the <u>Local</u> key menus. To access the parallel port for copy, set the selection to PARALLEL [COPY]. |
|---------------------|--|

PHASE LOCK CAL FAILED

- | | |
|-------------------|--|
| Error Number
4 | <p>An internal phase lock calibration routine is automatically executed at power-on, preset, and any time a loss of phase lock is detected. This message indicates that phase lock calibration was initiated and the first IF detected, but a problem prevented the calibration from completing successfully. Refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> and execute pretune correction test 48.</p> <p>This message may appear if you connect a mixer between the RF output and R input before turning on frequency offset mode. Ignore it: it will go away when you turn on frequency offset. This message may also appear if you turn on frequency offset mode before you define the offset.</p> |
|-------------------|--|

PHASE LOCK FAILURE

Error Number	The first IF signal was detected at pretune, but phase lock could not be acquired. Refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for troubleshooting.
7	

PHASE LOCK LOST

Error Number	Phase lock was acquired but then lost. Refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for troubleshooting information.
8	

PLOT ABORTED

Error Number	When you press the Local key, the analyzer aborts the plot in progress.
27	

PLOTTER: not on, not connect, wrong address

Error Number	The plotter does not respond to control. Verify power to the plotter, and check the HP-IB connection between the analyzer and the plotter. Ensure that the plotter address recognized by the analyzer matches the HP-IB address set on the plotter itself.
26	

PLOTTER NOT READY—PINCH WHEELS UP

Error Number	The plotter pinch wheels clamp the paper in place. If you raise the pinch wheels, the plotter indicates a “not ready” status on the bus.
28	

POSSIBLE FALSE LOCK

Error Number 6	Phase lock has been achieved, but the source may be phase locked to the wrong harmonic of the synthesizer. Perform the source pretune correction routine documented in the "Adjustments and Correction Constants" chapter in the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> .
-------------------	---

POWER METER INVALID

Error Number 116	The power meter indicates an out-of-range condition. Check the test setup.
---------------------	--

POWER METER NOT SETTLED

Error Number 118	Sequential power meter readings are not consistent. Verify that the equipment is set up correctly. If so, preset the instrument and restart the operation.
---------------------	--

POWER SUPPLY HOT!

Error Number 21	The temperature sensors on the A8 post-regulator assembly have detected an over-temperature condition. The power supplies regulated on the post-regulator have been shut down.
--------------------	--

POWER SUPPLY SHUT DOWN!

Error Number 22	One or more supplies on the A8 post-regulator assembly have been shut down due to an over-current, over-voltage, or under-voltage condition.
--------------------	--

PRESS [MENU], SELECT CW (IF) FREQ, THEN SWEPT LO

Error Number When you are sweeping the RF and LO, the IF must be
161 fixed.

PRINT ABORTED

Error Number When you press the **Local** key, the analyzer aborts
25 output to the printer.

print color not supported with EPSON

Error Number You have defined the printer type as EPSON-P2. Color
178 print is not supported with this printer. The print will
 abort.

PRINTER: busy

Error Number The parallel port printer is not accepting data.
176

PRINTER: error

Error Number The parallel port printer is malfunctioning. The
175 analyzer cannot complete the copy function.

PRINTER: not connected

Error Number There is no printer connected to the parallel port.
173

PRINTER: not handshaking

Error Number The printer at the parallel port is not responding.
177

PRINTER: not on line

Error Number The printer at the parallel port is not set on line.
172

PRINTER: not on, not connected, wrong address

Error Number The printer does not respond to control. Verify power
24 to the printer, and check the HP-IB connection between
 the analyzer and the printer. Ensure that the printer
 address recognized by the analyzer matches the HP-IB
 address set on the printer itself.

PRINTER: paper error

Error Number There is a paper-related problem with the parallel port
171 printer such as a paper jam or out-of-paper condition.

PRINTER: power off

Error Number The power to the printer at the parallel port is off.
174

PRINT/PLOT IN PROGRESS, ABORT WITH LOCAL

Error Number If a print or plot is in progress and you attempt a
166 second print or plot, this message is displayed and the
 second attempt is ignored. To abort a print or plot in
 progress, press **Local**.

PROCESSING DISPLAY LIST

Information The display information is being processed for a screen
Message print to a copy device and stored in the copy spool
 buffer. During this time, the analyzer's resources are
 dedicated to this task (which takes less than a few
 seconds.)

PWR MTR NOT ON/CONNECTED OR WRONG ADDR

Error Number The power meter cannot be accessed by the analyzer.
117 Verify that the power meter address and model number
 set in the analyzer match the address and model
 number of the actual power meter.

REQUESTED DATA NOT CURRENTLY AVAILABLE

Error Number The analyzer does not currently contain the data you
30 have requested. For example, this condition occurs
 when you request error term arrays and no calibration
 is active.

SAVE FAILED. INSUFFICIENT MEMORY

Error Number 151	You cannot store an instrument state in an internal register due to insufficient memory. Increase the available memory by clearing one or more save/recall registers and pressing (Preset) , or by storing files to a disk.
---------------------	--

SELECTED SEQUENCE IS EMPTY

Error Number 124	The sequence you attempted to run does not contain instrument commands.
---------------------	---

SELF TEST #n FAILED

Service Error Number 112	Internal test #n has failed. Several internal test routines are executed at instrument preset. The analyzer reports the first failure detected. Refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for troubleshooting information on internal tests and the self-diagnose feature.
-----------------------------	--

SEQUENCE ABORTED

Error Number 157	The sequence running was stopped prematurely when you pressed the (Local) key.
---------------------	---

SEQUENCE MAY HAVE CHANGED, CAN'T CONTINUE

Error Number 153	When you pause a sequence, you cannot continue it if you have modified it. You must start the sequence again.
---------------------	---

SLIDES ABORTED (MEMORY REALLOCATION)

Error Number 73	You cannot perform sliding load measurements due to insufficient memory. Increase the available memory by clearing one or more save/recall registers and pressing Preset , or by storing files to a disk.
---------------------------	--

SOURCE POWER TURNED OFF, RESET UNDER POWER MENU

Information Message	You have exceeded the maximum power level at one of the inputs and power has been automatically reduced. The annotation P↓ indicates that power trip has been activated. When this occurs, reset the power and then press Menu POWER SOURCE PWR on OFF, to switch on the power.
----------------------------	---

STARTING COPY SPOOLER

Information Message	The analyzer is beginning to output data from the spool buffer to the copy device. The analyzer resumes normal operation; the data is being output to the copy device in the background.
----------------------------	--

SWEEP MODE CHANGED TO CW TIME SWEEP

Error Number 187	If you select external source auto or manual instrument mode and you do not also select CW mode, the analyzer is automatically switched to CW.
----------------------------	--

SWEEP TIME INCREASED

Error Number 11	You have made instrument changes that cause the analyzer sweep time to be automatically increased. Some parameter changes that cause an increase in sweep time are narrower IF bandwidth, an increase in the number of points, and a change in sweep type.
--------------------	--

SWEEP TIME TOO FAST

Error Number 12	The fractional-N and digital IF circuits have lost synchronization. Refer to the <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> for troubleshooting information.
--------------------	--

SWEEP TRIGGER SET TO HOLD

Information Message	The instrument is in a hold state and is no longer sweeping. To take a new sweep, press Menu TRIGGER MENU SINGLE or CONTINUOUS.
------------------------	--

SYNTAX ERROR

Error Number 33	You have improperly formatted an HP-IB command. Refer to the <i>HP 8719D/20D/22D Network Analyzer Programmer's Guide</i> for proper command syntax.
--------------------	---

SYST CTRL OR PASS CTRL IN LOCAL MENU

Error Number **36** The analyzer is in talker/listener mode. In this mode, the analyzer cannot control a peripheral device on the bus. Use the local menu to change to system controller or pass control mode.

TEST ABORTED

Error Number **113** You have prematurely stopped a service test.

TEST PORT OVERLOAD, REDUCE POWER

Error Number **57** You have exceeded approximately +14 dBm at one of the test ports (or 0 dBm at the A or B sampler, Option 012 Only). When this occurs, reduce the power to a lower level.

THIS LIST FREQ INVALID

Error Number **133** You have set frequencies in the list that are outside of the allowable frequency range of the analyzer. Reduce the frequency range of the list.

TOO MANY NESTED SEQUENCES, SEQ ABORTED

Error Number **164** You can only nest sequences to a maximum level of six. The sequence will abort if you nest more than six.

TOO MANY SEGMENTS OR POINTS

Error Number 50	You can have a maximum of 30 segments or 1632 points in frequency list mode. In power meter calibrations, you can have a maximum of 12 segments for power sensor cal factors and power loss functions.
--------------------	--

TRANSFORM, GATE NOT ALLOWED

Error Number 16	You can perform a time domain transformation only in linear and CW sweep types.
--------------------	---

TROUBLE! CHECK SETUP AND START OVER

Service Error Number 115	Your equipment setup for the adjustment procedure in progress is not correct. Check the setup diagram and instructions <i>HP 8719D/20D/22D Network Analyzer Service Guide</i> . Start the procedure again.
-----------------------------	--

WAITING FOR CLEAN SWEEP

Information Message	In single sweep mode, the instrument ensures that all changes to the instrument state, if any, have been implemented before taking the sweep. The command that you have initiated is being processed and will not be complete until the new sweep is completed. An asterisk * is displayed in the left margin until a complete fresh sweep has been taken.
------------------------	--

WAITING FOR DISK

Information Message	This message is displayed between the start and finish of a read or write operation to a disk.
------------------------	--

WAITING FOR HP-IB CONTROL

Information Message	You have instructed the analyzer to use pass control (USEPASC). When you send the analyzer an instruction that requires active controller mode, the analyzer requests control of the bus and simultaneously displays this message. If the message remains, the system controller is not relinquishing the bus.
---------------------	--

WRITE ATTEMPTED WITHOUT SELECTING INPUT TYPE

Error Number 32	You have sent the data header "#A" to the analyzer with no preceding input command (such as INPUDATA). The instrument recognized the header but did not know what type of data to receive. Refer to the <i>HP 8719D/20D/22D Network Analyzer Programmer's Guide</i> for command syntax information.
--------------------	---

WRONG DISK FORMAT, INITIALIZE DISK

Error Number 77	You have attempted to store, load, or read file titles, but your disk format does not conform to the Logical Interchange Format (LIF) or DOS format. You must initialize the disk before reading or writing to it.
--------------------	--

Compatible Peripherals

Measurement Accessories Available

Calibration Kits

- HP 85050B/D 7-mm Calibration Kit
- HP 85031B 7-mm Calibration Kit
- HP 85054B/D 50-Ohm Type-N Calibration Kit
- HP 85032B/E 50-Ohm Type-N Calibration Kit
- HP 85052B/D 3.5-mm Calibration Kit
- HP 85033D 3.5-mm Calibration Kit
- HP 85033C 3.5-mm Calibration Kit
- HP 85052C 3.5-mm TRL Calibration Kit
- HP 85056K 2.92 * Calibration Kit
- HP 85056A/D 2.4-mm Calibration Kit
- HP 85036B/E 75-Ohm Type-N Calibration Kit

