# Programmer's Guide

## HP 8590 Series Spectrum Analyzer

HEWLETT PACKARD

HP Part No. 5960-6537 Microfiche Part No. 5960-6538
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## HP 8590 Series Spectrum Analyzer Documentation Description

In addition to the programmer's guide, the following guides are shipped with your spectrum analyzer:

The Calibration Guide for Your Spectrum Analyzer

- Tells you how to test your spectrum analyzer to determine if the spectrum analyzer meets its specifications.

*HP 8590 Series Spectrum Analyzer User's Guide*

- Tells you how to make measurements with your spectrum analyzer.
- Describes the spectrum analyzer features.
- Tells you what to do in case of a failure.

*HP 8590 Series Spectrum Analyzer Quick Reference Guide*

- Describes how to make a simple measurement with your spectrum analyzer.
- Briefly describes the spectrum analyzer functions.
- Lists all the programming commands.

### How to Order Guides

Each of the guides listed above can be ordered individually. To order, contact your local HP Sales and Service Office.

# How to Use This Guide

## Where to Start

- If you have not configured your spectrum analyzer in your computer system, first read Chapter 1, "Preparing for Use." This chapter tells you how to set up your computer and spectrum-analyzer system.
- If you are familiar with spectrum analyzer programming and wish to find the description of a programming command, turn to Chapter 5, "Programming Commands."
- If you are not familiar with spectrum analyzer programming:
  - Turn to Chapter 2, "Writing a Program." This chapter introduces spectrum analyzer programming by leading you through a simple spectrum analyzer measurement.
  - After you've successfully made your first measurement (or if you are experienced in remote operation of the spectrum analyzer), you can turn to Chapter 3, "Programming Topics," which demonstrates advanced programming techniques. Or, if you begin writing your own programs, turn to Chapter 5, "Programming Commands," for command descriptions.
  - If you want to learn how to write a downloadable program (DLP) or use the DLP editor, turn to Chapter 4, "Creating and Using Downloadable Programs."

## This guide uses the following conventions:

| | |
|---|---|
| (Front-Panel Key) | A boxed, uppercase name in this typeface represents a key physically located on the instrument. |
| **Softkey** | A boxed word written in this typeface indicates a "softkey," a key whose label is determined by the instrument's firmware. |
| `Screen Text` | Text printed in this typeface indicates text displayed on the spectrum analyzer screen. |

**Caution** The CAUTION symbol denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a CAUTION symbol until the indicated conditions are fully understood and met.

## Spectrum Analyzers with Earlier Versions of Firmware

This guide documents programming commands that may not have been available with earlier versions of firmware. The following table lists the programming commands that have been added with a firmware revision.

**Spectrum Analyzer Commands Added with Firmware Revision**

| Command Mnemonic | Option Required | First Available with Firmware Revision |
|---|---|---|
| ACP | | 17.3.92 |
| ACPBW | | 17.3.92 |
| ACPCONTM | | 17.3.92 |
| ACPE | | 17.3.92 |
| ACPGRAPH | | 17.3.92 |
| ACPPAR | | 17.3.92 |
| ACPSNGLM | | 17.3.92 |
| ACPSP | | 17.3.92 |
| AMPCOR | | 03.01.90 |
| AMPLEN | | 17.3.92 |
| ANLGPLUS | 101 or 301 | 17.7.91 |
| BITF | | 17.3.92 |
| CHP | | 17.3.92 |
| CLRBOX | | 17.3.92 |
| COUPLE | | 10.10.90 |
| DA | | 17.3.92 |
| DOTDENS | 101 or 301 | 17.7.91 |
| DRAWBOX | | 17.3.92 |
| FFTAUTO | | 17.3.92 |
| FFTCLIP | | 17.3.92 |
| FFTCONTS | | 17.3.92 |
| FFTMKR | | 17.3.92 |
| FFTMM | | 17.3.92 |
| FFTMS | | 17.3.92 |
| FFTOFF | | 17.3.92 |
| FFTPCTAM | | 17.3.92 |
| FFTPCTAMR | | 17.3.92 |
| FFTSNGLS | | 17.3.92 |
| FFTSTAT | | 17.3.92 |
| FFTSTOP | | 17.3.92 |
| GATE | 105 | 10.10.90 |
| GATECTL | 105 | 10.10.90 |
| GC | 105 | 10.10.90 |
| GD | 105 | 10.10.90 |
| GDRVCLPAR | 105 | 17.3.92 |
| GDRVGDEL | 105 | 17.3.92 |
| GDRVGLEN | 105 | 17.3.92 |
| GDRVGT | 105 | 17.3.92 |
| GDRVGTIM | 105 | 17.3.92 |
| GDRVPRI | 105 | 17.3.92 |
| GDRVPWID | 105 | 17.3.92 |
| GDRVRBW | 105 | 17.3.92 |
| GDRVREFE | 105 | 17.3.92 |
| GDRVST | 105 | 17.3.92 |

