Quick Reference Guide

HP 8753D Network Analyzer

HP Part No. 08753-90259
Printed in USA June 1994

1212 Valley House Drive, Rohnert Park, CA 94928-4999, USA

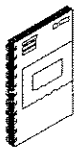
Quick Reference Guide Overview

- Chapter 1, "HP 8753D Descriptions" describes analyzer features and functions.
- Chapter 2, "Making Measurements" contains step-by-step procedures for making a basic measurement, and using the display and marker functions.
- Chapter 3, "Making Mixer Measurements" contains a procedure for making a conversion loss measurement, using the frequency offset mode.
- Chapter 4, "Printing, Plotting, or Saving Measurement Results" contains procedures for saving to disk or the analyzer memory, and printing or plotting displayed measurements.
- Chapter 5, "Optimizing Measurement Results" describes some techniques and functions for achieving the best measurement results.
- Chapter 6, "Application and Operation Concepts" contains information about some of the applications and analyzer operation.
- Chapter 7, "Specifications and Measurement Uncertainties" contains information on the analyzer's dynamic range and 7 mm test port performance capabilities.
- Chapter 8, "Menu Maps" contains the menus related to all the front panel keys.
- Chapter 9, "Key Definitions" contains a cross reference that shows softkeys and the corresponding front panel key.
- Chapter 10, "Error Messages" contains a table of all the possible error messages.
- Chapter 11, "Compatible Peripherals" contains lists of equipment that is compatible with the analyzer. Some HP-IB information is also included.
- Chapter 12, "Preset State and Memory Allocation" contains information on the analyzer internal memory and the analyzer parameters that correspond to a preset state.

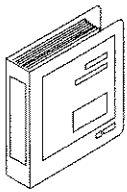
For additional information refer to:

- *HP 8753D Network Analyzer Installation and Quick Start Guide*
- *HP 8753D Network Analyzer User's Guide*
- *HP 8753D Network Analyzer Programmer's Guide*

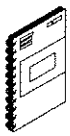
HP 8753D Network Analyzer Documentation Set



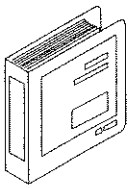
The **Installation and Quick Start Guide** familiarizes you with the HP 8753D network analyzer's front and rear panels, electrical and environmental operating requirements, as well as procedures for installing, configuring, and verifying the operation of the HP 8753D.



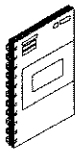
The **User's Guide** shows how to make measurements, explains commonly-used features, and tells you how to get the most performance from your analyzer.



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



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



The **System Verification and Test Guide** provides the system verification and performance tests and the Performance Test Record for your HP 8753D network analyzer.

1

HP 8753D Description and Options

Analyzer Description

- Combined digital signal processing and microprocessor controls
- Direct print or plot output of displayed measurement results, with a time stamp, 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)
  Temperature at 40 °C .....1244 days (3.4 years)
  Temperature at 25 °C .....11904 days (32.6 years) typical

- 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 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*.
- External source mode capability that allows you to phase lock the analyzer's receiver to an external source.
- Tuned receiver mode
- Reflection and transmission measurements in either 50 or 75 ohm impedance
- Receiver/source frequency offset mode

- Power meter calibration
- Test system automation with the addition of an HP 9000 series 200 or 300 computer
- External keyboard compatibility
- LIF/DOS disk format
- Integration of a high capacity micro-floppy disk drive
- Internal automation, using test sequencing
- A general purpose input/output (GPIO) bus

Front Panel Features

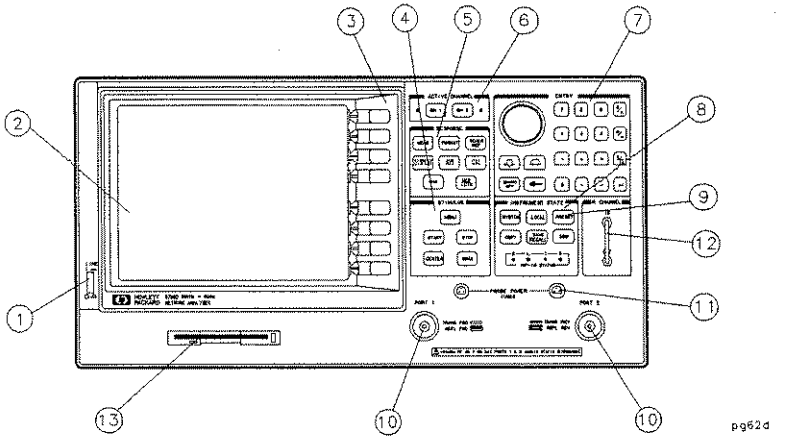


Figure 1-1. HP 8753D Front Panel

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. **Softkeys.** These keys provide access to menus that are shown on the display.

4. **STIMULUS function block.** The keys in this block allow you to control the analyzer source's frequency, power, and other stimulus functions.

5. **RESPONSE function block.** The keys in this block allow you to control the measurement and display functions of the active display channel.

6. **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.

7. **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.

8. **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
   - external source mode
   - tuned receiver mode
   - frequency offset mode
   - test sequence function
   - harmonic measurements (option 002)
   - time domain transform (option 010)

   HP-IB STATUS indicators are also included in this block.

9. **PRESET key.** This key returns the instrument to either a known factory preset state, or a user preset state that can be defined.

10. **PORT 1 and PORT 2.** These ports output a signal from the source and receive input signals from a device under test. PORT 1 allows you to measure S_{12} and S_{11}. PORT 2 allows you to measure S_{21} and S_{22}.

11. **PROBE POWER connector.** This connector (fused inside the instrument) supplies power to an active probe for in-circuit measurements of ac circuits.

12. **R CHANNEL connectors.** These connectors allow you to apply an input signal to the analyzer's R channel, for frequency offset mode.

13. **Disk drive.** This 3.5 inch drive allows you to store and recall instrument states and measurement results for later analysis.

Analyzer Display

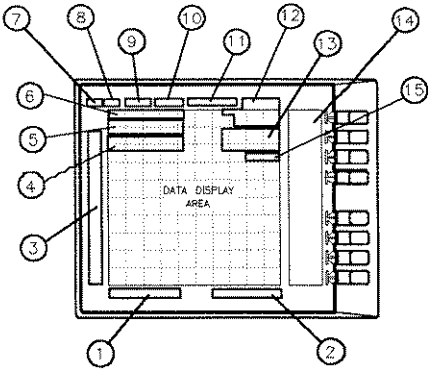


Figure 1-2. Analyzer Display (Single Channel, Cartesian Format)

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.

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. The stimulus values can be blanked.

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 when either the power range for each port is different (uncoupled), or the TESTSET HOLD is activated.

   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.

   Of? = Frequency offset mode error, 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).

   H=2 = Harmonic mode is on, and the second harmonic is being measured. (Harmonics option 002 only.)

   H=3 = Harmonic mode is on, and the third harmonic is being measured. (Harmonics option 002 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 unleveled at start or stop of sweep.

P↓ = 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. This hold mode may be overridden.

↑ = 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 (ACTIVE CHANNEL) 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, at the left for channel 1 and at the right for channel 2.

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 MKR 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.

Rear Panel Features and Connectors

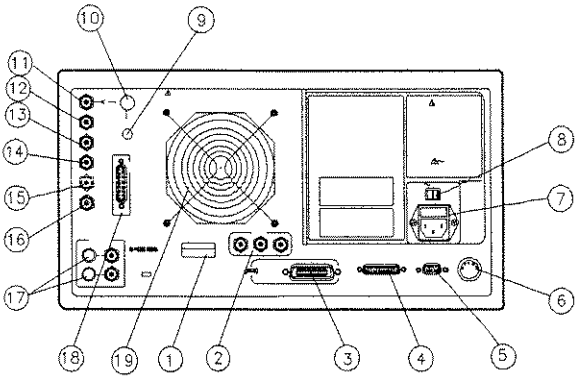


Figure 1-3. HP 8753 Rear Panel

1. **Serial number plate.**

2. **Ext Mon.** Red, green, and blue video output connectors provide analog red, green, and blue video signals which you can use to drive an external monitor such as the HP 3571A/B or monochrome monitor such as the HP 35731A/B. You can use other analog multi-sync monitors if they are compatible with the analyzer's 25.5 KHz scan rate and video levels: 1 Vp-p, 0.7 V=white, 0 V=black, −0.3 V sync, sync on green.

3. **HP-IB connector.** This allows you to connect the analyzer to an external controller, compatible peripherals, and other instruments for an automated system.

4. **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.

5. **RS-232 interface.** This connector allows the analyzer to output to a peripheral with an RS-232 (serial) input.

6. **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.

7. **Power cord receptacle, with fuse.**

8. **Line voltage selector switch.**

9. **10 MHZ REFERENCE ADJUST. (Option 1D5)**

10. **10 MHZ PRECISION REFERENCE OUTPUT. (Option 1D5)**

11. **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.

12. **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.

13. **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.

14. **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.

15. **TEST SEQUENCE.**

    Outputs a TTL signal that can be programmed in a test sequence to be high or low, or pulse (10 μseconds) high or low at the end of a sweep for robotic part handler interface.

16. **LIMIT TEST.**

    Outputs a TTL signal of the limit test results as follows:

    - Pass: TTL high
    - Fail: TTL low

17. **BIAS INPUTS AND FUSES.**

These connectors bias devices connected to port 1 and port 2. The fuses (1 A, 125 V) protect the port 1 and port 2 bias lines.

18. **TEST SET INTERCONNECT.** This allows you to connect an HP 8753D Option 011 analyzer to an HP 85046A/B or 85047A S-parameter test set using the interconnect cable supplied with the test set. The S-parameter test set is then fully controlled by the analyzer.

19. **Fan.** This fan provides forced-air cooling for the analyzer.

Changes between the HP 8753A/B/C/D

Table 1-1.
Comparing the HP 8753 Family of Network Analyzers

Feature	8753A	8753B	8753C	8753D
Fully integrated measurement system (built-in test set)	No	No	No	Yes
Test port power range (dBm)	†	†	†	+10 to −85
Auto/manual power range selecting	No	No	No	Yes
Port power coupling/uncoupling	No	No	No	Yes
Internal disk drive	No	No	No	Yes
Precision frequency reference (option 1D5)	No	No	No	Yes
Frequency range - low end	300 kHz	300 kHz	300 kHz	30 kHz
Ext. freq. range to 6 GHz (option 006)	No	Yes	Yes	Yes
75Ω system impedance (option 075)	†	†	†	Yes
TRL*/LRM* correction	No	No	No	Yes
Power meter calibration	No	Yes	Yes	Yes
Interpolated error correction	No	Yes	Yes	Yes
Max. Error corrected measurement points	801	1601	1601	1601
Segmented error correction in freq. list mode	No	No	Yes	Yes
Color CRT	No	No	Yes	Yes
Test sequencing	No	Yes	Yes	Yes

Table 1-1.
Comparing the HP 8753 Family of Network Analyzers
(continued)

Feature	8753A	8753B	8753C	8753D
Automatic sweep time	No	Yes	Yes	Yes
External source capability	No	Yes	Yes	Yes
Tuned receiver mode	No	Yes	Yes	Yes
Printer/plotter buffer	No	Yes	Yes	Yes
Harmonic measurements (option 002)	No	Yes	Yes	Yes
Frequency offset mode (mixer measurements)	No	Yes	Yes	Yes
dc bias to test device	†	†	†	Yes
Interfaces: RS-232, parallel, and DIN keyboard	No	No	No	Yes
User-defined preset	No	No	No	Yes
Non-volatile memory	16 Kbytes	16 Kbytes	16 Kbytes	512 Kbytes
Dynamic Range				
30 kHz to 3 GHz	100 dB	100 dB	100 dB	110 dB
3 GHz to 6 GHz	N/A	80 dB	80 dB	105 dB
Real time clock	No	No	No	Yes

† For this network analyzer, feature is dependent on the test set being used.

2

Making Measurements

Table 2-1. Connector Care Quick Reference

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

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

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

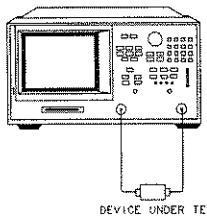


Figure 2-1. Basic Measurement Setup

Step 2. Choose the measurement parameters.

2. Press (PRESET) PRESET: FACTORY.

Setting the Frequency Range

3. To set the center frequency to 134 MHz, press:

(CENTER) (134) (M/μ)

4. To set the span to 30 MHz, press:

   (SPAN) (30) (M/μ)

   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 Your Measurement Results" chapter.

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) (134) (M/μ)

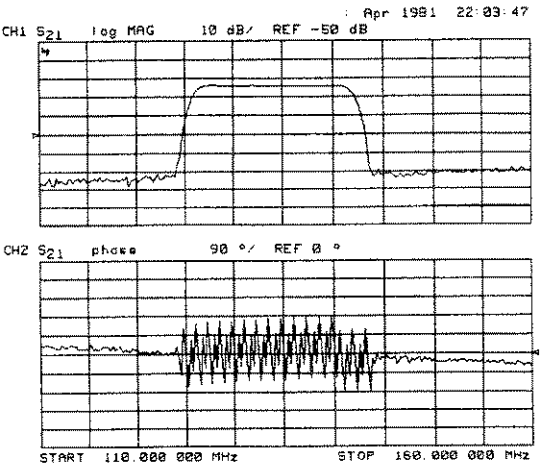
Step 5. Output the measurement results.

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

    (COPY) PRINT (or PLOT)

To View Both Measurement Channels

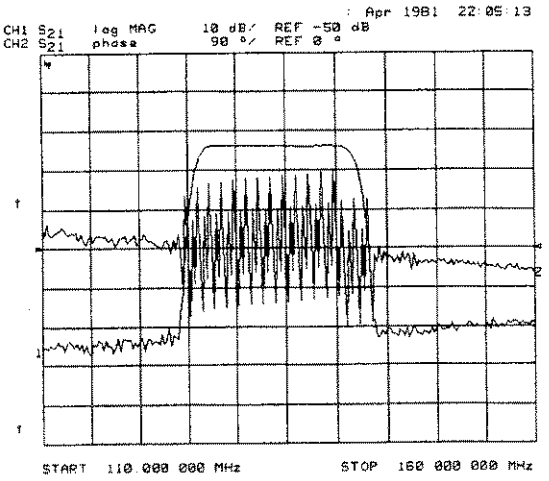
DISPLAY
DUAL CHAN ON
MORE
SPLIT DISP ON



aw000027

Figure 2-2. Dual Channel with Split Display ON

DISPLAY
DUAL CHAN ON
MORE
SPLIT DISP OFF



aw000028

Figure 2-3.
Dual Channel with Split Display OFF

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 (CH 1) (MENU) NUMBER OF POINTS.
2. Press (CH 2) (MENU) NUMBER OF POINTS and enter the same value that you observed for the channel 1 setting.
3. Press (DISPLAY) DUAL CHAN ON MORE D2/D1 TO D2 ON .

