HP-IB Programming and Command Reference Guide

HP 8753E Network Analyzer

Including Option 011

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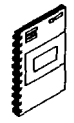
How to Use This Guide

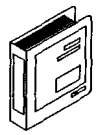
This guide uses the following conventions:

Front-Panel Key	This represents a key physically located on the instrument.
Softkey	This represents a "softkey," a key whose label is determined by the instrument's firmware.
Screen Text	This represents text displayed on the instrument's screen.

HP 8753E/Option 011 Network Analyzer Documentation Map



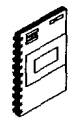
The Installation and Quick Start Guide familiarizes you with the HP 8753E/Option 011 network analyzer's front and rear panels, electrical and environmental operating requirements, as well as procedures for installing, configuring, and verifying the operation of the analyzer.



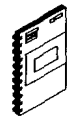
The **User's Guide** shows how to make measurements, explains commonly-used features, and tells you how to get the most performance from your analyzer.

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

The HP-IB Programming and Command Reference Guide provides programming information for operation of the network analyzer under HP-IB control.



The HP BASIC Programming Examples Guide provides a tutorial introduction **using** BASIC programming examples to demonstrate the remote operation of the network analyzer.



The System Verification and Test Guide provides the system verification and performance tests and the Performance Test Record for your HP 8753E/Option 011 network analyzer.

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HP-IB Programming and Command Reference Guide

This document is a reference for operation of the network analyzer under HP-IB control. For information about manual operation of the analyzer, refer to the ***HP 87533 Network Analyzer User's Guide.***

Where to Look for More Information

Additional information covering many of the topics discussed in this document is located in the following:

- ***Tutorial Description of the Hewlett-Packard Interface Bus***, presents a description and discussion of all aspects of the HP-IB. A thorough overview of all technical details as a broad tutorial. HP publication, HP part number 5021-1927.
- ***IEEE Standard Digital Interface for* Programmable *Instrumentation ANSI/IEEE std 488.1-1987*** contains detailed information on IEEE-488 operation. Published by the:
  Institute of Electrical and Electronics Engineers, Inc.,
  345 East 47th Street
  New York, New York 10017.
- ***HP BASIC Programming Examples Guide*** includes programming examples in HP BASIC.

Preset Conditions

When the PRESET key is pressed, the analyzer reverts to a known state called the factory preset state. This state is defined in Table l-l.

Table 1-1. Preset Conditions (1 of 5)

PRESET CONDITIONS	PRESET VALUE	PRESET CONDITIONS	PRESET VALUE
Analyzer Mode		Power Range	Auto; Range 0
Analyzer Mode	Network Analyzer Mode	No. of Points	201
Frequency Offset Operation	off	**Frequency List**	
		Frequency List	Empty
Offset Value	3	Edit Mode	Start/Stop, Number of Points
Harmonic Operation	Off		
Stimulus Conditions		List Frequency Sweep Mode	Swept
Sweep Type	Linear Frequency	List Power	Off
Step Sweep	Off	List IFBW	Off
Display Mode	Start/Stop		
Trigger Type	Continuous	**Response Conditions**	
External Trigger	Off	Parameter	Channel 1: Sll; Channel 2: 521; Channel 3: S12; Channel 4: S22
Sweep Time	100 ms, Auto Mode		
Start Frequency	30 kHz		
Frequency Span (std.)	2999.97 MHz		
Frequency Span (Opt. 006)	6999.97 MHz	Conversion	Off
		Format	Log Magnitude (all inputs)
Start Time	0		
Time Span	100 ms	Display	Data
CW Frequency	1000 MHz	Color Selections	Same as before PRESET
Source Power	0 dBm		
Power Slope	0 dB/GHz; Off	Dual Channel	Off
Start Power	-- 16.0 dBm	Auxiliary Channel	Off
Power Span	25 dB	Split Display	2X
Coupled Power	On	Active Channel	Channel 1
Source Power	On	Frequency Blank	Disabled
Coupled Channels	On		
Coupled Port Power			

Table 1-1. Preset Conditions (2 of 5)

PRESET CONDITIONS	PRESET VALUE
Response Conditions(cont.)	
Intensity	If set to ≥ 15%, PRESET has no effect. If set to < 16% increase intensity to 16%.
Beeper: Done	On
Beeper: Warning	Off
D2/D1 to D2	Off
Title	Channel 1 = [hp] Channel 2 = Empt
IF Bandwidth	3700 Hz
IF Averaging Factor	16; Off
Smoothing Aperture	1% SPAN; Off
Phase Offset	3 Degrees
Electrical Delay	) ns
Scale/Division	10 dB/Division
Calibration	
Correction	)ff
Calibration Type	None
Calibration Kit	' mm
SystemZO	50 Ohms
Velocity Factor	
Extensions	)ff
Port 1	IS
Port 2	) s
Input A	) s
Input B	) s
Chop A and B	)n
Power Meter Calibration	)ff
Number of Readings	
Power Loss Correction	)ff
Sensor A/B	
Interpolated Error Correction	)n

PRESET CONDITIONS	PRESET VALUE
Markers (coupled)	
Markers 1, 2, 3, 4	1 GHz; 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
imit Testing	Off
imit List	Empty
Edit Mode	Upper/Lower Limits
Stimulus Offset	0 Hz
Amplitude Offset	0 dB
dmit Type	Sloping Line
Beep Fail	Off
Time Domain	
Transform	Off
Transform Type	Bandpass
tart Transform	-20 nanoseconds
Transform Span	40 nanoseconds
ating	Off
ate Shape	Normal
ate Start	- 10 nanoseconds
ate Span	20 nanoseconds

Table 1-1. Preset Conditions (3 of 5)

PRESET CONDITIONS	PRESET VALUE
Time Domain (cont.)	
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
Copy Configuration	
Parallel Port	Last Active State
Plotter Type	Last Active State
Plotter Port	Last Active State
Plotter Baud Rate	Last Active State
Plotter Handshake	Last Active State
HP-IB Address	Last Active State
Printer Type	Last Active State
Printer Port	Last Active State
Printer Baud Rate	Last Active State
Printer Handshake	Last Active State
Printer HP-IB Address	Last Active State

PRESET CONDITIONS	PRESET VALUE
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
Select Disk	Internal Memory
Disk Format	LIF
Sequencing*	
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	Low
Analog Bus Node	11 (Aux Input)
Plot	
Plot Data	On
Plot Memory	On
Plot Graticule	On
Plot Text	On
Plot Marker	On

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.

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

Table 1-1. Preset Conditions (4 of 5)

'RESET CONDITIONS	PRESET VALUE	PRESET CONDITIONS	PRESET VALUE
'lot (cont.)		ine Type:	
\utofeed	On	Ch1/Ch3 Data	7
'lot Quadrant	Full Page	Ch1/Ch3 Memory	7
cale Plot	Full	Ch2/Ch4 Data	7
'lot Speed	Fast	Ch2/Ch4 Memory	7
'en Number:		tint	
Ch1/Ch3 Data	2	'rinter Mode	Last Active State
Ch1/Ch3 Memory	5	\uto-Feed	On
Ch1/Ch3			
Graticule	1	'rinter Colors	
Ch1/Ch3 Text	7	CH1/Ch3 Data	Magenta
Ch1/Ch3 Marker	7	CH1/Ch3 Memory	Green
Ch2/Ch4 Data	3	CH2/Ch4 Data	Blue
Ch2/Ch4 Memory	6	CH2/Ch4 Memory	Red
Ch2/Ch4		Graticule	Cyan
Graticule	1	Warning	Black
Ch2/Ch4 Text	7	Text	Black
Ch2/Ch4 Marker	7	Ref Line	Black

Table 1-1. Preset Conditions (5 of 5)

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

Analyzer Command Syntax

Code Naming Convention

The analyzer HP-ID commands are derived from their front-panel key titles (where possible), according to this naming convention:

Simple commands are the first four letters of the function they control, as in POWE, the command name for power. If the function label contains two words, the first three mnemonic letters are the first three letters of the first word, and the fourth mnemonic letter is the first letter of the second word. For example, ELED is derived from electrical delay.

If there are many commands grouped together in a category, as in markers or plotting pen numbers, the command is increased to 8 letters. The first 4 letters are the category label and the last 4 letters are the function specifier. As an example, category pen numbers are represented by the command PENN, which is used in combination with several functions such as PENNDATA, PENNMEMO.

The code naming guidelines, listed in Table 1-2, are used in order to:

- make commands more meaningful and easier to remember
- maintain compatibility with other products (including the HP 8510)

Note There are times when these guidelines are not followed due to technical considerations.

Table 1-2. Code Naming Convention

Convention	Key Title	For HP-IB Code Use	Example
One Word	Power	First Four Letters	POWE
	Start		STAR
Two Words	Electrical Delay	First Three Letters of First Word, First Letter of Second Word	ELED
	Search Right		SEAR
Two Words in a Group	Marker →Center	Four Letters of Both	MARKCENT
	Gate →Span		GATESPAN
Three Words	Cal Kit N 50 Ω	First Three Letters of First Word, First Letter of Second Word, First Four Letters of Third Word	CALKN50
	Pen Num Data		PENNDATA

Some codes require appendages (ON, OFF, 1, 2, etc.). Codes that do not have a front-panel equivalent are HP-B only commands. They use a similar convention based on the common name of the function.

Valid Characters

The analyzer accepts the following ASCII characters:

- letters
- numbers
- decimal points
- +/–
- semicolons (;)
- quotation marks (")
- carriage returns (CR)
- linefeeds (LF)

Both upper- and lower-case letters are acceptable. Carriage returns, leading zeros, spaces, and unnecessary terminators are ignored, except for those within a command or appendage. If the analyzer does not recognize a character as appropriate, it generates a syntax error message and recovers at the next terminator.

Units

The analyzer can input and output data in basic units such as Hz, dB, seconds, etc.

S	Seconds	Hz	Hertz
V	Volts	DB	dB or dBm

Input data is assumed to be in basic units (see above) unless one of the following units is used (upper and lower case are equivalent):

MS	Milliseconds	KHZ	Kilohertz
US	Microseconds	MHZ	Megahertz
NS	Nanoseconds	GHZ	Gigahertz
P S	Picoseconds	FS	Femtoseconds

Command Formats

The BP-IB commands accepted by the analyzer can be grouped into Eve input-syntax types. The analyzer does not distinguish between upper- and lower-case letters.

General Structure:

The general syntax structure is:
[code] [appendage][data] [unit] [terminator]

The individual sections of the syntax code are explained below.

[code]	The root mnemonic (these codes are described in the "Alphabetical Mnemonic Listing" later in this document.)
[appendage]	A qualifier attached to the root mnemonic. Possible appendages are ON or OFF (toggle a function ON or OFF), or integers, which specify one capability out of several. There can be no spaces or symbols between the code and the appendage.
[data]	A single operand used by the root mnemonic, usually to set the value of a function. The data can be a number or a character string. Numbers are accepted as integers or decimals, with power of ten specified by E (for example, `STAR 0.2E+10;` sets the start frequency to 2 GHz). Character strings must be enclosed by double quotation marks. For example: A title string using RMB BASIC would look like: `OUTPUT 716;"TITL""Unit1""";"` where the Erst two " " are an escape so that RMB BASIC will interpret the third " properly.
[unit]	The units of the operand, if applicable. If no units are specified, the analyzer assumes the basic units as described previously. The data is entered into the function when either units or a terminator are received.
[terminator]	Indicates the end of the command, enters the data, and switches the active-entry area OFF. A semicolon (;) is the recommended terminator. Terminators are not necessary for the analyzer to interpret commands correctly, but in the case of a syntax error, the analyzer will attempt to recover at

the next terminator. The analyzer also interprets line feeds and HP-ID END OR IDENTIFY (EOI) messages as terminators.

Syntax **Types**

The specific syntax types are:

SYNTAX TYPE 1: [code] [terminator]

These are simple action commands that require no complementary information, such as AUTO ; (autoscales the active channel).

SYNTAX TYPE 2: [code][appendage][terminator]

These are simple action commands requiring limited customization, such as CORRON; and CORROFF; (error correction ON or OFF) or RECA1;,RECA2;, RECA3; (recall register 1, 2, 3). There can be no characters or symbols between the code and the appendage.

Note In the following cases: CLEAREG[D], RECAREG[D], SAVEREG[D], and EG[D], [D] must be 2 characters. For example, CLEAREG0 1 ; will execute, while CLEAREG 1; will generate a syntax error.

SYNTAX TYPE 3: [code] [data] [unit][terminator]

These are data-input commands such as STAR 1.0 GHZ; (set the start frequency to 1 GHz).

SYNTAX TYPE 4: [code] [appendage] [data] [terminator]

These are titling and marker commands that have an appendage, such as TITR1"STATE1" (title register 1 STATE1), TITR2 "TEST2" (title register 2 TEST2).

QUERY SYNTAX: [code] [?]

lb query a front-panel-equivalent function, append a question mark (?) to the root mnemonic. (For example, POWE?, AVERO?, or REAL?.) 'lb query commands with integer appendages, place the question mark after the appendage.

Analyzer Operation

Held Commands

The analyzer cannot process HP-IB commands while executing certain key commands known as "held" commands. For example, SING; is a held command because it requires the analyzer to take one sweep of data before executing any other commands.

Once a held command is received, the analyzer will read new commands into the input buffer, but it will not begin the execution of any commands until the completion of the held command. When the 15-character input buffer is full, the analyzer will put hold on the bus until it is able to process the commands in the buffer.

Note Commands that call a calibration class are held if there is just one standard in the class, since such commands trigger a measurement.

Operation Complete

Occasionally, there is a need to know when certain analyzer operations have been completed. There is an operation-complete function (OPC) that allows a synchronization of programs with the execution of certain key commands. This mechanism is activated by issuing OPC; or OPC?; prior to an OPC-compatible command. The status byte or ESR operation-complete bit will then be set after the execution of the OPC-compatible command. For example, issuing OPC;SING; causes the OPC bit to be set when the single sweep is Enished. Issuing UPC?; in place of the OPC; causes the analyzer to output a one (1) when the command execution is complete. The analyzer will halt the computer by not transmitting the one (1) until the command has completed. For example, executing OPC?;PRES;, and then immediately querying the analyzer causes the bus to halt until the instrument preset is complete and the analyzer outputs a one (1).

As another example, consider the timing of sweep completion. Send the command string SWET 3 S;OPC?;SING; to the analyzer. This string sets the analyzer sweep time to 3 seconds, and then waits for completion of a single sweep to respond with a one (1). The computer should be programmed to read the number one (1) response from the analyzer indicating completion of the single sweep. At this point a valid trace exists and the trace data could be read into the computer.

Table 1-3. OPC-compatible Commands

AUXC<ON|OFF>	FWDI[2]	REFD
CHAN1	FWDM[2]	RESPDONE
CHAN2	FWDT[2]	REVI[2]
CHAN3[1]	GATEO<ON|OFF>	REVM[2]
CHAN4[1]	HARMOFF	REVT[2]
CLASS11A[2]	HARMSEC	RST
CLASS11B[2]	HARMTHIR	SAV1
CLASS11C[2]	INSMEXSA	SAV2
CLASS22A[2]	INSMEXSM	SAVC
CLASS22B[2]	INSMNETA	SAVE<1 to 5>
CLASS22C[2]	INSMTUNR	SAVEREG<01 to 31>
CLEA<1 to 5>	ISOD	SAVT
CLEARALL	MANTRIG	SING
CLEAREG<01 to 31)	NOOP	SLIS
DATI	NUMG	STAN<A to G>
EXTTOFF	PRES	SWPSTART
EXTTON	RAID	TRAD
EXTTPOIN	RECA<1 to 5>	WAIT
FREQOFFS<ON|OFF>	RECAREG<01 to 31>	

1 These commands are not queriable, but the active channel may be found by OUTPCHAN.

2 The class commands are OPC-compatible if there is only one standard in the class.

HP-IB Operation

The Hewlett-Packard Interface Bus (HP-IB) is Hewlett-Packard's hardware, software, documentation, and support for IEEE 488.2 and IEC-625 worldwide standards for interfacing instruments. This interface allows you to operate the analyzer and peripherals in two methods:

- by an external system controller
- by the network analyzer in system-controller mode

Device Types

The HP-IB employs a party-line bus structure in which up to 15 devices can be connected on one contiguous bus. The interface consists of 16 signal lines and 8 ground lines within a shielded cable. With this cabling system, many different types of devices including instruments, computers, power meters, plotters, printers, and disk drives can be connected in parallel.

Every HP-IB device must be capable of performing one or more of the following interface functions:

Talker

A talker is a device capable of transmitting device-dependent data when addressed to talk. There can be only one active talker at any given time. Examples of this type of device include:

- power meters
- disk drives
- voltmeters
- counters
- tape readers

The network analyzer is a talker when it sends trace data or marker information over the bus.

Listener

A listener is a device capable of receiving device-dependent data over the interface when addressed to listen. There can be as many as 14 listeners connected to the interface at any given time. Examples of this type of device include:

- printers
- power supplies
- signal generators

The network analyzer is a listener when it is controlled over the bus by a system controller.

Controller

A controller is defined as a device capable of:

1. managing the operation of the bus
2. addressing talkers and listeners

There can be only one active controller on the interface at any time. Examples of controllers include desktop computers, minicomputers, workstations, and the network analyzer. In a multiple-controller system, active control can be passed between controllers, but there can only be one ***system*** controller connected to the interface. The system controller acts as the master and can regain active control at any time. The analyzer is an active controller when it plots, prints, or stores to an external disk drive in the pass-control mode. The analyzer is also a system controller when it is operating in the system controller mode.

HP-IB Bus Structure

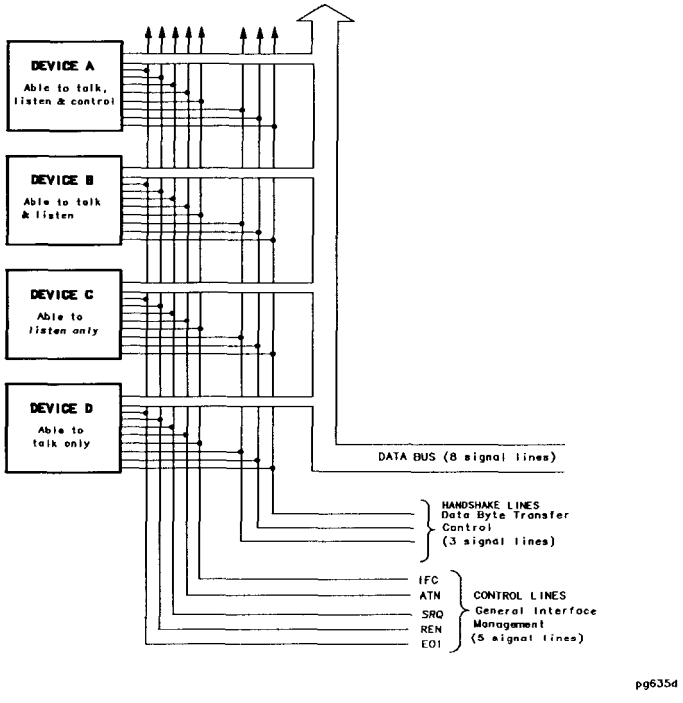

Figure 1-1. HP-IB Bus Structure

Data Bus

The data bus consists of 8 bi-directional lines that are used to transfer data from one device to another. Programming commands and data transmitted on these lines are typically encoded in ASCII, although binary encoding is often used to speed up the transfer of large arrays. Both ASCII- and binary-data formats are available to the analyzer. In addition, every byte transferred over HP-IB undergoes a handshake to insure valid data.

Handshake Lines

A three-line handshake scheme coordinates the transfer of data between talkers and listeners. 'lb insure data integrity in multiple-listener transfers, this technique forces data transfers to occur at the transfer

rate of the slowest device connected to the interface. With most computing controllers and instruments, the handshake is performed automatically, making it transparent to the programmer.

Control Lines

The data bus also has five control lines. The controller uses these lines to address devices and to send bus commands.

IFC (Interface Clear)	This line is used exclusively by the system controller. When this line is true (low), all devices (whether addressed or not) unaddress and revert to an idle state.
ATN (Attention)	The active controller uses this line to define whether the information on the data bus is command-oriented or data-oriented. When this line is true (low), the bus is in the command mode, and the data lines carry bus commands. When this line is false (high), the bus is in the data mode, and the data lines carry device-dependent instructions or data.
SRQ (Service Request)	This line is set true (low) when a device requests service and the active controller services the requesting device. The network analyzer can be enabled to pull the SRQ line for a variety of reasons such as requesting control of the interface, for the purposes of printing, plotting, or accessing a disk.
REN (Remote Enable)	This line is used exclusively by the system controller. When this line is set true (low), the bus is in the remote mode, and devices are addressed by the controller to either listen or talk. When the bus is in remote mode and a device is addressed, it receives instructions from the system controller via HP-IB rather than from its front panel

	(pressing Local) returns the device to front-panel operation). When this line is set false (high), the bus and all of the connected devices return to local operation.
EOI (End or Identify)	This line is used by a talker to indicate the last data byte in a multiple-byte transmission, or by an active controller to initiate a parallel-poll sequence. The analyzer recognizes the EOI line as a terminator, and it pulls the EOI line with the last byte of a message output (data, markers, plots, prints, error messages). The analyzer does not respond to parallel poll.

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 S-line handshake system.
Data Rate:	Maximum of 1 megabyte-per-second over the specified distances with tri-state drivers. Actual data rate depends on the transfer rate of the slowest device connected to the bus.
Address Capability:	Primary addresses: 31 talk, 31 listen. A maximum of 1 talker and 14 listeners can be connected to the interface at given time.
Multiple-Controller Capability:	In systems with more than one controller (such as this instrument), only one controller can be active at any given time. The active controller can pass control to another controller, but only the system controller can assume unconditional control. Only one *system* controller is allowed.

HP-IB Operational Capabilities

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

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

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

HP-IB Status Indicators

When the analyzer is connected to other instruments over the HP-IB, the HP-IB status indicators illuminate to display the current status of the analyzer. The HP-IB status indicators are located in the instrument-state function block on the front panel of the network analyzer.

R = Remote Operation

L = Listen mode

T = Talk mode

S = Service request (SRQ) asserted by the analyzer

Bus Device Modes

The analyzer uses a single-bus architecture. The single bus allows both the analyzer and the host controller to have complete access to the peripherals in the system.

Three different controller modes are possible in an HP-IB system:

- system-controller mode
- talker/listener mode
- pass-control mode

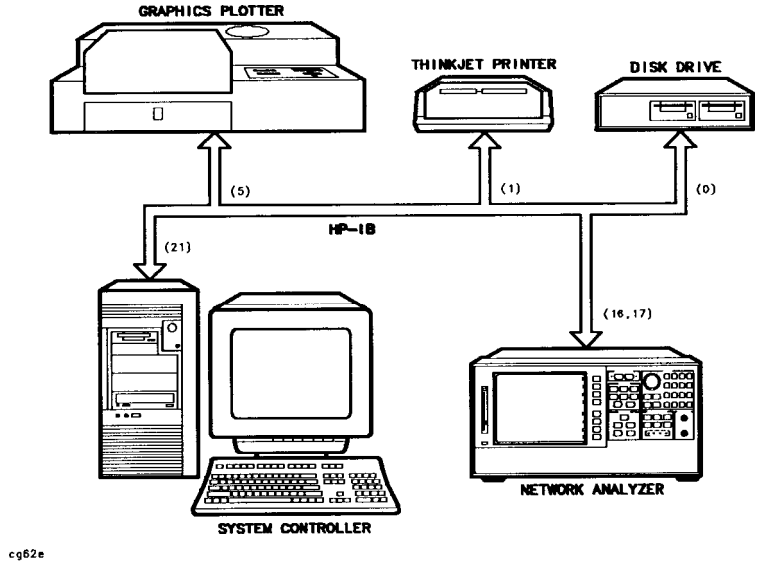

Figure 1-2. Analyzer Single Bus Concept

System-Controller Mode

This mode allows the analyzer to control peripherals directly in a stand-alone environment (without an external controller). This mode can only be selected manually from the analyzer's front panel. It can only be used if no active computer or instrument controller is connected to the system via HP-IB. If an attempt is made to set the network analyzer to the system-controller mode when another controller is connected to the interface, the following message is displayed on the analyzer's display screen:

"ANOTHER SYSTEM CONTROLLER ON HP-IB BUS"

The analyzer must be set to the system-controller mode in order to access peripherals from the front panel. In this mode, the analyzer can

directly control peripherals (plotters, printers, disk drives, power meters, etc.) and the analyzer may plot, print, store on disk or perform power meter functions.

Note Do not attempt to use this mode for programming. HP recommends using an external instrument controller when programming. See the following section, "Talker/Listener Mode."

Talker/Listener Mode

This is the mode that is normally used for remote programming of the analyzer. In talker/listener mode, the analyzer and all peripheral devices are controlled from an external instrument controller. The controller can command the analyzer to talk and other devices to listen. The analyzer and peripheral devices cannot talk directly to each other unless the computer sets up a data path between them. This mode allows the analyzer to act as either a talker or a listener, as required by the controlling computer for the particular operation in progress.

pass-Control Mode

This mode allows the computer to control the analyzer via HP-IB (as with the talker/listener mode), but also allows the analyzer to take control of the interface in order to plot, print, or access a disk. During an analyzer-controlled peripheral operation, the host computer is free to perform other internal tasks (i.e. data or display manipulation) while the analyzer is controlling the bus. After the analyzer-controlled task is completed, the analyzer returns control to the system controller.

Note Performing an instrument preset does not affect the selected bus mode, although the bus mode will return to talker/listener mode if the line power is cycled.

Note "Specifications and Measurement Uncertainties" in the ***HP 8753E Network Analyzer*** User's Guide provides information on setting the correct bus mode from the front-panel menu.

Analyzer Bus Modes

As discussed earlier, under HP-IB control, the analyzer can operate in one of three modes: talker/listener, pass-control, or system-controller mode.

In talker/listener mode, the analyzer behaves as a simple device on the bus. While in this mode, the analyzer can make a plot or print using the OUTPPLOT; or OUTPPRIN; commands. The analyzer will wait until it is addressed to talk by the system controller and then dump the display to a plotter/printer that the system controller has addressed to listen. Use of the commands PLOT; and PR I NALL; require control to be passed to another controller.

In pass-control mode, the analyzer can request control from the system controller and take control of the bus if the controller addresses it to take control. This allows the analyzer to take control of printers, plotters, and disk drives on an as-needed basis. The analyzer sets event-status register bit 1 when it needs control of the interface, and the analyzer will transfer control back to the system controller at the completion of the operation. It will pass control back to its controller address, specified by ADDRCONT.

The analyzer can also operate in the system-controller mode. This mode is only used when there is no remote controller on the bus. In this mode, the analyzer takes control of the bus, and uses it whenever it needs to access a peripheral. While the analyzer is in this mode, no other devices on the bus can attempt to take control. Specifically, the REN, ATN, and IFC lines must remain unasserted, and the data lines must be freed by all but the addressed talker.

Setting HP-IB Addresses

In systems interfaced using HP-IB, each instrument on the bus is identified by an HP-IB address. This address code must be different for each instrument on the bus. These addresses are stored in short-term, non-volatile memory and are not affected when you press (Preset) or cycle the power. The analyzer occupies two HP-IB addresses: the instrument itself and the display. The display address is derived from the instrument address by complementing the instrument's least-significant bit. Hence, if the instrument is at an even address, the display occupies the next higher address. If the instrument is at an odd address, the display occupies the next lower address.

The analyzer addresses are set by pressing (Local) SET ADDRESSES. In system-controller mode, the addresses must be set for the plotter, printer, disk drive, and power meter.

The default address for the analyzer is device 16, and the display address is device 17.

Note There is also an address for the system controller. This address refers to the controller when the network analyzer is being used in pass-control mode. This is the address that control is passed back to when the analyzer-controlled operation is complete.

Response to HP-IB Meta-Messages (IEEE-488 Universal Commands)

Abort

The analyzer responds to the abort message (IFC) by halting all listener, talker, and controller functions.

Device Clear

The analyzer responds to the device clear commands (DCL, SDC) by clearing the input and output queues, and clearing any HP-IB errors. The status registers and the error queue are unaffected.

Local

The analyzer will go into local mode if the local command (GTL) is received, the remote line is unasserted, or the front-panel local key is pressed. Changing the analyzer's HP-IB status from remote to local does not affect any of the front-panel functions or values.

Local Lockout

If the analyzer receives the local-lockout command (LLO) while it is in remote mode, it will disable the entire front panel except for the line power switch. A local-lockout condition can only be cleared by releasing the remote line, although the local command (GTL) will place the instrument temporarily in local mode.

Parallel Poll

The analyzer does not respond to parallel-poll configure (PPC) or parallel-poll unconfigure (PPU) messages.

Pass Control

If the analyzer is in pass-control mode, is addressed to talk, and receives the take-control command (TCT), from the system control it will take active control of the bus. If the analyzer is not requesting control, it will immediately pass control to the system controller's address. Otherwise, the analyzer will execute the function for which it sought control of the bus and then pass control back to the system controller.

Remote

The analyzer will go into remote mode when the remote line is asserted and the analyzer is addressed to listen. While the analyzer is held in remote mode, all front-panel keys (with the exception of (Local)) are disabled. Changing the analyzer's HP-ID status from remote to local does not affect any front-panel settings or values.

Serial Poll

The analyzer will respond to a serial poll with its status byte, as defined in the "Status Reporting" section of this document. lb initiate the serial-poll sequence, address the analyzer to talk and issue a serial-poll enable command (SPE). Upon receiving this command, the analyzer will return its status byte. End the sequence by issuing a serial-poll disable command (SPD). A serial poll does not affect the value of the status byte, and it does not set the instrument to remote mode.

Trigger

In hold mode, the analyzer responds to device trigger by taking a single sweep. The analyzer responds only to selected-device trigger (SDT). This means that it will not respond to group execute-trigger (GET) unless it is addressed to listen. The analyzer will not respond to GET if it is not in hold mode.

Reading Analyzer Data

Output Queue

Whenever an output-data command is received, the analyzer puts the data into the output queue (or buffer) where it is held until the system controller outputs the next read command. The queue, however, is only one event long: the next output-data command will overwrite the data already in the queue. Therefore, it is important to read the output queue immediately after every query or data request from the analyzer.

Command Query

All instrument functions can be queried to find the current ON/OFF state or value. For instrument state commands, append the question mark character (?) to the command to query the state of the functions. Suppose the operator has changed the power level from the analyzer's front panel. The computer can ascertain the new power level using the analyzer's command-query function. If a question mark is appended to the root of a command, the analyzer will output the value of that function. For instance, POWE 7 DB; sets the source power to 7 dB, and POWE?; outputs the current RF source power at the test port. When the analyzer receives POWE?; , it prepares to transmit the current RF source power level. This condition illuminates the analyzer front-panel talk light (T). In this case, the analyzer transmits the output power to the controller.

ON/OFF commands can also be queried. The reply is a one (1) if the function is ON or a zero (0) if it is OFF. For example, if a command controls an active function that is underlined on the analyzer display, querying that command yields a one (1) if the command is underlined or a zero (0) if it is not. As another example, there are nine options on the format menu and only one option is underlined at a time. Only the underlined option will return a one when queried.

For instance, send the command string DUAC?; to the analyzer. If dual-channel display is switched ON, the analyzer will return a one (1) to the instrument controller.

Similarly, to determine if phase is being measured and displayed, send the command string PHAS?; to the analyzer. In this case, the analyzer will return a one (1) if phase is currently being displayed. Since the command only applies to the active channel, the response to the PHAS?; query depends on which channel is active.

Identification

The analyzer's response to IDN?; is HEWLETT PACKARD,87NNE,0,X.XX where 87NNE is the model number of the instrument and X.XX is the firmware revision of the instrument.

The analyzer also has the capability to output its serial number with the command OUTPSERN;, and to output its installed options with the command OUTPOPTS;.

Output Syntax

The following three types of data are transmitted by the analyzer in ASCII format:

- response to query
- certain output commands
- ASCII floating-point (FORM4) array transfers

Marker-output commands and queried commands are output in ASCII format only, meaning that each character and each digit is transmitted as a separate byte, leaving the receiving computer to reconstruct the numbers and strings. Numbers are transmitted as 24-character strings, consisting of:

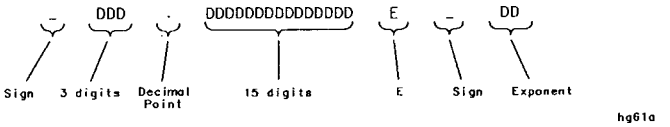

Figure 1-3. FORM4 (ASCII) Data-Transfer Character String

Sign	'-' for negative, blank for positive.
3 digits	Digits to the left of the decimal point.
Decimal point	Standard decimal point.
15 digits	Digits to the right of the decimal point.
E	Exponent notation.
Sign	'-' for negative, ' + ' for positive.
Exponent	Two digits for the exponent.

When multiple numbers are sent, the numbers are separated by commas. When number pairs are sent, the numbers are separated by a comma and terminated with a line feed (LF).

Marker Data

The network analyzer offers several options for outputting trace-related data. Data can be selectively read from the trace using the markers, or the entire trace can be read by the controller. If only specific information is required (such as a single point on the trace or the result of a marker search), the marker output command can be used to read the information. Specific data points can be read using the OUTPDATP or OUTPDATR commands. These commands allow a much faster data transfer than when using markers to output specific data points. For more information on these commands, see "Limit Line and Data Point Special Functions," located in *HP BASIC Programming Examples Guide*.

A marker must first be assigned to the desired frequency before it can be used to read the trace data. This is accomplished using the marker commands. The controller sends a marker command followed by a frequency within the trace-data range. If the actual desired frequency was not sampled, the markers can be set to continuous mode and the desired marker value will be linearly interpolated from the two nearest points. This interpolation can be prevented by putting the markers into discrete mode. Discrete mode allows the marker to only be positioned on a measured trace-data point.

As an alternative, the analyzer can be programmed to choose the stimulus value by using the MARKER SEARCH function. Maximum, minimum, target value, or bandwidths search can be automatically determined with MARKER SEARCH. lb continually update the search, switch the marker tracking ON. The trace-maximum search will remain activated until:

- The search is switched OFF.
- The tracking is switched OFF.
- All markers are switched OFF.

Marker data can be output to a controller by using analyzer commands. These commands cause the analyzer to transmit three numbers: marker value 1, marker value 2, and marker stimulus value. For example, in log-magnitude display mode we get the log magnitude at the marker (value 1), zero (value 2), and the marker frequency. See Table 1-4 for a complete listing of all the possibilities for values 1 and 2. The four possibilities for the marker stimulus value are:

- frequency
- time (as in time domain, Option 010 Only)
- CW time
- power (in power sweep mode)

Table 1-4. Units as a Function of Display Format

Display Format	Marker Mode	OUTPMARK value 1	OUTPMARK value 2	OUTPFORM value 1	OUTPFORM value 2	MARKER READOUT* value	MARKER READOUT* aux value
LOG MAG		dB	†	dB	t	dB	†
PHASE		degrees	†	degree	†	degrees	†
DELAY		seconds	†	second	†	seconds	†
SMITH CHAR?	LIN MKR	in mag	degrees	real	imag	lin mag	degree!
	LOG MKR	dB	degrees	real	imag	dB	degree!
	Re/Im	real	imag	real	imag	real	imag
	R + jX	real ohms	imag ohms	real	imag	real ohms	imag ohms
	G + jB	real Siemens	imag Siemen	real	imag	real Siemens	imag Siemen
POLAR	LIN MKR	in mag	degrees	real	imag	lin mag	degree!
	LOG MKR	dB	degrees	real	imag	dB	degree:
	Re/Im	real	imag	real	imag	real	imag
LIN MAG		lin mag	t	lin mag	t	lin mag	t
SWR		SWR	†	SWR	†	SWR	†
REAL		real	†	real	†	real	†
IMAGINARY		imag	†	imag	†	imag	†

The marker readout values are the marker values displayed in the upper right-hand comer of the display. They also correspond to the value and auxiliary value associated with the fixed marker.

Value 2 is not significant in this format, though it is included in data transfers. See also "Fast Data Transfer Commands."

Array-Data Formats

The analyzer can transmit and receive arrays in the analyzer's internal binary format as well as four different numeric formats. The current format is set with the FORMl, FORMS, FORMS, FORM4, and FORM5 commands. These commands do not affect learn-string transfers, calibration-kit string transfers, or non-array transfers, such as command query, or output marker values.

A transmitted array will be output in the current format, and the analyzer will attempt to read incoming arrays according to the current format. Each data point in an array is a pair of numbers, usually a real/imaginary pair. The number of data points in each array is the same as the number of points in the current sweep.

The five formats are described below:

FORM1 — The analyzer's internal binary format, 6 bytes-per-data point. The array is preceded by a four-byte header. The first two bytes represent the string "#A", the standard block header. The second two bytes are an integer representing the number of bytes in the block to follow. FORM1 is best applied when rapid data transfers, not to be modified by the computer nor interpreted by the user, are required.

FORM2 — IEEE 32-bit floating-point format, 8 bytes-per-data point. The data is preceded by the same header as in FORMl. Each number consists of a l-bit sign, an 8-bit biased exponent, and a 23-bit mantissa. FORM2 is the format of choice if your computer supports single-precision floating-point numbers.

FORM3 — IEEE 64-bit floating-point format, 16 bytes-per-data point. The data is preceded by the same header as in FORMl. Each number consists of a l-bit sign, an 1 l-bit biased exponent, and a 52-bit mantissa. This format may be used with double-precision floating-point numbers. No additional precision is available in the analyzer data, but FORM3 may be a convenient form for transferring data to your computer.

FORM4 ASCII floating-point format. The data is transmitted as ASCII numbers, as described previously in "Output Syntax". There is no header. The analyzer always uses FORM4 to transfer data that is not related to array transfers (i.e. marker responses and instrument settings).

FORM5 PC-DOS 32-bit floating-point format with 4 bytes-per-number, 8 bytes-per-data point. The data is preceded by the same header as in FORM1. The byte order is reversed to comply with PC-DOS formats. If you are using a PC-based controller, FORM5 is the most effective format to use.

The analyzer terminates each transmission by asserting the EOI interface line with the last byte transmitted. Table 1-5 offers a comparative overview of the five array-data formats.

Table 1-5.
HP 8753E Network Analyzer Array-Data Formats

Format type	Type of Data	Bytes per Data Value	Bytes per point 2 data values	(201 pts) Bytes per trace	Total Bytes with header
FORM 1	Internal Binary	N/A	6	1206	1210
FORM 2	IEEE 32-bit Floating-Point	4	8	1608	1612
FORM 3	IEEE 64-bit Floating-Point	8	16	3216	3220
FORM 4	ASCII Numbers	24 (Typical)	50 (Typical)	10,060 (Typical)	10,060' (Typical)
FORM 6	PC-DOS 32-bit Floating-Point	4	8	1608	1612

No header is used in FORM 4.

Trace-Data Transfers

Transferring trace-data from the analyzer using an instrument controller can be divided into three steps:

1. allocating an array to receive and store the data
2. commanding the analyzer to transmit the data
3. accepting the transferred data

Data residing in the analyzer is always stored in pairs for each data point (to accommodate real/imaginary pairs). Hence, the receiving array has to be two elements wide, and as deep as the number of points in the array being transferred. Memory space for the array must be declared before any data can be transferred from the analyzer to the computer.

As mentioned earlier, the analyzer can transmit data over HP-IB in five different formats. The type of format affects what kind of data array is declared (real or integer), because the format determines what type of data is transferred. Programming examples of data transfers using different formats are discussed in "Example 3: Measurement Data Transfer," located in ***HP BASIC Programming Examples Guide.*** For information on the various types of data that can be obtained (raw data, error-corrected data, etc.), see "Data Levels," located later in this document.

For information on transferring trace-data by selected points, see "Limit Line and Data Point Special Functions," located in ***HP BASIC Programming Examples Guide.***

Note "Example 7C: Reading ASCII Disk Files to the Instrument Controller's Disk File," located in ***HP BASIC Programming Examples Guide,*** explains how to access disk files from a computer.

Stimulus-Related Values

Frequency-related values are calculated for the analyzer display. The start and stop frequencies or center and span frequencies of the selected frequency range are available to the programmer.

In a linear frequency range, the frequency values can be easily calculated because the trace data points are equally spaced across the trace. Relating the data from a linear frequency sweep to frequency can be done by querying the start frequency, the frequency span, and the number of points in the trace.

Given that information, the frequency of point ***n*** in a linear-frequency sweep is represented by the equation:

F = Start frequency + (n- 1) x Span/(Points– 1)

In most cases, this is an easy solution for determining the related frequency value that corresponds with a data point. This technique is illustrated in "Example 3B: Data Transfer Using FORM 4 (ASCII Format)," located in ***HP BASIC Programming Examples Guide***.

When using log sweep or a list-frequency sweep, the points are not evenly spaced over the frequency range of the sweep. In these cases, an effective way of determining the frequencies of the current sweep is to use the OUTPLIML command. Although this command is normally used for limit lines, it can also be used to identify all of the frequency points in a sweep. Limit lines do not need to be on in order to read the frequencies directly out of the instrument with the OUTPLIML command. Refer to "Example 3D: Data Transfer Using Frequency Array Information," located in ***HP BASIC Programming Examples Guide***.

Note Another method of identifying all of the frequency points in a sweep is to use the marker commands MARKBUCKx and OUTPMARK in a FOR NEXT programming loop that corresponds to the number of points in the sweep. MARKBUCKx places a marker at a point in the sweep, where x is the number of the point in a sweep, and OUTPMARK outputs the stimulus value as part of the marker data.

Data-Processing Chain

This section describes the manner in which the analyzer processes measurement data. It includes information on data arrays, common output commands, data levels, the learn string, and the calibration kit string.

Data Arrays

Figure 1-4 shows the different kinds of data available within the instrument:

- pre-raw measured data
- raw measured data
- error-corrected data
- formatted data
- trace memory
- calibration coefficients

Trace memory can be directly output to a controller with `OUTPMEMO;`, but it cannot be directly transmitted back.

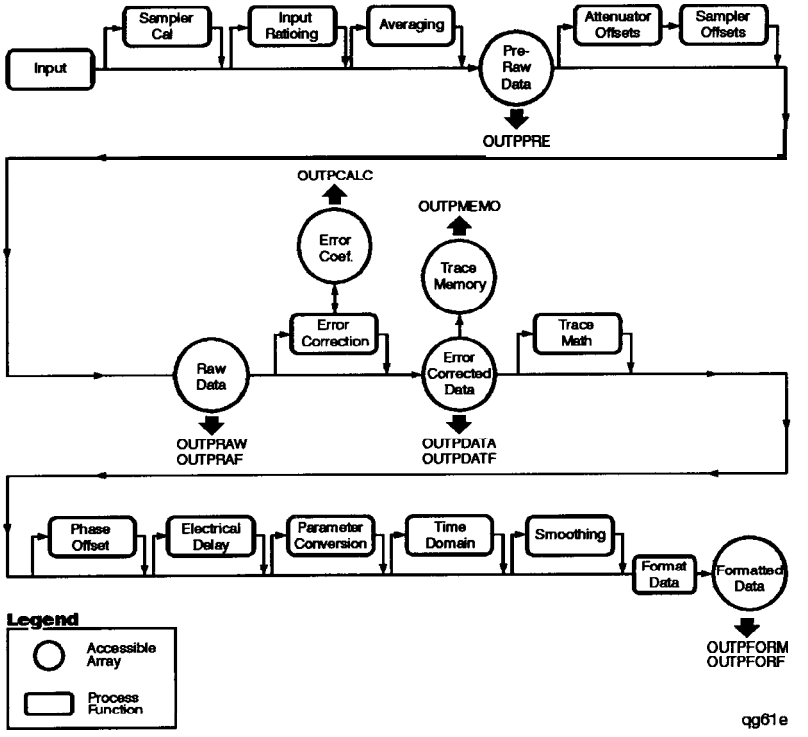

Figure **1-4.** The Data-Processing **Chain** for Measurement Outputs

All the data-output commands are designed to insure that the data transmitted reflects the current state of the instrument:

- OUTPDATA, OUTPRAW<I>, OUTPFORM, OUTPDATF, OUTPRAF<I> and OUTPFORF will not transmit data until all formatting functions have completed.
- OUTPPRE transmits data in conjunction with Take4 mode and the SWPSTART command. Refer to "Example 2E: Take4 — Error Correction Processed on an External PC," located in ***HP BASIC Programming Examples*** *Guide*.
- OUTPLIML, OUTPLIMM, and OUTPLIMF will not transmit data until the limit test has occurred (if activated).
- OUTPMARK will activate a marker if a marker is not already selected. It will also insure that any current marker searches have been completed before transmitting data.

- OUTPMSTA insures that the statistics have been calculated for the current trace before transmitting data. If the statistics are not activated, it will activate the statistics long enough to update the current values before deactivating the statistics.
- OUTPMWID insures that a bandwidth search has been executed for the current trace before transmitting data. If the bandwidth-search function is not activated, it will activate the bandwidth-search function long enough to update the current values before switching OFF the bandwidth-search functions.

Fast Data Transfer Commands

The HP 87533 has four distinct fast data transfer commands. These commands circumvent the internal "byte handler" routine and output trace dumps as block data. In other words, the analyzer outputs the entire array without allowing any process swapping to occur. FORM4, ASCII data transfer times are not affected by these routines. However, there are speed improvements with binary data formats. The following is a description of the four fast data transfer commands:

- OUTPDATF outputs the error corrected data from the active channel in the current output format. This data may be input to the analyzer using the INPUDATA command.
- OUTPFORF outputs the formatted display trace array from the active channel in the current output format. Only the first number in each of the OUTPFORM data pairs is actually transferred for the display formats LOG MAG, PHASE, group DELAY, LIt-I MAG, SWR, REAL and I MAGinary. Because the data array does not contain the second value for these display formats, the INPUFORM command may not be used to re-input the data back into the analyzer. The second value may not be significant in some display formats (see Table 1-4), thus reducing the number of bytes transferred.
- OUTPMEMF outputs the memory trace from the active channel. The data is in real/imaginary pairs, and, as such, may be input back into the memory trace using INPUDATA or INPUFORM followed by the DATI command.
- OUTPRAF<I> outputs the raw measurement data trace. The data may be input back into the memory trace using the INPURAW<I> command.

Data Levels

Different levels of data can be read out of the instrument. Refer to the data-processing chain in Figure 1-4. The following list describes the different types of data that are available from the network analyzer.

Pre-raw data

This is the raw data without sampler correction or attenuator offsets applied. With raw offsets turned off, the calibration coefficients generated can be transferred to an external controller and used with the data gathered using the OUTPPRE[1-4] commands. Refer to "Example 2E: Take4 — Error Correction Processed on an External Computer," located in ***HP BASIC Programming Examples Guide***. If a 2-port measurement calibration is active, or Take4 mode is on, the four arrays refer to S_{11}, S_{21}, S_{12}, and S_{22} respectively. This data is represented in real/imaginary pairs.

Raw data

The basic measurement data, reflecting the stimulus parameters, IF averaging, and IF bandwidth. If a full Z-port measurement calibration is activated, there are actually four raw arrays kept: one for each raw S-parameter. The data can be output to a controller with the commands OUTPRAW 1, OUTPRAW2 , OUTPRAW3, OUTPRAW4. Normally, only raw 1 is available, and it holds the current parameter. If a 2-port measurement calibration is active, the four arrays refer to S_{11}, S_{21}, S_{12}, and S_{22} respectively. This data is represented in real/imaginary pairs.

Error coefficients

The results of a measurement calibration are arrays containing error coefficients. These error coefficients are then used in the error-correction routines. Each array corresponds to a specific error term

	in the error model. The HP *8753E* ***Network Analyzer User's*** **Guide** details which error coefficients are used for specific calibration types, as well as the arrays those coefficients can be found in. Not all calibration types use all 12 arrays. The data is stored as real/imaginary pairs,
Error-corrected data	This is the raw data with error-correction applied. The array represents the currently measured parameter, and is stored in real/imaginary pairs. The error-corrected data can be output to a controller with the OUTPDATA; command. The OUTPMEM0; command reads the trace memory, if available. The trace memory also contains error-corrected data. Note that neither raw nor error-corrected data reflect such post-processing functions as electrical-delay offset, trace math, or time-domain gating.
Formatted data	This is the array of data actually being displayed. It reflects all post-processing functions such as electrical delay and time domain. The units of the array output depend on the current display format. See Table 1-4 for the various units defined as a function of display format.

Generally, formatted data is the most useful of the five data levels, because it is the same information the operator sees on the display. However, if post-processing is unnecessary (e.g. possibly in cases involving smoothing), error-corrected data may be more desirable. Error-corrected data also affords the user the opportunity to input the data to the network analyzer and apply post-processing at another time.

Learn String and Calibration-Kit String

The learn string is a summary of the instrument state. It includes all the front-panel settings, the limit-test tables, and the list-frequency table for the current instrument state. It does not include calibration data or the information stored in the save/recall registers.

The learn string can be output to a controller with the OUTPLEAS; command, which commands the analyzer to start transmitting the binary string. The string has a fixed length for a given firmware revision. The array has the same header as in FORM 1. Refer to "Example 5: Using the Learn String," located in ***HP BASIC Programming Examples Guide***.

The calibration kit includes a set of key characteristics of the calibration standards used to determine the calibration accuracy. There are default kits for several different connector types. There is also space for a user-defined calibration kit. The command OUTPCALK outputs the currently active calibration kit as a binary string in FORM 1. As with the learn string, the calibration-kit string has a fixed length for a given firmware revision.

Error Reporting

This section describes the analyzer's error-reporting process. It includes information on status reporting, the status byte, the event-status registers, and the error output.

Status Reporting

The analyzer status reporting structure is depicted in Figure 1-5. Refer to Table 1-6 for a description of each bit within the status reporting structure.

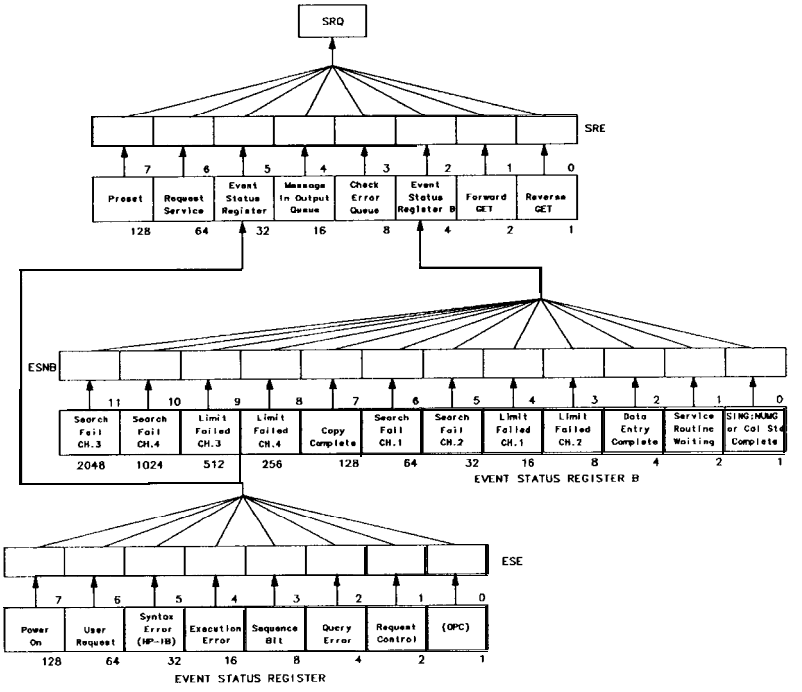

Figure 1-5. Status Reporting Structure

Table 1-6. Status Bit Definitions

Status Byte		
Bit	**Name**	**Definition**
0	Waiting for reverse GET	Not applicable for the HP 87633.
1	Waiting for forward GET	Not applicable for the HP 87633.
2	Check event-status register B	One of the enabled bits in event status register B has been set.
3	Check error queue	An error has occurred and the message has been placed in the error queue, but has not been read yet.
4	Message in output queue	A command has prepared information to be output, but it has not been read yet.
6	Check event-status register	One of the enabled bits in the event-status register has been set.
6	Request service	One of the enabled status-byte bits is causing an SRQ.
7	Preset	An instrument preset has been executed.
Event-Status Register		
Bit	**Name**	Definition
0	Operation complete	A command for which OPC has been enabled has completed operation.
1	Request control	The analyzer has been commanded to perform an operation that requires control of a peripheral, and needs control of HP-IB. Requires pass-control mode.
2	Query error	The analyzer has been addressed to talk but there is nothing in the output queue to transmit.
3	Sequence Bit	A sequence has executed the assert SRQ command.
4	Execution error	A command was received that could not be executed.
6	Syntax error	The incoming HP-IB commands contained a syntax error. The syntax error can only be cleared by a device clear or an instrument preset.
6	User request	The operator has pressed a front-panel key or turned the RPG.
7	Power on	A power-on sequence has occurred since the last read of the register.

Table 1-6. Status Bit Definitions (continued)

Event-Status Register B		
Bit	Name	**Definition**
0	Single sweep, number of groups, or calibration step complete	A single sweep, group, or calibration step has been completed since the last read of the register.
1	Service routine waiting or done	An internal service routine has completed operation, or is waiting for an operator response.
2	Data entry complete	A terminator key has been pressed or a value entered over HP-IB since the last read of the register.
3	Limit failed, Channel 2	Limit test failed on Channel 2.
4	Limit failed, Channel 1	Limit test failed on Channel 1.
6	Search failed, Channel 2	A marker search was executed on Channel 2, but the target value was not found.
6	Search failed, Channel 1	A marker search was executed on Channel 1, but the target value was not found.
7	Copy Complete	A copy has been completed since the last read of the register.
8	Limit failed, Channel 4	Limit test failed on Channel 4.
9	Limit failed, Channel 3	Limit test failed on Channel 3.
10	Search failed, Channel 4	A marker search was executed on Channel 4, but the target value was not found.
11	Search failed, Channel 3	A marker search was executed on Channel 3, but the target value was not found.

The Status Byte

The analyzer has a status-reporting mechanism that reports information about specific analyzer functions and events. The status byte (consisting of summary bits) is the top-level register. Each bit reflects the condition of another register or queue. If a summary bit is set (equals 1), the corresponding register or queue should be read to obtain the status information and clear the condition. Reading the status byte does not affect the state of the summary bits. The summary bits always reflect the condition of the summarized queue or register.

The status byte can be read by a serial poll or by using the command OUTPSTAT. OUTPSTAT does not automatically put the instrument in remote mode, thus giving the operator access to the analyzer front-panel functions. OUTPSTAT will return an ASCII (text) integer (0-255) that can be interpreted as the 8-bit status byte. Using the OUTPSTAT command

will not necessarily return the same status byte value as when using a serial poll because the "Message in Output Queue" bit is always set when using OUTPSTAT.

The status byte:

- summarizes the error queue
- summarizes two event-status registers that monitor specific conditions inside the instrument
- contains a bit that is set when the instrument is issuing a service request (SRQ) over BP-IB
- contains a bit that is set when the analyzer has data to transmit over HP-IB

Any bit in the status byte can be selectively enabled to generate a service request (SRQ) when set. Setting a bit in the service-request-enable register with the `SREnn;` command enables the corresponding bit in the status byte. The units variable ***nn*** represents the binary equivalent of the bit in the status byte. Fbr example, `SRE24;` enables status-byte bits 3 and 4 (since $2^3 + 2^4 = 24$) and disables all the other bits. SRE will not affect the state of the status-register bits.

The sequencing bit can be set during the execution of a test sequence to assert an SRQ.

The status byte also summarizes two queues: the output queue and the error queue. (The error queue is described in the next section.) When the analyzer outputs information, it puts the information in the output queue where it resides until the controller reads it. The output queue is only one event long. Therefore, the next output request will clear the current data. The summary bit is set whenever there is data in the output queue.

The Event-Status Register and Event-Status Register B

The event-status register and event-status register B are the other two registers in the status-reporting structure. They are selectively summarized by bits in the status byte via enable registers. The event-status registers consist of latched bits. A latched bit is set at the beginning of a specific trigger condition in the instrument. It can only be cleared by reading the register. The bit will not be reactivated until the condition occurs again. If a bit in one of these two registers is enabled, it is summarized by the summary bit in the status byte. The registers are enabled using the commands `ESEnn;` and `ESNBnn;` , both of which work in the same manner as `SREnn`. The units variable *nn* represents the binary equivalent of the bit in the status byte.

If a bit in one of the event-status registers is enabled, and therefore, the summary bit in the status byte is enabled, an SRQ will be generated. The SRQ will not be cleared until one of the five following conditions transpire:

1. The event-status register is read, clearing the latched bit.
2. The summary bit in the status byte is disabled.
3. The event-status register bit is disabled.
4. The status registers are cleared with the CLES ; command.
5. An instrument preset is performed.

Service requests generated when there are error messages or when the instrument is waiting for the Group Execute Trigger (GET) command are cleared by:

- reading the errors
- issuing GET (disabling the bits)
- clearing the status registers

Error Output

When an error condition is detected in the analyzer, a message is generated, displayed on the analyzer's display screen, and placed in the error queue. Error messages consist of an error number followed by an ASCII string no more than 50-characters long. The string contains the same message that appears on the analyzer's display. The error queue holds up to 20 error messages in the order in which they occur. The error messages remain in the error queue until the errors are read by the system controller using the command OUTPERRO. The OUTPERRO command outputs one error message.

Note The error queue can only be cleared by performing an instrument preset or by cycling the line power. In order to keep the queue up-to-date, it is important to read all of the messages out of the queue each time errors are detected.

Error Messages in Numerical Order

For explanations and suggestions in finding the cause of the error messages, refer to the alphabetical listing in Chapter 10 of the *HP 8753E Network Analyzer* User's *Guide*. Some error numbers have been omitted due to obsoleted error messages.

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
19	LIST TABLE EMPTY: occurs if user selects LIST sweep type but there is no list freq. table
20	AIR FLOW RESTRICTED: CHECK FAN FILTER
21	POWER SUPPLY HOT!
22	POWER SUPPLY SHUT DOWN!
23	PROBE POWER SHUT DOWN!

Error Number	Error
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
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	ANOTHER SYSTEM CONTROLLER ON HP-IB 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

Error Number	Error
51	INSUFFICIENT MEMORY
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	HP 8753 SOURCE PARAMETERS CHANGED
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

Error Number	Error
116	POWER METER INVALID
117	PWR MTR: NOT ON/CONNECTED OR WRONG ADDRS
118	POWER METER 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
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
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

Error Number	Error
163	FUNCTION ONLY VALID DURING MOD SEQUENCE
164	TOO MANY NESTED SEQUENCES. SEQ ABORTED
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
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

Error Number	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
202	FUNCTION NOT AVAILABLE
203	CANNOT READ/WRITE HFS FILE SYSTEM
204	FREQS CANNOT BE CHANGED, TOO MANY POINTS
205	LIMIT TABLE EMPTY
206	ARGUMENT OUT OF RANGE
207	POWER OUT MAY BE UNLEVELED
208	EXT R CHAN MUST BE ON FOR FREQUENCY OFFSET MODE
209	SWEEP MUST BE STEPPED FOR FREQUENCY OFFSET MODE
211	OVERLAP! LIST TYPE CHANGED TO STEPPED
212	ANALOG BUS DISABLED IN 6 kHz IFBW
213	RANGE CAUSED POWER LVL CHANGE IN LIST
214	CORRECTION ON: AUX CHANNEL(S) RESTORED
215	CAUTION: CORRECTION OFF: AUX CHANNEL(S) DISABLED
216	CAUTION: AUX CHANNELS MEASURE S-PARAMETERS ONLY
217	2-PORT CAL REQUIRED FOR AUX CHANNEL USE

Calibration

Measurement calibration over HP-IB follows the same command sequence as a calibration from the front-panel. For detailed information, refer to "Optimizing Measurement Results" in the *HP 8753E Network Analyzer User's Guide*

1. Start by selecting a calibration kit, such as 50 ohm type-N (CALKN50;).
2. Select a calibration type, such as S11 l-port (CAL IS 1 1 1;).
3. Call each class used by the calibration type, such as FORWARD: OPEN (CLASS 11 A;) During a 2-port calibration, the reflection, transmission, and isolation subsequences must be opened before the classes in the subsequence are called, and then closed at the end of each subsequence.
4. If a class has more than one standard in it, select a standard from the menu presented (STANA to STANG).
5. If, during a calibration, two standards are measured to satisfy one class, the class must be closed with DONE; .
6. Declare the calibration done, such as with DONE 1-PORT CAL (SAV 1; over HP-IB).

The STANA to STANG commands will hold off the HP-IB until completion because they trigger a sweep. If a class has only one standard in it, which means that it will trigger a sweep when called, the class command will also hold off the HI-IB.

Note Since different cal kits can have a different number of standards in a given class, any automated calibration sequence is valid only for a specific cal kit.

Table 1-7.
Relationship between Calibrations and Classes

Class	Response	Response and Isolation	S11 1-port	S22 1-port	One path 2-port	Full 2-port	TRL/LRM
Reflection:[1]					•	•	•
S11A, RE FW MTCH			•		•	•	•
S11B, LN FW MTCH			•		•	•	•
S11C, LN FW TRAN			•		•	•	•
S22A, LN RV MTCH				•		•	•
S22B, LN RV TRAN				•		•	•
S22C, LN RV TRAN				•		•	•
Transmission:[1]					•	•	•
Forward match					•	•	•
Forward trans					•	•	•
Reverse match						•	•
Reverse trans						•	•
Isolation:[1]					•	•	•
Forward					•	•	•
Reverse						•	•
Response	•						
Response and isolation:							
Response		•					
Isolation		•					
TRL thru:[2]							•
TRL reflect:[2]							•
TRL line or match:[2]							•

1 These subheadings must be called when doing full 2-port calibrations.

2 These subheadings must be called when doing TRL 2-port calibrations.

Table 1-8. Error Coefficient Arrays

Array	Response	Response and Isolation	1-port	2-port[1]	TRL/LRM
1	E_R or E_T	E_X (E_D)[2]	E_D	E_{DF}	E_{DF}
2		E_T (E_R)	E_S	E_{SF}	E_{SF}
3			E_R	E_{RF}	E_{RF}
4				E_{XF}	E_{XF}
5				E_{LF}	E_{LF}
6				E_{TF}	E_{TF}
7				E_{DR}	E_{DR}
8				E_{SR}	E_{SR}
9				E_{RR}	E_{RR}
10				E_{XR}	E_{XR}
11				E_{LR}	E_{LR}
12				E_{TR}	E_{TR}

1 One path, P-port cal duplicates arrays 1 to 6 in arrays 7 to 12.

2 Response and isolation corrects for crosstalk and transmission tracking in transmission measurements, and for directivity and reflection tracking in reflection measurements.

Meaning of first subscript:

D = directivity
S = source match
R = reflection tracking
X = crosstalk or isolation
L = load match
T = transmission tracking

Meaning of second subscript:

F = forward
R = reverse

Display Graphics

User Graphics Units

Size of Graticule only

- length = 350 to 4915
- height = 150 to 3950

Size of Complete Display (graticule plus annotation and **softkey** labels)

- length = 0 to 5850
- height = 0 to 4095

HP-GL subset:

Command	Description
AF;	Erases the user graphics display.
CS;	Turns off the measurement display.
DIrun,rise;	Specifies the direction in which characters are lettered. run,rise: 1,0 = 0 degrees 0,1 = 90 degrees -1,0 = 180 degrees 0,–1 = 270 degrees
DF;	Sets the default values.
LB[text][etx];	Labels the display, placing the symbols starting at the current pen position. All incoming characters are printed until the etx symbol is received. The default etx symbol is the ASCII value 3 (not the character 3).

LTa; Specifies line type:

a	line
0	solid
1	solid
2	short dashes
3	long dashes

OP; Outputs P1 and P2, the scaling limits: 0,0,5850,4095.

PAx,y; Draws from the current pen position to **x,y.** There can be many pairs of **x,y** coordinates within one command. They are separated by commas, and the entire sequence is terminated with a semicolon.

PD; Pen down. A line is drawn only if the pen is down.

PG; Erases the user graphics display.

PRx,y; Plot relative: draws a line from the current pen position to a position y up and x over.

PU; Pen up. Stops anything from being drawn.

RS; Turns ON the measurement display.

SIh,w; Sets the character size, for height h and width w in centimeters:

h	w	size
0.16	0.20	smallest
0.25	0.30	
0.33	0.39	
0.41	0.49	largest

SPn; Selects pen n:

n	brightness
0	blank
1	brightest
2	
3	dimmest

Accepted but ignored HP-GL commands:

IM Input service request mask
IP Input P1,P2 scaling points
IW Input window
OC Output current pen position
OE Output error
01 Output identity
OS Output status
SL Character slant
SR Relative character size

Disk File Names

Disk files created by the analyzer consist of a state name of up to eight characters, such as FILTER, appended with up to two characters. In LIF format, the file name is FILTERXX. In DOS format, the filename is FILTER.XX. The first appended character is the file type, telling the kind of information in the file. The second appended character is a data index, used to distinguish files of the same type.

Error-corrected data, raw data, formatted data, memory traces, and calibration files are FORM 3 data files (IEEE 64-bit floating point format). The other Eles are not meant to be decoded. Table 1-9 lists the appended characters and their meanings.

Table 1-9. Disk File Suffixes

Char 1	Meaning	Char 2	Meaning
I, P	Instrument state		
W	Four-channel instrument state		
G	Graphics	1	Display graphics
D	Error-corrected data	1	Channel 1
		2	Channel 2
		3	Channel 3
		4	Channel 4
R	Raw data	1 to 4	Ch1/Ch3, raw arrays 1 to 4
		5 to 8	Ch2/Ch4, raw arrays 1 to 4
F	Formatted data	1	Channel 1
		2	Channel 2
		3	Channel 3
		4	Channel 4
M	Memory trace	1	Channel 1
		2	Channel 2
		3	Channel 3
		4	Channel 4
C	Cal kit	K	

Table 1-9. Disk File Suffixes (continued)

Char 1	Meaning	Char 2	Meaning
1	Cal data, channel 1	0	Stimulus state
		1 to 9	Coefficients 1 to 9
		A	Coefficient 10
		B	Coefficient 11
		C	Coefficient 12
2	Cal data, channel 2	0 to c	Same as channel 1
F	Full page (HP-GL plot)	P	
L	Left (HP-GL plot)	L	Lower
		U	Upper
R	Right (HP-GL plot)	L	Lower
		U	Upper
S	Error-corrected data(S2P)	1	Channel 1
		2	Channel 2

Using Key Codes

Using key codes allows remote control of the analyzer keys and can be used as an alternative to using other HP-IB commands. This may be useful, but it is a highly recommended programming practice to use the HP-IB command mnemonic appropriate for the function desired.

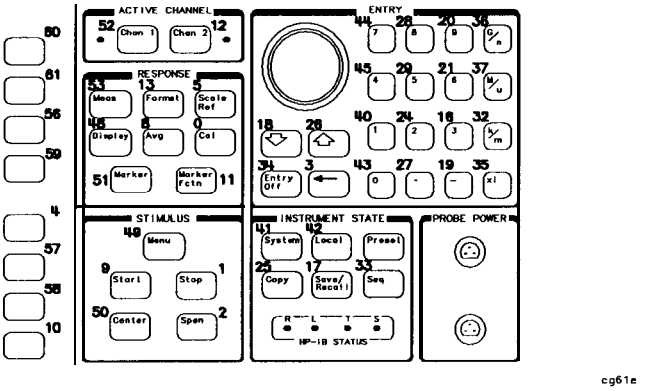

Figure **1-6.** Key Codes

When using key codes, the following notes must be taken into consideration:

Note 1: An “invalid key” is reported with a 63.

Note 2: OUTPKEY ; outputs the key code of the last key pressed. This command reports a knob turn as a -1.

Note 3: KOR?; outputs the last key code or knob count. If the reply is positive, it is a key code. If it is negative, then set bit 15 equal to bit 14, and the resulting two byte integer is the RPG knob count. It can be either positive or negative. There are about 120 counts per turn.

Key Select Codes Arranged by Front-Panel Hardkey

The HP-IB mnemonics in the following table are functionally arranged by their front-panel key equivalent. For example, all of the mnemonics that correspond to softkeys accessed by means of the [Cal] key, will be listed under the [Cal] key in the following table.

Keys
AVG
CAL-Error correction, calibration
CAL-Calibration kits
CAL-Power Meter Calibration
CHANNEL
COPY
DISPLAY
ENTRY
FORMAT
LOCAL
MEAS
MENU (stimulus)
MARKER
MARKER FCTN
SAVE/RECALL-Internal registers
SAVE/RECALL-Disk files
SCALE REF
SEQ-Sequencing
STIMULUS
SYSTEM
SYSTEM-Limit testing
SYSTEM-Transform

Column headings:

Function	The front-panel function affected by the mnemonic.
Action	The effects of the mnemonic on that function.
Mnemonic	The HP-IB mnemonic.
S	Syntax type. See "Syntax Types," earlier in this document.
?	Interrogate response. If a response is defined, it is listed.
0	OPC-compatible command.

Range	The range of acceptable inputs and corresponding units.

Symbol conventions:

[ ]	Optional data.
D	Numerical data.
I	An integer appendage that is part of the command. For example, CLEA<I>, where I= 1 to 5, indicates that the actual commands are CLEA1, CLEA2, CLEA3, CLEA4, and CLEA5.
$	A character string operand which must be enclosed by double quotes.
< >	A necessary appendage.
|	An either/or choice in appendages.