Verification Kits

- HP 85057B 2.4-mm Verification Kit
- HP 85053B 3.5-mm Verification Kit
- HP 85051B 7-mm Verification Kit
- HP 85055A 50-Ohm Type-N Verification Kit

Test Port Return Cables

- HP 85133C 2.4-mm Semi-Flexible Single Cable
- HP 85133D 2.4-mm Semi-Flexible Cable Set
- HP 85133E 2.4-mm Super-Flexible Single Cable
- HP 85133F 2.4-mm Super-Flexible Cable Set

- HP 85131C 3.5-mm Semi-Flexible Single Cable
- HP 85131D 3.5-mm Semi-Flexible Cable Set
- HP 85131E 3.5-mm Super-Flexible Single Cable
- HP 85131F 3.5-mm Super-Flexible Cable Set

- HP 85132C 7-mm Semi-Flexible Single Cable
- HP 85132D 7-mm Semi-Flexible Cable Set
- HP 85132E 7-mm Super-Flexible Single Cable
- HP 85132F 7-mm Super-Flexible Cable Set

Adapter Sets

- HP 85130D Special Adapter Set
- HP 85130E Special 2.4-mm to 7-mm Adapter Set
- HP 85130F Special 2.4-mm to 3.5-mm Adapter Set
- HP 85130G Special Adapter Set
- HP 85130B Special 3.5-mm to 7-mm Adapter Set
- HP 85130C Special 3.5-mm to Type-N Adapter Set
- HP 11904A Special 2.4-mm (m) to 2.92-mm (m) Adapter Set
- HP 11904B Special 2.4-mm (f) to 2.92-mm (f) Adapter Set

System Accessories Available

Plotters

- HP 7440A ColorPro Eight-Pen Color Graphics Plotter
- HP 7470A Two-Pen Graphics Plotter
- HP 7475A Six-Pen Graphics Plotter
- HP 7550A/B High-Speed Eight-Pen Graphics Plotter

Printers

- HP C2655A, DeskJet Portable 340
- HP C2642A, DeskJet 400
- HP C2106A, DeskJet 500
- HP C2114A, DeskJet 500C
- HP C2170A, DeskJet 520
- HP C2162A, DeskJet 540
- HP C2121A, DeskJet 550C
- HP C2168A, DeskJet 560C
- HP C2184A, DeskJet 600
- HP C2164A, DeskJet 660C
- HP C2145A, DeskJet 850C
- HP C1676A, DeskJet 1200C (can also be used to plot)
- HP C3540A, DeskJet 1600C (can also be used to plot)
- HP C2621A, DeskJet Portable 310
- HP C2634A, DeskJet Portable 320
- HP 2227B QuietJet
- HP 2225A ThinkJet
- All LaserJets (can also be used to plot)
- HP 3630A PaintJet Color Graphics Printer

HP-IB Cables

- HP 10833A HP-IB Cable, 1.0 m (3.3 ft.)
- HP 10833B HP-IB Cable, 2.0 m (6.6 ft.)
- HP 10833D HP-IB Cable, 0.5 m (1.6 ft.)

Interface Cables

- HP C2912B Centronics (Parallel) Interface Cable, 3.0 m (9.9 ft.)
- HP C2913A RS-232C Interface Cable, 1.2 m (3.9 ft.)
- HP C2914A Serial Interface Cable, 1.2 m (3.9 ft.)
- HP 24542G Serial Interface Cable, 3 m (9.9 ft.)
- HP 24542D Parallel Interface Cable, 2 m (6 ft.)
- HP 92284A Parallel Interface Cable, 2 m (6 ft.)

Keyboards

A keyboard can be connected to the analyzer for data input such as titling files.

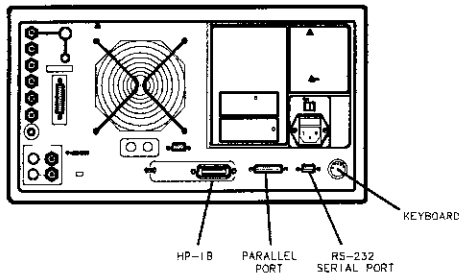
The HP C1405A Option ABA keyboard with the HP part number C1405-60015 adapter is suitable for this purpose. Or, the analyzer is designed to accept most PC-AT-compatible keyboards with a standard DIN connector. Keyboards with a mini-DIN connector are compatible with the HP part number C1405-60015 adapter.

External Monitor Requirements:

VGA Compatible

- 640 (horizontal) x 480 (vertical) resolution
- 59.83 Hz vertical refresh rate
- 16.716 mS vertical time
- 31.41 kHz horizontal refresh rate
- 31.840 μ S horizontal time
- 75 ohm video input impedance
- video analog amplitude 0.7 Vp-p
- negative true TTL logic for vertical and horizontal synchronization

Connecting Peripherals



pb624d

Figure 11-1. Peripheral Connections to the Analyzer

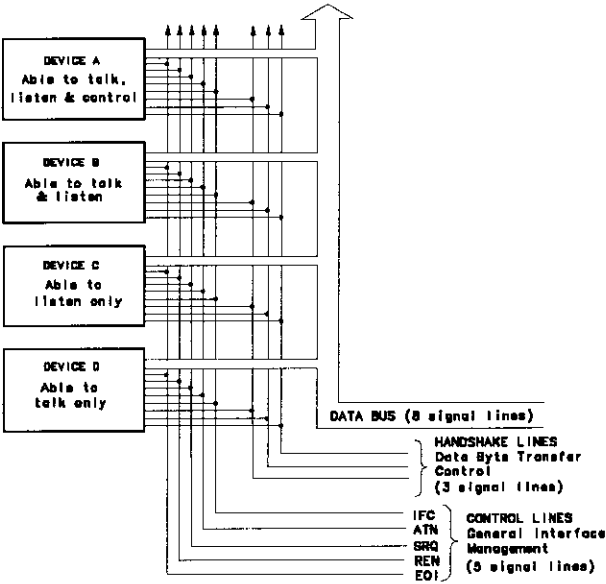
Configuring Peripherals with HP-IB Interface

- Press **Local** **SET ADDRESSES**

Table 11-1. Default Addresses for HP-IB Peripherals

Peripheral	Default HP-IB Address
Printer	01
Plotter	05
Power Meter	13
Disk Drive	00
Computer Controller	21

HP-IB Bus Structure



pg635d

Figure 11-2. HP-IB Bus Structure

HP-IB Requirements

Number of Interconnected Devices:	15 maximum.
Interconnection Path Maximum Cable Length:	20 meters maximum or 2 meters per device (whichever is less).
Message Transfer Scheme:	Byte serial, bit parallel a synchronous data transfer using a 3-line handshake system.
Data Rate:	Maximum of 1 megabyte-per-second over the specified distances with tri-state drivers. Actual data rate depends on the transfer rate of the slowest device connected to the bus.
Address Capability:	Primary addresses: 31 talk, 31 listen. A maximum of 1 talker and 14 listeners can be connected to the interface at given time.
Multi-ple-Controller Capability:	In systems with more than one controller (like this instrument), only one controller can be active at any given time. The active controller can pass control to another controller, but only the system controller can assume unconditional control. Only one <i>system</i> controller is allowed.

HP-IB Operational Capabilities

On the network analyzer's rear panel, next to the HP-IB connector, there is a list of HP-IB device subsets as defined by the IEEE 488.2 standard. The analyzer has the following capabilities:

SH1	Full-source handshake.
AH1	Full-acceptor handshake.
T6	Basic talker, answers serial poll, unaddresses if MLA is issued. No talk-only mode.
L4	Basic listener, unaddresses if MTA is issued. No listen-only mode.
SR1	Complete service request (SRQ) capabilities.
RL1	Complete remote/local capability including local lockout.
PP0	Does not respond to parallel poll.
DC1	Complete device clear.
DT1	Responds to a Group Execute Trigger (GET) in the hold-trigger mode.
C1,C2,C3	System controller capabilities in system-controller mode.
C10	Pass control capabilities in pass-control mode.
E2	Tri-state drivers.
LE0	No extended listener capabilities.
TE0	No extended talker capabilities.

These codes are completely explained in the IEEE Std 488 documents, published by the Institute of Electrical and Electronic Engineers, Inc., 345 East 47th Street, New York, New York 11017.

Preset State and Memory Allocation

Types of Memory and Data Storage

Volatile Memory

This is dynamic read/write memory, of approximately 2 Mbytes, that contains all of the parameters that make up the *current* instrument state.

Volatile memory is cleared upon a power cycle of the instrument and, except as noted, upon instrument preset.

Non-Volatile Memory

This is CMOS read/write memory that is protected by a battery to provide storage of data when line power to the instrument is turned off.

Non-volatile memory consists of a block of user-allocated memory and a block of fixed memory.

Table 12-1.
Memory Requirements of Calibration and Memory Trace
Arrays

Variable	Data Length (Bytes)	Approximate Totals (Bytes)			
		401 pts	801 pts	1601 pts	
		1 chan		1 chan	2 chans
Calibration Arrays					
Response	$N \times 6 + 52$	2.5 k	5 k	10 k	19 k
Response and Isolation	$N \times 6 \times 2 + 52$	5 k	10 k	19 k	38 k
1-Port	$N \times 6 \times 3 + 52$	7 k	14 k	29 k	58 k
2-Port	$N \times 6 \times 12 + 52$	29 k	58 k	115 k	230 k
Interpolated Cal	Same as above in addition to regular cal				
Power Meter Cal	$(N^{\dagger} \times 2 \times \text{number of channels}^{\ddagger}) + 208$	1 k	1.8 k	3.4 k	6.6 k
Measurement Data					
Memory Trace Array*	$N \times 6 + 52$	2.5 k	4.9 k	9.7 k	19 k
Instrument State[#]		3 k	3 k	3 k	3 k

N = number of points
 * This variable is allocated once per active channel.
 † The number of points that was set at the time the cal was turned on.
 ‡ If the channels are coupled, this number is always 1. If the channels are uncoupled, this number refers to the number of channels that have power meter cal on.
 # This value may change with different firmware revisions.