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.
   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.

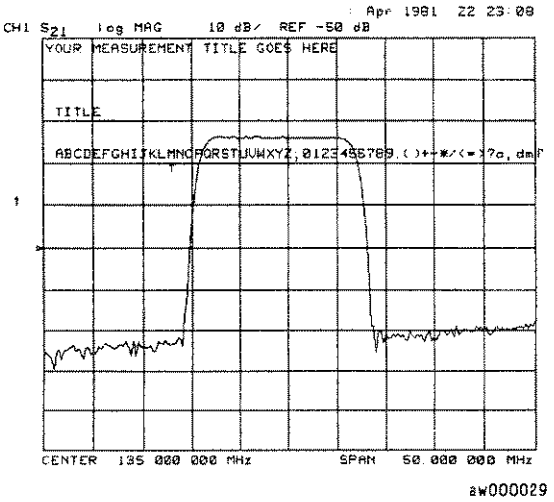


Figure 2-4.
Example of a Display Title

To Activate Display Markers

(MARKER) MARKER 1

Delta 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:
3. Press MARKER 2 and move marker 2 to any position that you want to measure in reference to marker 1.

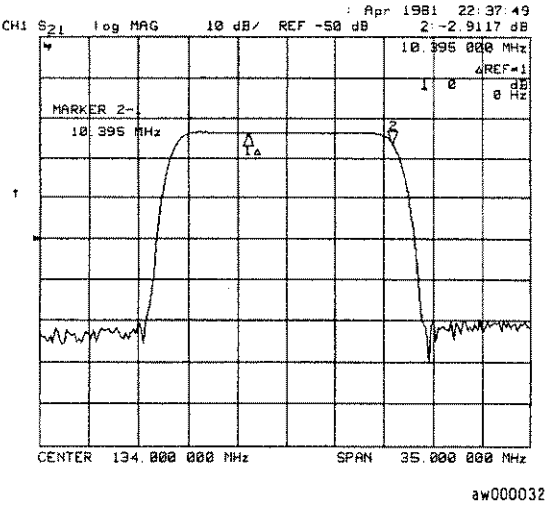


Figure 2-5. Marker 1 as the Reference Marker

Searching for the Maximum Amplitude

1. Press (MARKER FCTN) MARKER SEARCH.
2. Press SEARCH: MAX.

Searching for the Minimum Amplitude

1. Press (MARKER FCTN) MARKER SEARCH.
2. Press SEARCH: MIN.

3

Making Mixer Measurements

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. 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.

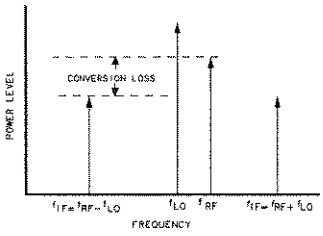


Figure 3-1.
An Example Spectrum of RF, LO, and IF Signals Present in a Conversion Loss Measurement

Swept RF/IF Mixer Measurements

The HP 8753 allows you to make a swept RF/IF conversion loss measurement. You can make this measurement by using the analyzer's frequency offset measurement mode.

Frequency Offset Mode

This mode of operation allows you to offset the analyzer's source by a fixed value, above or below the HP 8753's receiver. For example, this allows you to use a device input frequency range that is different from the receiver input frequency range.

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

1. Set the LO source to the desired CW frequency and power level. For this example the LO source is set to the following values:

   CW frequency = 1000 MHz
   power = 13 dBm

2. Initialize the analyzer by pressing (PRESET) on the HP 8753.

3. From the front panel of the HP 8753, set the desired receiver frequency and source output power, by pressing:

   (SYSTEM) INSTRUMENT MODE FREQ OFFS MENU
   FREQ OFFS ON
   START (100) (M/μ)
   STOP (350) (M/μ)
   (MENU)
   POWER (0) (x1)

4. Connect the instruments as shown in Figure 3-2.

Note You must activate the frequency offset mode *before* you disconnect the R channel jumper.

Caution To prevent connector damage, use an adapter (HP part number 1250-1462) as a connector saver for R CHANNEL IN.

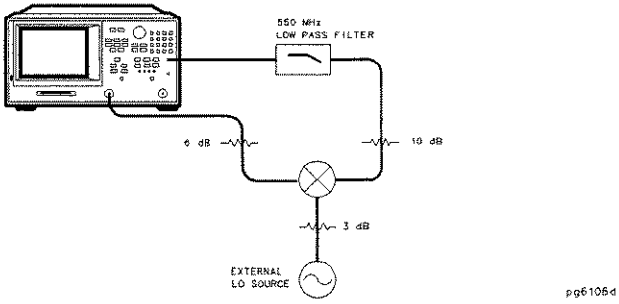


Figure 3-2. Connections for a Conversion Loss Measurement

5. To view the absolute input power to the HP 8753's R channel, press:

   (MEAS)
   INPUT PORTS
   R

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

   (SYSTEM)
   INSTRUMENT MODE
   FREQ OFFS MENU
   LO MENU
   FREQUENCY: CW (1000) (M/μ)
   POWER: FIXED (13) (x1)
   RETURN

7. 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 HP 8753's source is actually sweeping backwards, as shown in Figure 3-3. The measurements set-up diagram is shown in Figure 3-4.

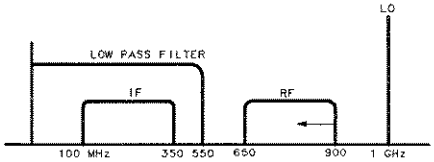


Figure 3-3. Diagram of Measurement Frequencies

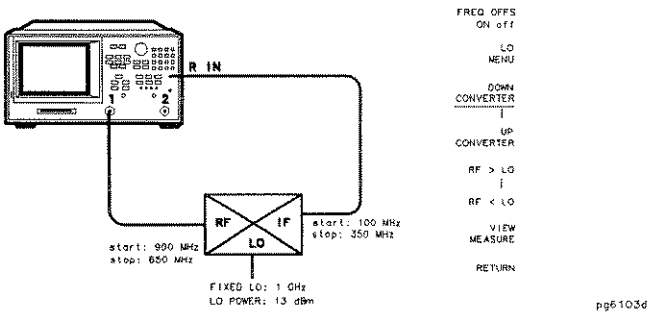


Figure 3-4. Measurement Setup from Display

8. View the conversion loss, shown in Figure 3-5.

   VIEW MEASURE

9. Scale the data for best vertical resolution.

   SCALE REF
   AUTOSCALE

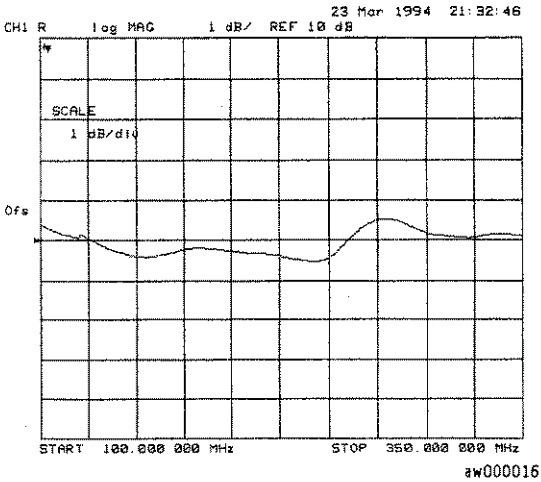


Figure 3-5. Conversion Loss Example Measurement

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

In this measurement, you set the input power and measured the output power. Figure 3-5 shows the absolute loss through the mixer versus mixer output frequency.

For procedures on removing systematic frequency response errors, and on performing a source power meter calibration, see the "Optimizing Your Measurement Results" chapter in the *HP 8753D Network Analyzer User's Guide*.

4

Printing, Plotting, and Saving Measurement Results

Printing or Plotting Your Measurement Results

If the printing or plotting peripheral is not already connected and configured, refer to the "Compatible Peripherals" chapter in the *HP 8753D Network Analyzer User's Guide* for procedures.

Defining the Print or Plot

Note The print or plot definition is lost if you cycle the power. However, you can save the print or plot definition by saving the instrument state.

If the Peripheral is a Printer

1. Press (COPY) DEFINE PRINT.
2. Press PRINT until the correct printer choice appears:
   - 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 appears:
   - 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.

Note Laser printers and some DeskJet printers do not begin to print until a full page, or a partial page and a form feed, have been received.

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 PRNT SETUP.

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

If the Peripheral is a Plotter

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

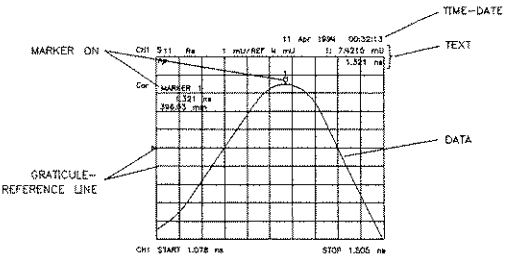


Figure 4-1. Plot Components Available through Definition

3. Press AUTO-FEED until the correct choice appears:
   - 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.

Note The peripheral ignores AUTO-FEED ON when you are plotting to a quadrant.

---

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 4-1.
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 4-2. Default Pen Numbers for Plot Elements

Corresponding Key	Plot Element	Channel 1 Pen Numbers	Channel 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 print elements 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, followed by (x1).
   - Select LINE TYPE MEMORY to modify the line type for the memory trace. Then enter the new line type, followed by (x1).

Table 4-3. 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

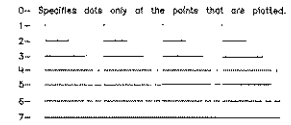


Figure 4-2. Line Types Available

Note

You should set the parameter between 0 and 7; a parameter in this range sets the line type as shown in Figure 4-2. A parameter in the range of 8 to 10 also specifies a solid line.

You must define the line types for each measurement channel (channel 1 and channel 2).

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.

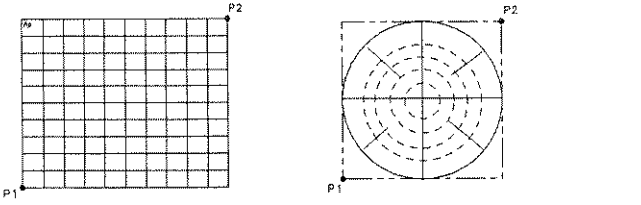


Figure 4-3. Locations of P1 and P2

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 4-4. 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
Channel 2 Data	3
Channel 1 Memory	5
Channel 2 Memory	6
Channel 1 Graticule	1
Channel 2 Graticule	1
Channel 1 Text	7
Channel 2 Text	7
Channel 1 Marker	7
Channel 2 Marker	7

Aborting a Print or Plot Process

1. Press the (LOCAL) key.
2. If your peripheral is not responding, press (LOCAL) again.

Saving an Instrument State

Places Where You Can Save

- analyzer internal memory
- floppy disk using the analyzer's internal disk drive
- floppy disk using an external disk drive

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(0-32).

- active measurement calibration
- displayed memory trace
- active power meter calibration
- print/plot definitions
- measurement parameters
  - frequency range
  - number of points
  - sweep time
  - output power
  - sweep type
  - measurement type

Note When the ac line power is switched off, the internal memory uses 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)
Temperature at 40 °C .....1244 days (3.4 years)
Temperature at 25 °C .....11904 days (32.6 years) typical

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 DATAnn, 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
- displayed measurement data trace
- displayed user graphics
- data only

Caution DO NOT use single-sided floppy disks in the analyzer disk drive.

To Save an Instrument State

You can save up to 32 files in the analyzer internal memory. The number of register files that the analyzer allows you to save depends on the size of associated error-correction sets, memory traces, and power meter calibrations. Refer to the "Preset State and Memory Allocation" chapter for further information.

1. Press (SAVE RECALL) SELECT DISK and select one of the storage devices:
   - INTERNAL MEMORY
   - INTERNAL DISK
   - EXTERNAL DISK
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 (FILE0 - FILE9), you must do one of the following:

- rename an existing file
- re-save a file
- delete an existing file

To Save Measurement Results

Note You can only save measurement data to a disk. The analyzer internal memory can only store instrument states and memory traces.

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're 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 DATA0D1 to DATA9D1, for channel 1, or DATA0D2 to DATA9D2, for channel 2. However, these files are not instrument states and cannot be recalled.

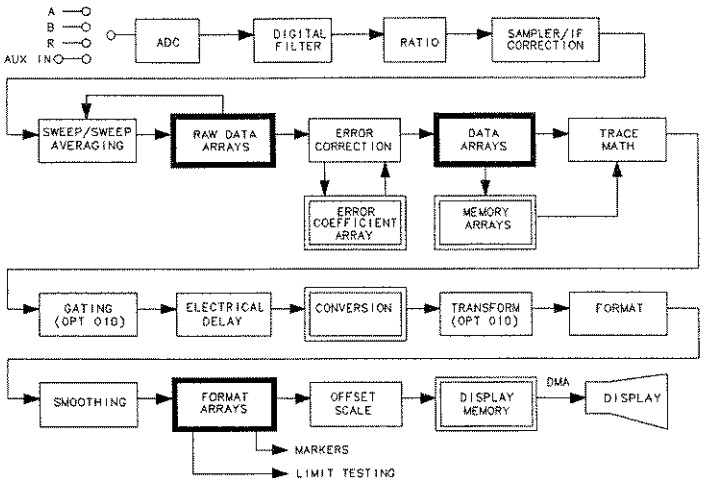


Figure 4-4. Data Processing Flow Diagram

1. If you want to title the displayed measurement, refer to "Titling the Displayed Measurement," located in the "Printing, Plotting, and Saving Measurement Results" chapter of the *HP 8753D Network Analyzer User's Guide*.
2. Press (SAVE RECALL) SELECT DISK.
3. Choose one of the following disk drives:
   - INTERNAL DISK
   - EXTERNAL DISK
4. Press (SAVE RECALL) DEFINE DISK-SAVE.
5. 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 If you select DATA ONLY ON, you cannot recall and display the file contents on the analyzer. This type of data is intended for computer manipulation.

6. Choose the type of format you want:
   - Choose SAVE USING BINARY for all applications except CITIFILE or CAE applications.
   - Choose SAVE USING ASCII for CITIFILE and CAE applications or when you want to import the information into a spread sheet format.
7. Press RETURN SAVE STATE.

Recalling an Instrument State

1. Press (SAVE RECALL) SELECT DISK.
2. Choose from the following storage devices:
   - INTERNAL MEMORY
   - INTERNAL DISK
   - EXTERNAL DISK
3. Press the (↓) repeatedly until the name of the file that you want to recall is high-lighted.
4. Press RETURN RECALL STATE.

5

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

Temperature Drift

- 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 $\pm 1^{\circ}$ of measurement calibration 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).

Press (CAL) MORE PORT EXTENSIONS EXTENSIONS ON. Then enter the delay to the reference plane.

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 as necessary for the currently selected S-parameter.

Measurement Error-Correction

Conditions Where Error-Correction is Suggested

- You are adapting to a different connector type or impedance.
- You are connecting a cable between the test device and an analyzer test port.
- You are 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[1]	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*	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

1 One-path, 2-port error correction is a variation of full 2-port that requires reversing the test device between forward and reverse measurements. Since the standard instrument does this with its internal switch, full 2-port is recommended because it is more convenient and more accurate. If the instrument should be used in a configuration where the incident/reflected signal separation device is external to it, then one-path 2-port would be useful.

Power Meter Measurement Calibration

Table 5-3.
Typical Power Meter Calibration Sweep Speed and Accuracy

Power Desired at Test Port (dBm)	Number of Readings	Sweep Time (seconds)[1]	Typical Accuracy (dB)[2]
+5	1	33	±0.7
	2	64	±0.2
	3	95	±0.1
−15	1	48	±0.7
	2	92	±0.2
	3	123	±0.1
−30	1	194	±0.7
	2	360	±0.2
	3	447	±0.1

1 Sweep speed applies to every sweep in continuous correction mode, and to the first sweep in sample-and-sweep mode. Subsequent sweeps in sample-and-sweep mode will be much faster.

2 The accuracy values were derived by combining the accuracy of the power meter and linearity of the analyzer's internal source, as well as the mismatch uncertainty associated with the power sensor.

Note

Loss of Power Calibration Data

The power correction data will be lost if any of the following circumstances exists.

- If you switch off the analyzer ac power and you haven't saved the correction in an internal register.
- If you change the sweep type (linear, log, list, CW, power) when the power meter correction is activated.
- If you change the frequency when the sweep type is in log or list mode.
- If you press (PRESET) and you haven't saved the correction in an internal register.

Increasing Sweep Speed

Decrease the Frequency Span

1. To see the band switch points (steps), press:

   (SYSTEM) SERVICE MENU ANALOG BUS ON
   (MEAS) ANALOG IN (29) (x1)
   (FORMAT) MORE REAL
   (SCALE REF) AUTO SCALE

2. Enter the measurement frequency span of the device under test. Autoscale and modify the frequency span as appropriate.

Set the Auto Sweep Time Mode

- Press (MENU) SWEEP TIME (0) (x1).

Widen the System Bandwidth

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

IF BW	Sweep Time (Seconds)[1]	
	Full Span	Narrow Sweep
3000 Hz	0.44	0.18
1000 Hz	0.5	0.33
300 Hz	0.95	0.76
100 Hz	2.24	2.07
30 Hz	7.75	7.14
10 Hz	21.93	21.52

1 The listed sweep times correspond to the analyzer being set to a preset state for the full span, and 900 MHz to 1 GHz for the narrow span.

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).

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	Sweep Time (Seconds)[1]			
	Full Span		Narrow Span	
	LIN	LIST/LOG	LIN	LIST
51	0.35	0.57	0.09	0.25
101	0.39	0.77	0.12	0.43
201	0.43	1.11	0.17	0.78
401	0.49	1.73	0.27	1.33
801	0.69	3.04	0.47	2.64
1601	1.09	5.7	0.87	5.3

1 The listed sweep times correspond to the analyzer being set to a preset state, with a 6 GHz span. A 3 GHz span would have faster sweep times.

Set the Sweep Type

1. Press (MENU) SWEEP TYPE MENU.
2. Select the sweep type:
   - LIN FREQ
   - LIST FREQ
   - LOG FREQ

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.

Activate Chop Sweep Mode

- Press (CAL) MORE CHOP A and B.

Increasing Dynamic Range

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: +26 dBm**

Reduce the Receiver Noise Floor

Change 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).

Change Measurement Averaging

1. Press (AVG) AVERAGING FACTOR.
2. Enter a value followed by (x1).
3. Press AVERAGING ON.

Reducing Trace Noise

Activate Averaging

1. Press (AVG) AVERAGING FACTOR.
2. Enter a value followed by (x1).
3. Press AVERAGING ON.

Change System Bandwidth

1. Press (AVG) IF BW.
2. Enter the IF bandwidth value that you want, followed by (x1).

Reducing Receiver Crosstalk

Set the alternate sweep, press (CAL) MORE ALTERNATE A AND B.

6

Application and Operation Concepts

How the HP 8753D Works

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

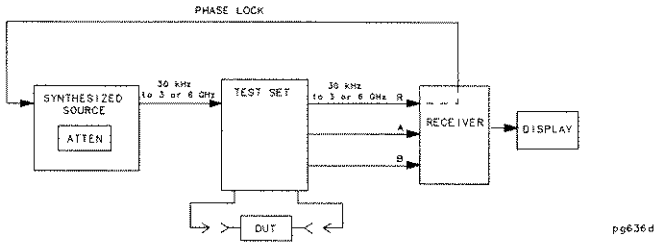


Figure 6-1. Simplified Block Diagram of the Network Analyzer System

Understanding the power ranges

The built-in synthesized source contains a programmable step attenuator that allows you to directly and accurately set power levels in eight different power ranges. Each range has a total span of 25 dB. The eight ranges cover the instrument's full operating range from +10 dBm to −85 dBm (see Figure 6-2). A power range can be selected either manually or automatically.

Automatic mode

If you select PWR RANGE AUTO, you can enter any power level within the total operating range of the instrument and the source attenuator will automatically switch to the corresponding range.

Manual mode

If you select PWR RANGE MAN, you must first manually select the power range that corresponds to the power level you want to use. Then press the POWER RANGES softkey and select one of the eight available ranges.

When a calibration is completed and turned on, the power range selection is switched from auto to manual mode, and PRm appears on the display.

Note

A measurement calibration is valid *only* for the power level at which it was performed; but you can change the power within a range and still maintain nearly full accuracy.

If you decide to switch power ranges, the calibration is no longer valid and specified accuracy is forfeited. However, the analyzer leaves the correction *on* even though it's invalid.

The annotation C? will be displayed whenever you change the power after calibration.

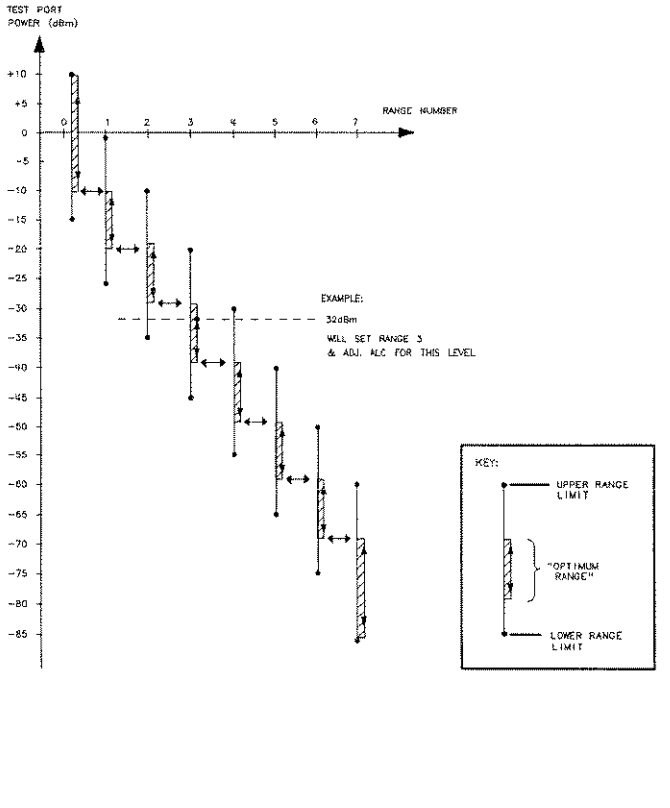


Figure 6-2. Power Range Transitions in the Automatic Mode

Power coupling options

Channel coupling

CHAN POWER [COUPLED] toggles between coupled and uncoupled channel power. With the channel power coupled, the power level is the same on each channel. With the channel power uncoupled, you can set different power levels for each channel.

Test port coupling

PORT POWER [COUPLED] toggles between coupled and uncoupled test ports. With the test ports coupled, the power level is the same at

each port. With the ports uncoupled, you can set a different power level at each port.

Channel stimulus coupling

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

In the stimulus coupled mode, both channels have the following parameters coupled:

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

Minimum sweep time

The minimum sweep time is dependent on several factors.

- the number of points selected
- IF bandwidth
- sweep-to-sweep averaging in dual channel display mode
- smoothing
- limit test
- error correction
- trace math
- marker statistics
- time domain
- type of sweep

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

Number of Points	IF Bandwidth			
	3000 Hz	1000 Hz	300 Hz	10 Hz
11	0.0055 sec.	0.012 sec.	0.037 sec.	1.14 sec.
51	0.0255 sec.	0.060 sec.	0.172 sec.	5.30 sec.
101	0.0505 sec.	0.120 sec.	0.341 sec.	10.5 sec.
201	0.1005 sec.	0.239 sec.	0.679 sec.	20.9 sec.
401	0.2005 sec.	0.476 sec.	1.355 sec.	41.7 sec.
801	0.4005 sec.	0.951 sec.	2.701 sec.	83.3 sec.
1601	0.8005 sec.	1.901 sec.	5.411 sec.	166.5 sec.

Alternate and Chop Sweep Modes

ALTERNATE A and B measures only one input per frequency sweep, in order to reduce spurious signals. Thus, this mode optimizes the dynamic range.

CHOP A and B measures both inputs A and B during each sweep.

To access the ALTERNATE A and B and CHOP A and B softkeys press (CAL) MORE. Figure 6-3 shows the *alternate* sweep mode (bold trace) overlaying the *chop* sweep mode in a band-pass filter measurement. Note the difference in the noise levels between the two modes.

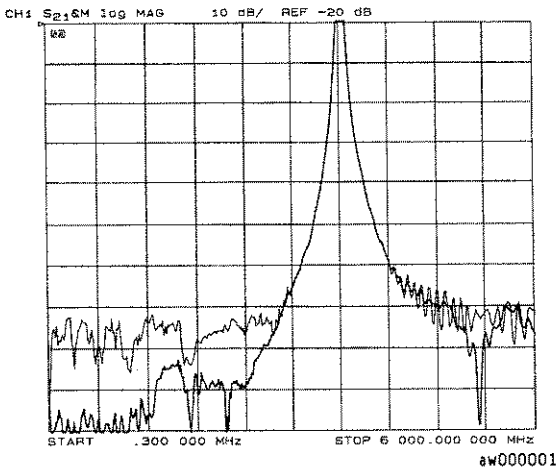


Figure 6-3. Alternate and Chop Sweeps Overlaid

Understanding S-parameters

S-parameters (scattering parameters) are a convention used to characterize the way a device modifies signal flow.

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.

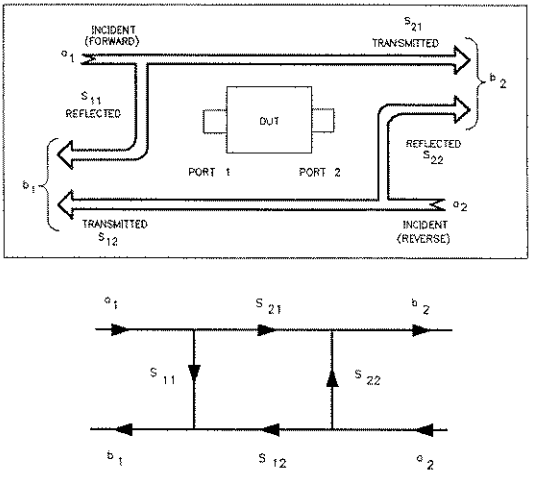


Figure 6-4. S-Parameters of a Two-Port Device

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}	$\frac{b_1}{a_1}$	$a_2 = 0$	Input reflection coefficient	FWD
S_{21}	$\frac{b_2}{a_1}$	$a_2 = 0$	Forward gain	FWD
S_{12}	$\frac{b_1}{a_2}$	$a_1 = 0$	Reverse gain	REV
S_{22}	$\frac{b_2}{a_2}$	$a_1 = 0$	Output reflection coefficient	REV

What is 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.

The resulting measurement is the vector sum of the test device response plus all error terms.

Understanding and Using Time Domain (option 010 only)

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 to an impulse input.

Time domain low pass step mode simulates the time domain response to 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 to 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, using the low pass modes you can determine the type of discontinuity.

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	30 kHz to 0.09 MHz
11	30 kHz to 0.33 MHz
26	30 kHz to 0.78 MHz
51	30 kHz to 1.53 MHz
101	30 kHz to 3.03 MHz
201	30 kHz to 6.03 MHz
401	30 kHz to 12.03 MHz
801	30 kHz to 24.03 MHz
1601	30 kHz to 48.03 MHz

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).

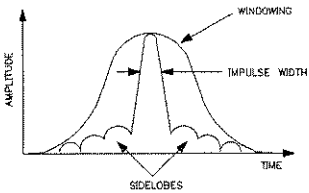


Figure 6-5. Impulse Width, Sidelobes, and Windowing

- **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.