## Spectrum Analyzer Commands Added with Firmware Revision (continued)

| Command Mnemonic | Option Required | First Available with Firmware Revision |
|---|---|---|
| GDRVSWAP | 105 | 17.3.92 |
| GDRVSWDE | 105 | 17.3.92 |
| GDRVSWP | 105 | 17.3.92 |
| GDRVUTIL | 105 | 17.3.92 |
| GDRVVBW | 105 | 17.3.92 |
| GL | 105 | 10.10.90 |
| GP | 105 | 10.10.90 |
| LIMIDEL | | 03.01.90 |
| LIMIDISP | | 17.3.92 |
| LIMIFAIL | | 03.01.90 |
| LIMIFT | | 17.3.92 |
| LIMISEGT | | 17.3.92 |
| LIMIHI | | 10.10.90 |
| LIMILINE | | 03.01.90 |
| LIMILO | | 10.10.90 |
| LIMIMIRROR | | 03.01.90 |
| LIMIMODE | | 03.01.90 |
| LIMIREL | | 03.01.90 |
| LIMISEG | | 03.01.90 |
| LIMISEGT | | 17.3.92 |
| LIMITEST | | 03.01.90 |
| LINFILL | | 17.3.92 |
| LSPAN | | 10.10.90 |
| MEANTH | | 10.10.90 |
| MEASOFF | | 17.3.92 |
| MEASURE | 010 or 011 | 03.01.90 |
| MERGE | | 17.3.92 |
| MKACTV | | 17.3.92 |
| MKDLMODE | | 17.3.92 |
| MKTBL | | 17.3.92 |
| NDB | | 17.3.92 |
| NDBPNT | | 17.3.92 |
| NDBPNTR | | 17.3.92 |
| NRL | | 03.01.90 |
| OBW | | 17.3.92 |
| OBWPCT | | 17.3.92 |
| ONMKRU | | 17.3.92 |
| PCTAM | | 17.3.92 |
| PCTAMR | | 17.3.92 |
| PKDLMODE | | 17.3.92 |
| PKRES | | 17.3.92 |
| PKSORT | | 17.3.92 |
| PKTBL | | 17.3.92 |
| PKZMOK | | 17.3.92 |
| PKZOOM | | 17.3.92 |
| POWERON | | 03.01.90 |
| PREAMPG | | 10.10.90 |
| PWRUPTIME | | 17.3.92 |
| RESETRL | | 03.01.90 |

## Spectrum Analyzer Commands Added with Firmware Revision (continued)

| Command Mnemonic | Option Required | First Available with Firmware Revision |
|---|---|---|
| RLPOS | | 03.01.90 |
| SEGDEL | | 03.01.90 |
| SENTER | | 03.01.90 |
| SENTERT | | 17.3.92 |
| SRCALC | 010 or 011 | 03.01.90 |
| SRCAT | 010 or 011 | 03.01.90 |
| SRCNORM | 010 or 011 | 03.01.90 |
| SRCPOFS | 010 or 011 | 03.01.90 |
| SRCPSTP | 010 or 011 | 03.01.90 |
| SRCPSWP | 010 or 011 | 03.01.90 |
| SRCPWR | 010 or 011 | 03.01.90 |
| SRCTK | 010 or 011 | 03.01.90 |
| SRCTKPK | 010 or 011 | 03.01.90 |
| SWPCPL | 010 or 011 | 03.01.90 |
| SYNCMODE | | 17.3.92 |
| TOI | | 17.3.92 |
| TOIR | | 17.3.92 |
| TVSTND | 101 and 102 (301) | 03.01.90 |
| WAIT | | 10.10.90 |
| WINNEXT | | 17.3.92 |
| ZMKCNTR | | 17.3.92 |
| ZMKSPAN | | 17.3.92 |
| ZMKPKNR | | 17.3.92 |
| ZMKPKNL | | 17.3.92 |

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# Preparing for Use

## What You'll Learn in This Chapter

This chapter tells you how to connect a computer to your spectrum analyzer via the Hewlett-Packard Interface Bus (HP-IB) or the RS-232 Interface and how to connect a printer or a plotter. The remainder of the chapter covers procedures to follow if a problem is encountered.

### Connecting Your Spectrum Analyzer to a Computer

The spectrum analyzer works with many popular computers. However, the steps required to connect your spectrum analyzer to a specific computer depend on the computer you are using. Before turning to the interconnection instructions for your computer, please read the following general information.

### Configuring Your Computer System

Every computer system has a specific configuration. Your system configuration might include a printer, external disk drive, or plotter. Whenever you add another piece of equipment (for example, your spectrum analyzer), you may need to reconfigure your computer system so that the computer knows where and how to send information to the newly added device.

Some computers do not require configuring when a spectrum analyzer is connected; others require a simple modification. The most common modification is changing the configuration information stored on the computer's operating system disk. A few computers require the insertion of an add-on board, or "card." Refer to your computer documentation if your system needs these modifications.

All of the test programs for HP-IB and RS-232 interfaces are written using the BASIC language of the computer under consideration. If you have never entered or run a BASIC program, refer to your computer documentation.

### Connecting the Computer to the Spectrum Analyzer

#### For the HP-IB Interface

Refer to Appendix B for a detailed description of the HP-IB interface.

Appendix B contains instructions for connecting the spectrum analyzer's HP-IB interface to either an HP 9000 Series 200, or a Series 300 computer, or to an HP Vectra PC equipped with an HP 82300B BASIC Language Processor. If your computer is not listed, but it supports an HP-IB interface, there is a good possibility that it can be connected to the spectrum analyzer. Consult your computer documentation to determine how to connect external devices on the bus.

### For the RS-232 Interface

Refer to Appendix C for a detailed description of the RS-232 interface.

Appendix C contains instructions for connecting the spectrum analyzer's RS-232 interface to an HP Vectra PC or IBM PC/AT or compatible computers. If your computer is not listed, but it supports a standard RS-232 interface, there is a good possibility that the spectrum analyzer may be connected to the computer. Consult your computer documentation to determine how to connect external devices to your computer's RS-232 connector.

There are two types of RS-232 devices: data terminal equipment (DTE) and data communication equipment (DCE). Types of DTE devices include display terminals. DCE equipment includes modems and, generally, other computer RS-232 devices. The spectrum analyzer RS-232 port is the DTE-type. Connections from the computer (DCE) to the spectrum analyzer (DTE) are shown in Appendix C.

## The Test Program

To test the system configuration, a simple test program is provided for each computer listed. After you have connected your computer and spectrum analyzer, you should enter and run the test program on your computer to make sure the computer is sending instructions to the spectrum analyzer through the interface cable. If the interface is working and the program is entered correctly, a statement is displayed on the computer screen.

**Note**

The listed computer and spectrum analyzer equipment includes the minimum components necessary to establish communication between your spectrum analyzer and computer. If you are using application software, check with your software supplier for specific computer hardware and memory requirements.

**Note**

Using an interface cable other than the one listed with your computer's interconnection instructions may prevent proper communication between the spectrum analyzer and computer.

Pressing (CONFIG) removes the spectrum analyzer from remote mode and enables front-panel control.

# HP-IB Connections for the HP 9000 Series 200 Technical Computers

## Equipment

- HP 9816, 9826, or 9836 Series 200 technical computer.
- HP 8590 Series spectrum analyzer with Option 021.
- HP 10833 (or equivalent) HP-IB cable.

## Interconnection Instructions

Connect the spectrum analyzer to the computer using the HP-IB cable. Figure 1-1 shows an HP 9836 computer connected to the spectrum analyzer.

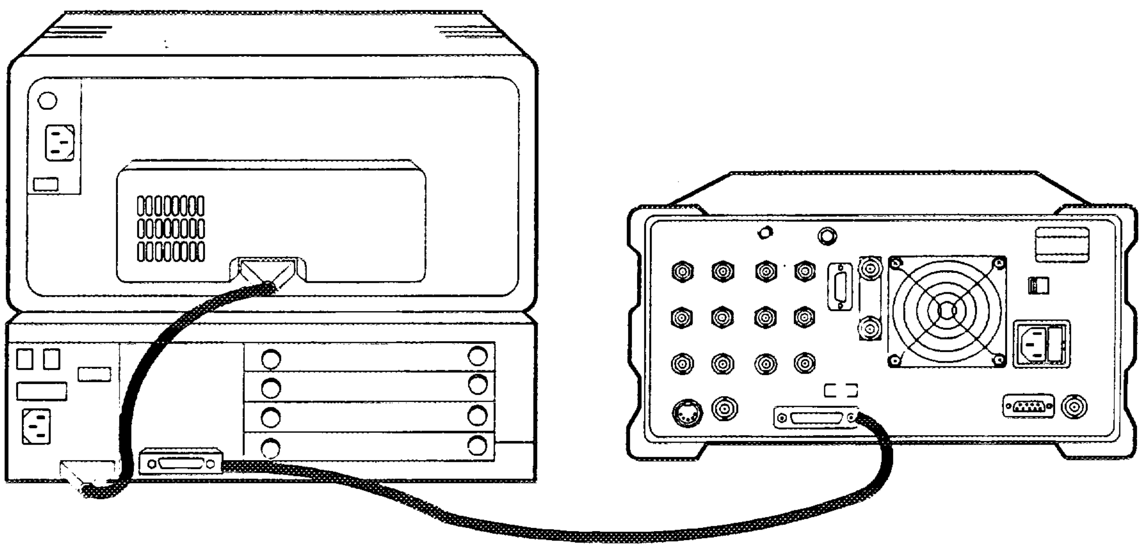



**Figure 1-1. Connecting the HP 9000 Series 200 Computer to the Spectrum Analyzer**

## Test Program

To test the connection between the computer and the spectrum analyzer, turn on your spectrum analyzer and follow the instructions below.

1. Your HP 9000 Series 200 computer may have either a soft-loaded or built-in language system. If your language system is built-in, remove any disks from the drives and turn on the computer.
2. If your language is soft-loaded, install the BASIC language disk into the proper drive. Turn the computer power on. After a few seconds, the `BASIC READY` message appears; the computer is now ready for use.

   For further information on loading BASIC on your system, consult your BASIC manual.
3. Check the HP-IB address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**. The usual address for the spectrum analyzer is 18. If necessary, reset

the address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, 18, (Hz) (or enter the appropriate address).

4. Enter the following program, then press (RUN) on the computer. If you need help entering and running the program, refer to your computer and software documentation.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 PRINTER IS 1
20 Analyzer=718
30 CLEAR Analyzer
40 OUTPUT Analyzer;"IP;SNGLS;"
50 OUTPUT Analyzer;"CF 300MZ;TS;"
60 OUTPUT Analyzer;"CF?;"
70 ENTER Analyzer;A
80 PRINT "CENTER FREQUENCY = ";A;"Hz";
90 END
```

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep.

The program then queries the center frequency value and tells the computer to display CENTER FREQUENCY = 3.0E+8 Hz.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## HP-IB Connections for the HP 9000 Series 300 Technical Computers

### Equipment

- HP 98580A, 98581A, 98582A, or 98583A Series 300 technical computer.
- HP 8590 Series spectrum analyzer with Option 021.
- HP 10833 (or equivalent) HP-IB cable.

### Interconnection Instructions

Connect the spectrum analyzer to the computer using the HP-IB cable as shown in Figure 1-2.

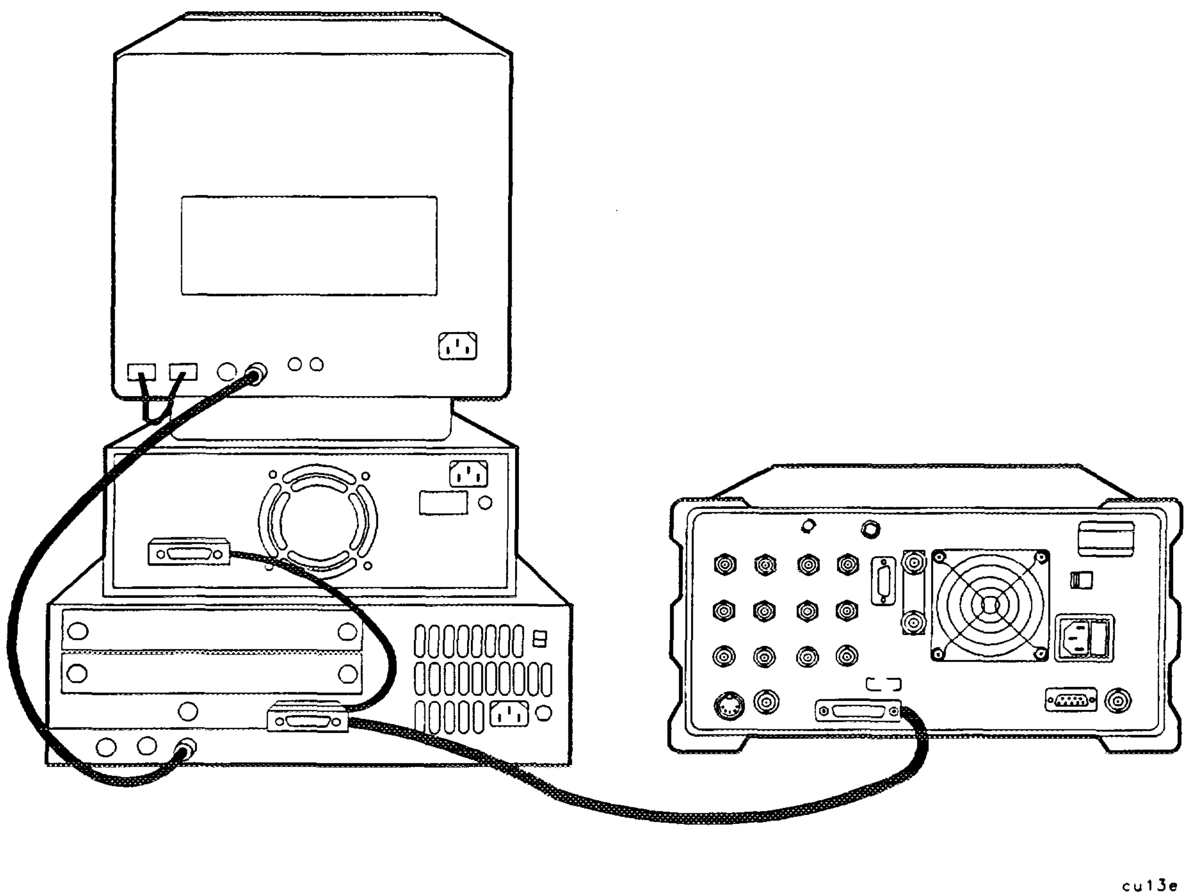



**Figure 1-2. Connecting the HP 9000 Series 300 Computer to the Spectrum Analyzer**

## Test Program

To test the connection between the computer and the spectrum analyzer, turn on your spectrum analyzer and follow the instructions below.

1. Your HP 9000 Series 300 computer may have either a soft-loaded or built-in language system. If your language system is built-in, remove any disks from the drives and turn on the computer.
2. If your language is soft-loaded, install the BASIC language disk into the proper drive. Turn the computer power on. After a few seconds, the BASIC READY message appears; the computer is now ready for use.

   For further information on loading BASIC on your system, consult your BASIC manual.
3. Check the HP-IB address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**. The usual address for the spectrum analyzer is 18. If necessary, reset the address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, 18, (Hz) (or enter the appropriate address).
4. Enter the following program, then press (RUN) on the computer. If you need help entering and running the program, refer to your computer and software documentation.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 PRINTER IS 1
20 Analyzer=718
30 CLEAR Analyzer
40 OUTPUT Analyzer;"IP;SNGLS;"
50 OUTPUT Analyzer;"CF 300MZ;TS;"
60 OUTPUT Analyzer;"CF?;"
70 ENTER Analyzer;A
80 PRINT "CENTER FREQUENCY = ";A;"Hz";
90 END
```

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep.

The program then queries the center frequency value and tells the computer to display CENTER FREQUENCY = 3.0E+8 Hz.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

# HP-IB Connections for the HP Vectra Personal Computer

## Equipment

- HP Vectra personal computer, with option HP 82300B, the HP BASIC Language Processor.
- HP 8590 Series spectrum analyzer with Option 021.
- HP 10833 (or equivalent) HP-IB cable.

## Interconnection Instructions

Connect the spectrum analyzer to the computer using the HP-IB cable as shown in Figure 1-3.

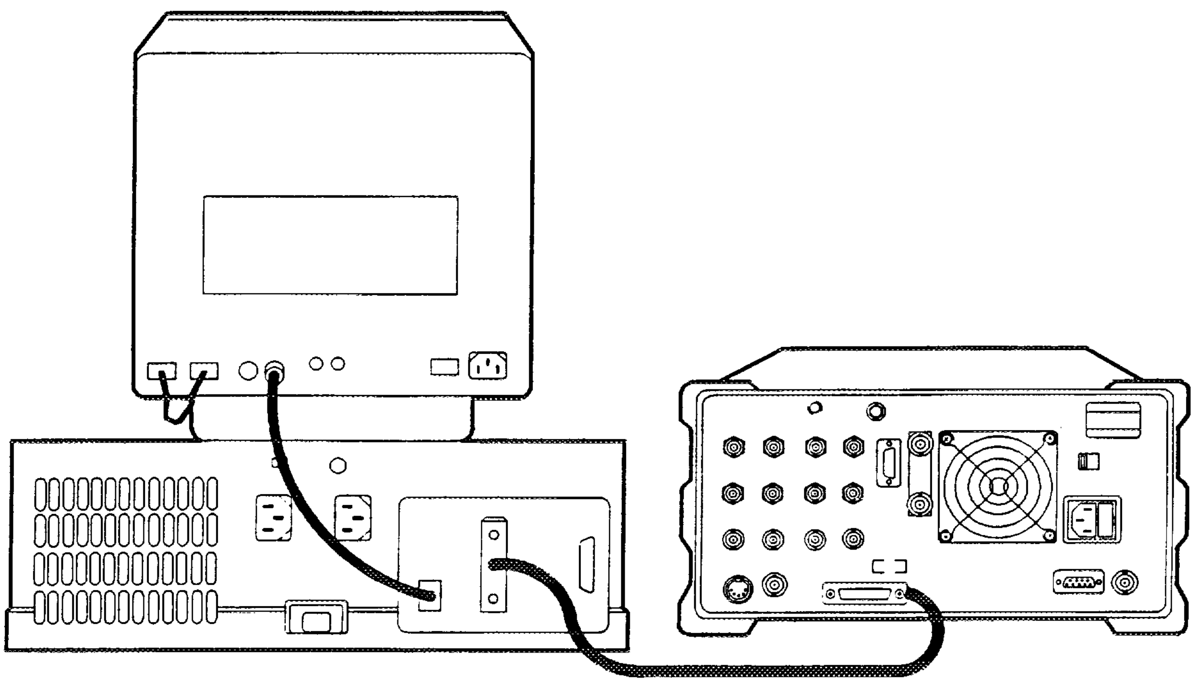



**Figure 1-3. Connecting the HP Vectra Personal Computer to the Spectrum Analyzer**

## Test Program

To test the connection between the computer and the spectrum analyzer, turn on your spectrum analyzer and follow the instructions below.

1. Refer to the HP 82300 Language Processor documentation to install the language processor board in your computer and load the BASIC programming language into your computer.
2. Check the HP-IB address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**. The usual address for the spectrum analyzer is 18. If necessary, reset the address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, 18 (Hz) (or enter the appropriate address).

3. Enter the following program, then press (F10) on the computer. If you need help entering and running the program, refer to your computer and software documentation.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 PRINTER IS 1
20 Analyzer=718
30 CLEAR Analyzer
40 OUTPUT Analyzer;"IP;SNGLS;"
50 OUTPUT Analyzer;"CF 300MZ;TS;"
60 OUTPUT Analyzer;"CF?;"
70 ENTER Analyzer;A
80 PRINT "CENTER FREQUENCY = ";A;"Hz";
90 END
```

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep. The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz.`

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## RS-232 Connections for the HP Vectra Personal Computer

### Equipment

- HP Vectra personal computer with RS-232 interface that has an 9-pin female port.
- HP 8590 Series spectrum analyzer with Option 023.
- HP 24542G RS-232 cable.

### Interconnection Instructions

1. Connect the spectrum analyzer to the computer using the RS-232 cable as shown in Figure 1-4.

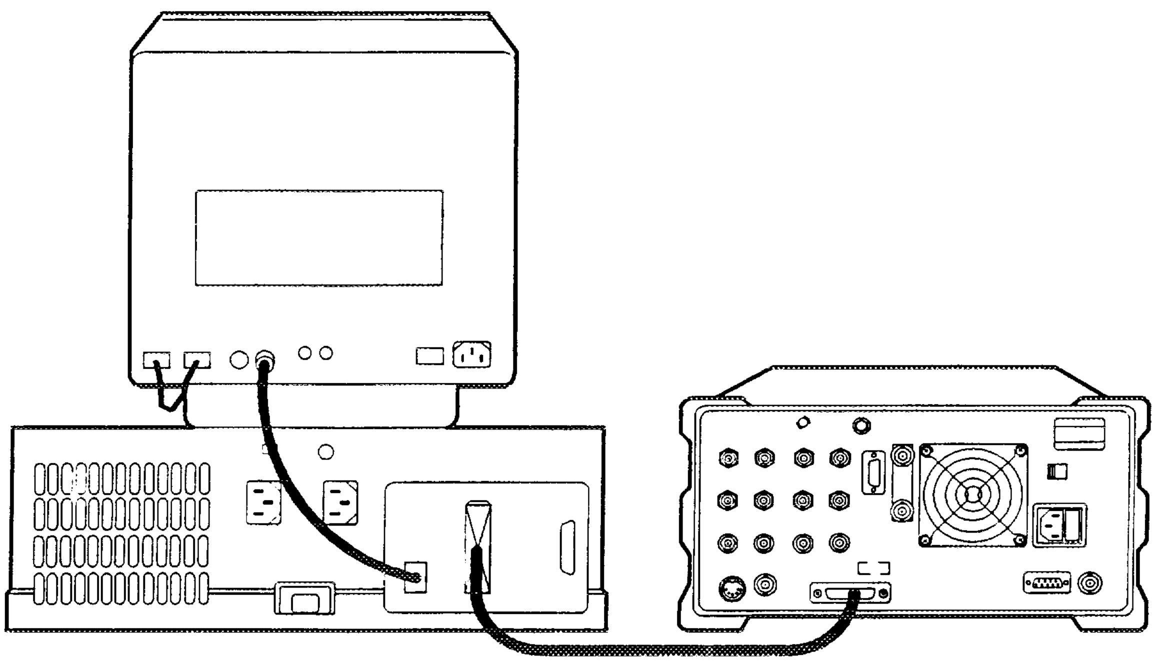



**Figure 1-4. Connecting the HP Vectra Personal Computer to the Spectrum Analyzer**

2. Turn on the spectrum analyzer and the computer.

### Test Program

The program shown below works with the following computers:

- HP Vectra PC using a version of BASIC (HP 45952A) for the Vectra PC. The MS BASIC Interpreter (HP 35190A) is compatible with the version of BASIC for the Vectra PC.
- IBM PC/AT and compatible computers using BASICA (version 2.0 or later) or GW BASIC.

To test the interconnection, first load the BASIC language for your computer and specify a communications buffer of 4096 bytes. Use the following command:

```
BASICA/C:4096
```

Set the spectrum analyzer baud rate to 1200, to match the baud rate set up for the computer port in the test program. In line 20, the "1200" indicates 1200 baud for the computer port. Press the following keys to set the baud rate: CONFIG, **More 1 of 3**, **BAUD RATE**, 1200, Hz.

Enter the following test program. The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 'File = TESTPGM
20 OPEN "COM1:1200,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;"
50 PRINT #1,"CF 300MZ;TS;"
60 PRINT #1,"CF?;"
70 INPUT #1,CENTER
80 PRINT,"CENTER FREQ = ";CENTER;"Hz"
90 END
```

When you have entered the program, type:

```
SAVE "TESTPGM"
```

When you are ready to run the program, turn on the spectrum analyzer and run your program.

The program tells the spectrum analyzer to perform an instrument preset and enter single sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep. The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## RS-232 Connections for the IBM PC/AT and Compatible Computers

### Equipment

- IBM PC/AT or compatible with RS-232 interface.
- HP 8590 Series spectrum analyzer with Option 023.
- HP 13242G RS-232 cable (DCE-DCE), 7 pins used (refer to Appendix C for wiring of this cable).

### Interconnection Instructions

1. Connect the spectrum analyzer to the computer with the RS-232 cable. (See Figure 1-5.) The spectrum analyzer uses a female RS-232 connector; the IBM PC/AT computer usually uses a male RS-232 connector. Some compatibles use a female RS-232 connector.

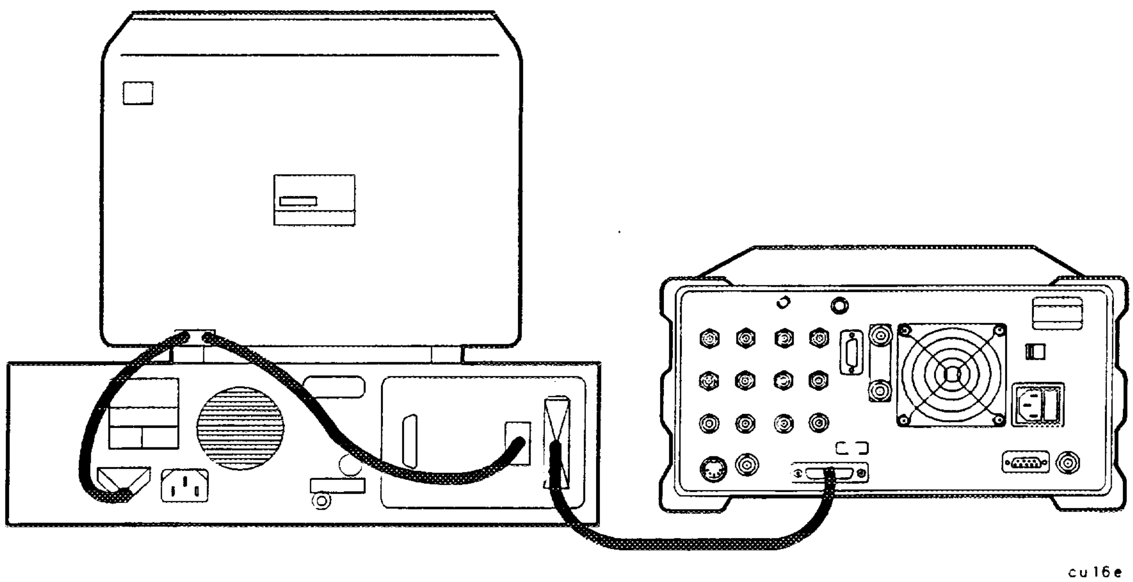



**Figure 1-5. Connecting an IBM PC/AT Compatible Computer to the Spectrum Analyzer**

2. Turn on the spectrum analyzer and the computer.

### Test Program

The program shown below is written to work with BASICA (version 2.0 or later) or GW BASIC.

To test the interconnection, first load the BASIC language for your computer and specify a communications buffer of 4096 bytes. Use the following command:

```
BASICA/C:4096
```

Set the spectrum analyzer baud rate to 1200, to match the baud rate set up for the computer port in the test program. In line 20, the "1200" indicates 1200 baud for the computer port. To set the baud rate to 1200:

1. Press (CONFIG), **More 1 of 3**.
2. Press the **BAUD RATE** softkey.
3. Press these keys: 1200 (Hz).

Enter the following test program.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 'File = TESTPGM
20 OPEN "COM1:1200,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;"
50 PRINT #1,"CF 300MZ;TS;"
60 PRINT #1,"CF?;"
70 INPUT #1,CENTER
80 PRINT,"CENTER FREQ = ";CENTER;"Hz"
90 END
```

When you have entered the program, type:

```
SAVE "TESTPGM"
```

When you are ready to run the program, turn on the spectrum analyzer and run your program.

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep. The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## Printing or Plotting

You may wish to obtain a permanent record of data displayed on the spectrum analyzer screen. This can be done using the (COPY) key of the spectrum analyzer, and a printer or plotter.

**Note** The HP 7470A plotter does not support 2 plots per page. If you use an HP 7470A plotter with an HP 8590 Series spectrum analyzer, you can select one plot per page or four plots per page, but not 2 plots per page.

### Printer with an HP-IB Interface

#### Equipment

- HP 8590 Series spectrum analyzer with Option 021.
- HP 2225 ThinkJet printer or HP 3630A PaintJet color printer.
- HP 10833 (or equivalent) HP-IB cable.

### Interconnection and Printing Instructions

1. Turn off the printer and the spectrum analyzer.
2. Connect the printer to the spectrum analyzer using the HP-IB cable.

**Note** Because HP-IB cables can be connected together, more than one instrument can communicate on the HP-IB. This means that both a printer and a plotter can be connected to the spectrum analyzer (using two HP-IB cables). Each device must have its own HP-IB address.

**Note** Because the spectrum analyzer cannot print or plot with two controllers (the computer and the spectrum analyzer) connected, the computer must be disconnected from the HP-IB.

3. Turn on the spectrum analyzer and printer.
4. On the spectrum analyzer, press (CONFIG), **Print Config**.
5. The printer usually resides at the first device address. To enter address 1 for the printer, press PRINTER ADDRESS, 1, (Hz).
6. If the spectrum analyzer is connected to an HP PaintJet printer and you want a color printout, press PAINTJET PRINTER (so that the PAINTJET PRINTER softkey label is underlined). If the spectrum analyzer is connected to an HP PaintJet printer and you want a black and white printout, press B&W PRINTER (so that the B&W PRINTER softkey label is underlined).
7. If you want the softkey labels to be printed with the spectrum analyzer display printout, press PRT MENU ON OFF so that ON is underlined.
8. Press **Previous Menu**, COPY DEV PRNT PLT (PRNT should be underlined), then (COPY).

## Plotter with an HP-IB Interface

### Equipment

- HP 8590 Series spectrum analyzer with Option 021.
- HP 7440A ColorPro plotter.
- HP 10833 (or equivalent) HP-IB cable.

### Interconnection and Plotting Instructions

1. Turn off the plotter and the spectrum analyzer.
2. Connect the plotter to the spectrum analyzer using the HP-IB cable.

**Note** Because HP-IB cables can be connected together, more than one instrument can communicate on the HP-IB. This means that both a printer and a plotter can be connected to the spectrum analyzer (using two HP-IB cables). Each device must have its own HP-IB address.

**Note** Because the spectrum analyzer cannot print or plot with two controllers (the computer and the spectrum analyzer) connected, the computer must be disconnected from the HP-IB.

3. Turn on the spectrum analyzer and the plotter.
4. On the spectrum analyzer, press (CONFIG), **Plot Config**.
5. The plotter usually resides at the fifth device address. To set the plotter address, press PLOTTER ADDRESS, 5, (Hz), to enter the address 5 for the plotter.
6. With PLTS/PG 1 2 4, you can choose a full-page, half-page, or quarter-page plot. Press PLTS/PG 1 2 4 to underline the number of plots per page desired.
7. If two or four plots per page are chosen, a function is displayed that allows you to select the location on the paper of the plotter output. If two plots per page are selected, then the PLT □LOC _ _ function is displayed. If four plots per page are selected, then the PLT □ _LOC _ _ is displayed. Press the softkey until the rectangular marker is in the desired section of the softkey label. The upper and lower sections of the softkey label graphically represent where the plotter output will be located.

**Note**

For a multi-pen plotter, the pens of the plotter draw the different components of the screen as follows:

| Pen Number | Description |
|---|---|
| 1 | Draws the annotation and graticule. |
| 2 | Draws trace A. |
| 3 | Draws trace B. |
| 4 | Draws trace C and the display line. |
| 5 | Draws user-generated graphics and the lower-limit line. |
| 6 | Draws the upper-limit line. |

8. Press **Previous Menu**, COPY DEV PRNT PLT (PLT should be underlined), then COPY.

**Note**

Once the address of the printer and plotter have been entered, the spectrum analyzer remembers these addresses even though the power is turned off. There is no need to reenter them when the spectrum analyzer is turned off and on.

## Printer with an RS-232 Interface

### Equipment

- HP 8590 Series spectrum analyzer with Option 023.
- HP 2225 ThinkJet printer with an RS-232 interface, or HP 3630A PaintJet color printer with an RS-232 interface.

**Note**

Refer to Appendix C of this manual for the appropriate RS-232 cable connectors.

### Interconnection and Printing Instructions

1. Turn off the spectrum analyzer and the printer.

**Note**

The RS-232 interface allows only one device (either the printer or the plotter) to be connected to the spectrum analyzer.

2. Connect the printer using an RS-232 cable.
3. Turn on the spectrum analyzer and printer.
4. Press CONFIG, **More 1 of 3**.

5. To set the baud rate to 9600 baud, press **BAUD RATE**, 9600, (Hz). To set the baud rate to 1200 baud, press: **BAUD RATE**, 1200, (Hz).

**Note** Some of the programs in this manual utilize 1200 baud. If your system uses the RS-232 handshake lines, you can use 9600 baud for all of the programs.

6. Press (CONFIG), **Print Config**.
7. If the spectrum analyzer is connected to an HP PaintJet printer and you want a color printout, press **PAINTJET PRINTER** (so that the PAINTJET PRINTER softkey label is underlined). If the spectrum analyzer is connected to an HP PaintJet printer and you want a black and white printout, press **B&W PRINTER** (so that the B&W PRINTER softkey label is underlined).
8. If you want the softkey labels to be printed with the spectrum analyzer display print out, press **PRT MENU ON OFF** so that ON is underlined.
9. Press **Previous Menu**, **COPY DEV PRNT PLT** (PRNT should be underlined), then (COPY).

## Plotter with an RS-232 Interface

### Equipment

- HP 8590 Series spectrum analyzer with Option 023.
- HP 7440A ColorPro plotter with an RS-232 interface.

**Note** Refer to Appendix C of this manual for the appropriate RS-232 cable connectors.

## Interconnection and Plotting Instructions

1. