

## For the HP 8700-series analyzers

This document provides a quick reference for the HP-IB operation of the HP 8700-series analyzer, including the HP 8702, 8719, 8720, 8752, and 8753. Use this information as a reference to the syntax requirements and general function of the individual commands. The reader should already be familiar with making measurements with the analyzer under control of the front panel keys and with general programming of the instrument using the HP-IB.

Not all commands listed apply to all instruments. The general response of an instrument that does not support a specific operation is to report a syntax error when the command is input. Refer to the tutorial and reference information in other portions of the Operating and Programming manual, particularly the menu structures, for the specific instrument you are working with to determine its capabilities.

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### Notation

Symbols used in this document are:

- BOLD** Upper case bold characters represent the program keywords which must appear exactly as shown with no embedded spaces.
- [ ] Square brackets indicate that the enclosed information is optional.
- [suffix] Optional programmer entry Units Terminator for stimulus values:

Frequency Suffix	Time Suffix	Voltage Suffix	Power Suffix
	fs		
	ps		
	ns		
GHz	us (micro)		
MHz	ms	mV	
kHz	s	V	
Hz			dB

If no suffix is used, the instrument assumes the basic units (Hz or seconds) for the instruction. Upper and lower case characters are equivalent.

- <appendage> Characters enclosed in the <> brackets are qualifiers attached to the root mnemonic. An example is <ON|OFF> which shows that either ON or OFF can be attached to the code. Another is <1-6> which shows that the numeral 1, 2, 3, 4, 5, or 6 can be attached to the code. There can be no spaces or symbols between the code and the appendage.
- ; semicolon is the required terminator character for each program instruction.
- ,
- the comma is used in program instructions to separate a series of values.
- (range of values) lower case characters enclosed in parenthesis describes the range of values which may be input for the selected function.
- value a constant or a pre-assigned simple or complex numeric or string variable transferred to the instrument.

# Display Graphics

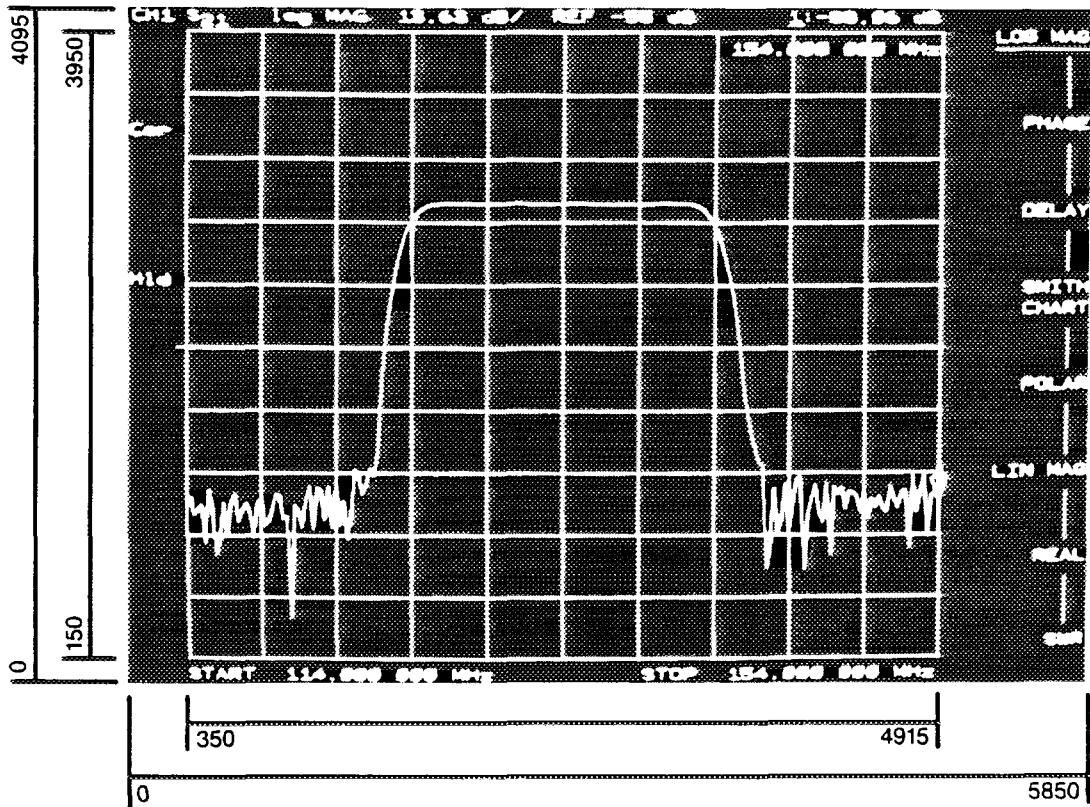
## HP-GL subset

<b>AF;</b>	Erases the user graphics display.															
<b>CS;</b>	Turns off the measurement display.															
<b>DF;</b>	Sets the default values.															
<b>LB[<i>text</i>][<i>etx</i>];</b>	Labels the display, placing the symbols starting at the current pen position. All incoming characters are printed until the <i>etx</i> symbol is received. The default <i>etx</i> symbol is the ASCII value 3 (not the character 3).															
<b>LTa;</b>	Specifies line type: <table><tr><td><u>a</u></td><td><u>line</u></td></tr><tr><td>0</td><td>solid</td></tr><tr><td>1</td><td>solid</td></tr><tr><td>2</td><td>short dashes</td></tr><tr><td>3</td><td>long dashes</td></tr></table>	<u>a</u>	<u>line</u>	0	solid	1	solid	2	short dashes	3	long dashes					
<u>a</u>	<u>line</u>															
0	solid															
1	solid															
2	short dashes															
3	long dashes															
<b>OP;</b>	Outputs P1 and P2, the scaling limits: 0,0,5850,4095.															
<b>PAx,y;</b>	Draws from the current pen position to x,y. There can be several pairs of x,y coordinates within one command. They are separated by commas, and the entire sequence is terminated with a semicolon.															
<b>PD;</b>	Pen down. A line is drawn only if the pen is down.															
<b>PG;</b>	Erases the user graphics display.															
<b>PRx,y;</b>	Plot relative: draws a line from the current pen position to a position y up and x over.															
<b>PU;</b>	Pen up. Stops anything from being drawn.															
<b>RS;</b>	Turns on the measurement display.															
<b>Slh,w;</b>	Sets the character size, for height h and width w in centimeters: <table><tr><td><u>h</u></td><td><u>w</u></td><td><u>size</u></td></tr><tr><td>.16</td><td>.20</td><td>smallest</td></tr><tr><td>.25</td><td>.30</td><td></td></tr><tr><td>.33</td><td>.39</td><td></td></tr><tr><td>.41</td><td>.49</td><td>largest</td></tr></table>	<u>h</u>	<u>w</u>	<u>size</u>	.16	.20	smallest	.25	.30		.33	.39		.41	.49	largest
<u>h</u>	<u>w</u>	<u>size</u>														
.16	.20	smallest														
.25	.30															
.33	.39															
.41	.49	largest														
<b>SPn;</b>	Selects color: n = 1-7															
<b>COLORm;</b>	m = 1-7															

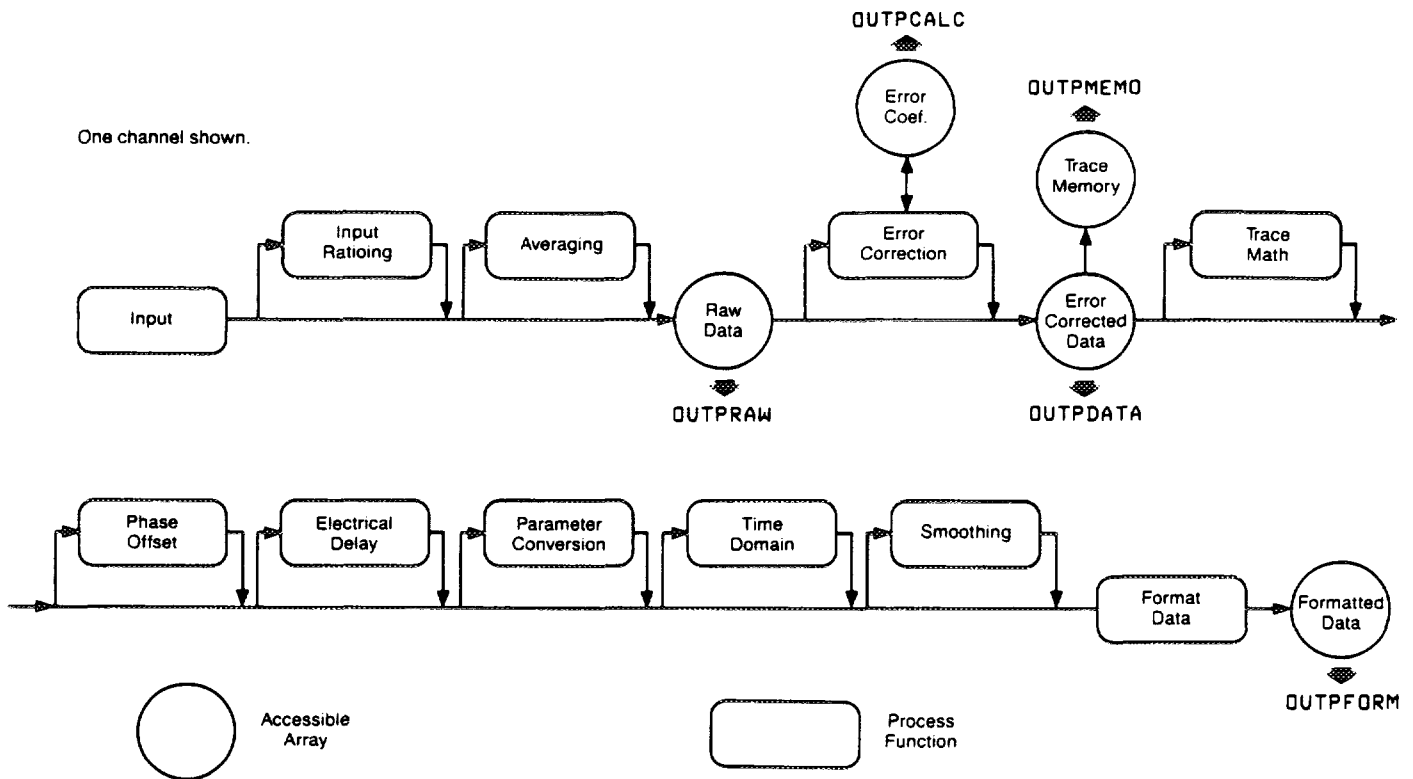
## Accepted but ignored HP-GL commands

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

# User Graphics Units



# Processing Chain



## Marker and Data Array Units

DISPLAY FORMAT	MARKER MODE	OUTPMARK value 1, value 2	OUTPFORM value 1, value 2	MARKET READOUT** value, aux value
LOG MAG		dB,*	dB,*	dB,*
PHASE		degrees,*	degrees,	degrees,*
DELAY		seconds,*	seconds,*	seconds,*
SMITH CHART	LIN MKR LOG MKR Re/Im R + jX G + jB	lin mag, degrees dB, degrees real, imag real, imag ohms real, imag Siemens	real, imag " " " "	lin mag, degrees dB, degrees real, imag real, imag ohms real, imag Siemens
POLAR	LIN MKR LOG MKR Re/Im	lin mag, degrees dB, degrees real, imag	real, imag " "	lin mag, degrees dB, degrees real, imag
LIN MAG		lin mag,*	lin mag,*	lin mag,*
REAL		real,*	real,*	real,*
SWR		SWR,*	SWR,*	SWR,*

\* Value not significant in this format, but is included in data transfers.

\*\* The marker readout values are the marker values displayed in the upper left hand corner of the display. They also correspond to the value and aux value associated with the fixed marker.

## Disk file names

Disk file names consist of a user-defined state name of up to 8 characters, such as FILTER, appended with up to two characters, defined by the instrument, which indicate what is in the file. ASCII files use the CITIFile format. Binary files are not meant to be decoded.

### FILTERXX

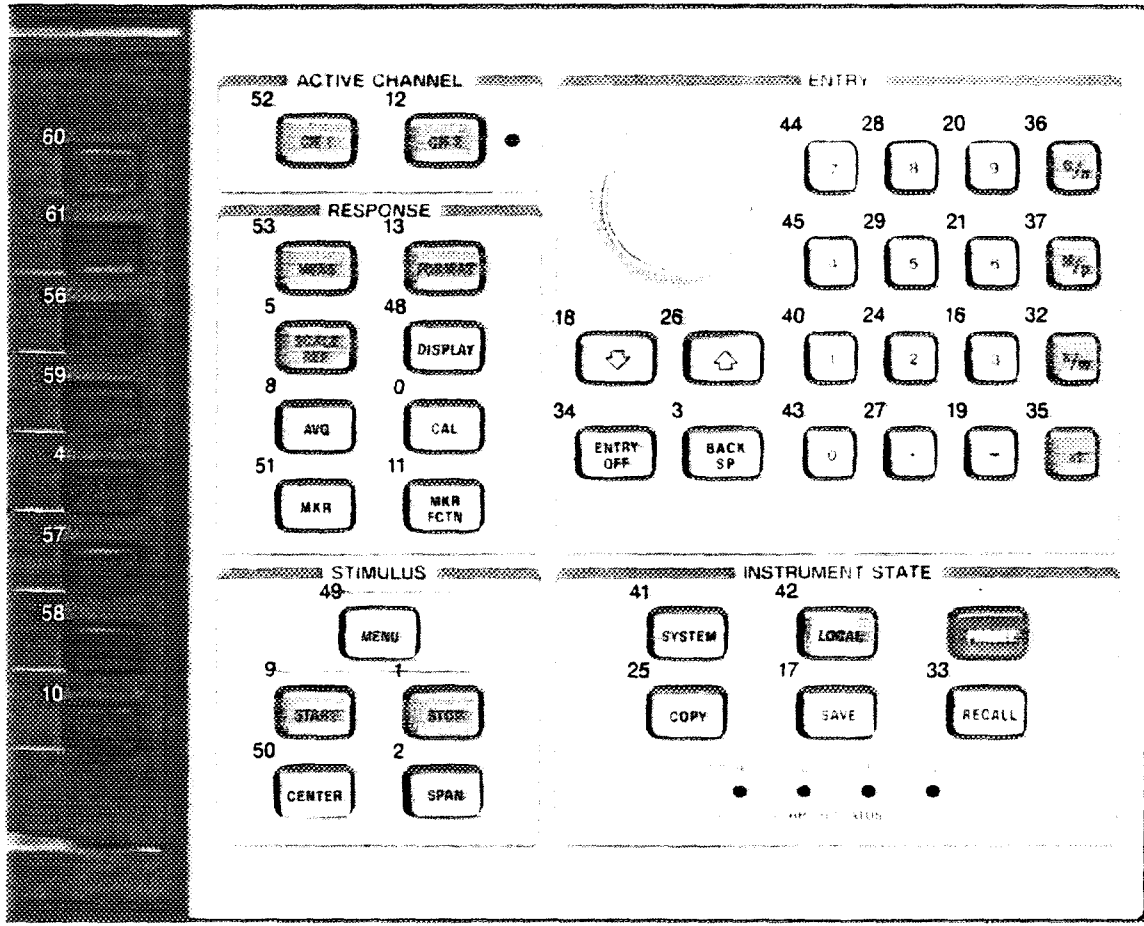
The first character is the file type, telling the kind of information in that file. The second character is a data index, used to distinguish files of the same type.

Char 1	Meaning	Char 2	Meaning
I	Instrument state	(blank)	
G	Graphics	1	Display graphics
		0	Graphics index
D	Error corrected data	1	Channel 1
		2	Channel 2
R	Raw data	<b>Binary</b>	
		1 to 4	Channel 1, raw arrays 1 to 4
		5 to 8	Channel 2, raw arrays 1 to 4
		<b>CITIFILE: single file</b>	
		Last digit 1 (ch 1) or 5 (ch 2)	
F	Formatted data	1	Channel 1
		2	Channel 2
M	Memory trace	1	Channel 1
		2	Channe 2
1	Cal data, channel 1	<b>Binary:</b>	
		K	Cal kit
		0	Stimulus state
		1 to 9	Coefficients 1 to 9
		A	Coefficient 10
		B	Coefficient 11
		C	Coefficient 12
		} Multiple files	
		<b>CITIFILE: single file</b>	
		last digit shows number of coefficients	
2	Cal data, channel 2	0 to C,K	Same as channel 1

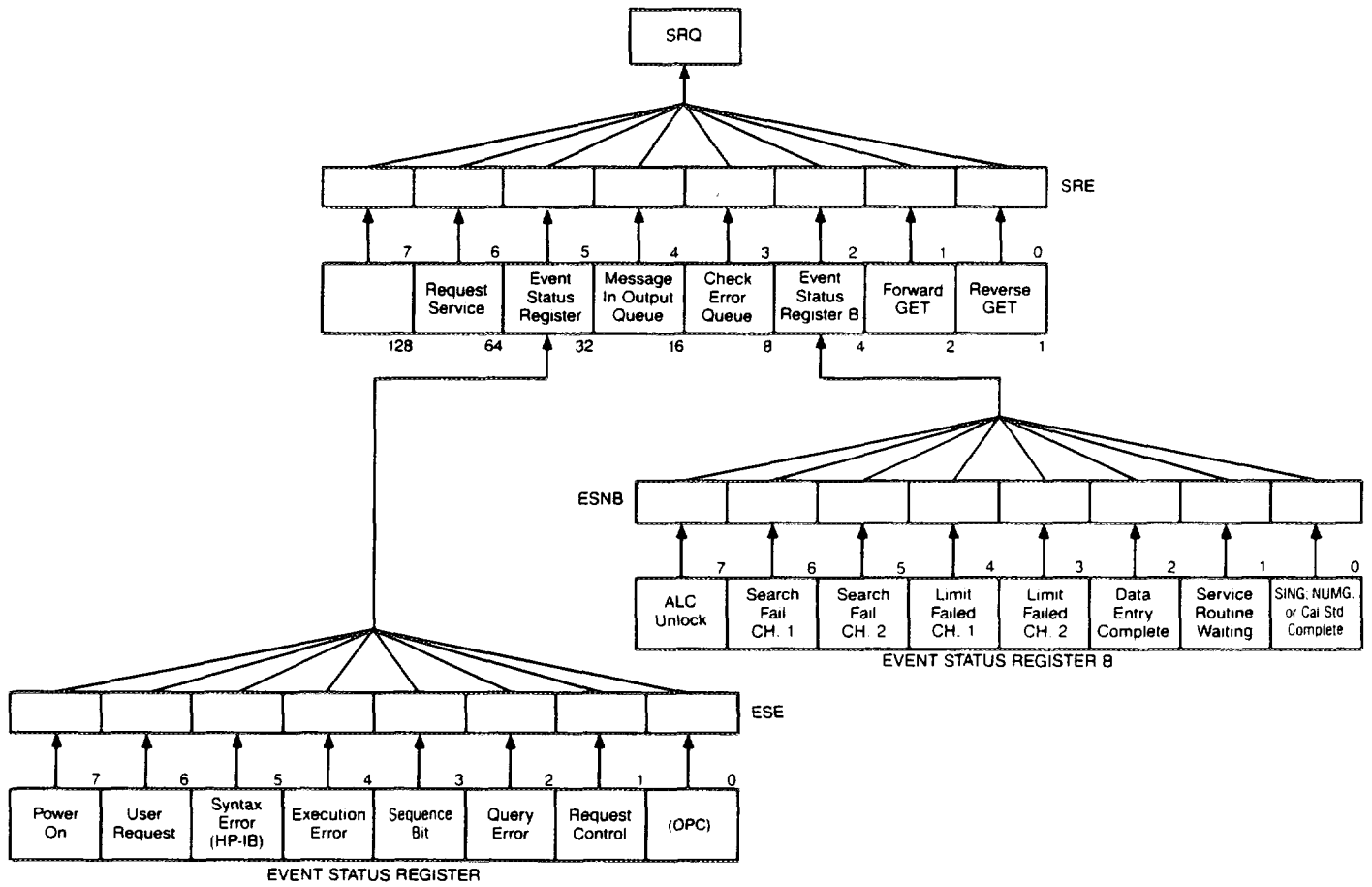
# Key Codes

## Notes:

1. Key code 63 is invalid key.
2. **OUTPKEY**; reports a knob turn as a  $-1$ .
3. If the two byte integer sent back from **KOR?** is negative, it is a knob count. If the knob count was negative, no modification is needed. If the knob count was positive, however, bit 14 will not be set. In this case, the number must be decoded by clearing the most significant byte, as by AND'ing the integer with 255.



# Status Reporting Structure



# Status Bit Definitions

## Status Byte

Bit	Name	Description
0	Waiting for reverse GET	A one path, 2-port calibration is active, and the instrument has stopped, waiting for the operator to connect the device for reverse measurement.
1	Waiting for forward GET	A one path, 2-port calibration is active, and the instrument has stopped, waiting for the operator to connect the device for forward measurement.
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.
5	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.

## Event Status Register

Bit	Name	Description
0	Operation complete	A command for which OPC has been enabled 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.
4	Execution error	A command was received that could not be executed. Commonly due to invalid operands.
5	Syntax error	The incoming HP-IB commands contained a syntax error. The syntax error is cleared only by a device clear or an instrument preset.
6	User request	The operator has pressed a front panel key or turned the knob.
7	Power on	A power on sequence has occurred since the last read of the register.

## Event Status Register

Bit	Name	Description
0	Sweep or group complete	A single sweep or group has been completed since the last read of the register. Operates in conjunction with SING or NUMG.
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 last read of the register.
3	Limit failed, Ch 2	Limit test failed on channel 2.
4	Limit failed, Ch 1	Limit test failed on channel 1.
5	Search failed, Ch 2	A marker search was executed, but the target value was not found.
6	Search failed, Ch 1	Same as on channel 2.
7	ALC unlock	Unleveled output power at the beginning or end of a sweep. Data may be invalid.



## Calibration Types and Standard Classes

Class	Response	Response and Isolation	S11 1-port	S22 1-port	One path 2-port	Full 2-port
Reflection: <sup>1</sup>					•	•
S11A (opens)			•		•	•
S11B (shorts)			•		•	•
S11C (loads)			•		•	•
S22A (opens)				•		•
S22B (shorts)				•		•
S22C (loads)				•		•
Transmission: <sup>1</sup>					•	•
Forward match					•	•
Forward thru					•	•
Reverse match						•
Reverse thru						•
Isolation: <sup>1</sup>					•	•
Forward					•	•
Reverse						•
Response	•					
Response and isolation:						
Response		•				
Isolation		•				

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

## Calibration Arrays

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

Meaning of first subscript: D=directivity; S=source match; R=reflection tracking; X=crosstalk; L=load match, T=transmission tracking.

Meaning of second subscript: F=forward; R=reverse.

- One path, 2-port cal duplicates arrays 1 to 6 in arrays 7 to 12.
- Response and isolation corrects for crosstalk and transmission tracking in transmission measurements, and for directivity and reflection tracking in reflection measurements.

## Alphabetical List of Codes

- AB;**  
Measure and display A/B on the active channel.
- ADDRCONT** [value];  
Controller HP-IB address.  
Control is returned to this address after a pass control.
- ADDRDISC** [value];  
Disk HP-IB address. (0-30)
- ADDRPLOT** [value];  
Plotter HP-IB address.
- ADDRPOWM** [value];  
Power Meter HP-IB address. (0-30)
- ADDRPRIN** [value];  
Printer HP-IB address. (0-30)
- ALC;**  
ALC control.
- ALIS** <ON | OFF>;  
Select time domain span limit.  
On to display past time domain alias-free range.  
Preset selects ALISOFF;.
- ALTAB;**  
Select alternate sweeps for Channel 1 and Channel 2.
- ANAB;**  
Analog bus Enable.
- ANAI;**  
Measure and display data at the Analog Input (ANALOG IN).
- ANNO** <ON | OFF>;  
Select measurement annotation.  
S-parameter test set = On;  
Reflection/transmission test set = Off.
- AR;**  
Measure and display A/R on the active channel.
- ASEG;**  
Measure all frequency list segments.
- ASSS;**  
Assert the sequence status bit.
- ATTP** <1 | 2> [value];  
Set port 1 or port 2 attenuator (0-90 dB, 10 dB steps).
- AUTO;**  
Automatic selection of REF VALUE and SCALE for the active channel.
- AVERFACT** [value];  
Set averaging factor for active channel.
- AVER** <ON | OFF>;  
Select averaging for active channel.
- AVERON** [value]; can also be used.
- AVERREST;**  
Restart averaging on the active channel.
- BACI** [0-100];  
Background intensity percent.
- BANDPASS;**  
Select time domain bandpass mode.
- BEEPDONE** <ON | OFF>;  
Beep when done:  
Save instrument state, Calibration standard, Data trace saved.
- BEEPFAIL** <ON | OFF>;  
Beep when limit test failure.
- BEEPWARN** <ON | OFF>;  
Beep when warning message displayed.
- BR;**  
Measure and display B/R on the active channel.
- C0** [value];       $\times 10^{15} \text{F}$   
**C1** [value];       $\times 10^{27} \text{F}$   
**C2** [value];       $\times 10^{36} \text{F}$   
**C3** [value];       $\times 10^{45} \text{F}$   
Open circuit capacitance model values:  
 $C = C0 + (C1 * F) + (C2 * F^2) + (C3 * F^3)$
- CAL1;**  
Begin measurement calibration.
- CALFCALC** [value].  
Set current frequency power meter calibration factor.
- CALFFREQ** [value{freq suffix}];  
Select power meter calibration factor frequency.
- CALFSEN** <A | B>;  
Edit the sensor A or B calibration factor table.
- CALIAPOW;** A input.  
**CALIARPO;** A/B ratio.  
**CALIBPOW;** B input.  
**CALIBRPO;** B/R ratio.  
Begin power calibration sequence for selected measurement.
- CALIFUL2;**  
Select Full 2-Port measurement calibration.
- CALIONE2;**  
Select One-Path 2-Port measurement calibration.
- CALIRAI;**  
Select Response and Isolation measurement calibration for current parameter.
- CALIRESP;**  
Select Response measurement calibration for current parameter.
- CALIS111;**  
Select 1-Port measurement calibration for current parameter at port 1.

**CALIS221;**

Select 1-Port measurement calibration for current parameter at port 2.

- CALK35MM;** 3.5 mm
- CALK7MM;** 7 mm
- CALKN50;** type-N, 50Ω
- CALKN75;** type-N, 75Ω
- CALKOPTS;** Standard optical
- CALKOPTU;** User-defined optical
- CALKUSED;** Use-defined electrical

Begin measurement calibration using selected cal kit.

**CALN;**

Select Cal none.

- CALPRECE;** O/E DUT
- CALPRES P;** Response cable
- CALPRFSC;** Source RF cable
- CALPRFTC;** Total RF cable

Select calibration standard class. Measure if single standard in class, or, if multiple standards in class, use **STAN**<char>; and **DONE**; to measure standards in class.

- CALSRECC;** Receiver coefficients
- CALSRECD;** Receiver from disc
- CALSSOUC;** Source coefficients
- CALSSOUD;** Source from disc

Select standard location for source/receiver model.

**CBRI** [0-100];

Color brightness percent.

**CENT** [value[suffix]];

Set CENTER stimulus value.

- CHAN1;** Channel 1
- CHAN2;** Channel 2

Select Active measurement Channel.

**CHOPAB;**

Alternate measurements between Channel 1 and Channel 2 at each frequency point.

**CLAD;**

Class done, modify cal kit, specify class.  
Current standard class is complete.

- CLASS11A;** S11A; S11 1-port
- CLASS11B;** S11B; S11 1-port
- CLASS11C;** S11C; S11 1-port
- CLASS22A;** S22A; S22 1-port
- CLASS22B;** S22B; S22 1-port
- CLASS22C;** S22B; S22 1-port

Select port 1 (S11) and port 2 (S22) calibration standard class. Measure if single standard in class, or, if multiple standards in class, use **STAN**<char>; and **DONE**; to measure standards in class.

**CLEA**<1-5>;

**CLEARALL;**

Clear specified Save/Recall register or all.

**CLEAL;**

**CLEL;**

Clear current list:  
Frequency list, Power Loss list, or Limit Test list.

**CLEASE**<1-6>;

Clear specified test sequence.

**CLES;**

**CLS;**

Clear Status. Clears (0) status byte, event status registers, and event status enable registers.

**COAX;**

Define current cal standard as Coaxial (linear phase).

**COEF**<A-I>;

Set optical cal **STDTsour**; and **STDTRECE**; coefficients.

**COLOCH1D;** Ch 1 data, limit line

**COLOCH1M;** Ch 1 memory

**COLOCH2D;** Ch 2 data, limit line

**COLOCH2M;** Ch 2 memory

**COLOGRAT;** Graticule

**COLOTEXT;** Text

**COLOWARN;** Warning message

Specify display element to change color.

**COLOR** [0-100];

Specify saturation percent.

**CONS;**

Continue test sequence.

**CONT;**

Continuous sweep trigger mode.

**CONV1DS;** Reciprocal (1/S)

**CONVOFF;** Conversion Off

**CONVYREF;** Y: reflection

**CONVYTRA;** Y: transmission

**CONVZREF;** Z: reflection

**CONVZTRA;** Z: transmission

Convert current measurement.

**COPYFRFT;**

Copy file titles to register titles.

**COPYFRRT;**

Copy save/recall register titles to disc.

**CORI**<ON | OFF>;

Select Interpolative error correction for active channel.

**CORR**<ON | OFF>;

Select error correction for active channel current parameter set.

**COUC**<ON | OFF>;

Couple/Uncouple channel stimulus values.

**COUP**<ON | OFF>;

Couple power when uncoupled channels.

**CWEXT;**

CW mode using external input.

**CWFREQ** [value[freq suffix]] to **ESR?**

**CWFREQ** [value[freq suffix]]:

Select CW frequency in single frequency measurement modes.  
During frequency list edit, set center frequency of current segment.

**CWTIME**:

Select CW time sweep type.

**D1DIVID2** <ON | OFF>;

Perform complex divide of current Channel 1 data by current Channel 2 data and display in Channel 2. Dual channel only.

**DATI**:

Active channel data stored to trace memory.

**DEBU** <ON | OFF>;

Select HP-IB program debug mode to display instrument commands.

**DECRLOOC**:

Decrement test sequence loop counter by one.

**DEFC**:

Set default colors.

**DEFS** [std no.];

Define number of cal standard to be modified.

**DELA**:

Select DELAY format for current measurement.

**DELO**:

Delta Marker mode Off.

**DELRL** <1-4>;

Select delta reference marker.

**DELRFIXM**:

Select fixed marker as delta reference marker.

**DEMOAMPL**: Amplitude Demodulation

**DEMOOFF**: Demodulation Off

**DEMOPHAS**: Phase Demodulation

Select CW Time transform demodulation.

**DEVT1PE**: 1-port electrical

**DEVT1PO**: 1-port optical

**DEVTEE**: E/E

**DEVTEO**: E/O

**DEVTOE**: O/E

**DEVTOO**: O/O

Specify current device type.

**DFLT**:

Select default plotter setup.

**DIRS** [value];

Set the number of files in directory at disc initialization.

**DISCUNIT** [value];

Specify disc unit number.  
Usually 0 (left drive); 1 (right drive).

**DISCVOLU** [value];

Specify disc volume number.

**DISM** <ON | OFF>;

Select display of all four marker values.

**DISPDATA**: Display data

**DISPDATM**: Display both data and memory

**DISPDDM**: Display data divided by memory

**DISPDMM**: Display data minus memory

**DISPMEMO**: Display memory only

Select display for active channel.

**DIVI**:

Select complex divide default trace math.

**DONACAL**;

**DONARCAL**;

**DONBCAL**;

**DONBRCAL**;

Done with power meter calibration sequence.

**DONE**:

Done with standard class during cal.

**DONM**:

Done with modify test sequence.

**DOSE** <1-6>;

Do specified test sequence.

**DOWN**:

Decrement current active function value.

**DUAC** <ON | OFF>;

Select dual (On) or single channel (Off) display.

**DUPLSE** <1-6> **SEQ** <1-6>;

Duplicate test sequence (from-to).

**EDITDONE**:

Done with edit frequency list or edit limit line table.

**EDITLIML**:

Begin edit limit line table.

**EDITLIST**:

Begin edit frequency list.

**ELEA** [value];

Electrical attenuation for power cal.

**ELED** [value[time suffix]];

Set electrical delay for active channel.

**EMIB**:

Beep during test sequence.

**ENTO**:

Entry Off.

Turn off active function and clear entry area.

**ESB?**:

Output event status register B value.

**ESE** [value];

Specify bits of event status register to be summarized by bit 5 of the status byte.

**ESNB** [value];

Specify bits of event status register B to be summarized by bit 2 of the status byte.

**ESR?**:

Output event status register value.

**EXET;**

Execute a service test.

**EXTMDATA** <ON | OFF>; Error-corrected data  
**EXTMFORM** <ON | OFF>; Formatted data  
**EXTMGRAP** <ON | OFF>; User graphics  
**EXTMRAW** <ON | OFF>; Raw data arrays  
 Specify data types included in register storage to disc.

**EXTT** <ON | OFF>; External/Internal trigger  
**EXTTPOIN;** External trigger  
 Select internal or external measurement trigger mode.

**FAST;**

Select fast plot speed.

**FIXE;**

Define load standard type as fixed.

**FOCU** [0-100];

Set CRT focus value percent.

**FORM1;** Instrument internal binary

**FORM2;** IEEE 32-bit fp (8 bytes/point)

**FORM3;** IEEE 64-bit fp (16 bytes/point)

**FORM4;** ASCII

**FORM5;** PC-DOS 32-bit fp (8 bytes/point)

Select HP-IB trace data input/output formats.

**FREQ;**

Select frequency annotation Off.  
 (Preset to turn On).

**FREQOFFS** <ON | OFF>;

Select frequency offset mode.

**FREQRANG** <3GHZ | 6GHZ>;

Select frequency doubler in HP 85047 test set.

**FRER;**

Select internal trigger free-run sweep (same as CONT;).

**FRES** <ON | OFF>;

Select frequency subset cal On/Off.

**FULP;**

Select full page plot.

**FWDI;** Isolation

**FWDM;** Load match

**FWDT;** Tracking

Select forward transmission (S21) calibration standard class.  
 Measure if single standard in class, or, if multiple standards in class, use **STAN** <char>; and **DONE**; to measure standards in class.

**GATECENT** [value{time suffix}];

Set gate center.

**GATE** <ON | OFF>;

Select gate off/on.

**GATESPAN** [value{time suffix}];

**GATESTAR** [value{time suffix}];

**GATESTOP** [value{time suffix}];

Set gate span, start, stop values.

**GATSMAXI;** Maximum

**GATSMINI;** Minimum

**GATSNORM;** Normal

**GATSWIDE;** Wide

Select gate shape.

**GUIS;**

Begin guided setup instructions.

**HARMOFF;**

**HARMSEC;** Second harmonic

**HARMTHIR;** Third harmonic

Select harmonic measurement.

**HOLD;**

Hold present measurement.

Restart using **CONT**;

**IDN?;**

Output ASCII instrument identification string. "HEWLETT  
 PACKARD, <model>, <op sys rev>"

**IFBW** [value];

Select IF bandwidth.

**IFLCEQZE** <1-6>; Loop counter equals zero

**IFLCNEZE** <1-6>; Loop counter does not equal zero

**IFLTFAIL** <1-6>; Limit test fail

**IFLTPASS** <1-6>; Limit test pass

Branch from executing test sequence to specified test sequence if condition is satisfied.

**IMAG;**

Select display of Imaginary data using cartesian format for active channel.

**INCRLOOC;**

Increment test sequence loop counter by one.

**INDEREFR;**

Index of refraction.

**INID;**

Initialize disc for instrument data storage.

**INPUCALC** <01-12>;

Store measurement calibration error coefficient set real/imaginary pairs input via HP-IB into instrument memory. Select appropriate cal type then input necessary coefficient sets (see **OUTPCALC**n;) then issue **SAVC**; Issue **SING**; or **CONT**; to measure.

**INPUCALK;**

Input cal kit, use **SAVEUSEK**;

**INPUCALR;**

Receiver cal data

**INPUCALS;**

Source cal data

**INPUDATA;**

Active channel corrected data

**INPUFORM;**

Active channel formatted data

**INPULEAS;**

Learn string

**INPUMCAL** <1-2>;

Power meter calibration array

**INPURAW** <1-4>;

Active channel raw data array

Input specified data via HP-IB.

**INSMEXSA;** External source, auto

**INSMEXSM;** External source, manual

**INSMNETA;** Standard analyzer

**INSMTUNR;** Tuned receiver

Select instrument mode.

**INTE** [0-100] to **MARKCENT** [value[suffix]]

**INTE** [0-100];  
Set display intensity percent.

**ISOD**;  
Done with isolation part of 2-port cal.

**ISOL**;  
Begin isolation part of 2-port cal.

**KEY** [keycode];  
Send keycode. See Keycode table.  
Equivalent to actually pressing a key.

**KITD**;  
Done with modify cal kit.  
Modified cal kit replaces existing kit.

**KOR?**;  
Output two byte key code or knob count.  
See Keycode table.  
Positive value = key code.  
Negative value can be converted to knob count.

**LABEFWDM** ["string"]; Forward match  
**LABEFWDT** ["string"]; Forward transmission  
**LABERESI** ["string"]; Response, Response & Isolation  
**LABERESP** ["string"]; Response  
**LABEREVM** ["string"]; Reverse match  
**LABEREVT** ["string"]; Reverse transmission  
**LABES11A** ["string"]; S11A (opens)  
**LABES11B** ["string"]; S11B (shorts)  
**LABES11C** ["string"]; S11C (loads)  
**LABES22A** ["string"]; S22A (opens)  
**LABES22B** ["string"]; S22B (shorts)  
**LABES22C** ["string"]; S22C (loads)  
Define standard class label during modify cal kit.

**LABK** ["string"]; Electrical cal kit  
**LABO** ["string"]; Optical cal kit  
Define cal kit label during modify cal kit.

**LABS** ["string"];  
Define standard label during modify cal kit.

**LEFL**; Left lower  
**LEFU**; Left upper  
Set plot quadrant option.

**LIMD** [value];  
Set limit line delta value.

**LIMIAMPO** [value];  
Set limit line amplitude offset.

**LIMILINE** <ON | OFF>;  
Select limit line display.

**LIMIMAOF** [value[suffix]];  
Marker to limit line stimulus offset.  
Center limit lines using active marker position and  
limit line amplitude offset.

**LIMISTIO** [value[suffix]];  
Set limit line stimulus offset.

**LIMITEST** <ON | OFF>;  
Select limit test.

**LIML** [value]; Lower limit  
**LIMM** [value]; Middle limit  
**LIMS** [value]; Stimulus break point limit  
**LIMTFL**; Flat line  
**LIMTSL**; Sloping line  
**LIMTSP**; Single point  
**LIMU** [value]; Upper limit  
Define characteristics of limit test segment.

**LINFREQ**;  
Select linear frequency sweep.

**LINM**;  
Select cartesian Linear Magnitude format for active  
channel.

**LINTDATA** [value]; Data  
**LINTMEMO** [value]; Memory  
Set line type plot options.

**LISFREQ**;  
Select frequency list sweep mode.

**LISV**;  
List data values to display.

**LOAD** <1-5>;  
Recall specified disc file.  
Must pass control.

**LOADREC** <1-5>;  
Load specified receiver cal data disc file.

**LOADSEQ** <1-6>;  
Load specified test sequence disc data file.

**LOADSOU** <1-5>;  
Load specified source cal data disc file.

**LOGFREQ**;  
Select log frequency sweep.

**LOGM**;  
Select log magnitude display format for active channel.

**LOOC** [value];  
Set value of test sequence loop counter.

**LOWPIMPU**; Impulse  
**LOWPSTEP**; Step  
Select time domain stimulus model.

**LRN?**;  
Output learn string

**MANTRIG**;  
Select manual trigger.

**MARK** <1-4> [value[suffix]];  
Select active marker  
Move it to specified stimulus value.

**MARKBUCK** [0-# of pts-1];  
Move active marker to specified data point number.

**MARKCENT** [value[suffix]];  
Move active marker to Center stimulus value.

**MARK <COUP | UNCO>;**

Select Markers always coupled/uncoupled.  
Preset selects Coupled.

**MARKCW;**

Change Center stimulus value to active marker stimulus value.

**MARKDELA;**

Set electrical delay to balance phase at marker frequency.  
Delay = zero seconds; flat phase at marker.

**MARK <DISC | CONT>;**

Select Discrete (measured data points only), or  
Continuous (linear interpolation between actual data points),  
Preset selects Discrete.

**MARKFAUV [value[suffix]];**

Set fixed marker auxiliary value offset.

**MARKFSTI [value[suffix]];**

Set fixed marker stimulus offset value.

**MARKFVAL [value];**

Set fixed marker position value offset.

**MARKMAXI;**

Select Marker Search mode; execute search for maximum data value.

**MARKMIDD;**

In limit table segment edit, change the segment middle value to the current marker amplitude.

**MARKMINI;**

Select Marker Search mode; execute search for minimum data value.

**MARKOFF;**

Select all markers and marker functions Off.

**MARKREF;**

Change reference position value to current marker amplitude value.

**MARKSPAN;**

Change stimulus span to current delta marker stimulus value.

**MARKSTAR;**

Change stimulus start to current marker stimulus value.

**MARKSTIM;**

In limit table segment edit, change the limit stimulus break point to the current marker stimulus value.

**MARKSTOP;**

Change stimulus stop to current marker stimulus value.

**MARKZERO;**

Fixed marker moves to current active marker position and becomes delta ref marker.

**MAXF [value[freq suffix]];**

Maximum frequency for current cal standard.

**MEASA; Input A**

**MEASB; Input B**

**MEASR; Input R**

Select measurement for active channel.

**MEASTAT <ONOFF>;**

Select trace statistics.

**MENUAVG;**

**MENUCAL;**

**MENUCOPY;**

**MENUDISP;**

**MENUFORM;**

**MENUMARK;**

**MENUMEAS;**

**MENUMRKF;**

**MENU <ONOFF>;**

**MENURECA;**

**MENUSAVE;**

**MENUSCAL;**

**MENUSTIM;**

**MENUSYST;**

Display specified softkey menu.

**MINF [value[freq suffix]];**

Minimum frequency for current cal standard.

**MINU;**

Select display of complex data minus memory.

**MODI1;**

Modify current electrical cal kit.

**MODIO;**

Modify current optical cal kit.

**NEWSE <1-6>;**

Modify specified test sequence.

**NEXP;**

Display next page of operating parameters list.

**NOOP;**

No Operation.

Sets Operation Complete status bit.

**NUMG [value];**

Restart averaging, execute the specified number of groups of sweeps, then hold.

**NUMR [value];**

Set number of power meter readings per point during cal.

**OFSD [value[time suffix]];** Electrical delay

**OFSL [value];** Electrical loss

**OFSOINDR [value];** Optical refractive index

**OFSOLENG [value];** Physical length

**OFSOLOSS [value];** Optical loss

**OFSORPOW [value];** Percent reflectance

**OFSZ [value];** Electrical offset line Z0.

Specify offset characteristics of current cal standard.

**OMII;**

Omit isolation part of cal.

**OPC[?];**

Operation complete.

If ?, send "1" when following command is complete.

**OPEP;**

Display operating parameters list.

**OPTA [value];**

Set optical attenuator.

**OUTPACTI** to **POWOM** <ON|OFF>

**OUTPACTI**; Active function value.  
**OUTPAFR**; Signal Processor RF frequency  
**OUTPAPER**; Smoothing aperture, stimulus units.  
**OUTPCALC** <01-12>; Active cal set array  
**OUTPCALK**; Current cal kit (Form1)  
**OUTPCALR**; Receiver cal data  
**OUTPCALS**; Source cal data  
**OUTPCNTR**; Service, abus counter.  
**OUTPDATA**; Active channel corrected data  
**OUTPERRO**; Error message (ASCII #, "string")  
**OUTPFORM**; Active channel formatted data  
**OUTPIDEN**; Instrument id string (see IDN?);  
**OUTPKEY**; Last key pressed (Keycode table)  
**OUTPLEAS**; Instrument learn string (Form1)  
**OUTPLIMF**; Limit test, failed point  
**OUTPLIML**; Limit test, each point  
**OUTPLIMM**; Limit test, marker position  
**OUTPMARK**; Active marker (x,y,stimulus)  
**OUTPMPUL**; Current memory data  
**OUTPMEMO**; Pulse width (x,y,duty cycle)  
**OUTPMRIS**; Rise time (x,y,z)  
**OUTPMSTA**; Marker stats (mean, std dev, p-p)  
**OUTPMWID**; Bandwidth search (bw, center, Q)  
**OUTPMWIL**; Band search (bw,center,Q,loss)  
**OUTPOPTS**; Service, option sum  
**OUTPPLOT**; HP-GL plot string  
**OUTPPMCAL** <1|2>; Power meter cal, Channel  
**OUTPPRIN**; Raster dump to printer  
**OUTPRAW** <1-4>; Current raw data  
**OUTPRFFR**; External source frequency  
**OUTPSEQ** <1-6>; Specified test sequence  
**OUTPSTAT**; Status byte (FORM4)  
**OUTPTESS**; Test status  
**OUTPTITL**; Display title (FORM4)  
**OUTPTPLL**; True pll sequence  
Output specified data via HP-IB.

**PAUS**;  
Pause in test sequence.

**PCB** [value];  
Pass Control Back address.  
See **ADDRCONT**;

**PDATA** <ON|OFF>;  
Select data trace plot option.

**PEEK**;  
**PEEL** <memory address>;  
Peek/Poke location.  
Service use only.

**PENNDATA** [value]; Data trace, limit lines  
**PENNGRAT** [value]; Graticule  
**PENNMARK** [value]; Markers and marker text  
**PENNMEMO** [value]; Memory trace  
**PENNTXT** [value]; Text and User graphics  
Define plotter pen color for portion of plot.

**PGRAT** <ON|OFF>;  
Select graticule plot option.

**PHAO** [value];  
Set phase offset.

**PHAS**;  
Select cartesian phase format for active channel.

**PLOS** <FAST|SLOW>;  
Select plotter pen speed  
Preset selects fast.

**PLOT**;  
Request a plot.  
Requires pass control mode.

**PMEM** <ON|OFF>;  
Select memory trace plot option.

**PMKR** <ON|OFF>;  
Select marker and marker text plot option.

**PMTRTTIT**;  
In test sequence, read power meter/HP-IB value into title string.

**POIN** [value];  
Define number of points in current frequency list segment.

**POKE** value;  
Change contents of memory location.  
Service use only.

**POLA**;  
Select Polar display format for active channel.

**POLMLIN**; lin mag, phase  
**POLMLOG**; log mag, phase  
**POLMRI**; real, imaginary  
Select polar format marker units.

**PORE** <ON|OFF>;  
Select Port Extensions On/Off.

**PORT1** [value{time suffix}];  
**PORT2** [value{time suffix}];  
**PORTA** [value{time suffix}];  
**PORTB** [value{time suffix}];  
Set port extensions electrical delay.

**PORTR** [value{time suffix}]; Reflection  
**PORTT** [value{time suffix}]; Transmission  
Set port extensions electrical delay

**POWE** [value];  
Set source output level (dBm).

**POWLFREQ** [value{freq suffix}];  
Define current frequency in the power loss list.

**POWLLIST**;  
Begin power loss list edit for power meter cal.

**POWLLOSS** [value];  
Set the power loss value for the current frequency in the power loss list.

**POWM** <ON|OFF>;  
Selects that HP 436 (On) or HP 438 (Off) is used in service procedures.

**POWOM** <ON|OFF>;  
Select guided setup instructions at instrument power up.



**POWS <ON | OFF>;**

Select Power sweep mode.

**POWT <ON | OFF>;**

Set Power Trip Off, then On to clear port input power overload condition.

**PRES;**

Instrument Preset.

**PRIC;**

Select color print.

**PRINALL;**

Copy measurement display to printer according to plot options.

**PRINSEQ <1-6>;**

Print specified test sequence.

**PRIS;**

Select standard print.

**PSOFT <ON | OFF>;**

Select plot softkey labels option.

**PTEXT <ON | OFF>;**

Select plot text option.

**PULV [value];**

Set pulse width search value.

**PULW <ON | OFF>;**

Select pulse width search Off/On.

**PURG <1-5>;**

Purge specified file from disc.

Requires pass control.

**PWMCEACS;** Cal each sweep; no cal sweep

**PWMCOFF;** Correction Off

**PWMCONES;** One sweep cal; use cal sweep

Select power meter cal.

Preset selects Off.

**PWRLOSS <ON | OFF>;**

Select power loss table.

Preset selects Off.

**RAID;**

Done with Response and Isolation cal. If all necessary standard classes have been measured, a cal set is created.

**RAISOL;**

Measure Isolation standard in Response & Isolation cal.

**RAIRESP;**

Measure Response standard in Response & Isolation cal.

**READRECT;** Receiver

**READSOUT;** Source

Read disc electro-optical cal data file titles.

**REAL;**

Select Real cartesian format for active channel.

**RECA <1-5>;**

Recall the specified instrument state.

**RECCSTDI;** Current coefficients

**RECDSTDI;** Load from disk.

Select receiver model.

**RECO;**

Recall colors.

**REFD;**

Done with Reflection part of Full 2-port cal.

**REFL;**

Begin Reflection part of Full 2-port cal.

**REFP [value];**

Set Reference Position Line graticule.

0 = bottom; 10 = top.

**REFT;**

Recall register titles from disk.

Requires pass control mode.

**REFV [value];**

Set current format reference position line value.

**RESC;**

Resume last measurement calibration sequence.

**RESD;**

Restore measurement display.

**RESPDONE;**

Finished with Response cal. If all necessary standards are measured, a cal set will be created.

**REST;**

Measurement restart.

**REVI;** Isolation

**REVM;** Load match

**REVT;** Tracking

Select reverse transmission (S12) calibration standard class.

Measure if single standard in class, or, if multiple standards in class, use **STAN <char>**; and **DONE**; to measure standards in class.

**RFLP;**

Select reflection port.

**RIGL;** Right Lower

**RIGU;** Right Upper

Select plot quadrant.

**RIST <ON | OFF>;**

Select rise time search Off/On.

**RSCO;**

Reset color.

**RST;**

Instrument Preset.

**S11;****S12;****S21;****S22;**

Select parameter displayed on current active channel.

## **SADD to SPAR<ON|OFF>**

### **SADD;**

Add a segment to current frequency list or limit table.

### **SAMC<ON|OFF>;**

Select internal sampler correction Off/On.  
Preset selects On.

### **SAV1;**

Finished with 1-port cal. If all necessary standards are measured, a 1-port cal set is created.

### **SAV2;**

Finished with 2=Port cal. If all necessary standards are measured, a 2-port cal set is created.

### **SAVC;**

Create a cal set using current error coefficient arrays.

### **SAVE<1-5>;**

Save the current instrument state in specified register.

### **SAVEOPTK;**

Save active optical cal kit as optical user cal kit.

### **SAVERECC;** Receiver

### **SAVESOUC;** Source

Store current electro-optical coefficients.

### **SAVEUSEK;**

Store the active calibration kit as the User kit.

### **SAVUASCI;** Save using CITIFile ASCII

### **SAVUBINA;** Save using binary

Select disc file format.

See Disc File Name table.

### **SCAL** [value];

Set graticule x-axis or polar scale/division for current format.

### **SCAPFULL;** Full plot.

### **SCAPGRAT;** Expand to P1 and P2.

Select plot option.

### **SDEL;**

Delete current frequency list segment or limit table segment.

### **SDON;**

Done with current frequency list segment or limit table segment, include segment in list.

### **SEAL;** Search Left

### **SEAR;** Search Right

Initiate marker search left or right from current position for selected Min, Max, or Target. Message if not found.

### **SEAMAX;** Search for Maximum

### **SEAMIN;** Search for Minimum

### **SEAOFF;** Search Mode Off

### **SEATARG** [value]; Search for target.

Select Marker Search mode; execute search.

### **SEDI** [value];

Edit current or specified frequency list segment.

### **SEQWAIT** [value];

In test sequence, wait integer seconds.

### **SETF;**

Set harmonic frequency steps for time domain low pass transform.

### **SETZ;**

Define Z0 of Smith Chart, Inverted Smith.  
Load cal standard type, **CONVZ**; and **CONV**;  
Preset selects Z0=50 ohms.

### **SHOM;**

In test sequence, show menu.

### **SING;**

Single sweep or set of sweeps, then hold.

### **SLID;**

Sliding load done.

### **SLIL;**

Define load standard type as sliding.

### **SLIS;**

Slide is set; measure sliding load.

### **SLOPE** [value];

Enter power slope value (dB/GHz)

### **SLOP<ON|OFF>;**

Select power slope Off/On.

### **SM<1-8>**

### **SM2<D,E,H,L, or M>;**

Service, source control.

### **SMIC;**

Select Smith chart display format for current channel.

### **SMIMGB;** $G \pm jB$

### **SMIMLIN;** linear magnitude, phase angle

### **SMIMLOG;** $20\log_{10}(\text{linear mag})$ , phase angle

### **SMIMRI;** real/imaginary pair

### **SMIMRX;** $R \pm jX$

Select Smith chart marker readout format.

### **SMOOAPER** [0.1-20]; Smoothing aperture

### **SMOOOFF;** Smoothing Off

### **SMOOON** [0.1-20]; Smoothing On

Control smoothing for selected channel.

value=percent of span: 0.1, 0.2, 0.5,...20 sequence.

### **SOFR;**

Display instrument operating system revision.

### **SOFT<1-8>;**

Select the softkey function for the current displayed menu.

### **SOUCSTDI;** Current coefficients

### **SOUDSTDI;** Load from disc.

Select source model

### **SPAN** [value[suffix]];

Set stimulus span.

### **SPAR<ON|OFF>;**

S-parameter notation On/Off.

**SPECFWDM** stanAno[,stanBno...[stanGno]];  
**SPECFWDT** stanAno[,stanBno...[stanGno]];  
**SPECRESI** stanAno[,stanBno...[stanGno]];  
**SPECRESP** stanAno[,stanBno...[stanGno]];  
**SPECREVM** stanAno[,stanBno...[stanGno]];  
**SPECREVT** stanAno[,stanBno...[stanGno]];  
**SPECS11A** stanAno[,stanBno...[stanGno]];  
**SPECS11B** stanAno[,stanBno...[stanGno]];  
**SPECS11C** stanAno[,stanBno...[stanGno]];  
**SPECS22A** stanAno[,stanBno...[stanGno]];  
**SPECS22B** stanAno[,stanBno...[stanGno]];  
**SPECS22C** stanAno[,stanBno...[stanGno]];  
Specify from 1 to 7 standards in each calibration standard class.  
StanAno=first standard in class,  
StanGno=last standard in class.

**SPEG<ON|OFF>;**  
Select gate markers.

**SPLD<ON|OFF>;**  
Select split display On/Off.

**SRE** [value];  
Service request enable. (0-256)  
Value defines bits enabled to generate SRQ.

**SSEG** [value];  
Measure specified single segment of frequency list.

**STAF** [value[freq suffix]];  
Set start frequency with transform On.

**STAN<A-G>;**  
Measure cal standard in current standard class.

**STAR** [value[suffix]];  
Set Start stimulus value.

**STB?;**  
Output status byte.

**STDD;**  
Done with current standard definition.

**STDDEFI;**  
Done with optical cal standards.

**STDARBI;** 1-port arbitrary impedance  
**STDDELA;** Delay/Thru 2-port  
**STDTFRES;** Fresnel  
**STDLOAD;** 1-port Z0 load  
**STDOPEN;** Open circuit  
**STDOTHR;** Thru  
**STDRECE;** Receiver  
**STDREFL;** Reflector  
**STDTHOR;** Short circuit  
**STDTSOUR;** Source  
**STDTHRR;** Thru/receiver  
Define current standard type.

**STOP** [value[suffix]];  
Set Stop stimulus value.

**STOR<1-5>;**  
Store file to disc.

**STORSEQ<1-6>;**  
Store specified test sequence.

**STPSIZE** [value[freq suffix];  
Define current frequency list segment step size.

**SVCO;**  
Save colors.

**SWEA;**  
Select sweep time, auto.

**SWET** [value[time suffix]];  
Set sweep time.

**SWR;**  
Select SWR display for active channel.

**TAKCS;**  
Begin power meter calibration sweep.

**TALKLIST;**  
Set instrument to talker/listener mode.

**TERI** [value];  
Define real terminal impedance of arbitrary impedance standard.

**TESR<1,2,4,6,or 8>;**  
Service, send test response.

**TESS?;**  
Return "1" if S-parameter test set.  
Return "2" if doubler test set.

**TEST** [value];  
Service, select test.

**TIMDTRAN<ON|OFF>;**  
Select time domain transform On/Off.

**TINT** [0-100];  
Set color hue  
(0=red, 100=violet).

**TITF<1-5>["string"];** Disk file.  
**TITL** ["string"]; CRT title.  
**TITR<1-5>["string"];** Save/recall register.  
**TITSEQ<1-6>["string"];** Test sequence.  
**TITSEQ** ["string"]; Current test sequence.  
**TITMEM** ["string"]; Trace memory.  
**TITPMTR** ["string"]; Power meter address  
**TITTPRIN** ["string"]; printer address  
Send title string to specified function.

**TO**<1-2> <**ON**|**OFF**> to **WRSK**<1-8>["string"]

**TO**<1-2> <**ON**|**OFF**>;  
Service, test record option.

**TRACK**<**ON**|**OFF**>;  
Select marker search tracking Off/On.

**TRAD**;  
Done with transmission part of Full 2-port cal.

**TRAN**;  
Begin transmission part of Full 2-port cal.

**TRAP**;  
Display frequency values with transform On.

**TRAS** [value[freq suffix]];  
Enter new frequency span with transform On.

**TRIG**;  
Select HP-IB triggered data acquisition.  
Instrument does Hold, sets status bit, then wait for HP-IB  
Group Execute Trigger for next measurement step,  
executes trigger, then sets status bit.  
Exit using **FRER**;, **CONT**;, or **PRES**;

**TST?**;  
Initiate self-test sequence;  
Return zero if pass.

**TTLOH**; High  
**TTLOL**; Low  
Defines active level of test set TTL output.

**UP**;  
Increment current active function value.

**USEPASC**;  
Instrument enters pass control mode.

**USESENSA**; Sensor A  
**USESENSB**; Sensor B  
Select power sensor.

**VELOFACT** [value];  
Define velocity factor of transmission medium.

**VOFF** [value];  
Define frequency offset value.

**WAIT**;  
Wait for a clean sweep.

**WAVE**;  
Define cal standard as Waveguide (dispersive) phase.  
Standard rectangular waveguide,  
**MAXF**; sets cutoff frequency.

**WIDT**<**ON**|**OFF**>;  
Select bandwidth search On/Off.

**WIDV** [value];  
Define bandwidth search value in current format.

**WINDMAXI**; Maximum window  
**WINDMINI**; Minimum window  
**WINDNORM**; Normal window  
**WINDOW** [value]; Arbitrary window  
**WINDUSEMOFF**; Above commands define window  
**WINDUSEMON**; Trace memory defines window  
Select time domain window shape.

**WRSK**<1-8>["string"];  
Enter new softkey label.

## List of OPC'able Codes

The Operation Complete (OPC) function allows synchronization of the program by causing a specific action when the current command has completed executing, before the next command begins executing. There are two forms for this process. The function is enabled by issuing **OPC**; or **OPC?**; prior to an OPC'able command. An example of this usage is **OPC; PRES**. In this instance, the Operation Complete bit is automatically set when the Preset command has completed execution. Issuing **OPC?**; prior to the command causes the instrument to set the Operation Complete status bit then output a "1" when the command has completed execution.

Following is an alphabetical list of OPC'able commands.

<b>CHAN1;</b>	<b>ISOD;</b>
<b>CHAN2;</b>	<b>MANTRIG;</b>
<b>CLEARALL;</b>	<b>NOOP;</b>
<b>DATI;</b>	<b>NUMG;</b>
<b>DONE;</b>	<b>PRES;</b>
<b>DON&lt;A,B,AR,BR&gt;CAL;</b>	<b>RAID;</b>
<b>EDITDONE;</b>	<b>RECA&lt;1-5&gt;;</b>
<b>EXTTOFF;</b>	<b>REFD;</b>
<b>EXTTPOIN;</b>	<b>RESPDNE;</b>
<b>FREQOFFS&lt;ON OFF&gt;;</b>	<b>RST;</b>
<b>FREQRANG&lt;3GHZ 6GHZ&gt;;</b>	<b>SAV1;</b>
<b>HARMOFF;</b>	<b>SAV2;</b>
<b>HARMSEC;</b>	<b>SAVC;</b>
<b>HARMTHIR;</b>	<b>SAVE&lt;1-5&gt;;</b>
<b>INSMEXSA;</b>	<b>SING;</b>
<b>INSMEXSM;</b>	<b>STAN&lt;A-G&gt;;</b>
<b>INSMNETA;</b>	<b>TRAD;</b>
<b>INSMTUNR;</b>	<b>WAIT;</b>

## Interrogate Instrument State (Query) Commands

All instrument functions can be interrogated to find the current On/Off state or value.

For instrument state commands, append the question mark (?) character instead of <ON|OFF> to interrogate the state of the functions. An example is **AVER?**. The analyzer responds to the next controller Enter operation with a "1" or a "0" to indicate On or Off, respectively.

For settable functions such as **SCAL** [value];, using **SCAL?**; causes the analyzer to respond to the next controller enter operation by outputting the current function value then clearing the instrument entry area.

If a command that does not have a defined response is interrogated, the instrument outputs a zero.