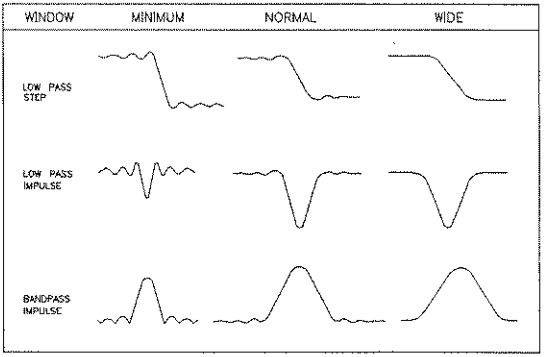


Figure 6-6.
The Effects of Windowing on the Time Domain Responses of a Short Circuit

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.

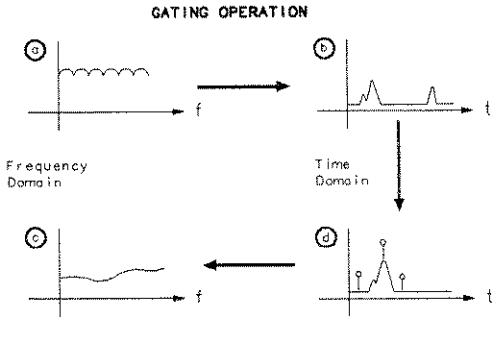


Figure 6-7. Sequence of Steps in Gating Operation

Selecting gate shape. Each gate has a different passband flatness, cutoff rate, and sidelobe levels.

Table 6-4. Gate Characteristics

Gate Shape	Passband Ripple	Sidelobe Levels	Cutoff Ti me	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 8753D allows you to measure the transmission and reflection characteristics of many amplifiers and active devices. You can measure scalar

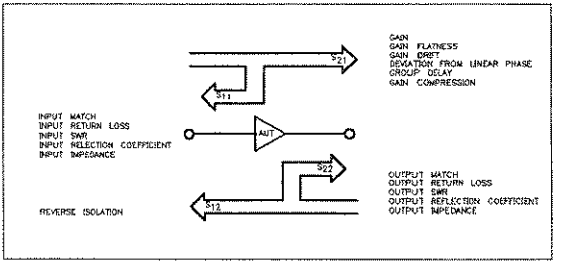


Figure 6-8. Amplifier Parameters

Mixer Testing

Mixer parameters that you can measure

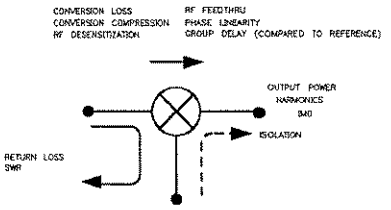


Figure 6-9. Mixer Parameters

- Transmission characteristics include conversion loss, conversion compression, RF desensitization, group delay, and RF feedthru.
- Reflection characteristics include return loss, SWR and complex impedance.
- Characteristics of the signal at the output port include the output power, the spurious or harmonic content of the signal, and intermodulation distortion.
- 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.

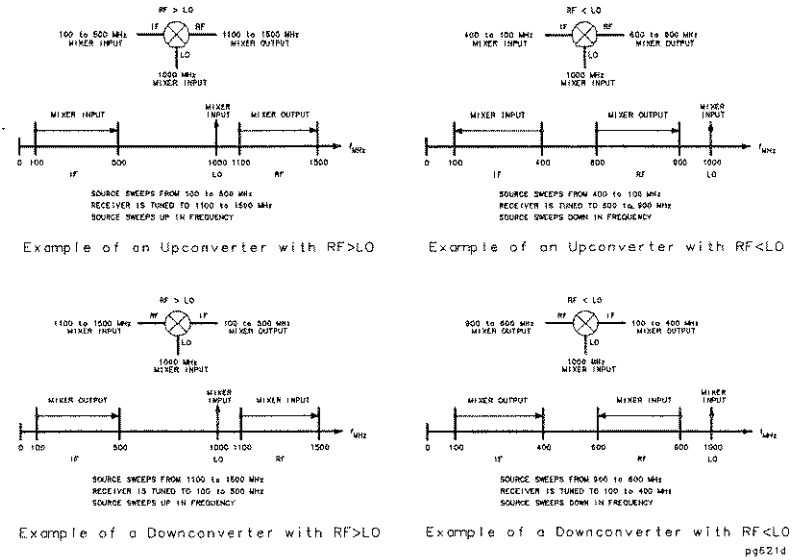


Figure 6-10. Examples of Up Converters and Down Converters

7

Specifications and Measurement Uncertainties

Dynamic Range

The specifications described in the table below apply to transmission measurements using 10 Hz IF BW and full 2-port correction. Dynamic range is limited by the maximum test port power and the receiver's noise floor.

Table 7-1.

DYNAMIC RANGE	
Frequency Range	**Dynamic Range**
30 kHz to 300 kHz	100 dB*
300 kHz to 1.3 GHz	110 dB† ‡
1.3 GHz to 3 GHz	110 dB‡
3 GHz to 6 GHz	105 dB

* 90 dB, 30 kHz to 50 kHz

† 100 dB, 300 kHz to 16 MHz, due to fixed spurs

‡ 105 dB, option 075

HP 8753D Network Analyzer Specifications

HP 8753D (50Ω) with 7 mm Test Ports

The following specifications describe the system performance of the HP 8753D network analyzer. The system hardware includes the following:

Options: 006

Calibration kit: ..... HP 85031B

Cables: ..... HP 11857D

Measurement Port Characteristics

The following tables describe the measurement port characteristics for both corrected and uncorrected HP 8753D network analyzers.

Table 7-2.

MEASUREMENT PORT CHARACTERISTICS (CORRECTED)*				
	Frequency Range			
	30 kHz to 300 kHz†	300 kHz to 1.3 GHz	1.3 GHz to 3 GHz	3 GHz to 6 GHz
Directivity	55 dB	55 dB	51 dB	46 dB
Source match	55 dB	51 dB	49 dB	43 dB
Load match	55 dB	55 dB	51 dB	46 dB
Reflection tracking	±0.001 dB	±0.001 dB	±0.005 dB	±0.020 dB
Transmission tracking	±0.008 dB	±0.006 dB	±0.009 dB	±0.021 dB

* These characteristics apply for an environmental temperature of 25 ± 5 °C, with less than 1 °C deviation from the calibration temperature.

† Typical Performance

Table 7-3.

MEASUREMENT PORT CHARACTERISTICS (UNCORRECTED)*				
	Frequency Range			
	30 kHz to 300 kHz†	300 kHz to 1.3 GHz	1.3 GHz to 3 GHz	3 GHz to GHz
Directivity	20 dB‡	35 dB	30 dB	25 dB
Source match	18 dB§	16 dB	16 dB	14 dB
Load match	20 dB§	18 dB	16 dB	14 dB
Reflection tracking	±2.0 dB	±1.5 dB	±1.5 dB	±2.5 dB
Transmission tracking	±2.0 dB	±1.5 dB	±1.5 dB	±2.5 dB
Crosstalk	100 dB	100 dB	100 dB	90 dB

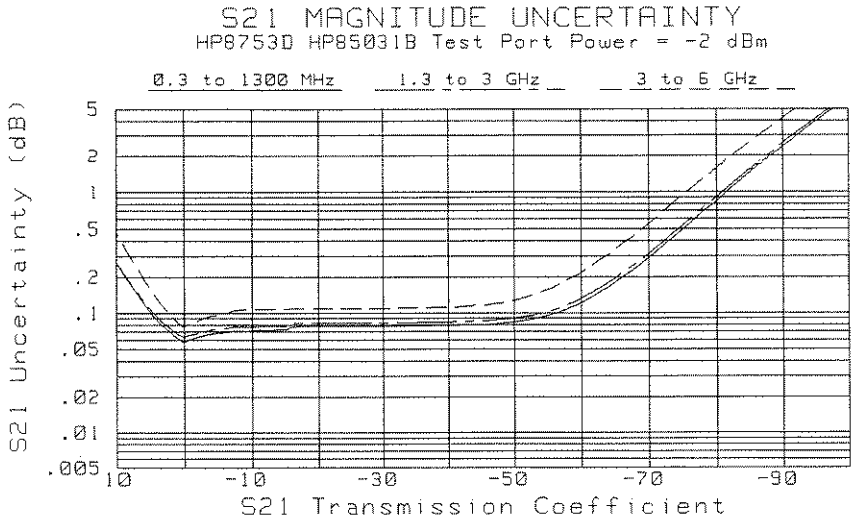
* Applies at 25 ±5 °C

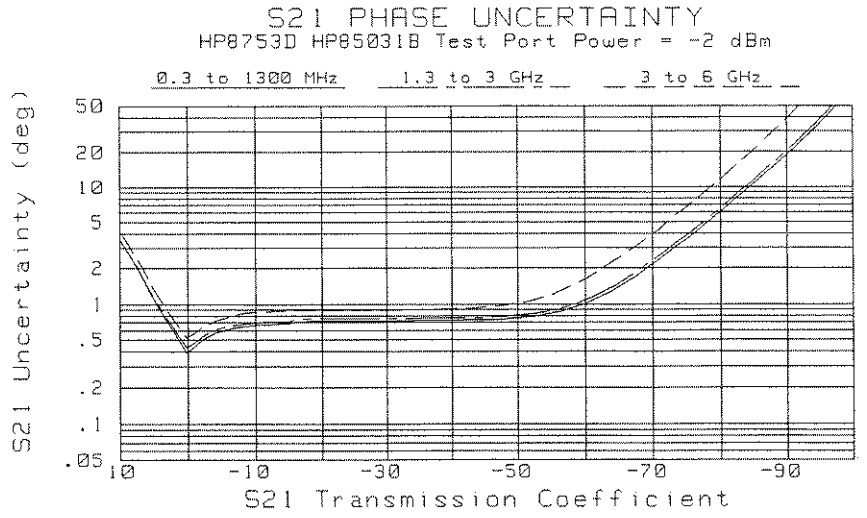
† Typical

§ 15 dB, 30 kHz to 50 kHz

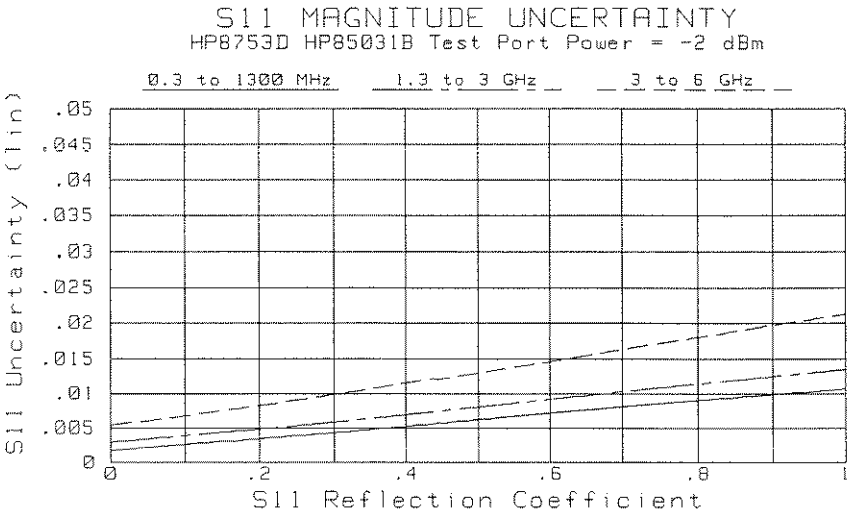
‡ 10 dB, 30 kHz to 50 kHz

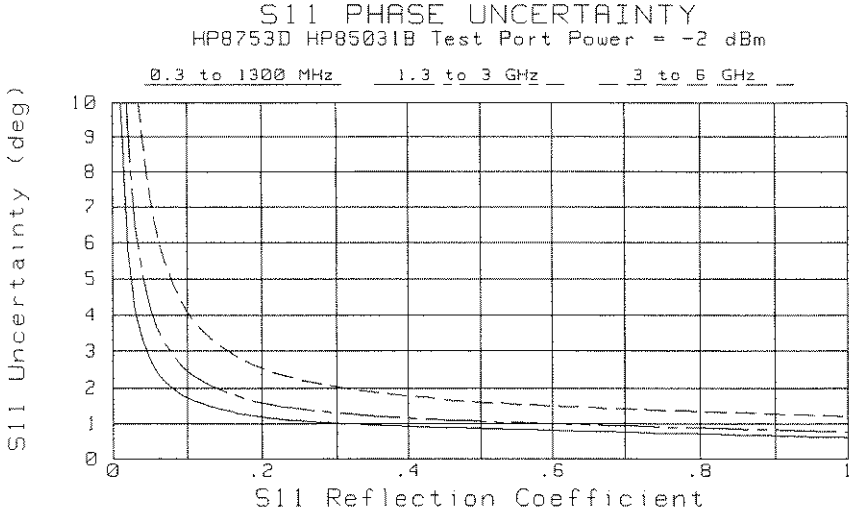
Transmission Measurement Uncertainties





Reflection Measurement Uncertainties





Front Panel Connectors

Connector Type ..... 7 mm precision

Impedance ..... 50 ohms (nominal)

Connector Conductor Depth ..... 0.000 to 0.003 in.

Environmental Characteristics

Operating Conditions

Operating Temperature ..... 0 ° to 55 °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

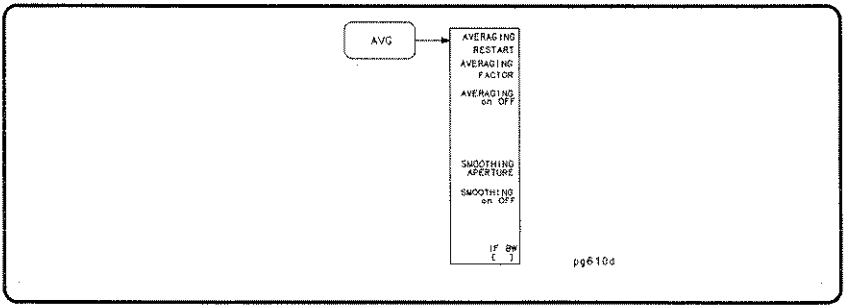
Temperature ..... −40 °C to +70 °C

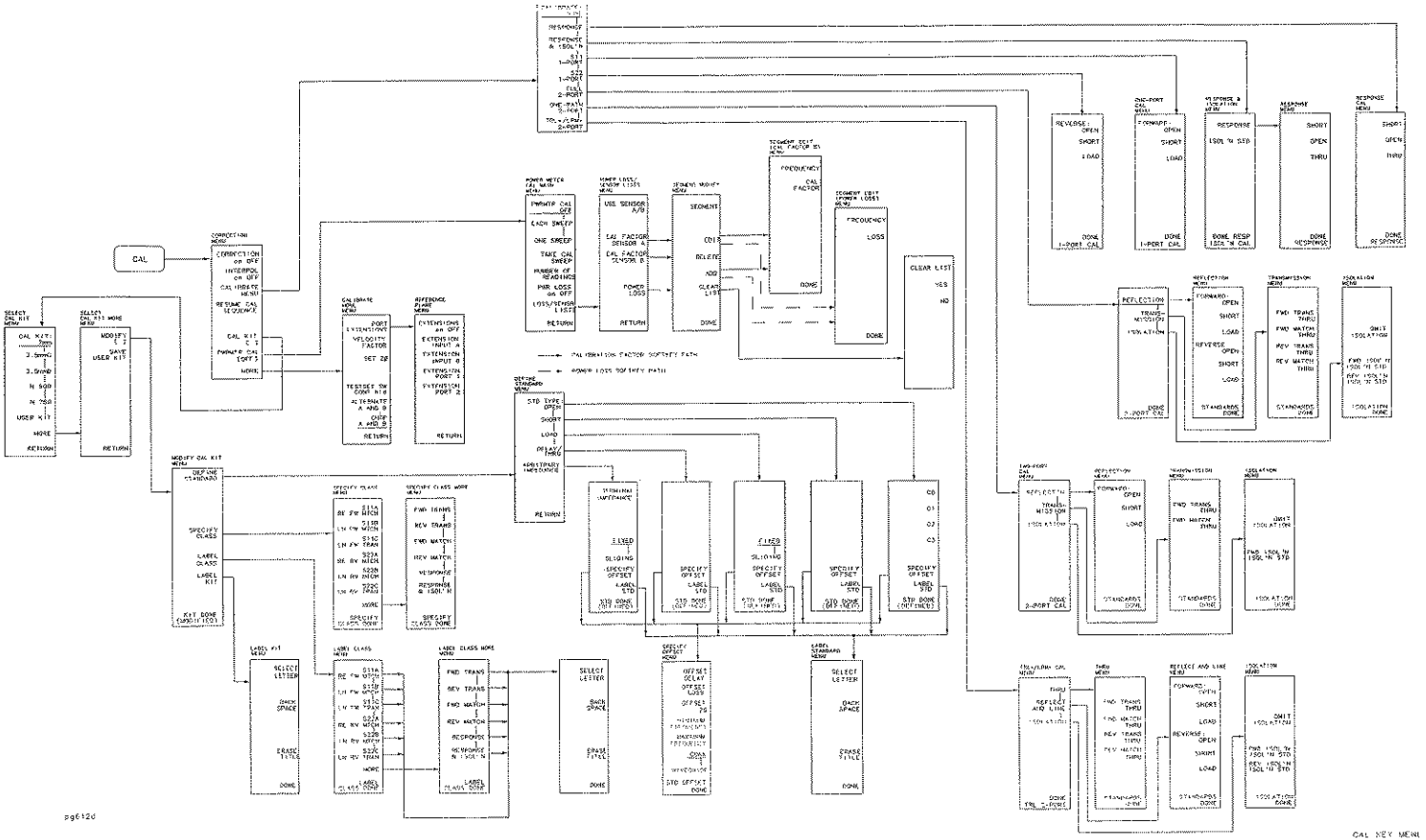
Humidity ..... 0 to 90% relative at +65 °C (non-condensing)

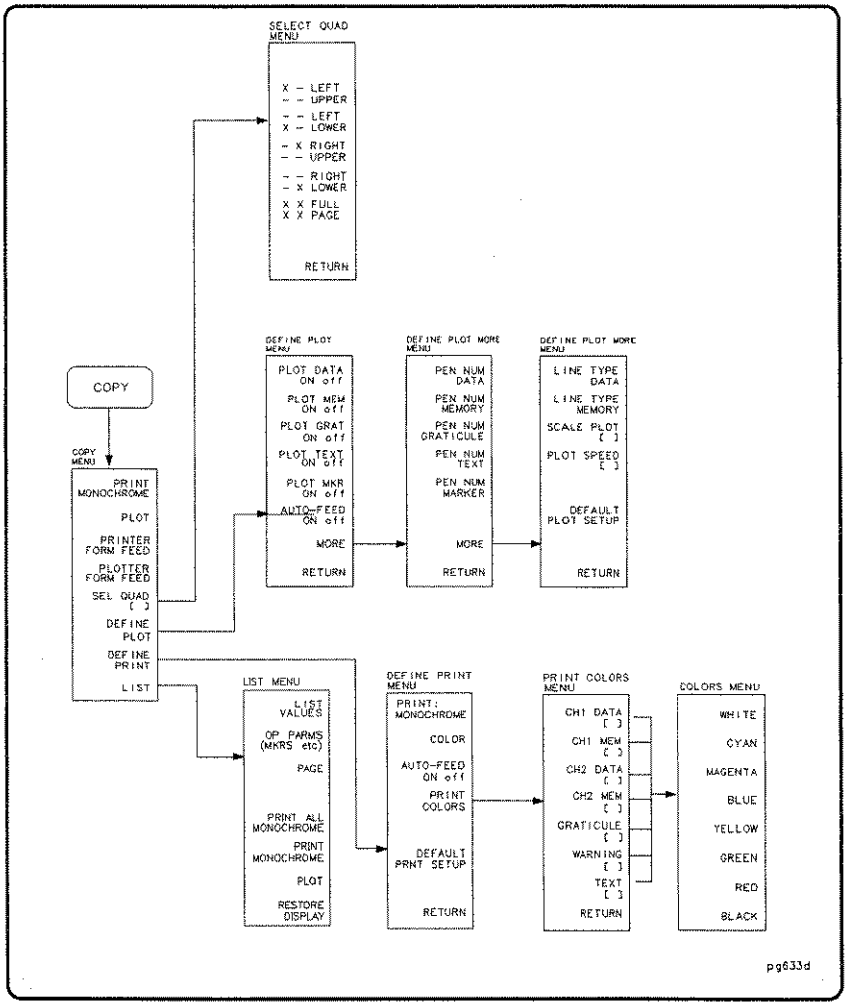
Altitude ..... 0 to 15,240 meters (50,000 feet)