Conserving Memory

If you are concerned about conserving memory, either internal memory or external disk space, some of the most memory-intensive operations include:

- two-port error correction
- interpolated error correction
- 1601 measurement points
- using time domain
- saving data arrays and graphics with the instrument state

Preset State

Table 12-2. Preset Conditions

Preset Conditions		Preset Value	
Analyzer Mode			
Analyzer Mode	Network Analyzer Mode	Stop Frequency (HP 8722D)	40.05 GHz
Frequency Offset (Opt. 089)	Off	Start Time	0
Offset Value	0 Hz	Time Span	100 ms
High Power (Opt. 085)		CW Frequency	1 GHz
External R Channel	Off	Test Port Power (HP 8719D/20D)	5 dBm
Attenuator A	0 dB	Test Port Power (HP 8719D/20D, Opt. 007)	10 dBm
Attenuator B	0 dB	Test Port Power (HP 8719D/20D, Opt. 400)	0 dBm
Stimulus Conditions		Test Port Power (HP 8722D)	-10 dBm
Sweep Type	Linear Frequency	Test Port Power (HP 8722D, Opt. 007)	-5 dBm
Step Sweep	off	Start Power (HP 8719D/20D)	-15.0 dBm
Step Sweep (Opt. 085)	on	Start Power (HP 8719D/20D, Opt. 007)	-10.0 dBm
Display Mode	Start/Stop	Start Power (HP 8719D/20D, Opt. 400)	-20.0 dBm
Trigger Type	Continuous	Start Power (HP 8722D)	-20.0 dBm
External Trigger	Off		
Sweep Time	100 ms, Auto Mode		
Start Frequency	50 MHz		
Stop Frequency (HP 8719D)	13.51 GHz		
Stop Frequency (HP 8720D)	20.05 GHz		

12-2. Preset Conditions (continued)

Preset Conditions	Preset Value	Preset Conditions	Preset Value
Start Power (HP 8722D, Opt. 007)	-15.0 dBm	Display	Data
Start Power (HP 8722D, Opt. 400)	-25.0 dBm	Color Selections	Same as before Preset
Power Span (HP 8719D/20D)	20 dB	Dual Channel	Off
Power Span (HP 8722D)	15 dB	Active Channel	Channel 1
Coupled Power	On	Frequency Blank	Disabled
Source Power	On	Retrace Power	Standard
Coupled Channels	On	Test Set Switch	Continuous
Coupled Port Power	On	Test Set Switch (Opt. 007 or 085)	Hold
Power Range	Auto; Range 0	Split Display	On
Power Range (Opt. 400)	Auto; Range 1	Intensity	Factory set to 100%; user selected value is not changed by Preset .
Number of Points	201	Beeper: Done	On
Frequency List		Beeper: Warning	Off
Frequency List	Empty	D2/D1 to D2	Off
Edit Mode	Start/Stop, Number of Points	Title	Channel 1 = [hp] Channel 2 = Empty
Response Conditions		IF Bandwidth	3000 Hz
Parameter	Channel 1: S11; Channel 2: S21	IF Averaging Factor	16; Off
Conversion	Off	Smoothing	1% SPAN; Off
Format	Log Magnitude (all parameters)	Aperture	
		Phase Offset	0 Degrees
		Electrical Delay	0 ns
		Scale/Division	10 dB/Division

Table 12-2. Preset Conditions (continued)

Preset Conditions	Preset Value	Preset Conditions	Preset Value
Calibration		Marker Mode	Continuous
Correction	Off	Display Markers	On
Calibration Type	None	Delta Marker Mode	Off
Calibration Kit (HP 8719D/20D)	3.5 mm	Coupling	On
Calibration Kit (HP 8722D)	2.4 mm	Marker Search	Off
Calibration (continued)		Marker Target Value	-3 dB
System Z0	50 Ohms	Marker Width Value	-3 dB; Off
Velocity Factor	1	Marker Tracking	Off
Extensions	Off	Marker Stimulus Offset	0 Hz
Port 1	0 s	Marker Value Offset	0 dB
Port 2	0 s	Marker Aux Offset (Phase)	0 Degrees
Input A	0 s	Marker Statistics	Off
Input B	0 s	Polar Marker	Lin Mkr
Chop A and B	On	Smith Marker	R + jX Mkr
Power Meter Calibration	Off		
Number of Readings	1	Limit Lines	
Power Loss Correction	Off	Limit Lines	Off
Sensor A/B	A	Limit Testing	Off
Interpolated Error Correction	Off	Limit List	Empty
		Edit Mode	Upper/Lower Limits
Markers (coupled)		Stimulus Offset	0 Hz
Markers 1, 2, 3, 4, 5	1 GHz; All Markers Off	Amplitude Offset	0 dB
Last Active Marker	1	Limit Type	Sloping Line
Reference Marker	None	Beep Fail	Off

Table 12-2. Preset Conditions (continued)

Preset Conditions	Preset Value	Preset Conditions	Preset Value
Time Domain		Plotter Port	Last Active State
Transform	Off	Plotter Baud Rate	Last Active State
Transform Type	Bandpass	Plotter Handshake	Last Active State
Start Transform	-1 nanosecond	HP-IB Address	Last Active State
Stop Transform	4 nanoseconds	Printer Type	Last Active State
Gating	Off	Printer Port	Last Active State
Gate Shape	Normal	Printer Baud Rate	Last Active State
Gate Start	-500 picoseconds	Printer Handshake	Last Active State
Gate Stop	500 picoseconds	Printer HP-IB Address	Last Active State
Demodulation	Off		
Window	Normal		
Use Memory	Off		
System Parameters		Disk Save Configuration	
		(Define Store)	
HP-IB Addresses	Last Active State	Data Array	Off
HP-IB Mode	Last Active State	Raw Data Array	Off
Focus	Last Active State	Formatted Data Array	Off
Clock Time Stamp	On	Graphics	Off
Preset:	Last Selected State	Data Only	Off
Factory/User		Directory Size	Default ¹
		Save Using	Binary
Copy Configuration		Select Disk	Internal Memory
Parallel Port	Last Active State	Disk Format	LIF
Plotter Type	Last Active State		

¹ The directory size is calculated as 0.013% of the floppy disk size (which is ≈ 256) or 0.005% of the hard disk size.

Table 12-2. Preset Conditions (continued)

Preset Conditions	Preset Value	Preset Conditions	Preset Value
Sequencing¹		Ch2 Graticule	1
Loop Counter	0	Ch1 Text	7
TTL OUT	High	Ch2 Text	7
Service Modes		Ch1 Marker	7
HP-IB Diagnostic	Off	Ch2 Marker	7
Source Phase Lock	Loop On	Line Type:	
Aux Input	Low	Ch1 Data	7
Resolution		Ch2 Data	7
Analog Bus Node	11 (Aux Input)	Ch1 Memory	7
		Ch2 Memory	7
Plot		Print	
Plot Data	On	Printer Mode	Last Active State
Plot Memory	On	Auto-Feed	On
Plot Graticule	On	Printer Colors	
Plot Text	On	CH1 Data	Magenta
Plot Marker	On	CH1 Mem	Green
Autofeed	On	CH2 Data	Blue
Plot Quadrant	Full Page	CH2 Mem	Red
Scale Plot	Full	Graticule	Cyan
Plot Speed	Fast	Warning	Black
Pen Number:		Text	Black
Ch1 Data	2		
Ch2 Data	3		
Ch1 Memory	5		
Ch2 Memory	6		
Ch1 Graticule	1		

1 Pressing preset turns off sequencing modify (edit) mode and stops any running sequence.

Table 12-3. Preset Conditions (continued)

Format Table	Scale	Reference	
		Position	Value
Log Magnitude (dB)	10.0	5.0	0.0
Phase (degree)	90.0	5.0	0.0
Group Delay (ns)	10.0	5.0	0.0
Smith Chart	1.00	-	1.0
Polar	1.00	-	1.0
Linear Magnitude	0.1	0.0	0.0
Real	0.2	5.0	0.0
Imaginary	0.2	5.0	0.0
SWR	1.00	0.0	1.0

Alphabetical Mnemonic Listing

Mnemonic	Description
AB	Measures and displays A/B on the active channel.
ADAP1[D]	Sets adapter electrical delay.
ADDRCONT[D]	Controller HP-IB address: the address where control is returned after a pass control.
ADDRDISC[D]	Disk HP-IB address.
ADDRPERI[D]	Peripheral HP-IB address (for sequencing). See also TITTPERI.
ADDRPLOT[D]	Plotter HP-IB address.
ADDRPOWM[D]	Power meter HP-IB address.
ADDRPRIN[D]	Printer HP-IB address.
ADPTCOAX	Sets adapter to COAXial.
ADPTWAVE	Sets adapter to WAVEguide.
ALC	ALC control.
ALTAB	Places the analyzer in the alternate inputs measurement mode, where measurements are made on alternate sweeps. See also CHOPAB;.
ANAB<ON OFF>	Enables the analog bus for service use.
ANAI[D]	Measures and displays the data at the auxiliary input (ANALOG IN).
AR	Measures and displays A/R on the active channel.
ASEG	Uses all segments for list frequency sweep. See also SSEG[D].

ASSS	Asserts the sequence status bit.
ATTA[D]	Attenuator A (Option 085 Only).
ATTB[D]	Attenuator B (Option 085 Only).
AUTO	Auto scale the active channel.
AVERFACT[D]	Sets the averaging factor on the active channel.
AVERO<ON OFF>	Turns averaging ON and OFF on the active channel.
AVERREST	Restart the averaging on the active channel.

BACI[D]	Sets the background intensity of the display.
----------------	---

BANDPASS	Selects the time domain bandpass mode.
-----------------	--

These 3 commands control the warning beeper, causing it to sound if the indicated condition occurs:

BEEPDONE<ON OFF>	The completion of functions such as save, done with calibration standard, and data trace saved.
BEEPFAIL<ON OFF>	A limit test failure.
BEEPWARN<ON OFF>	The generation of a warning message.
BLAD<ON OFF>	Blanks the display.
BR	Measures and displays B/R on the active channel.

These commands set the open capacitance values of an open circuit while it is being defined as a calibration standard.

C0[D]
C1[D]
C2[D]
C3[D]

CAL1 Accepted for compatibility with the HP 8510, where its function is to begin a calibration sequence.

These commands set the power meter calibration factor corrections for the particular sensor used. Sensor B is only valid for the HP 438A which has two input channels:

CALFCALF[D] Sets the calibration factor.

CALFFREQ[D] Selects the frequency for the calibration factor correction.

CALFSENA Edits the sensor A calibration factor table.

CALFSENB Edits the sensor B calibration factor table.

These commands begin a calibration sequence:

CALFUL2 Short, load, open, thru (SLOT) 2-port.

CALIONE2 One-path 2-port.

CALIRAI Response and isolation.

CALIRESP Response.

CALIS111 S11 1-port.

CALIS221 S22 1-port.

CALITRL2 Thru, reflect, line or Line, reflect, match (TRL*/LRM*) 2-port.

These commands select a default calibration kit:

CALK24MM 2.4-mm (HP 85056A/D cal kit).

CALK292MM 2.92-mm.

CALK292S 2.92* (HP 85056K cal kit).

CALK35MD 3.5-mm (HP 85052B/D, HP 85033D cal kit).

CALK35MC 3.5-mm (HP 85033C cal kit).

Note **CALK35MM** selects the HP 85033C cal kit for the HP 8752C/53D, and selects the HP 85052 series cal kits for the HP 8719D/20D/22D.

CALK7MM 7-mm (HP 85031B cal kit and HP 85050 series).

CALKN50 Type-N 50 ohm (HP 85032B/E cal kit).

CALKN75	Type-N 75 ohm (HP 85036B/E cal kit).
CALKTRLK	TRL 3.5-mm (HP 85052C cal kit).
CALKUSED	User-defined calibration kit.
CALN	Calibration: none. Turns calibration type to off.
CALPOW	Provides access to the power meter calibration functions.
CALSPORT1	Recalls cal set associated with Port 1 for adapter removal.
CALSPORT2	Recalls cal set associated with Port 2 for adapter removal.
CALZLINE	Establishes the line or match standard(s) as the characteristic impedance for a TRL/LRM calibration.
CALZSYST[D]	Establishes the system Z_0 (see SETZ) as the characteristic impedance for a TRL/LRM calibration.
CBRI[D]	Adjusts the color brightness of the selected display feature. (See COLOXXXX commands.)
CENT[D]	Sets the center stimulus value. If a list frequency segment is being edited, sets the center of the list segment.
CHAN1	Makes channel 1 the active channel. OPC-compatible.
CHAN2	Makes channel 2 the active channel. OPC-compatible.
CHOPAB	Places the analyzer in the chop measurement mode. See also ALTAB.
CLAD	Class done, modify cal kit, specify class.

These commands call reflection standard classes during a calibration sequence. If only one standard is in the class, it is measured. If there is more than one, the standard being used must be selected with STAN<A|B|C|D|E|F|G>. If there is only one standard in the class, these commands are OPC-compatible.

CLASS11A S11A: S11 1-port, opens.

CLASS11B S11B: S11 1-port, shorts.

CLASS11C S11C: S11 1-port, loads.

CLASS22A S22A: S22 1-port, opens.

CLASS22B S22B: S22 1-port, shorts.

CLASS22C S22C: S22 1-port, loads.

These commands (all OPC- compatible) clear the indicated save/recall registers:

CLEA1 Clears save/recall register 1.

CLEA2 Clears save/recall register 2.

CLEA3 Clears save/recall register 3.

CLEA4 Clears save/recall register 4.

CLEA5 Clears save/recall register 5.

CLEAL Clears the limit line list. Should be preceded by EDITLIML.

CLEARALL Clears all the save/recall registers. OPC-compatible.

CLEABIT[D] Clears the specified bit on the GPIO.

CLEAREG<I> Clears save/recall registers 01 through 31. CLEAREG01 through CLEAREG05 are the same as CLEA1 through CLEA5. OPC-compatible.

These commands clear the sequence from the internal registers:

CLESEQ1	Sequence 1.
CLESEQ2	Sequence 2.
CLESEQ3	Sequence 3.
CLESEQ4	Sequence 4.
CLESEQ5	Sequence 5.
CLESEQ6	Sequence 6.

CLEL	Clears the currently selected list. This could be a frequency list, power loss list, or limit test list.
CLES	Clears the status register, the event-status registers, and the enable registers.
CLS	Same as CLES.
COAD	Selects coaxial electrical delay. See also WAVD.
COAX	Selects coaxial offsets instead of waveguide while defining a standard during a cal kit modification.

These commands select the indicated display feature for color modification:

COLOCH1D	Channel 1 data and limit lines.
COLOCH1M	Channel 1 memory.
COLOCH2D	Channel 2 data and limit lines.
COLOCH2M	Channel 2 memory.
COLOGRAT	Graticule.
COLOTEXT	Text.
COLOWARN	Warning.
COLOR[D]	Adjusts the color saturation for the selected display feature.
CONS	Continues the paused sequence.

CONT Continuous sweep trigger mode.

These 6 commands convert the S-parameter data to:

CONV1DS Inverted S-parameters.

CONVOFF Conversion OFF.

CONVYREF Y:reflection.

CONVYTRA Y:transmission.

CONVZREF Z:reflection.

CONVZTRA Z:transmission.

COPYFRFT Copies labels from file titles.

COPYFRRT Copies labels from register titles.

CORI<ON|OFF> Turns interpolative error correction ON and OFF.

CORR<ON|OFF> Turns error correction ON and OFF.

COUC<ON|OFF> Couples and uncouples the stimulus between the channels.

COUP<ON|OFF> Couple the power when coupled channels is turned OFF, COUCOFF.

CSWI<ON|OFF> Selects test set continuous switching (ON) or test set hold (OFF) when there is a 2-port calibration active. Continuous switching is allowed only when the power ranges on both attenuator ports are set the same. When continuous switching is ON, the analyzer measures all four S-parameters each time before displaying the data for a full 2-port cal measurement. In test set hold mode, the analyzer measures all four S-parameters once and then measures the desired parameter continuously. This is known as a fast 2-port cal measurement and it is less accurate than a full 2-port calibrated measurement.

CWFREQ[D]	Sets the CW frequency for power sweep and CW frequency modes. While the list frequency table segment is being edited, it sets the center frequency of the current segment.
CWTIME	Selects the CW time sweep type.
D1DIVD2<ON OFF>	This command divides the data in channel 2 by the data in channel 1 and displays the result on channel 2. Dual display must be on (DUALCON \dagger).
DATI	Stores trace in channel memory. OPC-compatible.
DCONV	Selects down converter for mixer measurements.
DEBU<ON OFF>	Turns the HP-IB debug mode ON and OFF. When ON, the analyzer scrolls incoming HP-IB commands across the display.
DECRLOOC	Decrements the sequencing loop counter by 1.
DEFC	Sets the default colors for all display features.
DEFLPRINT	Sets the printer to the following default setup conditions:

Print	Monochrome
Auto-feed	On
Print Colors:	
Ch 1 Data	Magenta
Ch 1 Memory	Green
Ch 2 Data	Blue
Ch 2 Memory	Red
Graticule	Cyan
Warning	Black
Text	Black

DEFLTCPIO

Sets up the following default state for copy. There is no equivalent front-panel key.

Plotter Type:	PLOTTER	Printer Type:	DESKJET
Plotter Port:	SERIAL	Printer Port:	PARALLEL
Baud Rate:	9600	Baud Rate:	19200
Handshake:	Xon-Xoff	Handshake:	Xon-Xoff
HP-IB Address:	5	HP-IB Address:	1

Parallel Port: COPY

DEFS[D]

Begins standard definition during cal kit modification. D is the standard number.

DELA

Displays the data formatted as group delay.

DELO

Turns the delta marker mode OFF.

These 6 commands make the indicated marker the delta reference:

DELR1	Marker 1.
DELR2	Marker 2.
DELR3	Marker 3.
DELR4	Marker 4.
DELR5	Marker 5.
DELRFXM	Fixed marker.

DEMOAMPL

Turns on transform demodulation and sets the transform demodulation to amplitude demodulation. Only has a meaningful effect with a CW time transform.

DEMOOFF

Turns the transform demodulation function OFF.

DEMOPHAS

Sets the transform demodulation to phase demodulation. Only has a meaningful effect with a CW time transform.

DFLT	Sets the plotter to the following default setup conditions.			
	Plot Data	On	Pen Number:	
	Plot Mem	On	Data	2
	Plot Grat	On	Memory	5
	Plot Text	On	Graticule	1
	Plot Mkr	On	Text	7
	Auto-feed	On	Marker	7
	Scale Plot	Full	Line Type:	
	Plot Speed	Fast	Data	7
			Memory	7

DIRS[D] Sets the number of files in the directory at disk initialization. LIF only.

DISCUNIT[D] Specifies which disk in an external multiple-disk drive to be used for save/recall.

DISCVOLU[D] Specifies which volume of an external multiple-volume disk drive to be used for save/recall.

DISM<ON|OFF> When on, displays the response and stimulus values for all markers that are turned on; when off, only the active marker's value is displayed.

These 6 commands display the indicated combinations of data and trace memory on the active channel:

DISPDATA	Data only.
DISPDATM	Data and memory.
DISPDDM	Data divided by memory (linear division, log subtraction).
DISPDMM	Data minus memory (linear subtraction).
DISPMEMO	Memory only.
DIVI	Same as DISPDDM.

DONE	Done with a class of standards, during a calibration. Only needed when multiple standards are measured to complete the class.
DONM	Done modifying a test sequence.
DOSEQ<I>	Begins execution of the selected sequence. I = 1 to 6.
DOWN	Decrements the value in the active entry area (down key).
DUAC<ON OFF>	Dual channel display ON or OFF.
DUPLSEQ[X]SEQ[Y]	Duplicates sequence X to sequence Y. X, Y = 1 to 6.
EDITDONE	Done editing list frequency or limit table.
EDITLIML	Begins editing limit table.
EDITLIST	Begins editing list frequency table.
ELED[D]	Sets the electrical delay offset.
EMIB	Send out a beep during a sequence.
ENTO	Turns the active entry area OFF.
ESB?	Outputs event-status register B.
ESE[D]	Enables the selected event-status register bits to be summarized by bit 5 in the status byte. An event-status register bit is enabled when the corresponding bit in the operand D is set.
ESNB[D]	Enables the selected event-status register B bits to be summarized by bit 2 of the status byte. A bit is enabled in the register when the corresponding bit in the operand D is set.
ESR?	Outputs the value of the event-status register.
EXTD	Selects the external disk as the active storage device.

These commands include the indicated information when a register is stored on disk. See Figure 1-3, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for data types:

EXTMDATA<ON OFF>	Adds error corrected data (real and imaginary pairs) along with the other files.
EXTMDATO<ON OFF>	Error corrected data array only (real and imaginary pairs).
EXTMFORM<ON OFF>	Formatted trace data. Uses currently selected format for data.
EXTMGRAP<ON OFF>	User graphics.
EXTMRAW<ON OFF>	Raw data arrays (real and imaginary pairs).
EXTTHIGH	Sets the external trigger line high.
EXTTLOW	Sets the external trigger line low.
EXTTOFF	Deactivates the external trigger mode. OPC- compatible.
EXTTON	Activates the external trigger mode. OPC- compatible.
EXTTPOIN	Sets the external trigger to auto trigger on point. OPC- compatible.
EXTRCHAN<ON OFF>	Sets the internal phase lock reference selection switch on or off. This allows the analyzer to receive its R channel input through the R CHANNEL IN port or from its own internal source.
FIXE	Specifies a fixed load, as opposed to a sliding load or offset load, when defining a standard during a cal kit modification.

These 5 commands set the data format for array transfers in and out of the instrument:

FORM1	HP 8719D/20D/22D internal format. Preceded by 4 byte header.
FORM2	32 bit floating point format. Preceded by 4 byte header.
FORM3	64 bit floating point format. Preceded by 4 byte header.
FORM4	ASCII format. No header.
FORM5	32 bit floating point PC format. Bytes reversed. Preceded by 4 byte header.

These commands define the format to use on disk initializations:

FORMATDOS	Selects DOS as the disk format.
FORMATLIF	Selects LIF as the disk format.

FREQOFFS<ON OFF>	Activates the frequency offset instrument mode. OPC- compatible.
FREQO	Frequency blank. Turns OFF frequency notation.
FRER	HP-IB free run. Acts the same as CONT; .
FULP	Selects full page plotting, as opposed to plotting in one of the four quadrants.

These 3 commands select a forward calibration class, during a 2-port calibration sequence. They are OPC-compatible if there is only one standard in the class:

FWDI	Isolation.
FWDM	Match.
FWDT	Transmission.

These 5 commands control the time domain gate:

GATECENT[D]	Center time.
GATEO<ON OFF>	Gate ON/OFF. OPC-compatible.
GATESPAN[D]	Span time.
GATESTAR[D]	Start time.
GATESTOP[D]	Stop time.

These 4 commands set the gate shape:

GATSMAXI	Maximum.
GATSMINI	Minimum.
GATSNORM	Normal.
GATSWIDE	Wide.

GOSUB<I> Invokes a sequence as a subroutine. I = 1 to 6.

HOLD Puts the sweep trigger into hold.

IDN? Outputs the identification string:
HEWLETT PACKARD, 87NND, 0, X.XX,
where 87NND is the model number of
the instrument and X.XX is the firmware
revision of the instrument.

These 7 commands branch an executing sequence to a new sequence if the following condition is satisfied.

IFBIHIGH	Tests the specified input GPIO bit (see PARAIN[D]). If high, invokes the sequence which follows.
IFBILOW	Tests the specified input GPIO bit (see PARAIN[D]). If low, invokes the sequence which follows.
IFBW[D]	Sets the IF bandwidth.
IFLCEQZSEQ<I>	If loop counter equals zero, then do the sequence that follows.
IFLCNEZSEQ<I>	If loop counter does not equal zero, then do the sequence that follows.
IFLTFAILSEQ<I>	If limit test fails, then do sequence that follows.
IFLTPASSEQ<I>	If limit test passes, then do sequence that follows.
IMAG	Selects the imaginary display format.
INCRLOOC	Increments the sequencing loop counter by 1.
INID	Initializes the internal disk. All previous information on the disk will be destroyed.
INIE	Initializes the external disk. All previous information on the disk will be destroyed. Requires pass control when using the HP-IB port.

These commands input an individual error coefficient array. Before sending an array, issue a `CAL IXXXX;` command, where `XXXX` specifies the calibration type of the data. Then input the array or arrays. Lastly store the data with `SAVE;`. The instrument goes into hold, displaying uncorrected data. Complete the process by triggering a sweep. See Table 1-7, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for the contents of the different arrays.

INPUCALC01[D]	Array 1.
INPUCALC02[D]	Array 2.
INPUCALC03[D]	Array 3.
INPUCALC04[D]	Array 4.
INPUCALC05[D]	Array 5.
INPUCALC06[D]	Array 6.
INPUCALC07[D]	Array 7.
INPUCALC08[D]	Array 8.
INPUCALC09[D]	Array 9.
INPUCALC10[D]	Array 10.
INPUCALC11[D]	Array 11.
INPUCALC12[D]	Array 12.
INPUCALK[D]	Inputs a cal kit read out with <code>OUTCALK;</code> . After the transfer, the data should be saved into the user cal kit area with <code>SAVEUSEK;</code> .
INPUDATA[D]	Inputs an error corrected data array, using the current setting of the <code>FORM</code> command.
INPUFORM[D]	Inputs a formatted data array, using current the current setting of the <code>FORM</code> command.
INPULEAS[D]	Inputs a learn string read out by <code>OUTPLEAS;</code> .

These commands input power meter calibration arrays into the instrument. Values should be entered as $100 \times$ power meter reading in dB.

INPUPMCAL1	Channel 1.
INPUPMCAL2	Channel 2.

These commands input a raw data array using the current format. See OUTPRAW<I> for the meaning of the arrays. The instrument stops sweeping, error corrects the data, then formats and displays the data.

INPURAW1[D] Array 1.

INPURAW2[D] Array 2.

INPURAW3[D] Array 3.

INPURAW4[D] Array 4.

These commands select the instrument mode. They are all OPC-compatible.:

INSMNETA Standard network analyzer.
OPC-compatible.

INSMTUNR Tuned receiver. OPC-compatible.

INTD Selects the internal disk as the active storage device.

INTE[D] Sets the display intensity, 50 to 100 percent.

INTM Selects the internal memory for save/recall.

ISOD Done with isolation subsequence in a 2-port calibration. OPC-compatible.

ISOL Begins the isolation subsequence step in a 2-port calibration.

ISOOP Selects isolation for one path, two port calibration.

KEY[D] Sends a keycode, equivalent to actually pressing the key. It does not matter if the front-panel is in remote mode. See Figure 1-5, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for the key codes.

KITD Calibration kit done This is the last step in modifying a cal kit.

KOR? Outputs last key code or knob count. If the reply is positive, it is a key code. If it is negative, then set bit 15 equal to bit 14, and the resulting two byte integer is the RPG knob count. It can be either positive or negative. There are about 120 counts per turn.

These commands enter labels for the standard classes during a cal kit modification:

LABEFWDM[\$]	Forward match.
LABEFWDT[\$]	Forward transmission.
LABERESI[\$]	Response, response and isolation.
LABERESP[\$]	Response.
LABEREVM[\$]	Reverse match.
LABEREVT[\$]	Reverse transmission.
LABES11A[\$]	S11A (opens).
LABES11B[\$]	S11B (shorts).
LABES11C[\$]	S11C (loads).
LABES22A[\$]	S22A (opens).
LABES22B[\$]	S22B (shorts).
LABES22C[\$]	S22C (loads).
LABETRLI[\$]	TRL line or match.
LABETRLT[\$]	TRL thru.
LABETRLR[\$]	TRL reflect.
LABK[\$]	Enters a cal kit label during a cal kit modification.
LABS[\$]	Enters a standard's label during standard definition.
LEFL	Selects a plot in the left lower quadrant.
LEFU	Selects a plot in the left upper quadrant.
LIMIAMPO[D]	Enters the limit line amplitude offset.

LIMILINE<ON|OFF> Turns the display of the limit lines ON and OFF.

LIMMAOF Marker to limit offset. Centers the limit lines about the current marker position using the limit amplitude offset function.

LIMISTIO[D] Enters the stimulus offset of the limit lines.

LIMITEST<ON|OFF> Turns limit testing ON and OFF.

These 8 commands edit a limit test segment. The limit table editing is begun with **EDITLIML** ; , and a segment is brought up for editing with **SEDI N** ; or added using **SADD** ; . The segment is closed with **SDON** ; , the table is closed with **EDITDONE** ;

LIMD[D] Sets the limit delta value while editing a limit line segment.

LIML[D] Sets the lower limit value.

LIMM[D] Sets the middle limit value.

LIMS[D] Sets the limit stimulus break point.

LIMTFL Makes the segment a flat line.

LIMTSL Makes the segment a sloping line.

LIMTSP Makes the segment a single point.

LIMU[D] Set the upper limit value.

LINFREQ Selects a linear frequency sweep.

LINM Selects the linear magnitude display format.

LINTDATA[D] Enters the line type for plotting data.

LINTMEMO[D] Enters the line type for plotting memory.

LISFREQ Selects the list frequency sweep mode.

LISV Activates the list values function. The next page of values can be called with **NEXP;** and the previous page can be called with **PREP;**. The current page can be plotted or printed, in raster graphics mode, with **PLOT;**, or **PRINALL;** respectively. The entire L;”. (Since these commands may need to take control of an HP-IB peripheral, the system controller must have pass control capability.)

These 5 commands load the file from disk with the name indicated by the previous **TITF_n** command. The actual file loaded depends on the file title in the file position specified by the **TITF_n** command. Requires pass control mode.

LOAD1 Loads the file from disk using the file name provided by the preceding **TITF1;** command.

LOAD2 Loads the file from disk using the file name provided by the preceding **TITF2;** command.

LOAD3 Loads the file from disk using the file name provided by the preceding **TITF3;** command.

LOAD4 Loads the file from disk using the file name provided by the preceding **TITF4;** command.

LOAD5 Loads the file from disk using the file name provided by the preceding **TITF5;** command.

These 6 commands load the file from disk with the name indicated by the previous TITSEQn command. The actual file loaded depends on the file title in the file position specified in the TITSEQn command. Requires pass control mode.

LOADSEQ1 Loads sequence 1 from disk.

LOADSEQ2 Loads sequence 2 from disk.

LOADSEQ3 Loads sequence 3 from disk.

LOADSEQ4 Loads sequence 4 from disk.

LOADSEQ5 Loads sequence 5 from disk.

LOADSEQ6 Loads sequence 6 from disk.

LOAN Measures the load as not being offset when a standard has been defined as an offset load (see OFLS).

LOAO Measures the load as being offset when a standard has been defined as an offset load (see OFLS).

LOFREQ[D] Sets the local oscillator frequency for use in frequency offset mode.

LOGFREQ Selects a log frequency sweep.

LOGM Selects the log magnitude display format.

LOOC[D] Sets the value of the sequencing loop counter.

LOWPIMPU Turns ON the low pass impulse transform.

LOWPSTEP Turns ON the low pass step transform.

LRN? Same as OUTPLEAS (output learn string).

LRN[D] Same as INPULEAS (input learn string).

MANTRIG Sets the external trigger to manual trigger on point. OPC-compatible.

These commands make the indicated marker active and set its stimulus value:

MARK1[D]	Marker 1.
MARK2[D]	Marker 2.
MARK3[D]	Marker 3.
MARK4[D]	Marker 4.
MARK5[D]	Marker 5.
MARKBUCK[D]	Places the active marker on a specific sweep point (bucket). D is the bucket number, ranging from 0 to number of points less 1.
MARKCENT	Sets the center stimulus value to that of the active marker's stimulus value.
MARKCONT	Places the markers continuously on the trace, not on discrete points (interpolates the marker values between discrete points).
MARKCOUP	Couples the markers between the channels, as opposed to MARKUNCO.
MARKCW	Sets the CW frequency to the active marker's frequency.
MARKDELA	Sets electrical length so group delay is zero at the active marker's stimulus.
MARKDISC	Places the markers on the discrete measurement points.
MARKFAUV[D]	Sets the auxiliary value of the fixed marker position. Works in coordination with MARKFVAL and MARKFSTI.
MARKFSTI[D]	Sets the stimulus position of the fixed marker.
MARKFVAL[D]	Sets the value of the fixed marker position.
MARKMAXI	Same as SEAMAX (search for maximum on current channel's trace).

MARKMIDD	During a limit segment edit, makes the marker amplitude the limit segment middle value.
MARKMINI	Same as SEAMIN (search for minimum on current channel's trace).
MARKOFF	Turns all markers and marker functions OFF.
MARKREF	Sets the reference value to that of the active marker's amplitude.
MARKSPAN	Sets the span for the entire trace to that of the span between the active marker and the delta reference marker.
MARKSTAR	Sets the start stimulus to that of the active marker's.
MARKSTIM	During a limit segment edit, sets the limit stimulus break point to that of the active marker's.
MARKSTOP	Sets the stop stimulus to that of the active marker's.
MARKUNCO	Uncouples the markers between channels, as opposed to MARKCOUP.
MARKZERO	Places the fixed marker at the active marker position and makes it the delta reference.
MAXF[D]	Sets the maximum valid frequency of a standard being defined during a cal kit modification.
MEASA	Measures and displays input A on the active channel.
MEASB	Measures and displays input B on the active channel.
MEASR	Measures and displays input R on the active channel.
MEASTAT<ON OFF>	Turns trace statistics ON and OFF.

MENU<ON|OFF> Blanks the softkey menu. Use with caution, as this may give unusual results when setting up an instrument state. Recommend setting up states using MENU<ON> (default) and, when setup is complete, using MENU<OFF>.

These commands bring up the menu associated with the indicated front-panel key:

- MENUAVG** AVG
- MENUCAL** CAL
- MENUCOPY** COPY
- MENUDISP** DISPLAY
- MENUFORM** FORMAT
- MENUMARK** MARKER
- MENUMEAS** MEAS
- MENUMRKF** MARKER FCTN
- MENURECA** RECALL
- MENUSAVE** SAVE
- MENUSCAL** SCALE
- MENUSEQU** SEQUENCE
- MENUSTIM** STIMULUS MENU
- MENUSYST** SYSTEM

MINF[D] Sets the minimum valid frequency of a standard being defined during a cal kit modification.

MINU Displays data minus memory, the same as DISPDMM.

MINMAX<ON|OFF> Enables/disables min/max recording per segment. Min and max values are recorded per limit segment. Limit testing need not be active.

MODII	Begins the modify cal kit sequence.
MODS	Computes new cal set using adapter removal.
NEWSEQ<I>	Begins modifying a sequence.
NEXP	Displays the next page of the operating parameters list.
NOOP	No operation. OPC-compatible.
NUMG[D]	Activates D number of groups of sweeps. A group is whatever is needed to update the current parameter once. This function restarts averaging if ON. OPC-compatible.
NUMR[D]	Sets the number of power meter readings per point used during a power meter calibration.
OFFLD	Offset loads done.
OFLS	Selects the calibration standard load as being an offset load, as opposed to a sliding or fixed load, during a cal kit modification.
These 3 commands specify the offset value for the indicated parameter for a standard being defined during a cal kit modification:	
OFSD[D]	Delay offset.
OFSL[D]	Loss offset.
OFSZ[D]	Impedance offset.
OMII	Omits the isolation step of a calibration sequence.
OPC	Operation complete. Reports the completion of the next command received by setting bit 0 in the event-status register, or by replying to an interrogation if OPC? is issued.

OPEP	Presents a list of key operating parameters. NEXP ; calls the next page of parameters and the previous page can be called with PREP ; . Requesting a plot or print copies the current page. The current page can be plotted or printed, in raster graphics mode, with PLOT ; , or PRINALL ; respectively. The entire list can be printed, in ASCII text mode, with PRINTALL ; . Since these commands need to take control of an HP-IB peripheral, the system controller must have pass control capability.
OUTPACTI	Outputs the value of the active function, or the last active function if the active entry area is OFF.
OUTPAMAX	Outputs the max values for all limit line segments.
OUTPAMIN	Outputs the min values for all limit line segments.
OUTPAPER	Outputs the smoothing aperture in stimulus units, rather than as a percentage.

These 12 commands output an error correction array for the active calibration on the active channel. See Table 1-7, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for the contents of each array. Each array is output in the currently set form determined by the FORMn command. The data is in real/imaginary pairs, the same number of pairs as points in the sweep.

OUTPCALC01	Array 1.
OUTPCALC02	Array 2.
OUTPCALC03	Array 3.
OUTPCALC04	Array 4.
OUTPCALC05	Array 5.
OUTPCALC06	Array 6.
OUTPCALC07	Array 7.
OUTPCALC08	Array 8.
OUTPCALC09	Array 9.
OUTPCALC10	Array 10.
OUTPCALC11	Array 11.
OUTPCALC12	Array 12.

OUTPCALK Outputs the currently active calibration kit, as a less than 1000 byte string. The data is in FORM 1.

OUTPCHAN Outputs the active channel number.

OUTPDATA Outputs the error corrected data from the active channel. See Figure 1-3, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* and FORMn command.

OUTPDATF Fast data transfer command for OUTPDATA. =

OUTPDATP Outputs the trace data indexed by point (see SELPT[D]).

OUTPDATR Outputs the trace data for range of points (see SELMINPT[D], SELMAXPT[D]).

OUTPERRO	Outputs the oldest error message in the error queue. Sends first the error number, and then the error message itself as a string no longer than 50 characters.
OUTPFAIP	This command is similar to OUTPLIMF except that it reports the number of failures first, followed by the stimulus and trace values for each failed point in the test.
OUTPFORM	Outputs the formatted display data array from the active channel. See Table 1-3, located in Chapter 1 of the <i>HP 8719D/20D/22D Programmer's Guide</i> for the contents of the array as a function of display format. See also FORMn command.
OUTPFORF	Fast data transfer command for OUTPFORM.

These 12 commands output an interpolated error coefficient array for the active calibration on the active channel. See Table 1-8 for the contents of each array.

OUTPICAL01	Array 1.
OUTPICAL02	Array 2.
OUTPICAL03	Array 3.
OUTPICAL04	Array 4.
OUTPICAL05	Array 5.
OUTPICAL06	Array 6.
OUTPICAL07	Array 7.
OUTPICAL08	Array 8.
OUTPICAL09	Array 9.
OUTPICAL10	Array 10.
OUTPICAL11	Array 11.
OUTPICAL12	Array 12.

OUTPIDEN Outputs the identification string for the analyzer: HEWLETT
PACKARD, 87NND, 0, X.XX where 87NND is the model number of the instrument and X.XX is the firmware revision of the instrument.

These 2 commands output the interpolated power meter calibration arrays for channels 1 and 2.

OUTPIPMCL1 Channel 1.

OUTPIPMCL2 Channel 2.

OUTPKEY Outputs the key code of the last key pressed. An invalid key is reported with a 63, a knob turn with a -1. See Figure 1-5, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for the front-panel key codes.

OUTPLEAS Outputs the learn string, which contains the entire front panel state, the limit table, and the list frequency table. It is always in binary format not intended for decoding.

OUTPLIM1 Outputs the status of the limit test for channel 1.

OUTPLIM2 Outputs the status of the limit test for channel 2.

These 3 commands output the limit test results. The results consist of four fields. First is the stimulus value for the point. Second is an integer indicating test status. Third is the upper limit at that point. Fourth is the lower limit at that point. If there are no limits at that point, the third and fourth fields are zero. The test status is—1 for no test, 0 for fail, and 1 for pass.

OUTPLIMF	Outputs the limit test results for each failed point.
OUTPLIML	Outputs the limit test results for each point in the sweep. This is an ASCII transfer.
OUTPLIMM	Outputs the limit test results at the marker.
OUTPMARK	Outputs the marker values. The first two numbers are the marker response values, and the last is the stimulus value. See Table 1-3, located in Chapter 1 of the <i>HP 8719D/20D/22D Programmer's Guide</i> for the meaning of the response values as a function of display format.
OUTPMEMO	Outputs the memory trace from the active channel. The data is in real/imaginary pairs, and can be treated the same as data read with the OUTPDATA command.
OUTPMEMF	Fast data transfer command for OUTPMEMO.
OUTPMSTA	Outputs the marker statistics: mean, standard deviation, and peak-to-peak variation in that order. If statistics is not ON, it is turned ON to generate current values and turned OFF again. See also MEASTAT<ON OFF>.
OUTPMWID	Outputs the marker bandwidths search results: bandwidth, center, and Q in that order. If widths is not ON, it is turned ON to generate current values and turned OFF again.

OUTPMWIL	Performs the same operation as OUTPMWID plus appends the loss value as well.
OUTPOPTS	Outputs an ASCII string of the options installed.
OUTPPLOT	Outputs the plot string. Can be directed to a plotter, or read into the computer.

These commands output the power meter calibration array. Values should be entered as 100 times the power meter reading in dB. A default array is used if a power meter calibration sweep, TAKCS, has not been taken:

OUTPPMCAL1	Channel 1.
OUTPPMCAL2	Channel 2.

These 4 commands output the pre-raw measurement data. See Figure 1-3, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for the meaning of the data. Analogous to OUTPRAW except that pre-raw data has not had sampler correction nor attenuator offsets applied. These offsets are not necessary for data that will be fully error corrected. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer, located in Chapter 2 of the *HP 8719D/20D/22D Programmer's Guide*. The arrays hold S11, S21, S12, and S22, respectively:

OUTPPRE1	Array 1 (S11 data).
OUTPPRE2	Array 2 (S21 data).
OUTPPRE3	Array 3 (S12 data).
OUTPPRE4	Array 4 (S22 data).

OUTPPRIN	Outputs a raster dump of the display, intended for a graphics printer.
OUTPPRNALL	Outputs all of the List Values or Operating Parameters in text mode. Activate the desired function by preceding with LISV or OPEP, respectively.

These 5 commands output the raw measurement data. See Figure 1-3, located in Chapter 1 of the *HP 8719D/20D/22D Programmer's Guide* for the meaning of the data. Normally, array 1 holds the current parameter. If a 2-port calibration is active, the arrays hold S11, S21, S12, and S22, respectively:

OUTPRAF<I>	Fast data transfer command for OUTPRAW<I>.
OUTPRAW1	Array 1.
OUTPRAW2	Array 2.
OUTPRAW3	Array 3.
OUTPRAW4	Array 4.
OUTPSEGAf	Outputs the segment number and it's limit test status for all active segments.
OUTPSEGAM	Outputs the limit test min/max for all segments. Outputs the segment number, max stimulus, max value, min stimulus, min value for all active segments.
OUTPSEGF	Outputs the limit test status for a specified segment. See SELSEG[D].
OUTPSEGM	Outputs limit test min/max for a specified segment. See SELSEG[D].
OUTPSEQ<I>	Outputs I's sequence listing. I = 1 to 6.
OUTPSERN	Outputs the serial number of the analyzer.
OUTPSTAT	Outputs the status byte.
OUTPTITL	Outputs the display title.
PARAIN[D]	Specify the input GPIO bit to be used by IFBIHIGH and IFBILOW tests.
PARAL<GPIO CPY>	Selects use of the parallel port: for general purpose I/O or for the copy function.

PARAOUT[D]	Programs all GPIO output bits (0 to 255) at once.
PAUS	Inserts a pause into a sequence.
PCB[D]	Same as ADDRCONT. Indicates where control will be returned after a pass control.

These 7 commands select the color for printing the indicated display feature where <COLOR> is one of the following colors: white, cyan, magenta, blue, yellow, green, red, or black.

PCOLDATA1<COLOR>	Channel 1 data.
PCOLDATA2<COLOR>	Channel 2 data.
PCOLMEMO1<COLOR>	Channel 1 memory.
PCOLMEMO2<COLOR>	Channel 2 memory.
PCOLGRAT<COLOR>	Graticule.
PCOLTEXT<COLOR>	Displays text.
PCOLWARN<COLOR>	Warning text.
PDATA<ON OFF>	Selects whether trace data is plotted.

These 5 commands select the pen (value for D) for plotting the indicated display feature for the active channel:

PENNDATA[D]	Data trace.
PENNGRAT[D]	Graticule.
PENNMARK[D]	Markers and marker text.
PENNMEMO[D]	Memory trace.
PENNTTEXT[D]	Text and user graphics.
PGRAT<ON OFF>	Selects whether the graticule is plotted.
PHAO[D]	Sets the phase offset.
PHAS	Selects the phase display format.

PLOS<SLOW FAST>	Selects the pen speed for plotting. (Slow is useful for transparency plotting.)
PLOT	Initiates a plot.
PLTHNDSHK<XON DTR>	Selects the plotter handshake mode as either Xon-Xoff or DTR-DSR.
PLTPRTDISK	Sets the plotter port to disk (either internal disk or external disk).
PLTPRTHPIB	Sets the plotter port to HP-IB.
PLTPRTPARA	Sets the plotter port to parallel.
PLTPRTSERI	Sets the plotter port to serial.
PLTTRAUTF<ON OFF>	Turns ON and OFF the plotter auto feed.
PLTTRBAUD[D]	Sets the plotter baud rate.
PLTTRFORF	Sends a form feed to the plotter.
PLTTYHPGL	Selects HP-GL compatible <i>printer</i> as the plotter type.
PLTTYPLTR	Selects <i>plotter</i> as the plotter type.
PMEM<ON OFF>	Selects whether memory is plotted.
PMKR<ON OFF>	Selects whether markers are plotted.
PMTRTTIT	Reads value from power meter or peripheral at the power meter's HP-IB address into title string.
POIN[D]	Sets the number of points in the sweep.
POLA	Selects the polar display format.
These 3 commands select the marker readout format for polar display:	
POLMLIN	Linear markers.
POLMLOG	Log markers.
POLMRI	Real/imaginary markers.

PORE<ON|OFF> Turn port extensions ON and OFF.

These 4 commands set the port extension length for the indicated port or input. Ports 1 and 2 refer to the test set ports:

PORT1[D] Port 1.

PORT2[D] Port 2.

PORTA[D] Input A.

PORTB[D] Input B.

PORTP<CPLD|UNCPLD> Selects either coupled or uncoupled for the port powers for a given channel.

PORTR[D] Same as PORT1.

PORTT[D] Same as PORT2.

POWE[D] Sets the output power level. See also PWRR<PAUTO/PMAN>.

POWLFREQ[D] Selects the frequency for which a power loss correction is entered. This must be followed by a POWLLOSS[D], which sets the value.

POWLLIST Begins editing a power loss list for a power meter calibration.

POWLLOSS[D] Sets the loss value for a particular frequency, set by POWLFREQ[D], in the power loss list.

POWM<ON|OFF> Designates whether the HP 436A (ON) or the HP 437B/438A (OFF) is to be used as the power meter.

POWR<I> Selects power ranges 00 to 11 when in manual power range.

POWS Selects power sweep, from the sweep type menu.

POWT<ON|OFF> Trip power (set maximum attenuation) ON or OFF.

PRAN<I>	Selects power ranges 01 to 12 when in manual power range.
PREP	Displays the previous page of the operating parameters list.
PRES	Presets the analyzer to the factory preset state. OPC-compatible.
PRIC	Selects color print (as opposed to monochrome; see also PRIS).
PRINALL	Copies the display, in raster graphics mode, to a printer.
PRINSEQ<I>	Begins printing the sequence selected.
PRINTALL	Prints all list values or operating and marker parameters in ASCII text mode.
PRIS	Selects standard (monochrome) print.
PRNHNSHK<XON DTR>	Selects the printer handshake mode as either Xon-Xoff or DTR-DSR.
PRNPRTHPIB	Sets the printer port to HP-IB.
PRNPRTPARA	Sets the printer port to parallel.
PRNPRTSERI	Sets the printer port to serial.
PRNTRAUTF<ON OFF>	Turns ON and OFF the printer auto feed.
PRNTRBAUD[D]	Sets the printer baud rate.
PENTRFORF	Sends a form feed to the printer.
PENTYP540	Selects the DeskJet 540 or 850C printer as the printer type.
PRNTYPDJ	Selects the DeskJet printer as the printer type.
PRNTYPEP	Selects the Epson ESC/P2 printer control language-compatible printer as the printer type.

PRNTYPLJ	Selects the LaserJet printer as the printer type.
PRNTYPPJ	Selects the PaintJet printer as the printer type.
PRNTYPTJ	Selects the ThinkJet printer as the printer type.
PSOFT<ON OFF>	Controls whether softkeys are included in the hardcopy print or plot.
PTEXT<ON OFF>	Selects whether text is plotted.
PTOS	Pauses the sequence to be followed by selection one of the 6 sequences (SEQ<I>).

These 5 commands purge the indicated file from disk. Requires pass control mode when using an external disk drive.

PURG1	File 1.
PURG2	File 2.
PURG3	File 3.
PURG4	File 4.
PURG5	File 5.

These 3 commands select the type of power meter calibration desired. A calibration sweep should be taken (TAKCS) after selecting a "one sweep" Power meter calibration, to ensure a valid calibration. No calibration sweep is needed for "each sweep" power meter calibrations.

PWMCEACS[D]	Each sweep.
PWMCOFF[D]	Off.
PWMCONES[D]	One sweep.

PWRLOSS<ON OFF>	Selects whether or not to use the power loss table for a power meter calibration.
PWRMCAL	Displays the power meter cal menu and sets the drive port cal power.

PWRR<PAUTO PMAN>	Select the power range auto or manual mode.
Q<I>	Same as SEQ<I>.
RAID	Completes the response and isolation cal sequence. OPC-compatible.
RAISOL	Calls the isolation class for the response and isolation calibration.
RAIRESP	Calls the response class for the response and isolation calibration.
RAWOFFS<ON OFF>	Selects whether sampler and attenuator offsets are ON or OFF. By selecting raw offsets OFF, a full two port error correction can be performed without including the effects of the offsets. It also saves substantial time at recalls and during frequency changes. Raw offsets follow the channel coupling. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer, located in Chapter 2 of the <i>HP 8719D/20D/22D Programmer's Guide</i> .
READDATE	Outputs the date in the following string format: DD MMM YYYY. HP-IB only command.
READTIME	Outputs the time in the following string format: HH:MM:SS. HP-IB only command.
REAL	Selects the real display format.
RECO	Recalls previously saved display colors.

These 6 commands (OPC-compatible) recall the indicated internal register.

RECA1	Register 1.
RECA2	Register 2.
RECA3	Register 3.
RECA4	Register 4.
RECA5	Register 5.
RECAREG<I>	Recalls save/recall registers 01 through 31. RECAREG01 through RECAREG05 are the same as RECA1 through RECA5. OPC-compatible.
REFD	Completes the reflection calibration subsequence of a 2-port calibration. OPC-compatible.
REFL	Begins the reflection calibration subsequence of a 2-port calibration.
REFOP	Begins the reflection calibration subsequence for one path, two port calibration.
REFP[D]	Enters the reference position. 0 is the bottom, 10 is the top of the graticule.
REFT	Recalls file titles from disk.
REFV[D]	Enters the reference line value.
REIC[D]	Sets the power level reference value for a receiver calibration.
RESC	Resume cal sequence.
RESD	Restores the measurement display after viewing the operating parameters or list values.
RESPDONE	Completes the response calibration sequence. OPC-compatible.

REST	Measurement restart.
RETP<ON OFF>	Switches retrace power on or off.
These commands (OPC-compatible) call the reverse calibration classes, during a full 2-port calibration.	
REVI	Isolation.
REVM	Match.
REVT	Transmission.
These 2 commands are used in frequency offset mode (Option 089) measurements.	
RFGTLO	Sets RF greater than LO.
RFLTLO	Sets RF less than LO.
RFLP	Same as S11;
RIGL	Selects a plot in the lower right quadrant.
RIGU	Selects a plot in the upper right quadrant.
RSCO	Resets display colors to the factory default.
RST	Presets the instrument. OPC-compatible.

These 4 commands select the S-parameter for the active channel:

- S11**
- S12**
- S21**
- S22**

SADD	During either a list frequency or limit table edit, adds a new segment to the table.
-------------	--

SAV1	Completes the 1-port calibration sequence. OPC-compatible.
SAV2	Completes the 2-port calibration sequence. OPC-compatible.
SAVC	Completes the transfer of error correction coefficients back into the instrument. OPC-compatible.

These 6 commands (OPC-compatible) store the current instrument state in the indicated internal register.

SAVE1	Register 1.
SAVE2	Register 2.
SAVE3	Register 3.
SAVE4	Register 4.
SAVE5	Register 5.
SAVEREG<I>	Saves to save/recall registers 01 through 31. SAVEREG01 through SAVEREG05 are the same as SAVE1 through SAVE5. OPC-compatible.

SAVT	Completes the TRL/LRM calibration sequence. OPC-compatible.
-------------	--

The 2 following commands define the format for saving files to disk.

SAVUASCI	Selects ASCII format for saving to disk. Conforms to CITIFile specifications.
SAVUBINA	Selects binary format for saving to disk.

SAVEUSEK	Stores the active calibration kit as the user kit.
-----------------	---

SCAL[D]	Sets the trace scale factor.
----------------	------------------------------

SCAP<FULL GRAT>	Selects a full plot, or a plot where the graticule is expanded to the plotter's P1 and P2.
------------------------------	--

SDEL	During either a list frequency, a limit table edit, or power loss list, deletes the current segment.
SDON	During either a list frequency, a limit table edit, or power loss list, closes a segment after editing.

These 6 commands control the marker searches. The marker searches place the active marker according to the indicated search criteria. The search is continuously updated if tracking is ON (see TRACK):

SEAL	Search left for next occurrence of the target value.
SEAMAX	Search for trace maximum on the current channel.
SEAMIN	Search for trace minimum on the current channel.
SEAOFF	Turns the marker search OFF.
SEAR	Search right for next occurrence of the target value.
SEATARG[D]	Set the search target amplitude.

SEDI[D]	During either a frequency, limit, or power loss table edit, selects segment D for editing.
----------------	--

SELL[D]	<p>Selects the learn string revision (LRN) or OUTPLEAS, INPULEAS to be used by the analyzer. The valid parameters are:</p> <p>0: Defaults to current revision.</p> <p>201: Revision 8720A 2.01</p> <p>612: Revision 8720A 6.12</p>
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SELMAXPT[D]	Selects the last point number in the range of points that the OUTPDATR command will report. D can range from 0 to the number of points minus 1.
--------------------	---

SELMINPT[D]	Selects the first point number in the range of points that the OUTPDATR command will report. D can range from 0 to the number of points minus 1.
SELPT[D]	Selects the point number that the OUTPDATR command will report. D can range from 0 to the number of points minus 1.
SELSEG[D]	Selects the segment number to report on for the OUTPSEGF and OUTPSEGM commands. D can range from 1 to 18.
SEQ<I>	Selects sequence 1 through 6.
SEQWAIT[D]	Tells the instrument to wait D seconds during a sequence.
SETBIT[D]	Sets the specified bit (0 to 7) on the GPIO.
SETDATE[\$]	Sets the date in the following format: DD MMM YYYY, where DD is the day and must be 2 digits, MMM is the month and must be three alpha characters (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC), and YYYY is the year and must be 4 digits.
SETF	Set frequency for low pass transform, Option 010.
SETRTHRU	Set reference thru.
SETRREFL	Set reference reflect.
SETTIME[\$]	Sets the time in the following format: HH:MM:SS, where HH is the hour, MM is minutes, SS is seconds, and each must be 2 digits.
SETZ[D]	Set the characteristic impedance of the measurement system.
SHOM	Displays the desired softkey menu during a sequence.
SING	Single sweep. OPC-compatible.

SLID	Sliding load done.
SLIL	Specifies the standard as a sliding load during a standard definition as part of a cal kit modification, as opposed to a fixed or offset load.
SLIS	Sliding load set. OPC-compatible.
SMIC	Select Smith chart display format.
The following commands select the marker readout format on a Smith chart:	
SMIMGB	$G + jB$ (conductance and susceptance).
SMIMLIN	Linear magnitude.
SMIMLOG	Log magnitude.
SMIMRI	Real/imaginary pairs (resistance and reactance).
SMIMRX	$R + jX$.
SMOOAPER[D]	Sets the smoothing aperture as a percent of the trace.
SMOOO<ON OFF>	Turns smoothing ON and OFF.
SOFR	Displays the firmware revision on the screen.

The following 8 commands act as though the indicated soft key was pressed:

SOFT1 Softkey 1.

SOFT2 Softkey 2.

SOFT3 Softkey 3.

SOFT4 Softkey 4.

SOFT5 Softkey 5.

SOFT6 Softkey 6.

SOFT7 Softkey 7.

SOFT8 Softkey 8.

SOUP<ON|OFF> Turns the source power ON and OFF.

SPAN[D] Sets the stimulus span. If a list frequency segment is being edited, sets the span of the segment.

The following commands initiate the **SPECIFY CLASS** part of modifying a cal kit. After issuing each command, send the analyzer a series of standard numbers to be included in the class. When the class is full, send **CLAD;** to terminate the specification.

SPECFWDM[I]	Forward match.
SPECFWDT[I]	Forward transmission.
SPECRESP[I]	Response.
SPECRESI[I]	For Resp & Isol, specifies the response standards.
SPECREVM[I]	Reverse match.
SPECREVT[I]	Reverse transmission.
SPECS11A[I]	S11A.
SPECS11B[I]	S11B.
SPECS11C[I]	S11C.
SPECS22A[I]	S22A.
SPECS22B[I]	S22B.
SPECS22C[I]	S22C.
SPECTRLI[I]	TRL Line or Match.
SPECTRLT[I]	TRL Thru.
SPECTRLR[I]	TRL Reflect.
SPEG	Displays the specify gate menu. See also DUAC.
SPLD<ON OFF>	Turns the split display mode ON and OFF.

SRE[D]	Service request enable. A bit set in D enables the corresponding bit in the status byte to generate an SRQ.
SSEG[D]	Selects the desired segment of the frequency list for a list frequency sweep. See also ASEG.
STB?	Outputs the status byte. Same as OUTPSTAT.

The following 7 commands (OPC compatible) select a standard from a class during a calibration sequence. If a class is requested, as in CLASS11A (S11 1-port cal) the analyzer will do one of two things. If there is only one standard in the class, it will measure that standard automatically. If there are several standards in the class, then one of the following commands must be used to select one of these standards, causing it to be measured.

STANA	Standard listed under softkey 1.
STANB	Standard listed under softkey 2.
STANC	Standard listed under softkey 3.
STAND	Standard listed under softkey 4.
STANE	Standard listed under softkey 5.
STANF	Standard listed under softkey 6.
STANG	Standard listed under softkey 7.

STAR[D]	Enters the start stimulus value. If a list frequency segment is being edited, sets the start of the segment.
STDD	Standard done, terminating a define standard sequence, while modifying a cal kit.

The following 5 commands select the standard “type” after the standard number has been entered during a modify cal kit sequence:

STD TARBI	Arbitrary impedance.
STD TDELA	Delay/thru.
STD TLOAD	Load.
STD TOPEN	Open.
STD TSHOR	Short.

STEP SWP<ON OFF>	Step sweep on or off.
STOP[D]	Sets the stimulus stop value. If a list frequency segment is being edited, sets the stop of the segment.

These 5 commands store the indicated file on disk. Used with the INTD and EXTD commands to designate the internal or external disk.

STOR1	Stores the current instrument state to disk using the file name provided by the preceding TITF1; command.
STOR2	Stores the current instrument state to disk using the file name provided by the preceding TITF2; command.
STOR3	Stores the current instrument state to disk using the file name provided by the preceding TITF3; command.
STOR4	Stores the current instrument state to disk using the file name provided by the preceding TITF4; command.
STOR5	Stores the current instrument state to disk using the file name provided by the preceding TITF5; command.

These commands store the instrument state to the indicated sequence to disk. Used with the INTD and EXTD commands to designate the internal or external disk. Requires pass control mode when using the HP-IB port.

STORSEQ1	Sequence 1.
STORSEQ2	Sequence 2.
STORSEQ3	Sequence 3.
STORSEQ4	Sequence 4.
STORSEQ5	Sequence 5.
STORSEQ6	Sequence 6.

STPSIZE[D]	While editing a list frequency segment, sets step size.
-------------------	---

SVCO	Saves display colors.
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SWEA	Automatically selects the fastest sweep time based on the current analyzer settings for number of points, IF bandwidth, sweep mode, averaging condition and frequency span.
-------------	---

SWET[D]	Sets the sweep time.
----------------	----------------------

SWPSTART	This OPC-compatible command initiates a sweep and immediately releases the HP-IB bus, allowing the analyzer to initiate data output as soon as the appropriate data is ready. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer, located in Chapter 2 of the <i>HP 8719D/20D/22D Programmer's Guide</i> .
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SWR	Selects the SWR display format.
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TAKCS	Begins a power meter calibration sweep.
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TAKE4<ON OFF>	This command initiates a mode in which every measurement cycle is characterized by sweeping in both the forward and reverse directions and collecting raw data for all four S-parameters. The sweeping can occur when a SWPSTART or SING command is received or when the analyzer is in continuous, number of groups, or external trigger mode. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer, located in Chapter 2 of the <i>HP 8719D/20D/22D Programmer's Guide</i> .
TAKRS	Take receiver calibration sweep.
TALKLIST	Puts the analyzer in talker listener mode.
TERI[D]	Specifies the terminal impedance of an arbitrary impedance standard during a cal kit modification.
TESS?	Query testset. Returns a one on the standard analyzer. This command is compatible with the HP 8753D.
TIMDTRAN<ON OFF>	Turns the time domain transform ON and OFF. (Option 010). OPC-compatible.
TIMESTAM<ON OFF>	Turns on the clock time for prints and plots.
TITF0<I>[\$]	Titles the SAVE STATE filename, only in sequence mode.
TINT[D]	Adjusts the tint for the selected display feature.

These commands title the indicated file numbers:

TITF1[\$]	File 1.
TITF2[\$]	File 2.
TITF3[\$]	File 3.
TITF4[\$]	File 4.
TITF5[\$]	File 5.
TITL[\$]	Enters a new display title. A maximum of 50 characters are allowed.
TITP[\$]	Titles the plot to disk file.

These commands title the indicated internal register:

TITR1[\$]	Register 1.
TITR2[\$]	Register 2.
TITR3[\$]	Register 3.
TITR4[\$]	Register 4.
TITR5[\$]	Register 5.
TITREG<I>[\$]	Titles save/recall registers 01 through 31. TITREG01 through TITREG05 are the same as TITR1 through TITR5.

TITSEQ<I>[\$]	Selects the sequence to be titled. I = 1 to 6.
TITSQ	Provides access to the sequence title functions.
TITTMEM	Sends the title string to trace memory.
TITTPMTR	Sends the title string to the power meter's HP-IB address.
TITTPERI	Sends the title string to the peripheral address.

TITTPRIN	Sends the title string to the printer's HP-IB address.
TRACK<ON OFF>	Turns marker search tracking ON and OFF.
TRAD	Completes the transmission calibration subsequence of a 2-port calibration. OPC-compatible.
TRAN	Begins the transmission calibration subsequence of a 2-port calibration.
TRAOP	Begins the transmission calibration subsequence for one path, two port calibration.
TRAP	Same as S21.
TRIG	HP-IB trigger.
TRLL1	Measures TRL Line/match for Port 1 during a TRL/LRM 2-port calibration.
TRLL2	Measures TRL Line/match for Port 2 during a TRL/LRM 2-port calibration.
TRLR1	Measures TRL S11 reflect during a TRL/LRM 2-port calibration.
TRLR2	Measures TRL S22 reflect during a TRL/LRM 2-port calibration.
TRLT	Measures TRL thru during a TRL/LRM 2-port calibration.
TSSWI<ON/OFF>	Same as CSWI.
TST?	Causes a self test and returns a zero if the test is passed.
TSTIOFWD[D]	Defines 3 bits, D0 through D2, on the test set connector I/O for the channel 1 and channel 2 forward settings. These bits can be set to values of 0 through 7.

TSTIOREV[D] Defines 3 bits, D0 through D2, on the test set connector I/O for the channel 1 and channel 2 reverse settings. These bits can be set to values of 0 through 7.

TSTP<P1|P2> Selects test port 1 or 2 for non-S-parameter measurements.

These commands set the TTL output and end of sweep pulse:

TTLHPULS TTL normally low, high pulse at end of sweep.

TTLLPULS TTL normally high, low pulse at end of sweep.

TTLOH Sets TTL continuously high.

TTLOL Sets TTL continuously low.

UCONV Selects up converter for mixer measurements.

UP Increments the value in the active entry area (up key).

USEPASC Puts the analyzer in pass control mode.

These commands select the sensor input being used with the HP 438A power meter. For the HP 436A or 437B, the A sensor is always used:

USESENSA Sensor A.

USESENSB Sensor B.

VELOFACT[D] Enters the velocity factor of the transmission medium.

VIEM<ON|OFF> Displays the measurement trace (ON) or the mixer setup (OFF).

VOFF[D] Sets the local oscillator frequency for use in frequency offset mode. See also LOFREQ[D].

TSTIOREV[D] Defines 3 bits, D0 through D2, on the test set connector I/O for the channel 1 and channel 2 reverse settings. These bits can be set to values of 0 through 7.

TSTP<P1|P2> Selects test port 1 or 2 for non-S-parameter measurements.

These commands set the TTL output and end of sweep pulse:

TTLHPULS TTL normally low, high pulse at end of sweep.

TTLLPULS TTL normally high, low pulse at end of sweep.

TTLOH Sets TTL continuously high.

TTLOL Sets TTL continuously low.

UCONV Selects up converter for mixer measurements.

UP Increments the value in the active entry area (up key).

USEPASC Puts the analyzer in pass control mode.

These commands select the sensor input being used with the HP 438A power meter. For the HP 436A or 437B, the A sensor is always used:

USESENSA Sensor A.

USESENSB Sensor B.

VELOFACT[D] Enters the velocity factor of the transmission medium.

VIEM<ON|OFF> Displays the measurement trace (ON) or the mixer setup (OFF).

VOFF[D] Sets the local oscillator frequency for use in frequency offset mode. See also LOFREQ[D].

WAIT	Waits for a clean sweep when used with the OPC command.
WAVD	Selects waveguide electrical delay. (See also COAD.)
WAVE	Specifies a waveguide standard while defining a standard as part of a cal kit modification, as opposed to coaxial.
WIDT<ON OFF>	Turns the bandwidth search ON and OFF.
WIDV[D]	Enters the widths search parameter.

These 5 commands set the window for the transform (Option 010, time domain):

WINDMAXI	Maximum.
WINDMINI	Minimum.
WINDNORM	Normal.
WINDOW[D]	Enters arbitrary window.
WINDUSEM<ON OFF>	Turns the trace memory ON as the window shape.

These 8 commands enter new softkey labels into the indicated softkey positions. Initial use of these commands requires previous commands MENUFORM; and MENUOFF;.

WRSK1[\$]	Softkey 1.
WRSK2[\$]	Softkey 2.
WRSK3[\$]	Softkey 3.
WRSK4[\$]	Softkey 4.
WRSK5[\$]	Softkey 5.
WRSK6[\$]	Softkey 6.
WRSK7[\$]	Softkey 7.
WRSK8[\$]	Softkey 8.

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