Table 1-10. Key Select Codes

Function	Action	Mnemonic	S	?	0	Range
		AVG				
Averaging	Restart	AVERREST	1			
	Factor	AVERFACT[D]	3	D		0 to 999
	On/off	AVERO<ON|OFF>	2	1,0		
Smoothing	Set aperture	SMOOAPER[D]	3	D		0.06 to 20%
	On/off	SMOOO<ON|OFF>	2	1,0		
IF bandwidth	Set bandwidth	IFBW[D]	3	D		10, 30, 100, 300, 1000, 3000, 3700, 6000 Hz
		CAL-error correction, calibration				
Correction	On/off	CORR<ON|OFF>	2	1,0		
Interpolative correction	On/off	CORI<ON|OFF>	2	1,0		
Resume Cal sequence	Resume a previously started calibration	RESC	1			
Receiver calibration	Take receiver calibration sweep	REIC[D]	3			stimulus power range
Port extensions	Port 1	PORT1[D]	3	D		±10 s
	Port 2	PORT2[D]	3	D		±10 s
	Input A	PORTA[D]	3	D		±10 s
	Input B	PORTB[D]	3	D		±10 s
	Off	PORE<ON|OFF>	2	1,0		
Velocity factor	Set value	VELOFACT[D]	3	D		0 to 10
Z_0	Set Value	SETZ[D]	3	D		0.1 to 500Ω

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
CAL-error correction, calibration (continued)						
Adapter removal	Recall Cal Port1	CALSPORT1	1			
	Recall Cal Port2	CALSPORT2	1			
	Adapter delay	ADAP1[D]	3	D		±10 s
	Adapter: coax	ADPTCOAX	1			
	Adapter: waveguide	ADPTWAVE	1			
	Remove adapter	MODS	1			
Test set switching	Continuous/full 2-port cal (continuously measures all 4 S-parameters)	CSWION	2	1,0		
		TSSWION				
	Hold 2-port cal (initially measures all 4 S-parameters, then only 2 parameters)	CSWIOFF	2	1,o		
		TSSWIOFF				
	Number of sweeps 2-port cal	TSSWI[D]	3	D		
Sweep modes	Alternate A and B	ALTAB	1			
	Chop A and B	CHOPAB	1			
Calibrate menu	None	CALN	1	0,1		
	Response	CALIRESP	1	0,1		
	Response and Isol	CALIRAI	1	0,1		
	S11 1-port	CALIS111	1	0,1		
	S22 1-port	CALIS221	1	0,1		
	Full S-port	CALIFUL2	1	0,1		
	One path 2-port	CALIONE2	1	0,1		
	TRL/LRM 2-port	CALITRL2	1	0,1		
Intermediate cal steps, 1 path/2-port	Isolation	ISOOP	1			
	Reflection	REFOP	1			
	Transmission	TRAOP	1			
Intermediate cal steps, full S-port cal	Transmission	TRAN	1			
	Reflection	REFL	1			
	Isolation	ISOL	1			

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
CAL-error correction, calibration (continued)						
Intermediate cal steps, TRL/LRM	Transmission	TRLT	1			
	S_{11} Reflection	TRLR1	1			
	S_{22} Reflection	TRLR2	1			
	Line/match 1	TRLL1	1			
	Line/match 2	TRLL2	1			
Select response & isol. class	Response	RAIRESP	1			
	Isolation	RAIISOL	1			
Select reflection class	S11A (forward open)	CLASS11A	1		PC†	
	S11B (forward short)	CLASS11B	1		PC†	
	S11C (forward load)	CLASS11C	1		PC†	
	S22A (reverse open)	CLASS22A	1		PC†	
	S22B (reverse short)	CLASS22B	1		PC†	
	S22C (reverse load)	CLASS22C	1		PC†	
Select transmission class	Fwd transmission	FWDT	1		PC†	
	Rev transmission	REVT	1		PC†	
	Fwd match	FWDM	1		PC†	
	Rev match	REVM	1		PC†	
Select isolation class	Forward isolation	FWDI	1		PC†	
	Reverse isolation	REVI	1		PC†	
	Omit isolation	OMII	1			
Select standard in class	Standard A	STANA	1		PC	
	Standard B	STANB	1		PC	
	Standard C	STANC	1		PC	
	Standard D	STAND	1		PC	
	Standard E	STANE	1		PC	
	Standard F	STANF	1		PC	
	Standard G	STANG	1		PC	

† The class commands are OPC-compatible if there is only one standard in the class. If here is just one standard, that standard is measured automatically. If there is more than one standard in the class, the class command only calls another menu.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	I	?	0	Range
CAL-error correction, calibration (continued)							
liding load	Set	SLIS	1			OPC	
	Done	SLID	1				
)ffset load	Load no offset	LOAN	1				
	Load offset	LOAO	1				
)one with:	Class	DONE	1				
	Isolation	ISOD	1			OPC	
	Reflection	REFD	1			OPC	
	Transmission	TRAD	1			OPC	
	Offset load	OFLD	1				
ave cal	Response	RESPDONE	1			OPC	
	Resp and isol	RAID	1			OPC	
	l-port cal	SAV1	1			OPC	
	2-port cal	SAV2	1			OPC	
	TRWLRM	SAVT	1			OPC	
CAL-Calibration kits							
elect default its	7-mm	CALK7MM	1	1,0			
	3.5-mmC	CALK35MC*	1	1,0			
	3.5-mmD	CALK35MD	1	1,0			
	Type N, 60 ohm	CALKN50	1	1,0			
	Type N, 75 ohm	CALKN75	1	1,0			
	2.4-mm	CALK24MM	1	1,0			
	2.92-mm	CALK292MM	1	1,0			
	2.92'	CALK292S	1	1,0			
	User-defined	CALKUSED	1	1,0			
	TRL 3.5-mm	CALKTRLK	1	1,0			
lodify kit	Modify current	MODI1	1				
)efine std. number begin std. efinition)		DEFS[D]	3				1 to 8

CALK35MM selects the HP 85033C cal kit for the HP 8752C/53D.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	I	?	O	Range
	CAL-calil	·ation kits (continue					
Mine std. ype	Open	STDTOPEN	1	.,0			
	Short	STDTSHOR	1	.,0			
	Load	STDTLOAD	1	.,0			
	Delay/thru	STDTDELA	1	,0			
	Arbitrary imped.	STDTARBI	1	,0			
)efine std.	Open cap. CO	C0[D]	3				:10k (10^{-15} F)
parameters	Open cap. Cl	C1[D]	3				:10k (10^{-27} F/Hz)
	Open cap. C2	C2[D]	3				:10k (10^{-36} F/Hz^2)
	Open cap. C3	C3[D]	3				:10k (10^{-45} F/Hz^3)
	Fixed load	FIXE	1				
	Sliding load	SLIL	1				
	Offset load	OFLS	1				
	Terminal imped.	TERI[D]	3				to 1 kΩ
)efine std. ffsets	Delay	OFSD[D]	3				:1 s
	Loss	OFSL[D]	3				to 1000 TΩ/s
	zo	OFSZ[D]	3				.1 to 6000
	Min. frequency	MINF[D]	3				to 1000 GHz
	Max. frequency	MAXF[D]	3				to 1000 GHz
	Coaxial	COAX	1	),1			
	Waveguide	WAVE	1	),1			
td. done	Standard defined	STDD	1				
abel std		LABS[$]	3				0 char.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	O	Range
CAL-calibration kits (continue)						
Specify class	Response	SPECRESP[I,I..]	3			Std numbers
	Resp & Isol	SPECRESI[I,I..]	3			Std numbers
	S11A (forward open)	SPECS11A[I,I..]	3			Std numbers
	S11B (forward short)	SPECS11B[I,I..]	3			Std numbers
	S11C (forward load)	SPECS11C[I,I..]	3			Std numbers
	S22A (reverse open)	SPECS22A[I,I..]	3			Std numbers
	S22B (reverse short)	SPECS22B[I,I..]	3			Std numbers
	S22C (reverse load)	SPECS22C[I,I..]	3			Std numbers
	Forward Trans	SPECFWDT[I,I..]	3			Std numbers
	Forward Match	SPECFWDM[I,I..]	3			Std numbers
	Reverse Trans	SPECREVT[I,I..]	3			Std numbers
	Reverse Match	SPECREVM[I,I..]	3			Std numbers
	TRL Thru	SPECTRLT[I,I..]	3			Std numbers
	TRL Reflect	SPECTRLR[I,I..]	3			Std numbers
	TRL Line or Match	SPECTRLL[I,I..]	3			Std numbers
	TRL, Reflect, Forward, Match	SPECTRFM[I,I..]*	3			Std numbers
	TRL, Reflect, Reverse, Match	SPECTRRM[I,I..]*	3			Std numbers
	TRL, Line, Forward, Match	SPECTLFM[I,I..]*	3			Std numbers
	TRL, Line, Forward, Trans	SPECTLFT[I,I..]*	3			Std numbers
	TRL, Line, Reverse, Match	SPECTLRM[I,I..]*	3			Std numbers
	TRL, Line, Reverse, Trans	SPECTLRT[I,I..]*	3			Std numbers
	TRL, Thru, Forward, Match	SPECTTFM[I,I..]*	3			Std numbers
	TRL, Thru, Forward, Trans	SPECTTFT[I,I..]*	3			Std numbers
	TRL, Thru, Reverse, Match	SPECTTRM[I,I..]*	3			Std numbers
	TRL, Thru, Reverse, Trans	SPECTTRT[I,I..]*	3			Std numbers
These commands are accepted for compatibility with the HP 8753D revision 6.00 through 6.48.						

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
CAL-calibration kits (continued)						
Class done		CLAD	1			
Label class	Response	LABERESP[$]	3			10 char.
	Resp. & isolation	LABERESI[$]	3			10 char.
	S11A	LABES11A[$]	3			10 char.
	S11B	LABES11B[$]	3			10 char.
	S11C	LABES11C[$]	3			10 char.
	S22A	LABES22A[$]	3			10 char.
	S22B	LABES22B[$]	3			10 char.
	S22C	LABES22C[$]	3			10 char.
	Forward Trans	LABEFWDT[$]	3			10 char.
	Forward Match	LABEFWDM[$]	3			10 char.
	Reverse Trans	LABEREVT[$]	3			10 char.
	Reverse Match	LABEREVM[$]	3			10 char.
	TRL Thru	LABETRLT[$]	3			10 char.
	TRL Reflect	LABETRLR[$]	3			10 char.
	TRL Line or Match	LABETRLL[$]	3			10 char.
	TRL, Reflect, Forward, Match	LABETRFM[$]*	3			10 char.
	TRL, Reflect, Reverse, Match	LABETRRM[$]*	3			10 char.
	TRL, Line, Forward, Match	LABETLFM[$]*	3			10 char.
	TRL, Line, Forward, Trans	LABETLFT[$]*	3			10 char.
	TRL, Line, Reverse, Match	LABETLRM[$]*	3			10 char.
	TRL, Line, Reverse, Trans	LABETLRT[$]*	3			10 char.
	TRL, Thru, Forward, Match	LABETTFM[$]*	3			10 char.
	TRL, Thru, Forward, Trans	LABETTFT[$]*	3			10 char.
	TRL, Thru, Reverse, Match	LABETTRM[$]*	3			10 char.
	TRL, Thru, Reverse, Trans	LABETTRT[$]*	3			10 char.

These commands are accepted for compatibility with the HP 8753D revision 6.00 through 5.48.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
	CAL-calibration kits (continue					
abel kit		LABK[$]	3			10 char.
Kit done		KITD	1			
ave kit	into user kit	SAVEUSEK	1			
RL/LRM ption	Cal ZO: Line ZO	CALZLINE	1	0,1		
	Cal ZO: System ZO	CALZSYST	1	0,1		
	SET REF: Thru	SETRTHRU	1	0,1		
	SET REF: Reflect	SETRREFL	1	0,1		
	CAL-pov er meter calibratio					
ower meter al	Off	PWMCOFF[D]	3	D		al power:
						– 100 to 100 dB
	Each sweep	PWMCEACS[D]	3	D		al power:
						– 100 to 100 dB
	One sweep	PWMCONES[D]	3	D		al power:
						– 100 to 100 dB
	lake cal sweep§	TAKCS	1			
	Number of readings	NUMR[D]	3	D		to 100
	Set port cal pwr	PWRMCAL[D]	1	D		al power:
						– 100 to 100 dB
dit power oss	On/off	PWRLOSS<ON|OFF>	2	1,0		
table	Edit list	POWLLIST	1			
	Use sensor A or B	USES<ENSA|ENSB>	2			ensor B available vith HP 438A only
	Add segment	SADD	1			
	Edit segment N	SEDI[D]	3	D		to 12
	Done with segment	SDON	1			
	Delete segment	SDEL	1			
	Done	EDITDONE	1			
	Clear list	CLEL	1			

Requires pass control mode when using the HP-IB port.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	s	?	O	Range
	CAL-power meter calibration (continu		1)			
Edit power loss	**Frequency**	POWLFREQ[D]	3	D		Stimulus range†
segment	Value	POWLLOSS[D]	3	D		– 9900 to 9900 dB
Edit cal sensor	Edit sensor menu A	CALFSENA	1			
table	Edit sensor menu B	CALFSENB	1			HP 438A only
	Add segment	SADD	1			
	Edit segment N	SEDI[D]	3	D		1 to 30
	Done with segment	SDON	1			
	Delete segment	SDEL	1			
	Done	EDITDONE	1			
	Clear list	CLEL	1			
Edit cal sensor	Frequency	CALFFREQ[D]	3	D		Stimulus range†
segment	Cal factor	CALFCALF[D]	3	D		3 to 200%
		CHANNEL				
Channel	Channel 1 active	CHAN1	1		OPC	
	Channel 2 active	CHAN2	1		OPC	
	Channel 3 active	CHAN3	1		OPC	
	Channel 4 active	CHAN4	1		OPC	
		COPY				
Copy display	lb printers	PRINALL	1			
	lb plotters	PLOT	1			
Printer	Auto feed	PRNTRAUTF<ON|OFF>	2	1,0		
Printer	Form feed	PRNTRFORF	1			
Printer setup	Default	DEFLPRINT	1			
Plotter	Auto feed	PLTTRAUTF<ON|OFF>	2	.,0		
Plotter	Form feed	PLTTRFORF	1			
Plotter setup	Default	DFLT	1			

† For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory Allocation," in the *HP 8753E User's Guide.*

§ Requires pass control mode when using the HP-IB port.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	I	?	0	Range
C	PY (continued)						
List values		LISV	1				
Operating parameters		OPEP	1				
Next page		NEXP	1				
Previous page		PREP	1				
Print List Values or Operating parameters	Raster display dump to HP-IB§	PRINTALL	1				
Restore display		RESD	1				
Select print color	Monochrome	PRIS	1				
	Color	PRIC	1				
Print feature color	Data channel 1	PCOLDATA1<color>	2				Colors‡
	Data channel 2	PCOLDATA2<color>	2				Colors‡
	Data channel 3	PCOLDATA3<color>	2				Colors‡
	Data channel 4	PCOLDATA4< color>	2				Colors‡
	Memory channel 1	PCOLMEMO1<color>	2				Colors‡
	Memory channel 2	PCOLMEMO2< color>	2				Colors‡
	Memory channel 3	PCOLMEMO3<color>	2				Colors‡
	Memory channel 4	PCOLMEMO4<color>	2				Colors‡
	Graticule	PCOLGRAT< color>	2				Colors‡
	Reference line	PCOLREFL< color>	2				Colors‡
	Text	PCOLTEXT< color>	2				Colors‡
	Warning	PCOLWARN< color>	2				Colors‡
Features to be plotted	Data	PDATA<ON|OFF>	2	,0			
	Memory	PMEM<ON|OFF>	2	,0			
	Graticule	PGRAT<ON|OFF>	2	,0			
	Text	PTEXT<ON|OFF>	2	,0			
	Marker	PMKR<ON|OFF>	2	,0			

‡ Colors = white|cyan|magenta|blue|yellow|green|red|black

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	I	?	0	Range
COPY (continued)							
Quadrant	Left lower	LEFL	1		),1		
	Left upper	LEFU	1		),1		
	Right lower	RIGL	1		),1		
	Right upper	RIGU	1		),1		
	Full page	FULP	1		),1		
Pen number	Data	PENNDATA[D]	3				),1,2 10
	Memory	PENNMEMO[D]	3				),1,2 . 10
	Graticule	PENNGRAT[D]	3				),1,2 . 10
	Text	PENNTEXT[D]	3				),1,2 10
	Marker	PENNMARK[D]	3				),1,2 10
Line type	Data	LINTDATA[D]	3				),1,2 10
	Memory	LINTMEMO[D]	3				),1,2 10
Plot scale	Full page	SCAPFULL	1				
	Graticule to p1,p2	SCAPGRAT	1				
Plot speed	Slow	PLOSSLOW	1				
	Fast	PLOSFAST	1				

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
		DISPLAY				
)hannels	Auxiliary on/off	AUXC<ON|OFF>	2	1,0		
	Dual on/off	DUAC<ON|OFF>	2	1,0		
	Split on/off	SPLD<ON|OFF>	2	1,0		
	One-graticule display	SPLID1	1	1,0		
	Two-graticule display	SPLID2	1	1,0		
	One graticule per channel	SPLID4	1	1,0		
	2 graticule display with channel 2 on to	D2XUPCH2	1	1,0		
	2 graticule display with channel 3 on to	D2XUPCH3	1	1,0		
	4 graticule display with channel 2 in upper right	D4XUPCH2	1	1,0		
	4 graticule display with channel 3 in upper right	D4XUPCH3	1	1,0		
	D2/D1 to D2 (Channe 2 data divided by channel 1 data, and displayed on channel 2)	D1DIVD2<ON|OFF>	2	1,0		
)isplay	Data	DISPDATA	1	),1		
	Memory only	DISPMEMO	1	),1		
	Data and mem	DISPDATM	1	),1		
	Data/mem	DISPDDM DNI	1	),1		
	Data — mem	DISPDMM MINU	1	),1		
	Data to mem	DATI	1	),1	)PC	
	Intensity	INTE[D]	3	D		50 to 100
	Blank Display	BLAD<ON|OFF>	2	1,0		
	Title	TITL[$]	4	$		18 char.
Beeper	On done	BEEPDONE<ON|OFF>	2	1,0		
	On warning message	BEEPWARN<ON|OFF>	2	1,0		
Frequency notation	Blank	FREO	1			

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
DISPLAY (continued)						
Adjust display	Background intensity	BACI[D]	3	)		to 100
	Save colors	svco	1			
	Recall colors	RECO	1			
	Default colors	DEFC	1			
Modify specific display feature colors	Ch 1 data/lim In	COLOCH1D	1			
	Ch 1 memory	COLOCH1M	1			
	Ch 2 data/lim In	COLOCH2D	1			
	Ch 2 memory	COLOCH2M	1			
	Ch 3 data/lim In	COLOCH3D	1			
	Ch 3 memory	COLOCH3M	1			
	Ch 4 data/limit In	COLOCH4D	1			
	Ch 4 memory	COLOCH4M	1			
	Graticule	COLOGRAT	1			
	Reference line	COLOLREF	1			
	Text	COLOTEXT	1			
	Warning	COLQWARN	1			
Adjust specific display feature color	Brightness	CBRl[D]	3	)		to 100
	Color	COLOR[D]	3	)		to 100
	Tint	TINT[D]	3	)		to 100
	Reset color to default	RSCO	1			
ENTRY						
Step keys	Up	UP	1			
	Down	DOWN	1			
Entry off		ENTO	1			
FORMAT						
Format	Log mag	LOGM	1	0,1		
	Phase	PHAS	1	0,1		
	Delay	DELA	1	0,1		
	Smith chart	SMIC	1	0,1		
	Polar	POLA	1	0,1		
	Lin mag	LINM	1	0,1		
	Real	REAL	1	0,1		
	Imaginary	IMAG	1	0,1		
	SWR	SWR	1	0,1		

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
		LOCAL				
HP-IB modes	Talker/listener	TALKLIST	1	0,1		
	Use pass control	USEPASC	1	0,1		
Debug	Display commands	DEBU<ON|OFF>	2	1,0		
Disk drive	Unit	DISCUNIT[D]	3	D		0 to 30
	Volume	DISCVOLU[D]	3	D		0 to 30
HP-IB addresses	Plotter	ADDRPLOT[D]	3	D		0 to 30
	Printer	ADDRPRIN[D]	3	D		0 to 30
	Disk drive	ADDRDISC[D]	3	D		0 to 30
	Controller	ADDRCONT[D] PCB[D]	3	D		0 to 30
Power meter	Address	ADDRPOWM[D]	3			0 to 30
	Type	POWM<ON|OFF>	2	0,1		On = 436A, Off = 438A/437B
Select plotter type	Plotter	PLTTYPPLTR	1			
	HPGL printer	PLTTYPHPGL	1			
Select printer type	ThinkJet	PRNTYPTJ	1			
	DeskJet	PRNTYPDJ	1			
	LaserJet	PRNTYPLJ	1			
	PaintJet	PRNTYPPJ	1			
	Epson-P2	PRNTYPEP	1			
	DJ 540	PRNTYP540	1			
Select printer port	HP-IB	PRNPRTHPIB	1			
	Parallel	PRNPRTPARA	1			
	Serial	PRNPRTSERI	1			
Select plotter port	HP-IB	PLTPRTHPIB	1			
	Parallel	PLTPRTPARA	1			
	Serial	PLTPRTSERI	1			
	Disk	PLTPRTDISK	1			

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	s	?	0	Range
LOCAL (continued)						
Printer serial port	Baud rate	PRNTRBAUD[D]	3	D		1200, 2400, 4800, 9600, 19200
Printer serial port	Handshake	PRNHNDSHK<XON|DTR>	2	l,o		
Plotter serial port	Baud rate	PLTTRBAUD[D]	3	D		1200, 2400, 4800, 9600, 19200
Plotter serial port	Handshake	PLTHNDSHK<XON|DTR>	2	l,o		
Parallel port	Configure	PARAL<GPIO|CPY>	2	0,1		GPIO = Gen.Purpose I/O, CPY = COPY use
		MEAS				
Input ports	A/R	AR	1	0,1		
	B/R	BR	1	0,1		
	A/B	AB	1	0,1		
	A	MEASA	1	0,1		
	B	MEASB	1	0,1		
	R	MEASR	1	0,1		
	Selects testport 1 or 2	TSTP<P1|P2>	2			
Analog input		ANAl[D]	1 *	0,1		
j-parameters	Sll	S11	1	0,1		
		RFLP	1	0,1		
	S12	S12	1	0,1		
	S21	S21	1	0,1		
		TRAP	1	0,1		
	S22	S22	1	0,1		

* Syntax type 1 when ANABOFF. Syntax type 3, and range = 1 to 31, when ANABON.
Refer to the *HP 8753E Network Analyzer Service* Guide for information on the analog bus.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	O	Range
MEAS (continued)						
:onversion to	Off	CONVOFF	1	0,1		
alternate	Z:reflection	CONVZREF	1	0,1		
parameters	Z:transmission	CONVZTRA	1	0,1		
	Y:reflection	CONVYREF	1	0,1		
	Y:transmission	CONVYTRA	1	0,1		
	1/S	CONV1DS	1	0,1		
MENU (stimulus)						
'ower	Level	POWE[D]	3	D		option dependent#
	Trip	POWT<ON|OFF>	2	1,0		
	Always couple power	COUP<ON|OFF>	2	l,o		
	Port power coupling	PORTP<CPLD|UNCPLD>	2	1,0		
	Range 0	PRANO	1	0,1		
	Range 1	PRAN1	1	0,1		
	Range 2	PRAN2	1	0,1		
	Range 3	PRAN3	1	0,1		
	Range 4	PRAN4	1	0,1		
	Range 5	PRAN5	1	0,1		
	Range 6	PRAN6	1	0,1		
	Range 7	PRAN7	1	0,1		
	Power range auto/manual	PWRR<PAUTO|PMAN>	2	0,1		
	Source power on/off	SOUP<ON|OFF>	2	l,o		
'est set ttenuation	Port 1	ATTP1[D]*	3	D		0, 10, 20 . . . 70 dB
	Port 2	ATTP2[D]*	3	D		0, 10, 20 . . . 70 dB
'ime	Specify	SWET[D]	3	D		0.01 to 86,400 s
	Selects fastest sweep time	SWEA	1			
leasurement	Restart	REST	1			

'Output power ranges: HP 87633 std: -86 to + 10dBm; HP 87533 with Opt. 076: -86 to + 8dBm. HP 87533 Opt. 011: −5 to + 20dBm; HP 87633 Opt. 011 with Opt. 006: -6 to + 18dBm.

Option 011 only.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
MENU (stimulus) (continued)						
Digger	Hold	HOLD	1	0,1		
		TRIG				
	Single	SING	1		OPC	
	Number of groups	NUMG[D]	3		OPC	1 to 999
	Continuous	CONT	1	0,1		
		FREQ				
	External trigger off	EXTTOFF	2	0,1	OPC	
	External trigger on sweep	EXTTON	2	0,1	OPC	
	External trigger on point	EXTTPOIN	1	0,1	OPC	
	Manual trigger on point	MANTRIG	1	0,1	OPC	
Points	Specify	POlN[D]	3	D		3, 11, 26, 61, 101 201, 401, 801, 1601
Coupled channels	On/off	COUC<ON|OFF>	2	l,o		
CW freq	Set value	CWFREQ[D]	3	D		Stimulus range†
Power slope	Value	SLOPE[D]	3	D		-2 to 2 dB/GHz
	On/off	SLOPO<ON|OFF>	2	l,o		
Sweep type	Linear	LINFREQ	1	0,1		
	Log	LOGFREQ	1	0,1		
	List	LISFREQ	1	0,1		
	Select a segment	SSEG[D]	3	0,1		1 to 30
	Select all segments	ASEG	1	0,1		
	Power	POWS	1	0,1		
	CW time	CWTIME	1	0,1		

For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory Allocation," in the *HP 8753E User's Guide*. For CW time: 0 to 24 hours. For frequency sweep, transform on: ± l/frequency step. For CW time sweep, transform on: ±1/time step.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	s	?	0	Range
	MENU	**timulus) (continued)**				
;dit list	Begin	EDITLIST	1			
	Add segment	SADD	1			
	Edit segment N	SEDl[D]	3	D		l to 30
	Delete segment	SDEL	1			
	Done	EDITDONE	1			
	Clear list	CLEL	1			
	List Type	LISTTYPE<LSTP|LSWP>	2	1,0		
;dit segment	Start	STAR[D]	3	D		;timulus range[t]
	Stop	STOP[D]	3	D		;timulus range[t]
	Center	CENT[D]	3	D		;timulus range[t]
	Span	SPAN[D]	3	D		Ximulus range[t]
	Points	POIN[D]	3	D		;, 11, 21, 26, 51, l01 101, 401, 801, 1601
	Stepsize	STPSIZE[D]	3	D		Stimulus range[t]
	c w	CWFREQ[D]	3	D		stimulus range[t]
	Done with segment	SDON	1			
;dit more	List power	LISPWRM<ON|OFF>	2	1,0		
	Segment power	SEGPOWER[D]	3	D		;ption lependent[#]
	List IF BW	LISIFBWM<ON|OFF>	2	1,0		
	Segment IF BW	SEGIFBW[D]	3	D		l0, 30, 100, 300, 1000, 3000, 3700, 5000 Hz
ingle/All egment	Single segment sweep	SSEG[D]	1			
	All segment sweep	ASEG	1			

For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory llocation," in the *HP 8753E User's Guide.* For CW time: 0 to 24 hours. For frequency weep, transform on: ± l/frequency step. For CW time sweep, transform on: ± l/time tep.

'Output power ranges: HP 87533 std: -85 to + 10dBm; HP 87533 with Opt. 075: -85 to + 8dBm. HP 87633 Opt. 011: -5 to + 20dBm; HP 87533 Opt. 011 with Opt. 006: -5 to + 18dBm.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
		MARKER				
Select active	1 to 5	MARK<I>[D]	3	D		Stimulus range†
	All off	MARKOFF	1	0,1		
Marker zero	Zero offsets	MARKZERO	1			
Delta reference	1 to 5	DELR<I>	2	0,1		1 to 5
	Fixed marker	DELRFIXM	1	0,1		
	Mode off	DELO	1	0,1		
Fixed mkr position	Stimulus	MARKFSTI[D]	3	D		Stimulus range†
	Value	MARKFVAL[D]	3	D		Amplitude range#
	Aux value	MARKFAUV[D]	3	D		Amplitude range#
		MARKER FCTN				
Marker placement	Discrete	MARKDISC	1	0,1		
	Continuous	MARKCONT	1	0,1		
Coupled	Couple channels	MARKCOUP	1	0,1		
	Uncouple	MARKUNCO	1	0,1		
Displayed	On/off	DISM<ON|OFF>	2	1,0		
Polar markers	Log	POLMLOG	1	0,1		
	Linear	POLMLIN	1	0,1		
	Re/Im	POLMRI	1	0,1		

† For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory Allocation," in the *HP 8753E* User's Guide For CW time: 0 to 24 hours. For frequency sweep, transform on: ± 1/frequency step. For CW time sweep, transform on: ± 1/time step.

For log mag: ± 600 dB. For phase: ± 500 degrees. For Smith chart and Polar: ± 500 units. For linear magnitude: ± 500 units. For SWR: ± 600 units. The scale is always positive, and has minimum values of .001 dB, 10e-12 degrees, 10e-15 seconds, and 10 picounits.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
MARKER FCTN (continued)						
Smith markers	Linear	SMIMLIN	1	0,1		
	Log	SMIMLOG	1	0,1		
	Re/Im	SMIMRI	1	0,1		
	R+jX	SMIMRX	1	0,1		
	G+jB	SMIMGB	1	0,1		
Statistics	On/off	MEASTAT<ON|OFF>	2	1,0		
Set function to marker value	start	MARKSTAR	1			
	Stop	MARKSTOP	1			
	Center	MARKCENT	1			
	Span	MARKSPAN	1			
	Reference	MARKREF	1			
	Delay	MARKDELA	1			
Search	Off	SEAOFF	1	0,1		
	Maximum	SEAMAX MARKMAXI	1	0,1		
	Minimum	SEAMIN MARKMINI	1	0,1		
	Target	SEATARG[D]	3	D		Amplitude range#
	Search left	SEAL	1			
	Search right	SEAR	1			
Width	Value	WIDV[D]	3	D		Amplitude range#
	Width on/off	WIDT<ON|OFF>	2	1,0		
Tracking search	On/off	TRACK<ON|OFF>	2	1,0		
SAVE/RECALL internal registers						
Save	Selected reg	SAVE<I>	2		OPC	1 to 5
	Selected reg	SAVEREG<I>	2		OPC	01 to 31
Clear	Selected reg	CLEA<I>	2		OPC	1 to 5
	Selected reg	CLEAREG<I>	2		OPC	01 to 31
	All regs	CLEARALL	1		OPC	

For log mag: ± 500 dB. For phase: ± 500 degrees. For Smith chart and Polar: ± 500 units. For linear magnitude: ± 500 units. For SWR: ± 500 units.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
	SAVE/RECALL-internal registers (conti					
Recall	Selected reg	RECA<I>			OPC	1 to 5
	Selected reg	RECAREG<I>			OPC	01 to 31
Title	Internal reg	TITR<I>[$]				1 to 5, 10 char.
	Internal reg	TITREG<I>[$]				01 to 31, 10 char.
	Save state file	TITF0<I>[$]				01 to 31, 10 char.
	Plot	TITP<I>[$]				01 to 31, 10 char.
	SAVE/RECALL-disk files					
Purge	Selected file§	PURG<I>	2			1 to 5
Store	To disk§	STOR<I>	2			1 to 5
Title	Disk file	TITF<I>[$]	4			1 to 5, 10 char.
	Copy labels from file titles	COPYFRFT	1			
	Copy labels from register titles	COPYFRRT	1			
Include with disk	Data (error corrected, real and imaginary pairs)*	EXTMDATA<ON|OFF>	2	,0		
files	Raw data	EXTMRAW<ON|OFF>	2	,0		
	Formatted data	EXTMFORM<ON|OFF>	2	,0		
	User graphics	EXTMGRAP<ON|OFF>	2	,0		
	Data only (error corrected, real and imaginary pairs)*	EXTMDATO<ON|OFF>	2	,0		
Save format	Binary	SAVUBINA	1			
	ASCII/CITIFile	SAVUASCI	1			
Load	From disk§	LOAD<I>	2			1 to 5
	Recall file titles§	REFT	1			

§ Requires pass control mode when using the HP-IB port.
*See Figure 1-1. This error corrected data is the same as that output by the command OUTPDATA.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
	SAVE/REC/	**L-disk Ales (contin**	**d)**			
nitialize	Internal disk	INID	1			
	External disk	INIE	1			
	LIF Directory size	DIRS[D]	3	D		256 to 8192
'elect storage	Internal memory	INTM	1			
	Internal disk	INTD	1			
	External disk	EXTD	1			
	Internal disk	INTD	1			
)isk format	DOS	FQRMATDOS	1			
	LIF	FORMATLIF	1			
		;CALE REF				
cale	Auto	AUTO	1			
	Value	SCAL[D]	3	D		Amplitude range#
:eference	Position	REFP[D]	3	D		0 to 10
	Value	REFV[D]	3	D		Amplitude range#
	Set to mkr	MARKREF	1			
)elay	Set delay	ELED[D]	3	D		± 10.0 s
	Coaxial delay	COAD	1			
	Waveguide delay	WAVD	1			
'hase	Offset	PHAO[D]	3	D		0 to 360 deg

[1] For log mag: ± 600 dB. For phase: ± 500 degrees. For Smith chart and Polar: ± 500 nits. For linear magnitude: ± 500 units. For SWR: ± 500 units. The scale is always ositive, and has minimum values of .001 dB, 10e-12 degrees, 10e-15 seconds, and 10 icounits.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
	S	Q-sequencing				
sequencing nenu	Continue sequence	CONS	1			
	Do sequence	DOSEQ<I>	2			1 to 6
	Gosub sequence	GOSUB< I>	2			1 to 6
	New/modify sequence	NEWSEQ< I>	2			1 to 6
	Pause to select seq.	PTOS	1			
	Done modify	DONM	1			
	Select sequence	SEQ< I> Q<I>	2			1 to 6
	Duplicate seq. X to seq. Y	DUPLSEQ<X>SEQ<Y>	2			X, Y = 1 to 6
	Print sequence I	PRINSEQ< I>	2			1 to 6
	Begin title sequence	TITSQ	1			
	Title sequence I	TITSEQ<I>[$]	2			1 to 6, 10 char.
	Clear sequence I	CLEASEQ< I>	2			1 to 6
TL I/O	TTL out high continuously	TTLOH	1			
	TTL out low continuously	TTLOL	1			
	TTL low - end sweep high	TTLHPULS	1			
	TTL high end sweep low	TTLLPULS	1			
	Testset I/O forward	TSTIOFWD[D]	3	)		0 to 7
	Testset I/O reverse	TSTIOREV[D]	3	)		0 to 7
	Programs all GPIO output bits	PARAOUT[D]	3	)		0 to 255
	Set specified bit on GPIO	SETBIT[D]	3	)		0 to 7
	Clear specified bit on GPIO	CLEABIT[D]	3	)		0 to 7
	Specify input GPIO bit for IFBI	PARAIN[D]	3	)		0 to 4
	Input GPIO bit high - lo SEQ< I>	IFBIHIGH	1			
	Input GPIO bit low - lo SEQ<I>	IFBILOW	1			

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
SEQ-sequencing (continued)						
ave/recall sequences	Store sequence I to disk§	STORSEQ< I>	2			1 to 6
	Recall sequence I from disk§	LOADSEQ<I>	2			1 to 6
pecial functions	Peripheral address	ADDRPERI[D]	3	D		0 to 30
	Title to peripheral	TITTPERI	1			
	Wait D seconds	SEQWAIT[D]	3	D		0.1 to 3000 s
	Pause	PAUS	1			
	Marker to CW freq.	MARKCW	1			
	Emit beep	EMIB	1			
	Title to HP-IB printer	TITTPRIN	1			
	Title to pwr mtr/HPIB	TITTPMTR	1			
	Show menus	SHOM	1			
	Assert seq. status bit	ASSS	1			
	Read pwr mtr/HP-IB into title string	PMTRTTIT	1			
	Send number into trace memory	TITTMEM	1			
ecision aking	If limit test pass then do sequence I	IFLTPASSSEQ< I >	2			1 to 6
	If limit test fail then do sequence I	IFLTFAILSEQ< I >	2			1 to 6
oop counter	Set value	LOOC[D]	3			0 to 32,760
	Increment by 1	INCRLOOC				
	Decrement by 1	DECRLOOC				
	If counter equals 0 then do sequence	IFLCEQZESEQ< I >	2			1 to 6
	If counter not equal to 0 then do sequence	IFLCNEZESEQ<I>	2			1 to 6

Requires pass control when using the HP-IB port.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
		STIMULUS				
Stimulus	Center	CENT[D]	3	D		Stimulus range†
	Span	SPAN[D]	3	D		Stimulus range†
	Start	STAR[D]	3	D		Stimulus range†
	Stop	STOP[D]	3	D		Stimulus range†
		SYSTEM				
Set clock	Time stamp	TIMESTAM<ON|OFF>	2	1,0		
	Set date	SETDATE[$]	3			DD MMM YYY
	Set time	SETTIME[$]	3			HH:MM:SS
Configure	Sampler, attenuator offsets	RAWOFFS<ON|OFF>	2	l,o		
	Spur avoidance	SM8<ON|OFF>	2	l,o		
	Testset switching	CSWI<ON|OFF>	2	l,o		
		TSSWI<ON|OFF>	2	l,o		
Harmonic mode	Off	HARMOFF	1	0,1	OPC	
	Second	HARMSEC	1	0,1	OPC	
	Third	HARMTHIR	1	0,1	OPC	
Instrument mode	Network analyzer	INSMNETA	1	0,1	OPC	
	Ext. source auto	INSMEXSA	1	0,1	OPC	
	Ext. source manual	INSMEXSM	1	0,1	OPC	
	Tuned receiver	INSMTUNR	1	0,1	OPC	
Frequency offset	On/off	FREQOFFS<ON|OFF>	2	1,0	OPC	
	Value	VOFF[D]	3	D		frequency range of instrument
	Set RF > LO	RFGTLO	1			
	Set RF < LO	RFLTLO	1			
	Select up converter	UCONV	1			
	Select down converter	DCONV	1			

† For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory Allocation," in the *HP 8753E User's Guide.* For CW time: 0 to 24 hours. For frequency sweep, transform on: ± 1/frequency step. For CW time sweep, transform on: ±1/time step.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	I	?	0	Range
SYSTEM (continued)							
ervice	Analog bus	ANAB<ON|OFF>	2	l,o			
	Sampler correction	SAMC<ON|OFF>	2	l,o			
O	Frequency:CW	LOFREQ[D]	3	D			frequency range of instrument
	Frequency:start	LOFSTAR[D]	1	D			frequency range of instrument
	Frequency:stop	LOFSTOP[D]	1	D			frequency range of instrument
	Frequency:sweep	LOFSWE	1				
	Power:fixed	LOPOWER[D]	1	D			power range of instrument
	Power:start	LOPSTAR[D]	1	D			power range of instrument
	Power:stop	LOPSTOP[D]	1	D			power range of instrument
	Power:sweep	LOPSWE	1				
	LO control	LOCONT<ON]OFF>	2	l,o			
	Source address	ADDRLSRC[D]	3	D			0 to 30
	View measurement/mixer setup	VIEM<ON|OFF>	2	l,o			
	SYSTEM-limit testing						
imit line	On/off	LIMILINE<ON|OFF>	2	l,o			
imit test	On/off	LIMITEST<ON|OFF>	2	1,0			
	Beeper	BEEPFAIL<ON|OFF>	2	1 , 0			
imit offset	Stimulus	LIMISTIO[D]	3	D			Stimulus range]
	Amplitude	LIMIAMPO[D]	3	D			Amplitude range#
	Marker to offset	LIMIMAOF	1				

For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory llocation," in the *HP 8753E* User's *Guide.* For CW time: 0 to 24 hours. For frequency weep, transform on: ± l/frequency step. For CW time sweep, transform on: ± l/time tep.

t For log mag: ± 500 dB. For phase: ± 500 degrees. For Smith chart and Polar: ± 500 nits. For linear magnitude: ± 600 units. For SWR: ± 600 units. The scale is always ositive, and has minimum values of .001 dB, 10e-12 degrees, 10e-15 seconds, and 10 icounits.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
SYSTEM-limit testing (continued)						
Edit table	Begin edit	EDITLIML	1			
	Add segment	SADD	1			
	Edit segment D	SEDI[D]	3	)		to 18
	Delete segment	SDEL	1			
	Done with edit	EDITDONE	1			
	Clear list	CLEAL	1			
Edit segment	Stimulus value	LIMS[D]	3	)		Stimulus range[t]
	Marker to stimulus	MARKSTIM	1			
	Upper limit	LIMU[D]	3	)		Amplitude range[#]
	Lower limit	LIML[D]	3	)		Amplitude range[#]
	Delta limits	LIMD[D]	3	)		Amplitude range[#]
	Middle value	LIMM[D]	3	)		Amplitude range[#]
	Marker to middle	MARKMIDD	1			
	Segment done	SDON	1			
Limit type	Flat line type	LIMTFL	1	,1		
	Sloping line type	LIMTSL	1	,1		
	Single point type	LIMTSP	1	,1		

For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory Allocation," in the *HP 8753E User's* Guide For CW time: 0 to 24 hours. For frequency sweep, transform on: ± 1/frequency step. For CW time sweep, transform on: ±1/time step.

[#] For log mag: ± 600 dB. For phase: ± 500 degrees. For Smith chart and Polar: ± 500 units. For linear magnitude: ± 600 units. For SWR: ± 600 units. The scale is always positive, and has minimum values of .001 dB, 10e-12 degrees, 10e-15 seconds, and 10 picounits.

Table 1-10. Key Select Codes (continued)

Function	Action	Mnemonic	S	?	0	Range
		SY TEM-transform				
Transform	Time Domain Transform On/off	TIMDTRAN<ON|OFF>	2	0,1		
Set freq	Low pass	SETF	1			
Mode	Low pass impulse	LOWPIMPU	1	0,1		
	Low pass step	LOWPSTEP	1	0,1		
	Bandpass	BANDPASS	1	0,1		
	Specify gate menu	SPEG	1			
Window	Maximum	WINDMAXI	1			
	Normal	WINDNORM	1			
	Minimum	WINDMINI	1			
	Any value	WINDOW[D]	3	D		tate dependent
Window hape	Use trace memory	WINDUSEM<ON|OFF>	2	1,0		
Demodulation	off	DEMOOFF	1	0,1		
	Amplitude	DEMOAMPL	1	0,1		
	Phase	DEMOPHAS	1	0,1		
Gate	On/off	GATEO<ON|OFF>	2	1,0	PC	
	Start	GATESTAR[D]	3	D		timulus range†
	Stop	GATESTOP[D]	3	D		timulus range†
	Center	GATECENT[D]	3	D		timulus range†
	Span	GATESPAN[D]	3	D		timulus range†
Gate shape	Maximum	GATSMAXI	1	0,1		
	Wide	GATSWIDE	1	0,1		
	Normal	GATSNORM	1	0,1		
	Minimum	GATSMINI	1	0,1		

For frequency or power sweeps, refer to Chapter 12, "Preset State and Memory Allocation," in the *HP 8753E* User's Guide For CW time: 0 to 24 hours. For frequency sweep, transform on: ± 1/frequency step. For CW time sweep, transform on: ±1/time step.

HP-IB Only Commands

Table 1-11. HP-IB Only Commands

Action	Mnemonic	$	?	Description
		INPUT		
'rror oefflcient	INPUCALC<01, 02,. . . 12>	2		Inputs an individual error coefficient array. Issue the command CALIXXXX;(XXXX specifies the data calibration type), then input each of the appropriate individual error coefficients using INPUCALC. Finally, issue SAVC; and trigger a sweep.
	SAVC	1		This OPC compatible command denotes completion of the error coefficients transfer to the instrument.
'al kit	INPUCALK[D]	3	D	Input a cal kit.
'rror-orrected)ata	INPUDATA[D]	3	D	Inputs error-corrected data.
'ormatted)ata	INPUFORM[D]	3	D	Inputs formatted data.
earn string	INPULEAS[D]	3	D	Inputs the learn string. Preceded by SELL if learn string is not current revision.
'ower meter al.	INPUPMCAL<I>	3		Inputs power meter cal array. Values should be entered as 100 times the power meter reading in dB.
'aw Data	INPURAW1[D]	3	D	Inputs raw data.
	INPURAW2[D]	3	D	
	INPURAW3[D]	3	D	
	INPURAW4[D]	3	D	

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	s	?	Description
LIMIT LINE AND DATA POINT TEST				
lin/max ecording	MINMAX<ON|OFF>*	2	1,0	Enables/disables min/max recording per segment. Min and max values are recorded per limit segment.
egment	SELSEG[D]*	3	D	Selects segment number for the OUTPSEGF and OUTPSEGM commands to report on. D can range from 1 to 18.†
ast point	SELMAXPT[D]	3	D	Selects the last point number in the range o points that the OUTPDATR command will report. D can range from 0 to the number ol points minus 1.
irst point	SELMINPT[D]	3	D	Selects the first point number in the range of points that the OUTPDATR command will report. D can range from 0 to the number ol points minus 1.
pecify oint	SELPT[D]	3	D	Selects point number that the OUTPDATR command will report. D can range from 0 to the number of points minus 1.
		MENUS		
veraging	MENUAVG	1		
alibration	MENUCAL	1		
opy	MENUCOPY	1		
isplay	MENUDISP	1		
ormat	MENUFORM	1		
larker	MENUMARK	1		
leas	MENUMEAS	1		
larker unction	MENUMRKF	1		
ff	MENU<ON|OFF>	2		
ave Recall	MENURECA	1		
ave Recall	MENUSAVE	1		
cale	MENUSCAL	1		
equencing	MENUSEQU	1		
timulus	MENUSTIM	1		
ystem	MENUSYST	1		

Refer to the "Limit Line and Data Point Special Functions" section in *HP BASIC rogramming Examples Guide.*

For the definition of a limit segment, see "Example Display of Limit Lines" in the *'P BASIC Programming Examples Guide* section titled "Limit Line and Data Point pecial Functions."

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	$	?	Description
			MISCELLANEOUS	
Select l-port cal	CAL1	1		Provides access to functions within the l-port cal menu. (HP 8610 compatibility.)
Copy defaull	DEFLTCPIO	1		Sets up a default state for copy.
External rigger	EXTTHIGH	1		Sets the trigger polarity high.
	EXTTLOW	1		Sets the trigger polarity low.
Identify instrument	IDN?	1		Outputs the identification string: "HEWLETT PACKARD, 87NNE,0,X.XX", where 87NNE is the model number of the instrument and XXX is the firmware revision of the instrument.
Key	KEY[D]	1	)	Imitates pressing a key. The data transmitted is the key code, as defined in Figure 1-6. Range for D- 1 to 61.
Key code	KOR?	1		Outputs last key code or knob count. If the reply is positive, it is a key code. If it is negative, then set bit 16 equal to bit 14, and th resulting two byte integer is the RPG knob count. It can be either positive or negative. There are about 120 counts per turn.
Move marker	MARKBUCK[D]	2	)	Moves the marker to the selected point on the trace. On a 201 point sweep, D can range from) to 200.
No operation	NOOP	1		Creates a cycle that has no operation. OPC compatible.
On completion	OPC	1		Causes reporting of the last OPC-compatible command completion.
Plot/print softkeys	PSOFT<ON|OFF>	?		Includes the softkey menu keys when printing or plotting the screen.

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	S	?	Description
MISCELLANEOUS (continued)				
earn string	ELL[D]	2	D	Selects the learn string revision to input to and output from the analyzer. The valid parameters are: 0: Defaults to current revision. 201: Revision 8753B 2.01 300: Revision 8753B 3.00 401: Revision 8753C 4.01 402: Revision 8753C 4.02 412: Revision 8753C 4.12 413: Revision 8753C 4.13 500: Revision 8753D 5.00 520: Revision 8753D 5.20 626: Revision 8753D 5.26 534: Revision 8753D 5.34 536: Revision 8753D 6.36 538: Revision 8753D 6.38 540: Revision 8753D 5.40 542: Revision 8753D 5.42 546: Revision 8753D 5.46 548: Revision 8753D 5.48 612: Revision 8753D 6.12 710: Revision 87633 7.10
evision	)FR			Displays the software revision on the analyzer.
weep start	WPSTART			This OPC-compatible command initiates a sweep and immediately releases the HP-IB bus, allowing the analyzer to initiate data output as soon as the appropriate data is ready. Use in conjunction with Take4 mode only.
ollect raw ata	AKE4<ON|OFF>		1.0	This command initiates a mode in which every measurement cycle is characterized by sweeping in both the forward and reverse directions and collecting raw data for all four S-parameters. The sweeping can occur when a SWPSTART or SING command is received or when the analyzer is in continuous, number of groups, or external trigger mode.

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	s	?	Description
MISCELLANEOUS (continued)				
Self test	TST?	1		Causes a self test. Returns a zero if the test passes.
Wait	WAIT	1		Makes the analyzer wait for a clean sweep when used with the OPC command.
OUTPUT				
Active function	OUTPACTI	1		Outputs value of function in active entry area in ASCII format.
Max values	OUTPAMAX*	1		Outputs max values for all limit line segments.
Min values	OUTPAMIN*	1		Outputs min values for all limit line segments.
Smoothing	OUTPAPER	1		Outputs the smoothing aperture.
Error coefficient	OUTPCALC<01,02...12>	2		Outputs the selected error coefficient array from the active channel. Each array is the sam as a data array. See Table 1-8, for the contents of the arrays.
Cal kit	OUTPCALK	1		Outputs the active cal kit, a less than 1000 byt string in FORM 1.
Active channel	OUTPCHAN	1		Outputs the active channel number.
Data	OUTPDATA	1		Outputs the error corrected data from the activ channel in real/imaginary pairs. See Figure 1-4
	OUTPDATF	1		Fast data transfer command for OUTPDATA.
Data: point	OUTPDATP	1		Outputs trace data indexed by point. (see SELPT[D])
Data: range	OUTPDATR	1		Outputs trace data for range of point-s. (see SELMINPT[D],SELMAXPT[D])
Error	OUTPERRO	1		Outputs the oldest error in the error queue. The error number is followed by the error message in ASCII format (FORM 4).

* Refer to the "Limit Line and Data Point Special Functions" section in *HP BASIC Programming Examples Guide*.

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	S	?	Description
OUTPUT (continued)				
ıil report	OUTPFAIP*	1		This command is similar to OUTPLIMF except that it reports the number of failures first, followed by the stimulus and trace values for each failed point in the test.
›rmatted	OUTPFORM	1		Outputs the formatted trace data from the active channel in current display units. See Table 1-4 for data transferred.
	OUTPFORF	1		Fast data transfer command for OUTPFORM. Only the first number of the OUTPFORM data pairs is transferred. See Table 1-4.
ıterp. cal.	OUTPICAL< I>	2		Outputs the selected interpolated cal coefficien array.
lentify ıstrument	OUTPIDEN	1		See IDN?
›wer meter ıl.	OUTPIPMCAL<I>	2		Outputs the interpolated power meter cal array for channel 1 or channel 2.
ey code	OUTPKEY	1		Outputs the code of the last key pressed, in ASCII format. See Figure 1-6 for key codes. – 1 is transmitted for a knob turn.
earn string	OUTPLEAS	1		Outputs the learn string in binary, not intended for decoding.
imit test: ıl	OUTPLIM1*	1		Outputs status§ of limit test for channel 1.
imit test: ı2	OUTPLIM2*	1		Outputs status§ of limit test for channel 2.
imit test: ı3	OUTPLIM3*	1		Outputs status§ of limit test for channel 3.
imit test: ı4	OUTPLIM4*	1		Outputs status§ of limit test for channel 4.
imit ıilures	OUTPLIMF	1		Outputs the limit results as described under OUTPLIML for only those stimulus points that failed.

Refer to the "Limit Line and Data Point Special Functions" section in *HP BASIC rogramming Examples Guide.*

Values returned for limit test status are: 1 (PASS), 0 (FAIL), – 1 (NO_LIMIT)

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	$	?	Description
OUTPUT (continued)				
.imit list	)UTPLIML	1		Outputs the limit test results for each stimulus point. The results consist of four numbers. The first is the stimulus value tested, the second is the test result:—1 for no test, 0 for fail, 1 for pass. The third number is the upper limit value and the fourth is the lower limit value. This is an ASCII transfer (FORM 4).
imit narker	)UTPLIMM	1		Outputs the limit test results as described for OUTPLIML for the active marker
darker	)UTPMARK	1		Outputs the active marker values in 3 numbers The first two numbers are the marker values, and the last is the stimulus value. See Table 1-4 for the marker values.
Memory	)UTPMEMO	1		Outputs the memory trace from the active channel. It is error corrected data in real/imaginary pairs, and can be treated the same as data from OUTPDATA.
	)UTPMEMF	1		Fast data transfer command for OUTPMEMO.
Marker tatistics	)UTPMSTA	1		Outputs marker statistics: mean, standard deviation, and peak to peak deviation. ASCII format (FORM 4).
Bandwidth	)UTPMWID	1		Outputs results of bandwidth search:bandwidth center, and Q. ASCII format (FORM 4).
Bandwidth + loss	)UTPMWIL	1		Same operation as OUTPMWID plus the loss value.
Options	)UTPOPTS	1		Outputs an ASCII string of the options installed
'lot	)UTPPLOT	1		Outputs the HP-GL plot string in ASCII format to the HP-IB port. Can be directed to an HP-GL plotter or printer.
Power mete: :al.	)UTPPMCAL< I>	2		Outputs power meter cal array for channel 1 or channel 2. Values are sent as 100 times the power meter reading in dB.

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	S	?	Description
OUTPUT (continued)				
Pre-raw data	OUTPPRE1	1		Array 1 (S11 data). Analogous to OUTPRAW except that pre-raw data has not had sampler correction nor attenuator offsets applied. Use ir conjunction with Take4 mode only.
	OUTPPRE2	1		Array 2 (S21 data).
	OUTPPRE3	1		Array 3 (512 data).
	OUTPPRE4	1		Array 4 (522 data).
Print	OUTPPRIN	1		Outputs the print string of the display graphics.
	OUTPPRNALL	1		Outputs all pages List Values or current page of Operating and marker parameters in ASCII. Activate the desired function with LISV to print values or OPEP to print operating parameters prior to this command.
Raw data	OUTPRAW 1	1		Array 1 (Sll data).Outputs uncorrected data arrays for the active channel. Raw 1 holds the single parameter data unless a 2-port calibratior is on, in which case raw 1 holds S11 and the following arrays hold S21, 512, and S22, respectively. The data is in real/imaginary pain
	OUTPRAW2	1		Array 2 (521 data).
	OUTPRAW3	1		Array 3 (S12 data).
	OUTPRAW4	1		Array 4 (S22 data).
	OUTPRAF< I>	1		Fast data transfer command for OUTPRAW<I>.
External source	OUTPRFFR	1		Outputs external source RF frequency when in external source instrument mode.
Limit test status	OUTPSEGAF'	1		Outputs the segment number and its limit test status§ for all active segments.†
Min/max values	OUTPSEGAM'	1		Outputs limit test min/max all segs. Outputs the segment number, max stimulus, max value, min stimulus, min value for all active segments.†

• Refer to the "Limit Line and Data Point Special Functions" section in *HP BASIC Programming Examples Guide*.

§ Values returned for limit test status are: 1 (PASS), 0 (FAIL), −1 (NO-LIMIT)

† For the definition of a limit segment, see "Example Display of Limit Lines" in the *HP BASIC Programming Examples Guide* section titled "Limit Line and Data Point Special Functions."

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	$	?	Description
OUTPUT (continued)				
Limit test status	OUTPSEGF*	1		Outputs the limit test status§ for a specified segment. See SELSEG[D].†
Min/max value	OUTPSEGM*	1		Outputs limit test min/max for a specified segment. See SELSEG[D].†
Sequencing	OUTPSEQ< I >	2		Outputs sequence I (I- 1 to 6) listing over HP-IB
Serial number	OUTPSERN	1		Outputs the serial number of the analyzer.
Status byte	OUTPSTAT STB?	1		Outputs the status byte. ASCII format (FORM 4)
Display title	OUTPTITL	1		Outputs the display title. ASCII format (FORM 4).
Clock	READDATE	1		Outputs the date of the clock in the following format: DD MMM YYYY
Clock	READTIME	1		Outputs the time of the clock in the following format: HH:MM:SS

* Refer to the "Limit Line and Data Point Special Functions" section in *HP BASIC* Programming *Examples Guide*.

§ Values returned for limit test status are: 1 (PASS), 0 (FAIL), -1 (NO-LIMIT)

† For the definition of a limit segment, see "Example Display of Limit Lines" in the *HP BASIC* Programming *Examples Guide* section titled "Limit Line and Data Point Special Functions."

Table 1-11. HP-IB Only Commands (continued)

Action	Mnemonic	$	?	Description
		OUTPUT FORMATS		
	FORM1	1		HP 8719/20/22 internal format, with header.
	FORM2	1		32 bit floating point, with header (IEEE).
	FORM3	1		64 bit floating point, with header (IEEE).
	FORM4	1		ASCII format. No header.
	FORM5	1		32 bit PC format (bytes reversed).
		SOFTKEYS		
Press	SOFT[I]	2		Activates softkey I, I- 1 to 8.
Label	WRSK<I>[$]	4		Writes label (10 char) to indicated softkey I, where I- 1 to 8. Initial use of this command requires previous commands MENUFORM; and MENUOFF;.
		STATUS		EPORTING
Clear	CLES	1		Clears the status byte.
	CLS			
Interrogate	ESB?	1		Returns event-status register B.
	ESR?	1		Returns the event-status register.
	OUTPSTAT	1		Returns the status byte.
Enable	ESE[D]	1	D	Enables event-status register. (0<D<255)
	ESNB[D]	1	D	Enables event-status register B. (0<D<255)
	SRE[D]	1	D	Enables SRQ. (0<D<255)

Alphabetical Mnemonic Listing

Symbol conventions:

[ ]	Optional data.
D	Numerical data.
I	An integer appendage that is part of the command. For example, CLEA<I>, where I = 1 to 5, indicates that the actual commands are CLEA1 , CLEA2, CLEA3, CLEA4, and CLEA5.
$	A character string operand which must be enclosed by double quotes.
< >	A necessary appendage.
|	An either/or choice in appendages.

Note All instrument functions can be queried to find the current ON/OFF state or value. lb perform a query, append the question mark character (?) to the command. For example: POWE? ; .

Mnemonic	Description
AB	Measures and displays A/B on the active channel.
ADAP1[D]	Sets adapter electrical delay. *Range: ±10* s.
ADDRCONT[D]	Controller HP-IB address: the address where control is returned after a pass control. Range: 0 *to 30.*
ADDRDISC[D]	Disk HP-IB address. Range: 0 *to 30.*
ADDRLSRC[D]	LO Source HPIB address. *Range:* 0 *to 30.*
ADDRPERI[D]	Peripheral HI-IB address (for sequencing). See also TITTPERI. Range: 0 *to 30.*
ADDRPLOT[D]	Plotter HP-IB address. Range: 0 *to 30.*
ADDRPOWM[D]	Power meter HP-IB address. *Range: 0 to* 30.
ADDRPRIN[D]	Printer HP-IB address. *Range: 0 to 30.*
ADPTCOAX	Sets adapter to COAXial.

ADPTWAVE	Sets adapter to WAVEguide.
ALC	ALC control.
ALTAB	Places the analyzer in the alternate inputs measurement mode, where measurements are made on alternate sweeps. See also CHOPAB;.
ANAB<ON|OFF>	Enables the analog bus for service use.
ANAI[D]	Measures and displays the data at the auxiliary input (ANALOG IN). Requires no complementary information [D] when used with ANAB<OFF>. However, when used with ANAB<ON>: ***Range: 1 to 31.***
AR	Measures and displays A/R on the active channel.
ASEG	Uses all segments for list frequency sweep. See also SSEG[D].
ASSS	Asserts the sequence status bit.
ATTP1[D]	Selects the amount of attenuation at PORT 1 (Option 011 with test set only). ***Range: 0, 10, 20 ... 70dB.***
ATTP2[D]	Selects the amount of attenuation at PORT 2 (Option 011 with test set only). ***Range: 0, 10, 20 ... 70dB.***
AUTO	Auto scale the active channel.
AUXC<ON|OFF>	Enables and disables the auxiliary channels 3 and 4. OPC-compatible.
AVERFACT[D]	Sets the averaging factor on the active channel. ***Range: 0 to 999.***
AVERO<ON|OFF>	Turns averaging ON and OFF on the active channel.
AVERREST	Restarts the averaging on the active channel.
BACI[D]	Sets the background intensity of the display. ***Range: 0 to 100.***
BANDPASS	Selects the time domain bandpass mode.

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

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

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

C0[D]	***Range:*** $\pm 10k(10^{-15}\ F)$
C1[D]	***Range:*** $\pm 10k(10^{-27}\ F)$
C2[D]	***Range:*** $\pm 10k(10^{-36}\ F)$
C3[D]	***Range:*** $\pm 10k(10^{-45}\ F)$
CAL1	Accepted for compatibility with the HP 8510, where its function is to begin a calibration sequence.

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

CALFCALF[D]	Sets the calibration factor. ***Range: 0 to 200%.***
CALFFREQ[D]	Selects the frequency for the calibration factor correction. ***Range: stimulus*** range.
CALFSENA	Edits the sensor A calibration factor table.
CALFSENB	Edits the sensor B (HP 438A only) calibration factor table.

These commands begin a calibration sequence:

CALIFUL2	Short, load, open, thru (SLOT) 2-port.
CALIONE2	One-path 2-port.
CALIRAI	Response and isolation.
CALIRESP	Response.
CALIS111	S11 l-port.
CALIS221	S22 l-port.
CALITRL2	Thru, reflect, line or Line, reflect, match (TRL*/LRM*) 2-port.

These commands select a default calibration kit:

CALK24MM	2.4-mm (HP 85056A/D cal kit).
CALK292MM	2.92-mm.
CALK292S	2.92' (HP 85056K cal kit).
CALK35MD	3.5-mm (HP 85052B/D, HP 85033D cal kit).
CALK35MC	3.5-mm (HP 85033C cal kit).

Note **CALK35MM** selects the HP 85033C cal kit for the HP 8752C/53D.

CALK7MM	7-mm (HP 85031B cal kit and HP 85050 series).
CALKN50	Type-N 50 ohm (HP 85032B/E cal kit).
CALKN75	Type-N 75 ohm (HP 85036B/E cal kit).
CALKTRLK	TRL 3.5-mm (HP 85052C cal kit).
CALKUSED	User-defined calibration kit.
CALN	Calibration: none. Turns calibration type to OFF.
CALPOW	Provides access to the power meter calibration functions.

CALSPORT1	Recalls cal set associated with Port 1 for adapter removal.
CALSPORT2	Recalls cal set associated with Port *2* for adapter removal.
CALZLINE	Establishes the line or match standard(s) as the characteristic impedance for a TRL/LRM calibration.
CALZSYST	Establishes the system Z_0 (see SETZ) as the characteristic impedance for a TRL/LRM calibration.
CBRI[D]	Adjusts the color brightness of the selected display feature. (See COLOXXXX commands.) ***Range: 0 to 100.***
CENT[D]	Sets the center stimulus value. If a list frequency segment is being edited, sets the center of the list segment. Range: ***stimulus range.***
CHAN1	Makes channel 1 the active channel. OPC-compatible.
CHAN2	Makes channel 2 the active channel. OPC-compatible.
CHAN3	Makes channel 3 the active channel. OPC-compatible.
CHAN4	Makes channel 4 the active channel. OPC-compatible.
CHOPAB	Places the analyzer in the chop measurement mode. See also ALTAB.
CLAD	Class done, modify cal kit, specify class.

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

CLASS11A	S11A: S11 l-port, opens.
CLASS11B	S11B: S11 l-port, shorts.
CLASS11C	S11C: S11 l-port, loads.
CLASS22A	S22A: S22 l-port, opens.
CLASS22B	S22B: S22 l-port, shorts.
CLASS22C	S22C: S22 l-port, loads.
CLEA<I>	Clears the indicated save/recall registers. OPC-compatible. ***Range: 1 to 5.***
CLEAL	Clears the limit line list. Should be preceded by EDITLIML.
CLEARALL	Clears all the save/recall registers. OPC-compatible.
CLEABIT[D]	Clears the specified bit on the GPIO. ***Range: 0 to 7.***
CLEAREG<I>	Clears save/recall registers 01 through 31. CLEAREG01 through CLEAREG05 are the same as CLEA1 through CLEA5. OPC-compatible. ***Range: 01 to 31.***
CLEASEQ<I>	Clears the indicated sequence from the internal registers. ***Range: 1 to 6.***
CLEL	Clears the currently selected list. This could be a frequency list, power loss list, or limit test list.
CLES	Clears the status register, the event-status registers, and the enable registers.
CLS	Same as CLES.
COAD	Selects coaxial electrical delay. See also WAVD.
COAX	Selects coaxial offsets instead of waveguide while defining a standard during a cal kit modification.

These commands select the indicated display feature for color modification:

COLOCH1D	Channel 1 data and limit line.
COLOCH2D	Channel 2 data and limit line.
COLOCH3D	Channel 3 data and limit line.
COLOCH4D	Channel 4 data and limit line.
COLOCH1M	Channel 1 memory.
COLOCH2M	Channel 2 memory.
COLOCH3M	Channel 3 memory.
COLOCH4M	Channel 4 memory.
COLOGRAT	Graticule.
COLOTEXT	Text.
COLOLREF	Reference line.
COLOWARN	Warning.

COLOR[D]	Adjusts the color saturation for the selected display feature. Range: 0 ***to 100.***
CONS	Continues the paused sequence.
CONT	Continuous sweep trigger mode.

These 6 commands convert the S-parameter data to:

CONV1DS	Inverted S-parameters.
CONVOFF	Conversion OFF.
CONVYREF	Y:reflection.
CONVYTRA	Y:transmission.
CONVZREF	Z:reflection.
CONVZTRA	Z:transmission.

COPYFRFT	Copies labels from file titles.
COPYFRRT	Copies labels from register titles.

CORI<ON|OFF>	Turns interpolative error correction ON and OFF'.
CORR<ON|OFF>	Turns error correction ON and OFF.
COUC<ON|OFF>	Couples and uncouples the stimulus between the channels.
COUP<ON|OFF>	Couple the power when coupled channels is turned OFF, COUCOFF.
CSWI<ON|OFF>	Selects test set continuous switching (ON) or test set hold (OFF) when there is a 2-port calibration active. Continuous switching is allowed only when the power ranges on both attenuator ports are set the same. When continuous switching is ON, the analyzer measures all four S-parameters each time before displaying the data for a full 2-port cal measurement. In test set hold mode, the analyzer measures all four S-parameters once and then measures the desired parameter continuously. This is known as a fast 2-port cal measurement and it is less accurate than a full 2-port calibrated measurement.
CWFREQ[D]	Sets the CW frequency for power sweep and CW frequency modes. While the list frequency table segment is being edited, it sets the center frequency of the current segment. ***Range: stimulus range***
CWTIME	Selects the CW time sweep type.
D2XUPCH2	Sets ups a two-graticule display with channel 2 on top.
D2XUPCH3	Sets ups a two-graticule display with channel 3 on top.
D4XUPCH2	Sets ups a four-graticule display with channel 2 in the upper right quadrant of the display.

D4XUPCH3 Sets ups a four-graticule display with channel 3 in the upper right quadrant of the display.

D1DIVD2<ON|OFF> This command divides the data in channel 2 by the data in channel 1 and displays the result on channel 2. Dual display must be on (DUACON;).

DATI Stores trace in channel memory. OPC-compatible.

DCONV Selects down converter for mixer measurements.

DEBU<ON|OFF> Turns the HP-IB debug mode ON and OFF. When ON, the analyzer scrolls incoming HP-IB commands across the display.

DECRLOOC Decrements the sequencing loop counter by 1.

DEFC Sets the default colors for all display features.

DEFLPRINT Sets the printer to the following default setup conditions:

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

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

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

Parallel Port: COPY

DEFS[D] Begins standard definition during cal kit modification. D is the standard number. Range: ***1 to 8.***

DELA Displays the data formatted as group delay.

DELO Turns the delta marker mode OFF.

DELR<I> Makes the indicated marker the delta reference. Range: ***1 to 5.***

DELRFIXM Makes the fixed marker the delta reference.

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

DEMOOFF Turns the transform demodulation function OFF

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

DFLT

Sets the plotter to the following default setup conditions:

Plot Data On	Pen Number:	
Plot Mem On	Data	2
Plot Grat On	Memory	5
Plot Text On	Graticule	1
Plot Mkr On	Text	7
Auto-feed On	Marker	7
Scale Plot Full	Line Type:	
Plot Speed Fast	Data	7
	Memory	7

DIRS[D]

Sets the number of files in the directory at disk initialization. LIF only. *Range: 256 to 8192.*

DISCUNIT[D]

Specifies which disk in an external multiple-disk drive to be used for save/recall. *Range: 0 to 30.*

DISCVOLU[D]

Specifies which volume of an external multiple-volume disk drive to be used for save/recall. *Range: 0 to 30.*

DISM<ON|OFF>

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

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

DISPDATA	Data only.
DISPDATM	Data and memory.
DISPDDM	Data divided by memory (linear division, log subtraction).
DISPDMM	Data minus memory (linear subtraction).
DISPMEMO	Memory only.
DIVI	Same as DISPDDM.
DONE	Done with a class of standards, during a calibration. Only needed when multiple standards are measured to complete the class.
DONM	Done modifying a test sequence.
DOSEQ<I>	Begins execution of the selected sequence. ***Range: 1 to 6.***
DOWN	Decrements the value in the active entry area (down key).
DUAC<ON|OFF>	Dual channel display ON or OFF.
DUPLSEQ[X]SEQ[Y]	Duplicates sequence X to sequence Y. ***Range X, Y: 1 to 6.***
EDITDONE	Done editing list frequency or limit table.
EDITLIML	Begins editing limit table.
EDITLIST	Begins editing list frequency table.
ELED[D]	Sets the electrical delay offset. *Range: ±10 s.*
EMIB	Sends out a beep during a sequence.
ENTO	Turns the active entry area OFF.
ESB?	Outputs event-status register B.

ESE[D] Enables the selected event-status register bits to be summarized by bit 5 in the status byte. An event-status register bit is enabled when the corresponding bit in the operand D is set. Range: $0<D<255$.

ESNB[D] Enables the selected event-status register B bits to be summarized by bit 2 of the status byte. A bit is enabled in the register when the corresponding bit in the operand D is set. Range: $0<D<255$.

ESR? Outputs the value of the event-status register.

EXTD Selects the external disk as the active storage device.

These commands include the indicated information when a register is stored on disk.

EXTMDATA<ON|OFF> Adds error corrected data (real and imaginary pairs) along with the other files.

EXTMDATO<ON|OFF> Error corrected data array only (real and imaginary pairs).

EXTMFORM<ON|OFF> Formatted trace data. Uses currently selected format for data.

EXTMGRAP<ON|OFF> User graphics.

EXTMRAW<ON|OFF> Raw data arrays (real and imaginary pairs).

EXTTHIGH Sets the external trigger line high.

EXTTLOW Sets the external trigger line low.

EXTTOFF Deactivates the external trigger mode. OPC-compatible.

EXTTON Activates the external trigger mode. OPC-compatible.

EXTTPOIN Sets the external trigger to auto trigger on point. OPC-compatible.

FIXE Specifies a fixed load, as opposed to a sliding load or offset load, when defining a standard during a cal kit modification.

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

FORM1 The analyzer's internal binary format, 6 bytes-per-data point. The array is preceded by a four-byte header. The first two bytes represent the string "#A", the standard block header. The second two bytes are an integer representing the number of bytes in the block to follow. FORM1 is best applied when rapid data transfers, not to be modified by the computer nor interpreted by the user, are required.

FORM2 IEEE 32-bit floating-point format, 8 bytes-per-data point. The data is preceded by the same header as in FORM1. Each number consists of a l-bit sign, an 8-bit biased exponent, and a 23-bit mantissa. FORM2 is the format of choice if your computer supports single-precision floating-point numbers.

FORM3 IEEE 64-bit floating-point format, 16 bytes-per-data point. The data is preceded by the same header as in FORM1. Each number consists of a l-bit sign, an 1 1 l-bit biased exponent, and a 52-bit mantissa. This format may be used with double-precision floating-point numbers. No additional precision is available in the analyzer data, but FORM3 may be a convenient form for transferring data to your computer.

FORM4 ASCII floating-point format. The data is transmitted as ASCII numbers, as described previously in "Output Syntax". There is no header. The analyzer always uses FORM4 to transfer data that is not related to array transfers (i.e. marker responses and instrument settings).

FORM5 PC-DOS 32-bit floating-point format with 4 bytes-per-number, 8 bytes-per-data point. The data is preceded by the same header as in FORM1. The byte order is reversed to comply with PC-DOS formats. If you are using a PC-based controller, FORM5 is the most effective format to use.

These commands define the format to use on disk initializations:

FORMATDOS Selects DOS as the disk format.

FORMATLIF Selects LIF as the disk format.

FREQOFFS<ON|OFF> Activates the frequency offset instrument mode. OPC-compatible.

FREO Frequency blank. Turns OFF frequency notation.

FRER HP-IB free run. Acts the same as CONT ; .

FULP Selects full page plotting, as opposed to plotting in one of the four quadrants.

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

FWDI Isolation.

FWDM Match.

FWDT Transmission.

These 5 commands control the time domain gate. ***Range: stimulus range.***

GATECENT[D] Center time.

GATEO<ON|OFF> Gate ON/OFF. OPC-compatible.

GATESPAN[D] Span time.

GATESTAR[D] Start time.

GATESTOP[D] Stop time.

These 4 commands set the gate shape:

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

GOSUB<I>	Invokes a sequence as a subroutine. Range: ***1 to 6.***

These commands activate the harmonic measurement mode, Option 002. They are all OPC-compatible:

HARMOFF	Turns OFF harmonic mode. OPC-compatible.
HARMSEC	Measures the second harmonic. OPC-compatible.
HARMTHIR	Measures the third harmonic. OPC-compatible.
HOLD	Puts the sweep trigger into hold.
IDN?	Outputs the identification string: HEWLETT PACKARD,87NNE,0,X.XX, where 87NNE is the model number of the instrument and X.XX is the firmware revision of the instrument.

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

IFBIHIGH	Tests the specified input GPIO bit (see PARAIN[D 1). If high, invokes the sequence which follows.
IFBILOW	Tests the specified input GPIO bit (see PARAIN[D]). If low, invokes the sequence which follows.
IFBW[D]	Sets the IF' bandwidth. ***Values: 10, 30, 100, 300, 1000, 3000, 3700, 6000 Hz.***
IFLCEQZESEQ<I>	If loop counter equals zero, then do the sequence that follows. Range: ***1 to 6.***
IFLCNEZESEQ<I>	If loop counter does not equal zero, then do the sequence that follows. Range: ***1 to 6.***
IFLTFAILSEQ<I>	If limit test fails, then do sequence that follows. ***Range: 1 to 6.***
IFLTPASSSEQ<I>	If limit test passes, then do sequence that follows. ***Range: 1 to 6.***
IMAG	Selects the imaginary display format.
INCRLOOC	Increments the sequencing loop counter by 1.
INID	Initializes the internal disk. All previous information on the disk will be destroyed.
INIE	Initializes the external disk. All previous information on the disk will be destroyed. Requires pass control when using the HP-IB port.

Note The commands for array input and output require the user to set the data format for transfers in and out of the instrument. Refer to Table 1-5 and the mnemonic descriptions of FORM1, FORM2, FORM3, FORM4, and FORM5.

These commands input an individual error coefficient array. Before sending an array, issue a CAL I XXXX; command, where XXXX specifies the calibration type of the data. Then input the array or arrays. Lastly store the data with SAVC;. The instrument goes into hold, displaying uncorrected data. Complete the process by triggering a sweep. See Table 1-8 for the contents of the different arrays.

INPUCALC01[D] Array 1.

INPUCALC02[D] Array 2.

INPUCALC03[D] Array 3.

INPUCALC04[D] Array 4.

INPUCALC05[D] Array 5.

INPUCALC06[D] Array 6.

INPUCALC07[D] Array 7.

INPUCALC08[D] Array 8.

INPUCALC09[D] Array 9.

INPUCALC10[D] Array 10.

INPUCALC11[D] Array 11.

INPUCALC12[D] Array 12.

INPUCALK[D] Inputs a cal kit read out with OUTCALK; . After the transfer, the data should be saved into the user cal kit area with SAVEUSEK;.

INPUDATA[D] Inputs an error corrected data array, using the current setting of the FORM command.

INPUFORM[D] Inputs a formatted data array, using the current setting of the FORM command.

INPULEAS[D] Inputs a learn string read out by OUTPLEAS;.

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

INPUPMCAL1 Channel 1.

INPUPMCAL2 Channel 2.

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

INPURAW1[D] Array 1.

INPURAW2[D] Array 2.

INPURAW3[D] Array 3.

INPURAW4[D] Array 4.

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

INSMEXSA External source, auto. OPC-compatible.

INSMEXSM External source, manual. OPC-compatible.

INSMNETA Standard network analyzer. OPC-compatible.

INSMTUNR Tuned receiver, OPC-compatible.

INTD Selects the internal disk as the active storage device.

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

INTM Selects the internal memory for save/recall.

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

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

ISOOP Selects isolation for one path, two port calibration.

KEY[D] Sends a keycode, equivalent to actually pressing the key. It does not matter if the front-panel is in remote mode. See Figure 1-6 for the key codes.

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

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

These commands enter labels (max. length = 10 char) for the standard classes during a cal kit modification:

LABEFWDM[$] Forward match.

LABEFWDT[$] Forward transmission.

LABERESI[$] Response, response and isolation.

LABERESP[$] Response.

LABEREVM[$] Reverse match.

LABEREVT[$] Reverse transmission.

LABES11A[$] S11A (opens).

LABES11B[$] S11B (shorts).

LABES11C[$] S11C (loads).

LABES22A[$] S22A (opens).

LABES22B[$] S22B (shorts).

LABES22C[$] S22C (loads).

LABETRLL[$] TRL line or match.

LABETRLT[$] TRL thru.

LABETRLR[$] TRL reflect.

LABETLFM[$] TRL, Line, Forward, Match. Compatible with the HP 8753D revisions 5.00 through 5.48.

LABETLFT[$]	TRL, Line, Forward, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETLRM[$]	TRL, Line, Reverse, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETLRT[$]	TRL, Line, Reverse, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETRFM[$]	TRL, Reflect, Forward, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETRRM[$]	TRL, Reflect, Reverse, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETTFM[$]	TRL, Thru, Forward, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETTFT[$]	TRL, Thru, Forward, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETTRM[$]	TRL, Thru, Reverse, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABETTRT[$]	TRL, Thru, Reverse, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***
LABK[$]	Enters a cal kit label during a cal kit modification. ***Max. length = 10 char***
LABS[$]	Enters a standard's label during standard definition.
LEFL	Selects a plot in the left lower quadrant.
LEFU	Selects a plot in the left upper quadrant.
LIMIAMPO[D]	Enters the limit line amplitude offset, ***Range: amplitude range***

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

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

LIMISTIO[D] Enters the stimulus offset of the limit lines. ***Range: stimulus range.***

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

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

LIMD[D] Sets the limit delta value while editing a limit line segment. ***Range: amplitude range.***

LIML[D] Sets the lower limit value. Range: ***amplitude range.***

LIMM[D] Sets the middle limit value. *Range:* ***amplitude range.***

LIMS[D] Sets the limit stimulus break point. ***Range:*** *stimulus* ***range.***

LIMTFL Makes the segment a flat line.

LIMTSL Makes the segment a sloping line.

LIMTSP Makes the segment a single point.

LIMU[D] Sets the upper limit value. Range: ***amplitude range.***

LINFREQ Selects a linear frequency sweep.

LINM Selects the linear magnitude display format.

LINTDATA[D] Enters the line type for plotting data. ***Range: 0 to 10.***

LINTMEMO[D] Enters the line type for plotting memory. ***Range: 0 to 10.***

LISFREQ Selects the list frequency sweep mode.

LISIFBWM<ON|OFF> Enables/disables the IFBW setting for a list-frequency table in swept list mode.

LISPWRM<ON|OFF> Enables/disables the power setting for a list-frequency table in swept list mode.

LISTTYPE<LSTP|LSWP> Selects either the stepped list mode or the swept list mode to use with a list-frequency table.

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

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

LOAD1 Loads the file from disk using the file name provided by the preceding TITF 1; command.

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

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

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

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

LOADSEQ<I>	Loads the file from disk with the name indicated by the previous TITSEQn command. The actual file loaded depends on the file title in the file position specified in the TITSEQn command. Requires pass control mode. ***Range: 1 to 6.***
LOAN	Measures the load as not being offset when a standard has been defined as an offset load (see OFLS).
LOAO	Measures the load as being offset when a standard has been defined as an offset load (see OFLS).
LOCONT<ON|OFF>	Turns external LO control on/off.
LOFREQ[D]	Sets the LO frequency. ***Range: frequency range of instrument.***
LOFSTAR[D]	Sets the LO start frequency. ***Range: frequency range of instrument.***
LOFSTOP[D]	Sets the LO stop frequency. ***Range: frequency range of instrument.***
LOFSWE	Selects the LO sweep frequency mode.
LOGFREQ	Selects a log frequency sweep.
LOGM	Selects the log magnitude display format.
LOOC[D]	Sets the value of the sequencing loop counter. ***Range: 0 to 32,760.***
LOPOWER[D]	Sets the LO power level. ***Range: power range of instrument.***
LOPSTAR[D]	Sets the LO start power level. ***Range: power range of instrument.***
LOPSTOP[D]	Sets the LO stop power level. ***Range: power range of instrument.***
LOPSWE	Selects sweep power mode.
LOWPIMPU	Turns ON the low pass impulse transform.
LOWPSTEP	Turns ON the low pass step transform.
LRN?	Same as OUTPLEAS (output lean string).
LRN[D]	Same as INPULEAS (input learn string).

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

These commands make the indicated marker active and set its stimulus value. ***Range: stimulus range.***

MARK1[D] Marker 1.

MARK2[D] Marker 2.

MARK3[D] Marker 3.

MARK4[D] Marker 4.

MARK5[D] Marker 5.

MARKBUCK[D] Places the active marker on a specific sweep point (bucket). D is the bucket number. ***Range: 0 to number of points less 1.***

MARKCENT Sets the center stimulus value to that of the active marker's stimulus value.

MARKCONT Places the markers continuously on the trace, not on discrete points (interpolates the marker values between discrete points).

MARKCOUP Couples the markers between the channels, as opposed to MARKUNCO.

MARKCW Sets the CW frequency to the active marker's frequency.

MARKDELA Sets electrical length so group delay is zero at the active marker's stimulus.

MARKDISC Places the markers on the discrete measurement points.

MARKFAUV[D] Sets the auxiliary value of the fixed marker position. Works in coordination with MARKFVAL and MARKFSTI. ***Range: amplitude range.***

MARKFSTI[D] Sets the stimulus position of the fixed marker. ***Range: stimulus range.***

MARKFVAL[D]	Sets the value of the fixed marker position. ***Range: amplitude range.***
MARKMAXI	Same as SEAMAX (search for maximum on current channel's trace).
MARKMIDD	During a limit segment edit, makes the marker amplitude the limit segment middle value.
MARKMINI	Same as SEAMIN (search for minimum on current channel's trace).
MARKOFF	Turns all markers and marker functions OFF.
MARKREF	Sets the reference value to that of the active marker's amplitude.
MARKSPAN	Sets the span for the entire trace to that of the span between the active marker and the delta reference marker.
MARKSTAR	Sets the start stimulus to that of the active marker's.
MARKSTIM	During a limit segment edit, sets the limit stimulus break point to that of the active marker's.
MARKSTOP	Sets the stop stimulus to that of the active marker's.
MARKUNCO	Uncouples the markers between channels, as opposed to MARKCOUP.
MARKZERO	Places the fixed marker at the active marker position and makes it the delta reference.
MAXF[D]	Sets the maximum valid frequency of a standard being defined during a cal kit modification. ***Range: 0 to 1000 GHz.***
MEASA	Measures and displays input A on the active channel.
MEASB	Measures and displays input B on the active channel.
MEASR	Measures and displays input R on the active channel.

MEASTAT<ON|OFF> Turns trace statistics ON and OFF.

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

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

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

MINF[D] Sets the minimum valid frequency of a standard being defined during a cal kit modification. ***Range: 0 to 1000 GHz.***

MINU Displays data minus memory, the same as DISPDMM .

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

MODI1 Begins the modify cal kit sequence.

MODS Computes new cal set using adapter removal.

NEWSEQ<I> Begins modifying a sequence. ***Range: 1 to 6.***

NEXP Displays the next page of the operating parameters fist.

NOOP No operation. OPC-compatible.

NUMG[D] Activates D number of groups of sweeps. A group is whatever is needed to update the current parameter once. This function restarts averaging if ON. OPC-compatible. ***Range: 1 to 999.***

NUMR[D] Sets the number of power meter readings per point used during a power meter calibration. Range: ***1 to 100.***

OFLD Offset loads done.

OFLS Selects the calibration standard load as being an offset load, as opposed to a sliding or fixed load, during a cal kit modification.

These 3 commands specify the offset value for the indicated parameter for a standard being defined during a cal kit modification:

OFSD[D] Delay offset. ***Range: ± 1 s.***

OFSL[D] Loss offset. ***Range: 0 to 2000 TΩ/s .***

OFSZ[D] Impedance offset. *Range:* ***0.1 to 500 Ω.***

OMII Omits the isolation step of a calibration sequence.

OPC Operation complete. Reports the completion of the next command received by setting bit 0 in the event-status register, or by replying to an interrogation if OPC?; is issued.

OPEP

Presents a list of key operating parameters. NEXP ; calls the next page of parameters and the previous page can be called with PREP ; . Requesting a plot or print copies the current page. The current page can be plotted or printed, in raster graphics mode, with PLOT ; , or PR I NALL ; respectively. The entire list can be printed, in ASCII text mode, with PR I NTALL ; . Since these commands need to take control of an HP-IB peripheral, the system controller must have pass control capability.

Note The commands for array input and output require the user to set the data format for transfers in and out of the instrument. Refer to Table 1-5 and the mnemonic descriptions of FORM1, FORM2, FORM3, FORM4, and FORM5.

OUTPACTI Outputs the value of the active function, or the last active function if the active entry area is OFF.

OUTPAMAX Outputs the max values for all limit line segments.

OUTPAMIN Outputs the min values for all limit line segments.

OUTPAPER Outputs the smoothing aperture in stimulus units, rather than as a percentage.

These 12 commands output an error correction array for the active calibration on the active channel. See Table 1-8, for the contents of each array. Each array is output in the currently set form determined by the FORMn command. The data is in real/imaginary pairs, the same number of pairs as points in the sweep.

OUTPCALC01 Array 1.

OUTPCALC02 Array 2.

OUTPCALC03 Array 3.

OUTPCALC04 Array 4.

OUTPCALC05 Array 5.

OUTPCALC06 Array 6.

OUTPCALC07 Array 7.

OUTPCALC08 Array 8.

OUTPCALC09 Array 9.

OUTPCALC10 Array 10.

OUTPCALC11 Array 11.

OUTPCALC12 Array 12.

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

OUTPCHAN Outputs the active channel number, where:

- 1 = channel 1
- 2 = channel 2
- 3 = channel 3
- 4 = channel 4

OUTPDATA Outputs the error corrected data from the active channel.

OUTPDATF Fast data transfer command for OUTPDATA .

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

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

OUTPERRO Outputs the oldest error message in the error queue. Sends first the error number, and then the error message itself as a string no longer than 50 characters.

OUTPFAIP This command is similar to OUTPLIMF except that it reports the number of failures first, followed by the stimulus and trace values for each failed point in the test.

OUTPFORM Outputs the formatted display data array from the active channel. See Table 1-4 for the contents of the array as a function of display format. See also FORMn command.

OUTPFORF Fast data transfer command for OUTPFORM.

These 12 commands output an interpolated error coefficient array for the active calibration on the active channel. See Table 1-7 for the contents of each array.

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

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

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

OUTPIPMCL1	Channel 1.
OUTPIPMCL2	Channel 2.

OUTPKEY Outputs the key code of the last key pressed. An invalid key is reported with a 63, a knob turn with a -1. See Figure 1-6 for the front-panel key codes.

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

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

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

OUTPLIM3 Outputs the status of the limit test for channel 3.

OUTPLIM4 Outputs the status of the limit test for channel 4.

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

OUTPLIMF Outputs the limit test results for each failed point.

OUTPLIML Outputs the limit test results for each point in the sweep. This is an ASCII transfer.

OUTPLIMM Outputs the limit test results at the marker.

OUTPMARK Outputs the marker values. The first two numbers are the marker response values, and the last is the stimulus value. See Table 1-4 for the meaning of the response values as a function of display format.

OUTPMEMO Outputs the memory trace from the active channel. The data is in real/imaginary pairs, and can be treated the same as data read with the OUTPDATA command.

OUTPMEMF Fast data transfer command for OUTPMEMO.

OUTPMSTA	Outputs the marker statistics: mean, standard deviation, and peak-to-peak variation in that order. If statistics is not ON, it is turned ON to generate current values and turned OFF again. See also MEASTAT<ON|OFF>.
OUTPMWID	Outputs the marker bandwidths search results: bandwidth, center, and Q in that order. If widths is not ON, it is turned ON to generate current values and turned OFF again.
OUTPMWIL	Performs the same operation as OUTPMWID plus appends the loss value as well.
OUTPOPTS	Outputs an ASCII string of the options installed.
OUTPPLOT	Outputs the plot string. Can be directed to a plotter, or read into the computer.

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

OUTPPMCAL1	Channel 1.
OUTPPMCAL2	Channel 2.

These 4 commands output the pre-raw measurement data. Analogous to OUTPRAW except that pre-raw data has not had sampler correction nor attenuator offsets applied. These offsets are not necessary for data that will be fully error corrected. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer. The arrays hold S1 1, S2 1, S12, and S22, respectively:

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

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

These 5 commands output the raw measurement data. Normally, array 1 holds the current parameter. If a 2-port calibration is active, the arrays hold S11, S21, S12, and S22, respectively:

OUTPRAF<I>	Fast data transfer command for OUTPRAW<I>. Range: ***1 to 4.***
OUTPRAW1	Array 1 (S11 data).
OUTPRAW2	Array 2 (S21 data).
OUTPRAW3	Array 3 (S12 data).
OUTPRAW4	Array 4 (S22 data).
OUTPRFFR	Outputs the external source RF frequency. The instrument must be in external source mode, using either INSMEXSA or INSMEXSM.
OUTPSEGAF	Outputs the segment number and it's limit test status for all active segments.
OUTPSEGAM	Outputs the limit test min/max for all segments. Outputs the segment number, max stimulus, max value, min stimulus, min value for all active segments.
OUTPSEGF	Outputs the limit test status for a specified segment. See SELSEG[D].
OUTPSEGM	Outputs limit test min/max for a specified segment. See SELSEG[D].
OUTPSEQ<I>	Outputs I's sequence listing. Range: ***1 to 6.***
OUTPSERN	Outputs the serial number of the analyzer.
OUTPSTAT	Outputs the status byte.
OUTPTITL	Outputs the display title.
PARAIN[D]	Specifies the input GPIO bit to be used by IFBIHIGH and IFBILOW tests. *Range: 0 to 4.*

PARAL<GPIO|CPY>	Selects use of the parallel port: for general purpose I/O (GPIO) or for the copy (CPY) function.
PARAOUT[D]	Programs all GPIO output bits at once. ***Range: 0 to 255.***
PAUS	Inserts a pause into a sequence.
PCB[D]	Same as ADDRCONT. Indicates where control will be returned after a pass control. ***Range: 0 to 30.***

These 12 commands select the color for printing the indicated display feature where <COLOR> is one of the following colors: white, cyan, magenta, blue, yellow, green, red, or black.

PCOLDATA1<COLOR>	Channel 1 data.
PCOLDATA2<COLOR>	Channel 2 data.
PCOLDATA3<COLOR>	Channel 3 data.
PCOLDATA4<COLOR>	Channel 4 data.
PCOLMEMO1<COLOR>	Channel 1 memory.
PCOLMEMO2<COLOR>	Channel 2 memory.
PCOLMEMO3<COLOR>	Channel 3 memory.
PCOLMEMO4<COLOR>	Channel 4 memory.
PCOLGRAT<COLOR>	Graticule.
PCOLREFL<COLOR>	Reference line color.
PCOLTEXT<COLOR>	Displays text.
PCOLWARN<COLOR>	Warning text.

PDATA<ON|OFF>	Selects whether trace data is plotted.

These 5 commands select the pen (value for D) for plotting the indicated display feature for the active channel. *Range:* 0 ***to 10.***

PENNDATA[D]	Data trace.
PENNGRAT[D]	Graticule.
PENNMARK[D]	Markers and marker text.
PENNMEMO[D]	Memory trace.
PENNTEXT[D]	Text and user graphics.
PGRAT<ON|OFF>	Selects whether the graticule is plotted.
PHAO[D]	Sets the phase offset. Range: 0 ***to 360 degrees.***
PHAS	Selects the phase display format.
PLOS<SLOW|FAST>	Selects the pen speed for plotting. (Slow is useful for transparency plotting.)
PLOT	Initiates a plot.
PLTHNDSHK<XON|DTR>	Selects the plotter handshake mode as either Xon-Xoff or DTR-DSR.
PLTPRTDISK	Sets the plotter port to disk (either internal disk or external disk).
PLTPRTHPIB	Sets the plotter port to HP-IB.
PLTPRTPARA	Sets the plotter port to parallel.
PLTPRTSERI	Sets the plotter port to serial.
PLTTRAUTF<ON|OFF>	Turns ON and OFF the plotter auto feed.
PLTTRBAUD[D]	Sets the plotter baud rate. Values: ***1200, 2400, 4800, 9600, 19200.***
PLTTRFORF	Sends a form feed to the plotter.
PLTTYPHPGL	Selects HP-GL compatible ***printer*** as the plotter type.
PLTTYPPLTR	Selects ***plotter*** as the plotter type.
PMEM<ON|OFF>	Selects whether memory is plotted.
PMKR<ON|OFF>	Selects whether markers are plotted.

PMTRTTIT Reads value from power meter or peripheral at the power meter's HP-IB address into title string.

POIN[D] Sets the number of points in the sweep. ***Values: 3, 11, 21, 26, 51, 101, 201, 401, 801, 1601.***

POLA Selects the polar display format.

These 3 commands select the marker readout format for polar display:

POLMLIN Linear markers.

POLMLOG Log markers.

POLMRI Real/imaginary markers.

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

These 4 commands set the port extension length for the indicated port or input. Ports 1 and 2 refer to the test set ports. *Range: ±10 s.*

PORT1[D] Port 1.

PORT2[D] Port 2.

PORTA[D] Input A.

PORTB[D] Input B.

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

PORTR[D] Same as PORT1. *Range: ±10 s.*

PORTT[D] Same as PORT2. Range: ***± 10 s.***

POWE[D] Sets the output power level. See also PWRR<PAUTO/PMAN>. ***Range: option dependent.***

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

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

POWLLOSS[D]	Sets the loss value for a particular frequency, set by POWLFREQ[D], in the power loss list. ***Range: -9900 to 9900 dB.***
POWM<ON|OFF>	Designates whether the HP 436A (ON) or the HP 437B/438A (OFF) is to be used as the power meter.
POWR<I>	Selects power ranges when in manual power range. Range: 00 ***to 07.***
POWS	Selects power sweep, from the sweep type menu.
POWT<ON|OFF>	Trip power (set maximum attenuation) ON or OFF.
PRAN<I>	Selects power ranges when in manual power range. Range: 00 ***to 07.***
PREP	Displays the previous page of the operating parameters list.
PRES	Presets the analyzer to the factory preset state. OPC-compatible.
PRIC	Selects color print (as opposed to monochrome; see also PRIS).
PRINALL	Copies the display, in raster graphics mode, to a printer.
PRINSEQ<I>	Begins printing the sequence selected. ***Range: 1 to 6.***
PRINTALL	Prints all list values or operating and marker parameters in ASCII text mode.
PRIS	Selects standard (monochrome) print.
PRNHNDSHK<XON|DTR>	Selects the printer handshake mode as either Xon-Xoff or DTR-DSR.
PRNPRTHPIB	Sets the printer port to HP-IB.
PRNPRTPARA	Sets the printer port to parallel.
PRNPRTSERI	Sets the printer port to serial.
PRNTRAUTF<ON|OFF>	Turns ON and OFF the printer auto feed.
PRNTRBAUD[D]	Sets the printer baud rate. ***Values: 1200, 2400, 4800, 9600, 19200.***

PRNTRFORF	Sends a form feed to the printer.
PRNTYP540	Selects the DeskJet 540 or 850C printer as the printer type.
PRNTYPDJ	Selects the DeskJet printer as the printer type.
PRNTYPEP	Selects the Epson ESC/P2 printer control language-compatible printer as the printer type.
PRNTYPLJ	Selects the LaserJet printer as the printer type.
PRNTYPPJ	Selects the PaintJet printer as the printer type.
PRNTYPTJ	Selects the ThinkJet printer as the printer type.
PSOFT<ON|OFF>	Controls whether softkeys are included in the hardcopy print or plot.
PTEXT<ON|OFF>	Selects whether text is plotted.
PTOS	Pauses the sequence; to be followed by selection one of the 6 sequences (SEQ<I>).
PURG<I>	Purges the indicated file from disk. Requires pass control mode when using an external disk drive. ***Range: 1 to 5.***

These 3 commands select the type of power meter calibration desired. A calibration sweep should be taken (TAKCS) after selecting a "one sweep" power meter calibration, to ensure a valid calibration. No calibration sweep is needed for "each sweep" power meter calibrations. ***Range: -100 to 100 dB.***

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

PWRLOSS<ON|OFF>	Selects whether or not to use the power loss table for a power meter calibration.

PWRMCAL[D]	Displays the power meter cal menu and sets the drive port cal power. *Range: -100 to 100 dB.*
PWRR<PAUTO|PMAN>	Select whether the power range is in auto or manual mode.
Q<I>	Same as SEQ<I>. ***Range: 1 to 6.***
RAID	Completes the response and isolation cal sequence. OPC-compatible.
RAIISOL	Calls the isolation class for the response and isolation calibration.
RAIRESP	Calls the response class for the response and isolation calibration.
RAWOFFS<ON|OFF>	Selects whether sampler and attenuator offsets are ON or OFF By selecting raw offsets OFF, a full two port error correction can be performed without including the effects of the offsets. It also saves substantial time at recalls and during frequency changes (see SM8<ON|OFF>). Raw offsets follow the channel coupling. RAWOFFS<ON|OFF> and SAMC<ON|OFF> are linked: when one changes state, so does the other. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer.
READDATE	Outputs the date in the following string format: DD MMM YYYY. HP-IB only command.
READTIME	Outputs the time in the following string format: HH:MM:SS. HP-IB only command.
REAL	Selects the real display format.
RECA<I>	Recalls the indicated internal register. OPC-compatible. ***Range: 1 to 5.***
RECAREG<I>	Recalls save/recall registers 01 through 31. RECAREG01 through RECAREG05

	are the same as RECA1 through RECA5. OPC-compatible. ***Range: 01 to 31.***
RECO	Recalls previously saved display colors.
REFD	Completes the reflection calibration subsequence of a 2-port calibration. OPC-compatible.
REFL	Begins the reflection calibration subsequence of a 2-port calibration.
REFOP	Begins the reflection calibration subsequence for one path, two port calibration.
REFP[D]	Enters the reference position. 0 is the bottom, 10 is the top of the graticule. ***Range: 0 to 10.***
REFT	Recalls file titles from disk.
REFV[D]	Enters the reference line value. Range: ***amplitude range.***
REIC[D]	Sets the power level reference value for a receiver calibration. ***Range: stimulus range.***
RESC	Resume cal sequence.
RESD	Restores the measurement display after viewing the operating parameters or list values.
RESPDONE	Completes the response calibration sequence. OPC-compatible.
REST	Measurement restart.

These commands (OPC-compatible) call the reverse calibration classes, during a full 2-port calibration.

REVI	Isolation.
REVM	Match.
REVT	Transmission.

These 2 commands are used in frequency offset mode measurements.

RFGTLO	Sets RF greater than LO.
RFLTLO	Sets RF less than LO.

RFLP	Same as S11;
RIGL	Selects a plot in the lower right quadrant.
RIGU	Selects a plot in the upper right quadrant.
RSCO	Resets display colors to the factory default.
RST	Presets the instrument. OPC-compatible.

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

S11

S12

S21

S22

SADD	During either a list frequency or limit table edit, adds a new segment to the table.
SAMC	Selects whether sampler correction is ON or OFF. SAMC<ON|OFF> and RAWOFFS<ON|OFF> are linked: when one changes state, so does the other.
SAV1	Completes the l-port calibration sequence. OPC-compatible.
SAV2	Completes the 2-port calibration sequence. OPC-compatible.
SAVC	Completes the transfer of error correction coefficients back into the instrument. OPC-compatible.

SAVE<I>	Saves the current instrument state in the indicated internal register. OPC-compatible. ***Range: 1 to 5.***
SAVEREG<I>	Saves to save/recall registers 01 through 31. SAVEREG01 through SAVEREG05 are the same as SAVE1 through SAVE5. OPC-compatible. *Range:* ***01 to 31.***
SAVT	Completes the TRL/LRM calibration sequence. OPC-compatible.

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

SAVUASCI	Selects ASCII format for saving to disk. Conforms to CITIFile specifications.
SAVUBINA	Selects binary format for saving to disk.
SAVEUSEK	Stores the active calibration kit as the user kit.
SCAL[D]	Sets the trace scale factor. Range: ***amplitude range.***
SCAP<FULL|GRAT>	Selects a full plot, or a plot where the graticule is expanded to the plotter's P1 and P2.
SDEL	During either a list frequency, a limit table edit, or power loss list, deletes the current segment.
SDON	During either a list frequency, a limit table edit, or power loss list, closes a segment after editing.

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

SEAL	Search left for next occurrence of the target value.
SEAMAX	Search for trace maximum on the current channel.
SEAMIN	Search for trace minimum on the current channel.
SEAOFF	Turns the marker search OFF.
SEAR	Search right for next occurrence of the target value.
SEATARG[D]	Set the search target amplitude. ***Range: amplitude range.***
SEDI[D]	During either a frequency, limit, or power loss table edit, selects segment D for editing. ***Range: state dependent.***
SEGIFBW[D]	Sets the IFBW for the active segment of a list-frequency table in swept list mode. ***Values: IO, 30, 100, 300, 1000, 3000, 3700, 6000 Hz.***
SEGPOWER[D]	Sets the power for the active segment of a list-frequency table in swept list mode. ***Range: option dependent***

SELL[D]

Selects the learn string revision (LRN) or OUTPLEAS, INPULEAS to be used by the analyzer. The valid parameters are:

0: Defaults to current revision.

201: Revision 8753B 2.01

300: Revision 8753B 3.00

401: Revision 8753C 4.01

402: Revision 8753C 4.02

412: Revision 8753C 4.12

413: Revision 8753C 4.13

500: Revision 8753D 5.00

520: Revision 8753D 5.20

526: Revision 8753D 5.26

534: Revision 8753D 5.34

536: Revision 8753D 5.36

538: Revision 8753D 5.38

540: Revision 8753D 5.40

542: Revision 8753D 5.42

546: Revision 8753D 5.46

548: Revision 8753D 5.48

612: Revision 8753D 6.12

710: Revision 87533 7.10

SELMAXPT[D]

Selects the last point number in the range of points that the OUTPDATR command will report.
Range: 0 to the number** of points **minus 1.

SELMINPT[D]

Selects the first point number in the range of points that the OUTPDATR command will report.
Range: 0 ***to the number** of points minus **1.***

SELPT[D]	Selects the point number that the OUTPDATR command will report. ***Range: 0 to the number** of points minus **1.***
SELSEG[D]	Selects the segment number to report on for the OUTPSEGF and OUTPSEGM commands. *Range: **1** to **18.***
SEQ<I>	Selects sequence. Range: ***1** to* 6.
SEQWAIT[D]	Tells the instrument to wait D seconds during a sequence. *Range: **0.1** to* 3000 s.
SETBIT[D]	Sets the specified bit on the GPIO. *Range:* 0 *to* 7.
SETDATE[$]	Sets the date in the following format: DD MMM YYYY, where DD is the day and must be 2 digits, MMM is the month and must be three alpha characters (JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC), and YYYY is the year and must be 4 digits.
SETF	Sets the frequency for low pass transform, Option 010.
SETRTHRU	Sets the reference thru.
SETRREFL	Sets the reference reflect.
SETTIME[$]	Sets the time in the following format: HH:MM:SS, where HH is the hour, MM is minutes, SS is seconds, and each must be 2 digits.
SETZ[D]	Sets the characteristic impedance of the measurement system.*Range: **0.1** to* 500 Ω.
SHOM	Displays the desired softkey menu during a sequence.
SING	Single sweep. OPC-compatible.
SLID	Sliding load done.
SLIL	Specifies the standard as a sliding load during a standard definition as part of a cal kit modification, as opposed to a fixed or offset load.
SLIS	Sliding load set. OPC-compatible.

SLOPE[D]	Enters the power slope value. ***Range: -2 to 2 dB/GHz***
SLOPO<ON|OFF>	Selects whether the power slope is ON or OFF.
SM8<ON|OFF>	Selects whether spur avoidance is ON or OFF. Selecting spur avoidance OFF, along with selecting sampler and attenuator offsets OFF (see RAWOFFS<ON|OFF>), saves substantial time at recalls and during frequency changes. Spur avoidance is always coupled between channels: select SM8<OFF> to turn off spur avoidance for both channels. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer.
SMIC	Selects Smith chart display format.

The following commands select the marker readout format on a Smith chart:

SMIMGB	G + jB (conductance and susceptance).
SMIMLIN	Linear magnitude.
SMIMLOG	Log magnitude.
SMIMRI	Real/imaginary pairs (resistance and reactance).
SMIMRX	R+jX.
SMOOAPER[D]	Sets the smoothing aperture as a percent of the trace. ***Range: 0.05 to 20%***
SMOOO<ON|OFF>	Selects whether smoothing is ON or OFF.
SOFR	Displays the firmware revision on the screen.
SOFT<I>	Acts as though the indicated softkey was pressed. Range: ***1 to 8.***
SOUP<ON|OFF>	Selects whether the source power is ON or OFF.

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

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

SPECFWDM[I] Forward match.

SPECFWDT[I] Forward transmission.

SPECRESP[I] Response.

SPECRESI[I] For Resp & Isol, specifies the response standards.

SPECREVM[I] Reverse match.

SPECREVT[I] Reverse transmission.

SPECS11A[I] S11A.

SPECS11B[I] S11B.

SPECS11C[I] S11C.

SPECS22A[I] S22A.

SPECS22B[I] S22B.

SPECS22C[I] S22C.

SPECTRLL[I] TRL Line or Match.

SPECTRLT[I] TRL Thru.

SPECTRLR[I] TRL Reflect.

SPECTRFM TRL, Reflect, Forward, Match. Compatible with the HP 8753D revisions 5.00 through 5.48.

SPECTRRM TRL, Reflect, Reverse, Match. Compatible with the HP 8753D revisions 5.00 through 5.48.

SPECTLFM TRL, Line, Forward, Match. Compatible with the HP 8753D revisions 5.00 through 5.48.

SPECTLFT TRL, Line, Forward, Trans. Compatible with the HP 8753D revisions 5.00 through 5.48.

SPECTLRM TRL, Line, Reverse, Match. Compatible with the HP 8753D revisions 5.00 through 5.48.

SPECTLRT TRL, Line, Reverse, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***

SPECTTFM TRL, Thru, Forward, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***

SPECTTFT TRL, Thru, Forward, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***

SPECTTRM TRL, Thru, Reverse, Match. Compatible with the HP 8753D revisions 5.00 through ***5.48.***

SPECTTRT TRL, Thru, Reverse, Trans. Compatible with the HP 8753D revisions 5.00 through ***5.48.***

SPEG Displays the specify gate menu. See also DUAC.

SPLD<ON|OFF> Turns the split display mode ON and OFF.

SPLID1 Puts all displayed channels on one full-size graticule.

SPLID2 Ruts all displayed channels on two graticules.

SPLID4 Ruts each displayed channel on a separate graticule.

SRE[D] Service request enable. A bit set in D enables the corresponding bit in the status byte to generate an SRQ. *Range: 0<D<255.*

SSEG[D] Selects the desired segment of the frequency list for a list frequency sweep. See also ASEG. Range: ***1 to 30.***

STB? Outputs the status byte. Same as OUTPSTAT.

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

STANA Standard listed under softkey 1.

STANB Standard listed under softkey 2.

STANC Standard listed under softkey 3.

STAND Standard listed under softkey 4.

STANE Standard listed under softkey 5.

STANF Standard listed under softkey 6.

STANG Standard listed under softkey 7.

STAR[D] Enters the start stimulus value. If a list frequency segment is being edited, sets the start of the segment. *Range: **stimulus range.***

STDD Standard done, terminating a define standard sequence, while modifying a cal kit.

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

STDTARBI Arbitrary impedance.

STDTDELA Delay/thru.

STDTLOAD Load.

STDTOPEN Open.

STDTSHOR Short.

STOP[D] Sets the stimulus stop value. If a list frequency segment is being edited, sets the stop of the segment. Range: ***stimulus range.***

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

STOR1 Stores the current instrument state to disk using the file name provided by the preceding T I TF 1; command.

STOR2 Stores the current instrument state to disk using the file name provided by the preceding T I TF2; command.

STOR3 Stores the current instrument state to disk using the file name provided by the preceding T I TF3; command.

STOR4 Stores the current instrument state to disk using the file name provided by the preceding T I TF4; command.

STOR5 Stores the current instrument state to disk using the file name provided by the preceding T I TF5; command.

STORSEQ<I> Stores the instrument state of the indicated sequence to disk. Used with the INTD and EXTD commands to designate the internal or external disk. Requires pass control mode when using the HP-IB port. *Range:* ***1 to 6.***

STPSIZE[D] While editing a list frequency segment, sets step size. *Range:* ***stimulus range***

SVCO	Saves display colors.
SWEA	Automatically selects the fastest sweep time based on the current analyzer settings for number of points, IF bandwidth, sweep mode, averaging condition and frequency span.
SWET[D]	Sets the sweep time. *Range: 0.01 to* 86,400 s.
SWPSTART	Initiates a sweep and immediately releases the HP-IB bus, allowing the analyzer to initiate data output as soon as the appropriate data is ready. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer. OPC-compatible.
SWR	Selects the SWR display format.
TAKCS	Begins a power meter calibration sweep.
TAKE4<ON|OFF>	Initiates a mode in which every measurement cycle is characterized by sweeping in both the forward and reverse directions and collecting raw data for all four S-parameters. The sweeping can occur when a SWPSTART or SING command is received or when the analyzer is in continuous, number of groups, or external trigger mode. See BASIC programming Example 2E: Take4 — Error Correction Processed on an External Computer.
TAKRS	Begins a receiver calibration sweep.
TALKLIST	Selects the talker listener mode.
TERI[D]	Specifies the terminal impedance of an arbitrary impedance standard during a cal kit modification. *Range:* 0 *to* ***lk*** Ω
TESS?	Query test set. Returns a one on the standard analyzer. This command is compatible with the HP 8753D.

TIMDTRAN<ON|OFF>	Turns the time domain transform ON and OFF. (Option 010).
TIMESTAM<ON|OFF>	Turns on the clock time for prints and plots.
TINT[D]	Adjusts the tint for the selected display feature. Range: 0 ***to 100.***
TITF0<I>[$]	Titles the SAVE STATE filename, only in sequence mode. ***Range: 01 to 31, 10 char max.***
TITF<I>[$]	Titles the indicated file numbers. ***Range: 1 to 5, 10 char max.***
TITL[$]	Enters a new display title. A maximum of 50 characters are allowed.
TITP[$]	Titles the plot to disk file. *Range: 01* to ***31, 10 char. max.***
TITR<I>[$]	Titles the indicated internal register. ***Range: 1 to 5, 10 char. max.***
TITREG<I>[$]	Titles save/recall registers 01 through 3 1. TITREGO 1 through TITREG05 are the same as TITR1 through TITR5. ***Range: 01 to 31, 10 char. max.***
TITSEQ<I>[$]	Selects the sequence to be titled. *Range: 1* ***to 6, 10 char.*** *max.*
TITSQ	Provides access to the sequence title functions.
TITTMEM	Sends the title string to trace memory.
TITTPMTR	Sends the title string to the power meter's HP-IB address.
TITTPERI	Sends the title string to the peripheral address.
TITTPRIN	Sends the title string to the printer's HP-IB address.
TRACK<ON|OFF>	Turns marker search tracking ON and OFF.
TRAD	Completes the transmission calibration subsequence of a 2-port calibration. OPC-compatible.

TRAN	Begins the transmission calibration subsequence of a 2-port calibration.
TRAOP	Begins the transmission calibration subsequence for one path, two port calibration.
TRAP	Same as S21.
TRIG	HP-IB trigger.
TRLL1	Measures TRL Line/match for Port 1 during a TRL/LRM 2-port calibration.
TRLL2	Measures TRL Line/match for Port 2 during a TRL/LRM 2-port calibration.
TRLR1	Measures TRL S11 reflect during a TRL/LRM 2-port calibration.
TRLR2	Measures TRL S22 reflect during a TRL/LRM 2-port calibration.
TRLT	Measures TRL thru during a TRL/LRM 2-port calibration.
TSSWI<ON/OFF>	Same as CSWI.
TST?	Causes a self test and returns a zero if the test is passed.

TSTIOFWD[D]

Defines 3 bits, DO through D2, on the test set connector I/O for the channel 1 and channel 2 forward settings. These bits can be set to values of 0 through 7. Be careful that you do not also set a value to ATTP1 and ATTP2 as there is interaction between these commands and they will change the values you have set for DO through D2 and will couple the channels together. Values for ATTPl and ATTP2 translate to the following values for DO through D2:

ATTP1/ATTP2	D0 - D2
0 dB	7
10 dB	6
20 dB	5
30 dB	4
40 dB	3
50 dB	2
60 dB	1
70 dB	0

TSTIOREV[D] Defines 3 bits, DO through D2, on the test set connector I/O for the channel 1 and channel 2 reverse settings. These bits can be set to values of 0 through 7. Be careful that you do not also set a value to ATTP1 and ATTP2 as there is interaction between these commands and they will change the values you have set for DO through D2 and will couple the channels together. Values for ATTP1 and ATTP2 translate to the following values for DO through D2:

ATTP1/ATTP2	D0 - D2
0 dB	7
10 dB	6
20 dB	5
30 dB	4
40 dB	3
50 dB	2
60 dB	1
70 dB	0

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

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

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

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

TTLOH Sets TTL continuously high.

TTLOL Sets TTL continuously low.

UCONV Selects up converter for mixer measurements.

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

USEPASC Puts the analyzer in pass control mode.

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

USESENSA Sensor A.

USESENSB Sensor B (available with HP 438A only).

VELOFACT[D] Enters the velocity factor of the transmission medium. ***Range: 0 to 10.***

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

VOFF[D] Sets the local oscillator frequency for use in frequency offset mode. See also LOFREQ[D]. Range: ***frequency range of instrument.***

WAIT Waits for a clean sweep when used with the OPC command.

WAVD Selects waveguide electrical delay. (See also COAD.)

WAVE Specifies a waveguide standard while defining a standard as part of a cal kit modification, as opposed to coaxial.

WIDT<ON|OFF> Turns the bandwidth search ON and OFF.

WIDV[D] Enters the widths search parameter. ***Range: amplitude range.***

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

WINDMAXI	Maximum.
WINDMINI	Minimum.
WINDNORM	Normal.
WINDOW[D]	Enters arbitrary window. Range: ***state dependent.***
WINDUSEM<ON|OFF>	Turns the trace memory ON as the window shape.
WRSK<I>[$]	Enters new **softkey** labels into the indicated **softkey** positions. Initial use of these commands requires previous commands `MENUFORM;` and `MENUOFF;` . ***Range: 1 to 8.***

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