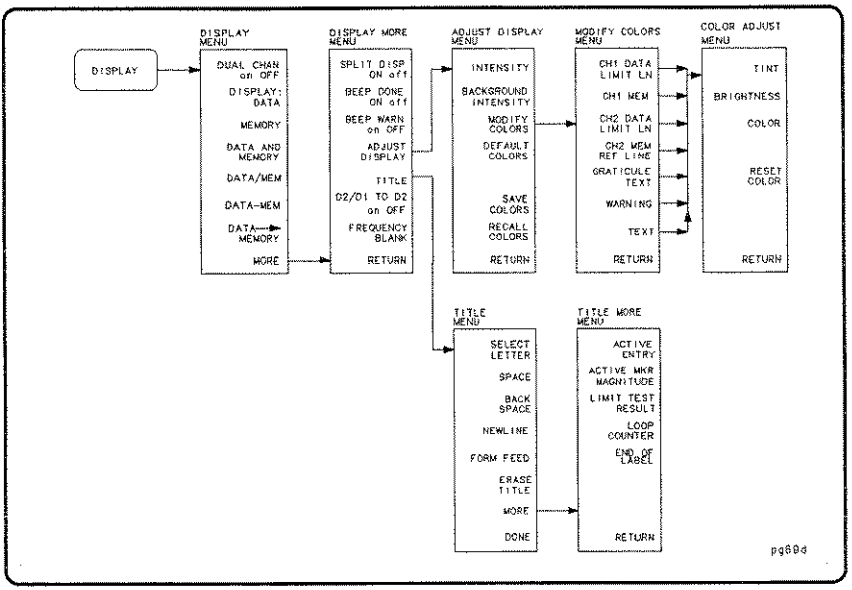
8

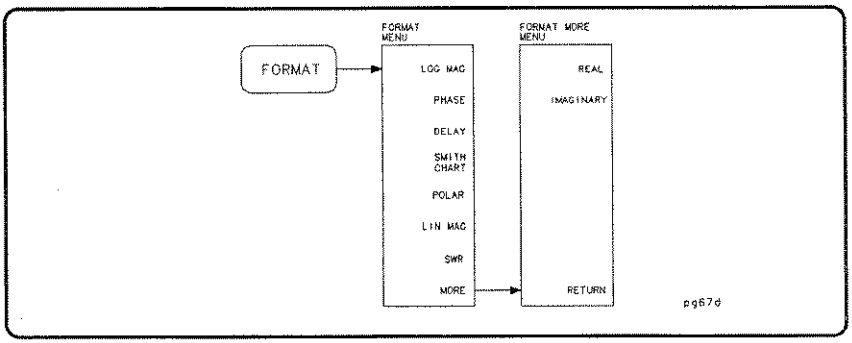
Menu Maps

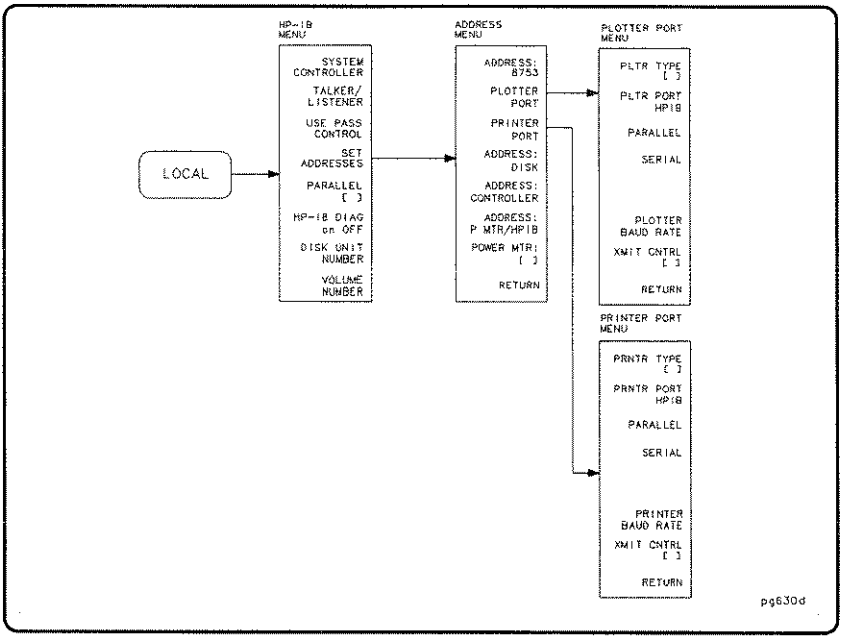


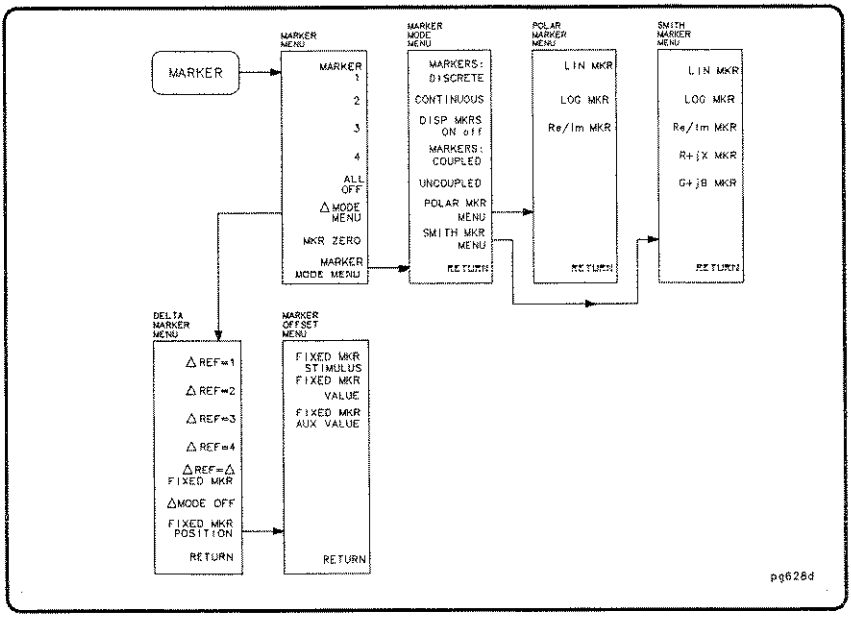


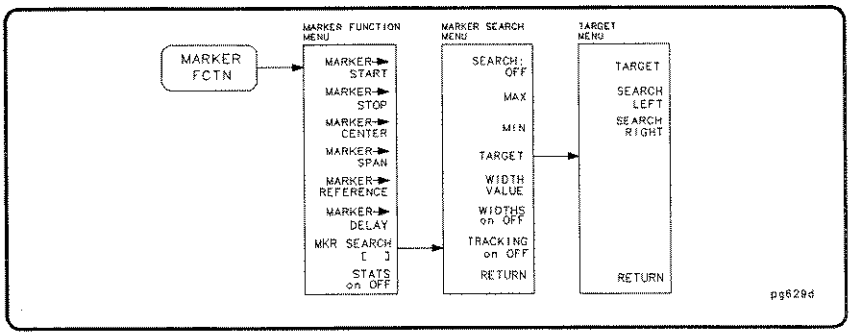


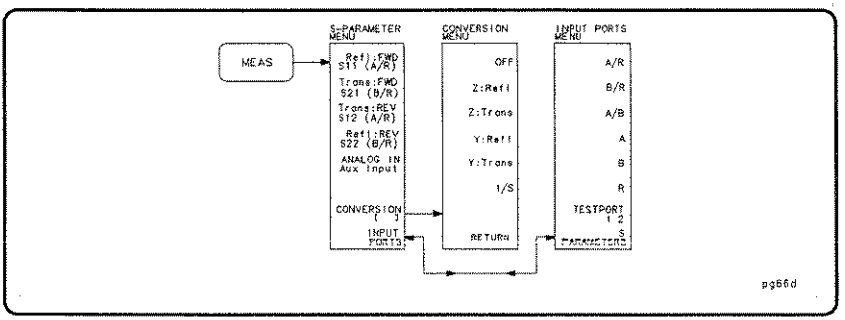


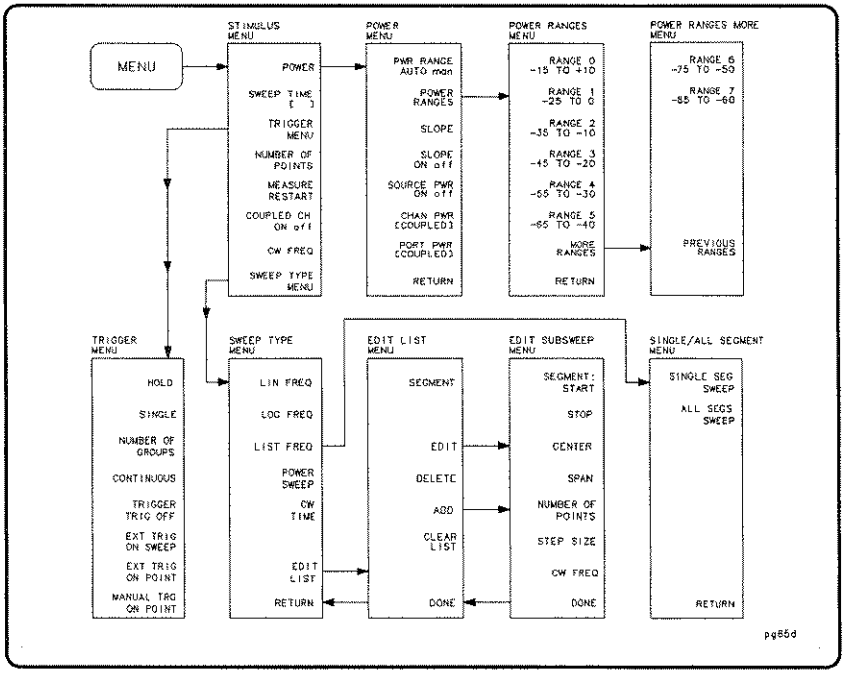


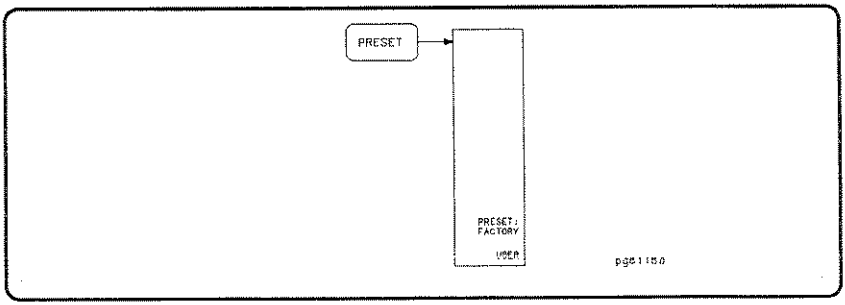


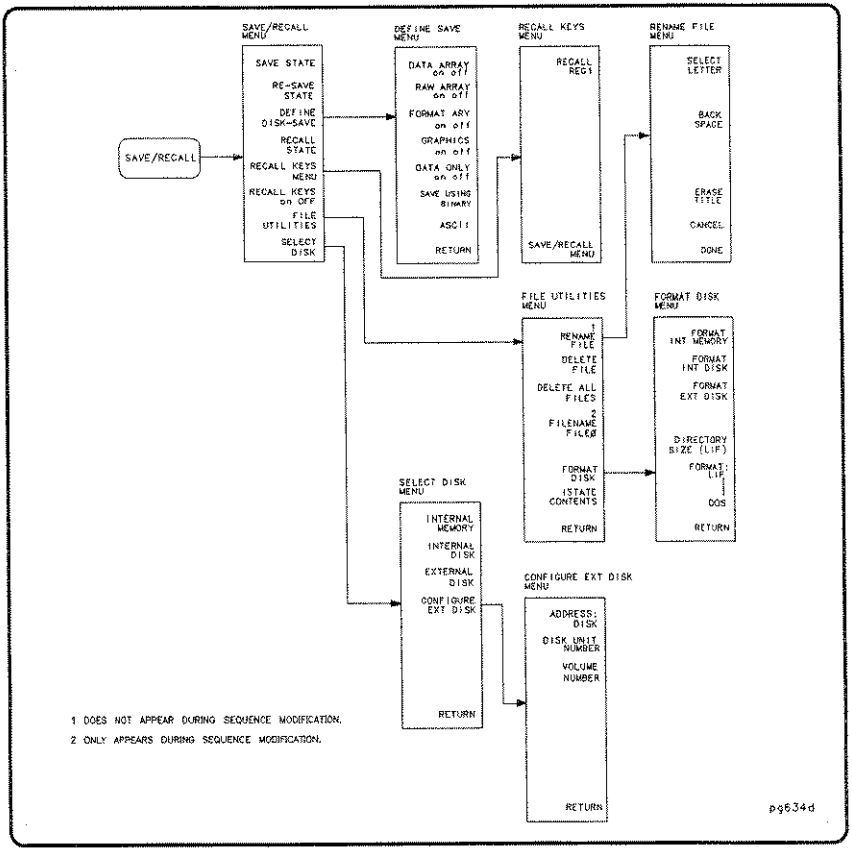


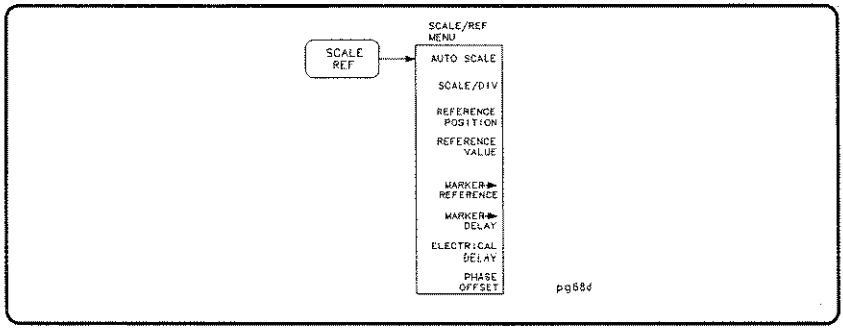


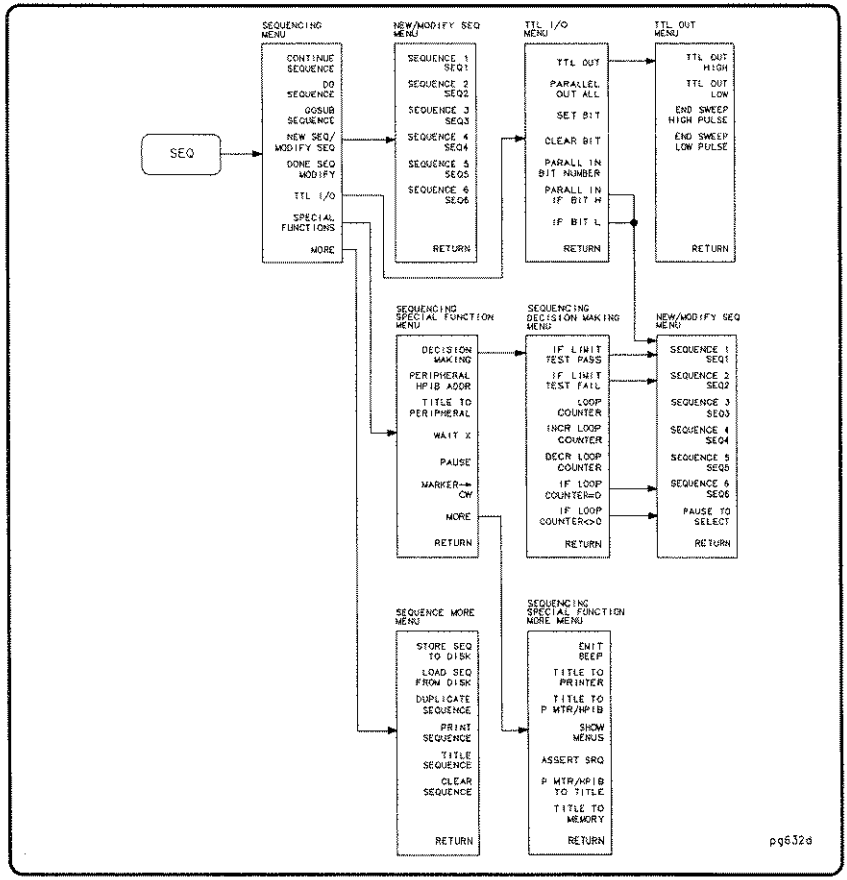


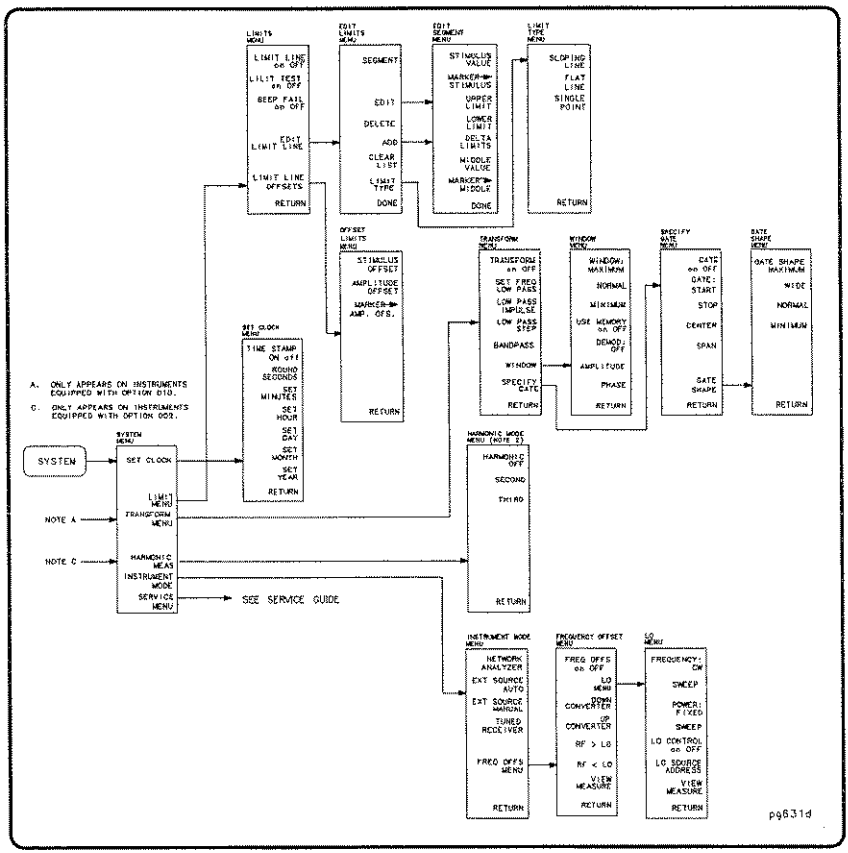












9

Key Definitions

Softkey Locations

The following table lists the softkey functions alphabetically, and the corresponding front-panel access key.

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 = Δ FIXED MKR	MARKER
1/S	MEAS
3.5mmC	CAL
3.5mmD	CAL
A	MEAS
A/B	MEAS
A/R	MEAS
ACTIVE ENTRY	DISPLAY
ACTIVE MRK MAGNITUDE	DISPLAY
ADDRESS: 8753	LOCAL
ADDRESS: CONTROLLER	LOCAL
ADDRESS: DISK	LOCAL
ADDRESS: DISK	SAVE/RECALL
ADDRESS: P MTR/HPIB	LOCAL
ADJUST DISPLAY	DISPLAY
ALL OFF	MARKER
ALL SEGS SWEEP	MENU
ALTERNATE A and B	CAL
AMPLITUDE	SYSTEM
AMPLITUDE OFFSET	SYSTEM

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
ANALOG IN Aux Input	MEAS
ARBITRARY IMPEDANCE	CAL
ASCII	SAVE RECALL
ASSERT SRQ	SEQ
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
BRIGHTNESS	DISPLAY
C0	CAL
C1	CAL
C2	CAL
C3	CAL
CAL FACTOR	CAL
CAL FACTOR SENSOR A	CAL
CAL FACTOR SENSOR B	CAL
CAL KIT [ ]	CAL
CAL KIT: 3.5mmC	CAL

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
CAL KIT: 3.5mmD	CAL
CAL KIT: 7mm	CAL
CAL KIT: N 50Ω	CAL
CAL KIT: N 75Ω	CAL
CALIBRATE MENU	CAL
CALIBRATE: NONE	CAL
CENTER	MENU
CENTER	SYSTEM
CH1 DATA [ ]	COPY
CH1 DATA LIMIT LN	DISPLAY
CH1 MEM	DISPLAY
CH1 MEM [ ]	COPY
CH2 DATA [ ]	COPY
CH2 DATA LIMIT LN	DISPLAY
CH2 MEM [ ]	COPY
CH2 MEM REF LINE	DISPLAY
CHAN PWR [COUPLED]	MENU
CHAN PWR [UNCOUPLED]	MENU
CHOP A and B	CAL
CLEAR BIT	SEQ
CLEAR SEQUENCE	SEQ
COAX	CAL
COLOR	DISPLAY
CONFIGURE EXTERNAL DISK	SAVE/RECALL
CONTINUE SEQUENCE	SEQ
CONTINUOUS	MENU

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
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
DEFINE PRINT	COPY
DEFINE STANDARD	CAL
DELAY	FORMAT
DELAY/THRU	CAL
DELETE FILE	SAVE/RECALL
DELTA LIMITS	SYSTEM
DEMOD: OFF	SYSTEM

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
DIRECTORY SIZE (LIF)	SAVE RECALL
DISK UNIT NUMBER	LOCAL
DISK UNIT NUMBER	SAVE/RECALL
DISPLAY: DATA	DISPLAY
DISP MKRS ON off	MARKER
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 2-PORT	CAL
DOWN CONVERTER	SYSTEM
DUAL CHAN on OFF	DISPLAY
DUPLICATE SEQUENCE	SEQ
EACH SWEEP	CAL
EDIT LIMIT LINE	SYSTEM
EDIT LIST	MENU
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

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
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
FILETITLE FILE0	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
FORMAT ARY on OFF	SAVE/RECALL
FORMAT DISK	SAVE/RECALL
FORMAT: DOS	SAVE/RECALL
FORMAT EXT DISK	SAVE/RECALL
FORMAT INT DISK	SAVE/RECALL
FORMAT INT MEMORY	SAVE/RECALL
FORMAT: LIF	SAVE/RECALL
FREQ OFFS MENU	SYSTEM

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
FREQ OFFS on OFF	SYSTEM
FREQUENCY	CAL
FREQUENCY BLANK	DISPLAY
FREQUENCY: CW	SYSTEM
FREQUENCY: SWEEP	SYSTEM
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 on OFF	SYSTEM
GATE SHAPE	SYSTEM
GATE SHAPE MAXIMUM	SYSTEM
GATE SHAPE MINIMUM	SYSTEM
GATE SHAPE NORMAL	SYSTEM
GATE: SPAN	SYSTEM
GATE: START	SYSTEM
GATE: STOP	SYSTEM
GOSUB SEQUENCE	SEQ
GRAPHICS on OFF	SAVE RECALL
GRATICULE [ ]	COPY
GRATICULE TEXT	DISPLAY

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
HARMONIC MEAS	SYSTEM
HARMONIC OFF	SYSTEM
HARMONIC SECOND	SYSTEM
HARMONIC THIRD	SYSTEM
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

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
LABEL CLASS	CAL
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
LIST FREQ	MENU
LIN MKR	MARKER
LINE TYPE DATA	COPY
LINE TYPE MEMORY	COPY
LIST	COPY
LO CONTROL on OFF	SYSTEM
LO MENU	SYSTEM
LO SOURCE ADDRESS	SYSTEM
LOAD	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
LOSS	CAL
LOSS/SENSR LISTS	CAL
LOWER LIMIT	SYSTEM
LOW PASS IMPULSE	SYSTEM
LOW PASS STEP	SYSTEM
MANUAL TRG ON POINT	MENU
MARKER -> AMP. OFS.	SYSTEM
MARKER -> CENTER	MARKER FCTN
MARKER -> CW	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 MODE MENU	MARKER

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
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
N 50Ω	CAL
N 75Ω	CAL
NETWORK ANALYZER	SYSTEM
NEW SEQ/MODIFY SEQ	SEQ
NEWLINE	DISPLAY
NORMAL	SYSTEM
NUMBER OF GROUPS	MENU
NUMBER OF POINTS	MENU
NUMBER OF READINGS	CAL
OFFSET DELAY	CAL

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
OFFSET LOSS	CAL
OFFSET Z0	CAL
OMIT ISOLATION	CAL
ONE-PATH 2-PORT	CAL
ONE SWEEP	CAL
OPEN	CAL
P MTR/HPIB TO TITLE	SEQ
PARALLEL	LOCAL
PARALLEL [ ]	LOCAL
PARALLEL OUT ALL	SEQ
PARALL IN BIT NUMBER	SEQ
PARALL IN IF BIT H	SEQ
PARALL IN IF BIT L	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 SPEED [ ]	COPY
PLOT TEXT ON off	COPY
PLOTTER BAUD RATE	LOCAL
PLOTTER FORM FEED	COPY
PLOTTER PORT	LOCAL
PLTR PORT HPIB	LOCAL
PLTR TYPE [ ]	LOCAL
POLAR	FORMAT
POLAR MKR MENU	MARKER
PORT EXTENSIONS	CAL
PORT PWR [COUPLED]	MENU
PORT PWR [UNCOUPLED]	MENU
POWER	MENU
POWER: FIXED	SYSTEM
POWER LOSS	CAL
POWER MTR [ ]	LOCAL
POWER RANGES	MENU
POWER SWEEP	MENU
PRESET: FACTORY	PRESET
PRESET: USER	PRESET
PRINT: COLOR	COPY
PRINT COLORS	COPY
PRINT: MONOCHROME	COPY
PRINT MONOCHROME	COPY

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
PRINT SEQUENCE	SEQ
PRINTER BAUD RATE	LOCAL
PRINTER FORM FEED	COPY
PRINTER PORT	LOCAL
PRNTR PORT HPIB	LOCAL
PRNTR TYPE [ ]	LOCAL
PWR LOSS on OFF	CAL
PWR RANGE AUTO man	MENU
PWRMTR CAL [ ]	CAL
PWRMTR CAL [OFF]	CAL
R	MEAS
R+jX MKR	MARKER
RANGE 0 -15 TO +10	MENU
RANGE 1 -25 TO 0	MENU
RANGE 2 -35 TO -10	MENU
RANGE 3 -45 TO -20	MENU
RANGE 4 -55 TO -30	MENU
RANGE 5 -65 TO -40	MENU
RANGE 6 -75 TO -50	MENU
RANGE 7 -85 TO -60	MENU
RAW ARRAY on OFF	SAVE/RECALL
Re/Im MKR	MARKER
REAL	FORMAT
RECALL COLORS	DISPLAY
RECALL KEYS on OFF	SAVE/RECALL
RECALL REG1	SAVE/RECALL

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
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
REFERENCE POSITION	SCALE REF
REFERENCE VALUE	SCALE REF
Refl: FWD S11 (A/R)	MEAS
Refl: REV S22 (B/R)	MEAS
REFLECT AND LINE	CAL
REFLECTION	CAL
RE-SAVE STATE	SAVE/RECALL
RESET COLOR	DISPLAY
RESPONSE	CAL
RESPONSE & ISOL'N	CAL
RESUME CAL SEQUENCE	CAL
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

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
RIGHT UPPER	COPY
ROUND SECONDS	SYSTEM
S PARAMETERS	MEAS
S11 1-PORT	CAL
S11A RE FW MTCH	CAL
S11B LN FW MTCH	CAL
S11C LN FW TRAN	CAL
S22 1-PORT	CAL
S22A RE RV MTCH	CAL
S22B LN RV MTCH	CAL
S22C LN RV TRAN	CAL
SAVE COLORS	DISPLAY
SAVE USER KIT	CAL
SAVE USING BINARY	SAVE/RECALL
SCALE/DIV	SCALE REF
SCALE PLOT [ ]	COPY
SEARCH LEFT	MARKER FCTN
SEARCH: MAX	MARKER FCTN
SEARCH: MIN	MARKER FCTN
SEARCH: OFF	MARKER FCTN
SEARCH RIGHT	MARKER FCTN
SECOND	SYSTEM
SEGMENT	CAL
SEGMENT	SYSTEM
SEGMENT: CENTER	MENU
SEGMENT: SPAN	MENU

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
SEGMENT: START	MENU
SEGMENT: STOP	MENU
SEL QUAD 1 2 3 4	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
SET ADDRESSES	LOCAL
SET BIT	SEQ
SET CLOCK	SYSTEM
SET DAY	SYSTEM
SET FREQ LOW PASS	SYSTEM
SET HOUR	SYSTEM
SET MINUTES	SYSTEM
SET MONTH	SYSTEM
SET YEAR	SYSTEM
SET Z0	CAL
SHORT	CAL
SINGLE	MENU
SINGLE POINT	SYSTEM
SINGLE SEG SWEEP	MENU
SLIDING	CAL
SLOPE	MENU
SLOPE on OFF	MENU

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
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
STIMULUS VALUE	SYSTEM
STIMULUS OFFSET	SYSTEM
STORE SEQ TO DISK	SEQ
SWEEP	SYSTEM
SWEEP TIME [ ]	MENU
SWEEP TYPE MENU	MENU
SWR	FORMAT

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
SYSTEM CONTROLLER	LOCAL
TAKE CAL SWEEP	CAL
TALKER/LISTENER	LOCAL
TARGET	MARKER FCTN
TERMINAL IMPEDANCE	CAL
TEST PORT 1 2	MEAS
TESTSET SWP CONT hld	CAL
TEXT	DISPLAY
TEXT [ ]	COPY
THIRD	SYSTEM
THRU	CAL
TIME STAMP ON off	SYSTEM
TINT	DISPLAY
TITLE	DISPLAY
TITLE SEQUENCE	SEQ
TITLE TO MEMORY	SEQ
TITLE TO P MTR/HPIB	SEQ
TITLE TO PERIPHERAL	SEQ
TITLE TO PRINTER	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

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
TRIGGER MENU	MENU
TRIGGER: TRIG OFF	MENU
TRL*/LRM* 2-PORT	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
VIEW MEASURE	SYSTEM
VOLUME NUMBER	LOCAL
VOLUME NUMBER	SAVE/RECALL
WAIT X	SEQ
WARNING	DISPLAY
WARNING C I	COPY
WAVEGUIDE	CAL
WIDE	SYSTEM
WIDTH VALUE	MARKER FCTN
WIDTHS on OFF	MARKER FCTN

Table 9-1. Softkey Locations (continued)

Softkey	Front-Panel Access Key
WINDOW	SYSTEM
WINDOW: MAXIMUM	SYSTEM
WINDOW: MINIMUM	SYSTEM
WINDOW: NORMAL	SYSTEM
XMIT CNTRL E J	LOCAL
Y: Refl	MEAS
Y: Trans	MEAS
Z: Refl	MEAS
Z: Trans	MEAS

10

Error Messages

Error Messages in Numerical Order

Refer to the alphabetical listing for explanations and suggestions for solving the problems.

Error Number	Error
1	OPTIONAL FUNCTION; NOT INSTALLED
2	INVALID KEY
3	CORRECTION CONSTANTS NOT STORED
4	PHASE LOCK CAL FAILED
5	NO IF FOUND: CHECK R INPUT LEVEL
6	POSSIBLE FALSE LOCK
7	NO PHASE LOCK: CHECK R INPUT LEVEL
8	PHASE LOCK LOST
9	LIST TABLE EMPTY
10	CONTINUOUS SWITCHING NOT ALLOWED
11	SWEEP TIME INCREASED
12	SWEEP TIME TOO FAST
13	AVERAGING INVALID ON NON-RATIO MEASURE
14	FUNCTION NOT VALID
15	NO MARKER DELTA - SPAN NOT SET
16	TRANSFORM, GATE NOT ALLOWED
17	DEMODULATION NOT VALID
18	LOW PASS MODE NOT ALLOWED
21	POWER SUPPLY HOT!
22	POWER SUPPLY SHUT DOWN!
23	PROBE POWER SHUT DOWN!
24	PRINTER: not on, not connect, wrong addrs
25	PRINT ABORTED
26	PLOTTER: not on, not connect, wrong addrs
27	PLOT ABORTED
28	PLOTTER NOT READY-PINCH WHEELS UP
30	REQUESTED DATA NOT CURRENTLY AVAILABLE
31	ADDRESSED TO TALK WITH NOTHING TO SAY

Error Number	Error
32	WRITE ATTEMPTED WITHOUT SELECTING INPUT TYPE
33	SYNTAX ERROR
34	BLOCK INPUT ERROR
35	BLOCK INPUT LENGTH ERROR
36	SYST CTRL OR PASS CTRL IN LOCAL MENU
37	CAN'T CHANGE-ANOTHER CONTROLLER ON BUS
38	DISK: not on, not connected, wrong addrs
39	DISK HARDWARE PROBLEM
40	DISK MEDIUM NOT INITIALIZED
41	NO DISK MEDIUM IN DRIVE
42	FIRST CHARACTER MUST BE A LETTER
43	ONLY LETTERS AND NUMBERS ARE ALLOWED
44	NOT ENOUGH SPACE ON DISK FOR STORE
45	NO FILE(S) FOUND ON DISK
46	ILLEGAL UNIT OR VOLUME NUMBER
47	INITIALIZATION FAILED
48	DISK IS WRITE PROTECTED
49	DISK WEAR-REPLACE DISK SOON
50	TOO MANY SEGMENTS OR POINTS
51	INSUFFICIENT MEMORY
52	SYSTEM IS NOT IN REMOTE
54	NO VALID MEMORY TRACE
55	NO VALID STATE IN REGISTER
56	INSTRUMENT STATE MEMORY CLEARED
57	OVERLOAD ON INPUT R, POWER REDUCED
58	OVERLOAD ON INPUT A, POWER REDUCED
59	OVERLOAD ON INPUT B, POWER REDUCED
61	SOURCE PARAMETERS CHANGED

Error Number	Error
63	CALIBRATION REQUIRED
64	CURRENT PARAMETER NOT IN CAL SET
65	CORRECTION AND DOMAIN RESET
66	CORRECTION TURNED OFF
67	DOMAIN RESET
68	ADDITIONAL STANDARDS NEEDED
69	NO CALIBRATION CURRENTLY IN PROGRESS
70	NO SPACE FOR NEW CAL \ CLEAR REGISTERS
71	MORE SLIDES NEEDED
72	EXCEEDED 7 STANDARDS PER CLASS
73	SLIDES ABORTED (MEMORY REALLOCATION)
74	CALIBRATION ABORTED
75	FORMAT NOT VALID FOR MEASUREMENT
77	WRONG DISK FORMAT, INITIALIZE DISK
111	DEADLOCK
112	SELF TEST #n FAILED
113	TEST ABORTED
114	NO FAIL FOUND
115	TROUBLE! CHECK SETUP AND START OVER
116	POW MET INVALID
117	POW MET: not on, not connected, wrong addrs
118	POW MET NOT SETTLED
119	DEVICE: not on, not connect, wrong addrs
123	NO MEMORY AVAILABLE FOR INTERPOLATION
124	SELECTED SEQUENCE IS EMPTY
125	DUPLICATING TO THIS SEQUENCE NOT ALLOWED
126	NO MEMORY AVAILABLE FOR SEQUENCING
127	CAN'T STORE/LOAD SEQUENCE, INSUFFICIENT MEMORY

Error Number	Error
130	D2/D1 INVALID WITH SINGLE CHANNEL
131	FUNCTION NOT VALID DURING MOD SEQUENCE
132	MEMORY FOR CURRENT SEQUENCE IS FULL
133	THIS LIST FREQ INVALID IN HARM/3 GHZ RNG
140	FREQ OFFSET ONLY VALID IN NETWORK ANALYZER MODE
141	STOP/CW FREQ + OFFSET MUST BE < 3 GHz
144	NO LIMIT LINES DISPLAYED
145	SWEEP TYPE CHANGED TO LINEAR SWEEP
148	EXTERNAL SOURCE MODE REQUIRES CW TIME
150	LOG SWEEP REQUIRES 2 OCTAVE MINIMUM SPAN
151	SAVE FAILED \ INSUFFICIENT MEMORY
152	D2/D1 INVALID \ CH1 CH2 NUM PTS DIFFERENT
153	SEQUENCE MAY HAVE CHANGED, CAN'T CONTINUE
154	INSUFFICIENT MEMORY, PWR MTR CAL OFF
157	SEQUENCE ABORTED
159	CH1 (CH2) TARGET VALUE NOT FOUND
161	PRESS [MENU], SELECT CW (IF) FREQ, THEN SWEPT LO
162	EXT SRC: NOT ON/CONNECTED OR WRONG ADDR
163	FUNCTION ONLY VALID DURING MOD SEQUENCE
164	TOO MANY NESTED SEQUENCES
165	PARALLEL PORT NOT AVAILABLE FOR GPIO
166	PRINT/PLOT IN PROGRESS, ABORT WITH LOCAL
167	PARALLEL PORT NOT AVAILABLE FOR COPY
168	INSUFFICIENT MEMORY FOR PRINT/PLOT
169	HPIB COPY IN PROGRESS, ABORT WITH LOCAL
170	COPY:device not responding; copy aborted
171	PRINTER: paper error
172	PRINTER: not on line

Error Number	Error
173	PRINTER: not connected
174	PRINTER: power off
175	PRINTER: error
176	PRINTER: busy
177	PRINTER: not handshaking
178	print color not supported with EPSON
179	POWER UNLEVELED
180	DOS NAME LIMITED TO 8 CHARS + 3 CHAR EXTENSION
181	BAD FREQ FOR HARMONIC OR FREQ OFFSET
182	LIST MODE OFF: INVALID WITH LO FREQ
183	BATTERY FAILED. STATE MEMORY CLEARED
184	BATTERY LOW! STORE SAVE REGS TO DISK
185	CANNOT FORMAT DOS DISKS ON THIS DRIVE
187	SWEEP MODE CHANGED TO CW TIME SWEEP
188	DIRECTORY FULL
189	DISK READ/WRITE ERROR
190	DISK MESSAGE LENGTH ERROR
191	EXT SOURCE NOT READY FOR TRIGGER
192	FILE NOT FOUND
193	ASCII: MISSING 'BEGIN' statement
194	ASCII: MISSING 'CITIFILE' statement
195	ASCII: MISSING 'DATA' statement
196	ASCII: MISSING 'VAR' statement
197	FILE NOT FOUND OR WRONG TYPE
198	NOT ALLOWED DURING POWER METER CAL
199	CANNOT MODIFY FACTORY PRESET
200	ALL REGISTERS HAVE BEEN USED
201	FUNCTION NOT VALID FOR INTERNAL MEMORY

11

Compatible Peripherals

Measurement Accessories Available

Calibration Kits

- HP 85031B 7 mm Calibration Kit
- HP 85032B 50 Ohm Type-N Calibration Kit
- HP 85033D 3.5 mm Calibration Kit
- HP 85033C 3.5 mm Calibration Kit
- HP 85036B 75 Ohm Type-N Calibration Kit
- HP 85039A 75 Ohm Type-F Calibration Kit

Verification Kit

HP 85029B 7 mm Verification Kit

Test Port Return Cables

- HP 11857D 7 mm Test Port Return Cable Set
- HP 11857B 75 Ohm Type-N Test Port Return Cable Set

Adapter Kits

- HP 11852B 50 to 75 Ohm Minimum Loss Pad.
- HP 11853A 50 Ohm Type-N Adapter Kit
- HP 11854A 50 Ohm BNC Adapter Kit
- HP 11855A 75 Ohm Type-N Adapter Kit
- HP 11856A 75 Ohm BNC Adapter Kit

System Accessories Available

Plotters and Printers

- 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
- HP Deskjet 1200C (can also be used to plot)
- HP Deskjet 500
- HP Deskjet 520
- HP Deskjet 500C
- HP Deskjet 550C
- HP Deskjet 560C
- All LaserJets (LaserJet III and IV can also be used to plot)
- HP DeskJet Portable/310
- PaintJet 3630A

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

HP C1405A Option ABA keyboard

Connecting and Configuring Peripherals

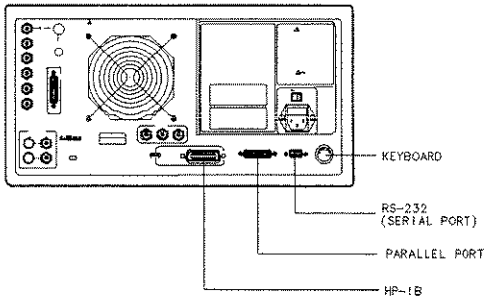


Figure 11-1. Printer Connections to the Analyzer

Configuring Peripherals with HP-IB Interface

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 Structure

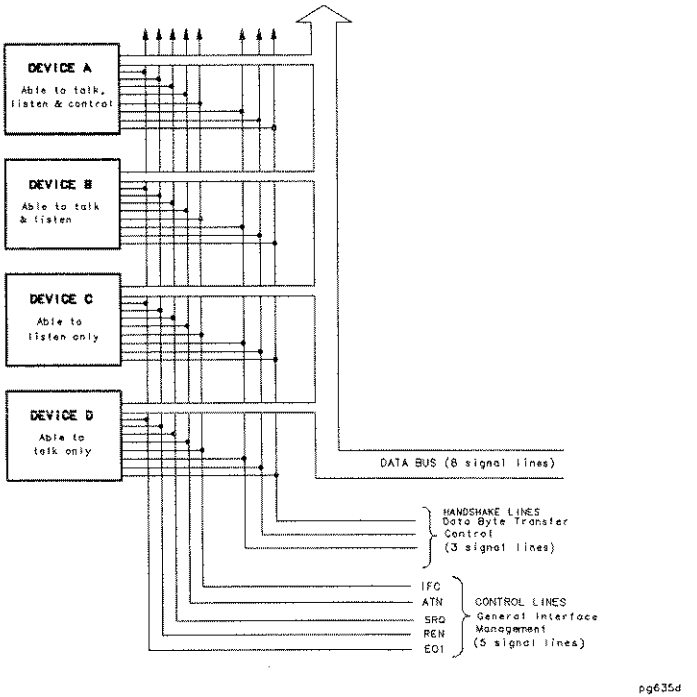


Figure 11-2. HP-IB Structure

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 asynchronous data transfer using a 3-line handshake system.
Data Rate:	Maximum of 1 megabyte per second over limited distances with tri-state drivers. Actual data rate depends on the transfer rate of the slowest device involved.
Address Capability:	Primary addresses: 31 talk, 31 listen. A maximum of 1 talker and 14 listeners at one time.
Multiple Controller Capability:	In systems with more than one controller (like the analyzer system), only one can be active at a time.

Analyzer HP-IB Capabilities

As defined by the IEEE 488.1 standard, the analyzer has the following capabilities:

SH1	Full source handshake capability.
AH1	Full acceptor handshake capability.
T6	Can be a basic talker, answers serial poll, unaddresses if MLA is issued.
TE0	No extended talker capabilities.
L4	Acts as a basic listener and unaddresses if MTA is issued.
SR1	Can issue service requests.

RL1	Will do remote, local, and local lockout.
PP0	Does not respond to parallel poll.
DC1	Device clear capability.
DT1	Will respond to device trigger in hold mode.
C1, C2, C3	No controller capabilities in talker/listener mode. System controller mode can be selected under the LOCAL menu.
C10	Pass control capability in pass control mode.
E2	Tri-state drivers.

12

Preset State and Memory Allocation

Types of Memory

The analyzer utilizes three types of memory:

- volitile
- non-volitile
- external

Volatile Memory

This is dynamic read/write memory, of approximately 2 M bytes, 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 short term 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 Arrays

Variable	Data Length (Bytes)	Approximate Totals (Bytes)			
		401 pts	801 pts	1601 pts	
		1 chan		1 chan	2 chans
Calibration Arrays					
Response	N x 6 + 52	2.5 k	5 k	10 k	19 k
Response and Isolation	N x 6 x 2 + 52	5 k	10 k	19 k	38 k
1-Port	N x 6 x 3 + 52	7 k	14 k	29 k	58 k
2-Port	N x 6 x 12 + 52	29 k	58 k	115 k	230 k
Interpolated Cal	Same as above in addition to regular cal				
Power Meter Cal*	(N† x 2 x number of channels‡) +208	1 k	1.8 k	3.4 k	6.6 k
Measurement Data Memory Array*	N x 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.

External Memory

External memory is defined as either the internal floppy disk or an external disk.

Preset State

Table 12-2. Preset Conditions (1 of 10)

Preset Conditions	Preset Value
Analyzer Mode	
Analyzer Mode	Network Analyzer Mode
Frequency Offset	Off
Operation	
Offset Value	0
Harmonic Operation	Off
Stimulus Conditions	
Sweep Type	Linear Frequency
Display Mode	Start/Stop
Trigger Type	Continuous
External Trigger	Off
Sweep Time	100 ms, Auto Mode
Start Frequency	30 kHz
Frequency Span (std.)	2999.97 MHz
Frequency Span (Opt. 006)	5999.97 MHz
Start Time	0
Time Span	100 ms
CW Frequency	1000 MHz
Source Power	0 dBm
Power Slope	0 dB/GHz; Off
Start Power	−15.0 dBm
Power Span	25 dB
Coupled Power	On
Source Power	On
Coupled Channels	On
Coupled Port Power	On

Preset Conditions (2 of 10)

Preset Conditions	Preset Value
Power Range	Auto; Range 0
Number of Points	201
Frequency List	
Frequency List	Empty
Edit Mode	Start/Stop, Number of Points
Response Conditions	
Parameter	Channel 1: S11; Channel 2: S21
Conversion	Off
Format	Log Magnitude (all inputs)
Display	Data
Color Selections	Same as before [PRESET]
Dual Channel	Off
Active Channel	Channel 1
Frequency Blank	Disabled
Split Display	On
Intensity	If set to $\geq$ 15%, [PRESET] has no effect. If set to $<$ 15% [PRESET] increases intensity to 15%.
Beeper: Done	On
Beeper: Warning	Off
D2/D1 to D2	Off
Title	Channel 1 = [hp]

Preset Conditions (3 of 10)

Preset Conditions	Preset Value
	Channel 2 = Empty
IF Bandwidth	3000 Hz
IF Averaging Factor	16; Off
Smoothing Aperture	1% SPAN; Off
Phase Offset	0 Degrees
Electrical Delay	0 ns
Scale/Division	10 dB/Division
Calibration	
Correction	Off
Calibration Type	None
Calibration Kit	7 mm
System Z0	50 Ohms
Velocity Factor	1
Extensions	Off
Port 1	0 s
Port 2	0 s
Input A	0 s
Input B	0 s
Chop A and B	On
Power Meter Calibration	Off
Number of Readings	1
Power Loss Correction	Off
Sensor A/B	A

Preset Conditions (4 of 10)

Preset Conditions	Preset Value
Interpolated Error Correction	Off
Markers (coupled)	
Markers 1, 2, 3, 4	1 GHz; All Markers Off
Last Active Marker	1
Reference Marker	None
Marker Mode	Continuous
Display Markers	On
Delta Marker Mode	Off
Coupling	On
Marker Search	Off
Marker Target Value	−3 dB
Marker Width Value	−3 dB; Off
Marker Tracking	Off
Marker Stimulus Offset	0 Hz
Marker Value Offset	0 dB
Marker Aux Offset (Phase)	0 Degrees
Marker Statistics	Off
Polar Marker	Lin Mkr
Smith Marker	R+jX Mkr
Limit Lines	
Limit Lines	Off
Limit Testing	Off

Preset Conditions (5 of 10)

Preset Conditions	Preset Value
Limit List	Empty
Edit Mode	Upper/Lower Limits
Stimulus Offset	0 Hz
Amplitude Offset	0 dB
Limit Type	Sloping Line
Beep Fail	Off
Time Domain	
Transform	Off
Transform Type	Bandpass
Start Transform	−20 nanoseconds
Transform Span	40 nanoseconds
Gating	Off
Gate Shape	Normal
Gate Start	−10 nanoseconds
Gate Span	20 nanoseconds
Demodulation	Off
Window	Normal
Use Memory	Off
System Parameters	
HP-IB Addresses	Last Active State
HP-IB Mode	Last Active State
Focus	Last Active State
Clock Time Stamp	On
Preset: Factory/User	Last Selected State

Preset Conditions (6 of 10)

Preset Conditions	Preset Value
Copy Configuration	
Parallel Port	Copy
Plotter Type	Plotter
Plotter Port	Serial
Plotter Baud Rate	9600
Plotter Handshake	Xon-Xoff
HP-IB Address	5
Printer Type	DeskJet
Printer Port	Parallel
Printer Baud Rate	19200
Printer Handshake	Xon-Xoff
Printer HP-IB Address	1
Disk Save Configuration (Define Store)	
Data Array	Off
Raw Data Array	Off
Formatted Data Array	Off
Graphics	Off
Data Only	Off
Directory Size	Default[1]
Save Using	Binary

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.

Preset Conditions (7 of 10)

Preset Conditions	Preset Value
Select Disk	Internal Memory
Disk Format	LIF
Sequencing[1]	
Loop Counter	0
TTL OUT	High
Service Modes	
HP-IB Diagnostic	Off
Source Phase Lock	Loop On
Sampler Correction	On
Spur Avoidance	On
Aux Input Resolution	High
Analog Bus Node	11 (Aux Input)
Plot	
Plot Data	On
Plot Memory	On
Plot Graticule	On
Plot Text	On
Plot Marker	On
Autofeed	On
Plot Quadrant	Full Page
Scale Plot	Full

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

Preset Conditions (8 of 10)

Preset Conditions	Preset Value
Plot Speed	Fast
Pen Number:	
Ch1 Data	2
Ch2 Data	3
Ch1 Memory	5
Ch2 Memory	6
Ch1 Graticule	1
Ch2 Graticule	1
Ch1 Text	7
Ch2 Text	7
Ch1 Marker	7
Ch2 Marker	7
Line Type:	
Ch1 Data	7
Ch2 Data	7
Ch1 Memory	7
Ch2 Memory	7
Print	
Printer Mode	Last Active State
Auto-Feed	On

Preset Conditions (9 of 10)

Preset Conditions	Preset Value
Printer Colors	
CH1 Data	Magenta
CH1 Mem	Green
CH2 Data	Blue
CH2 Mem	Red
Graticule	Cyan
Warning	Black
Text	Black

Preset Conditions (10 of 10)

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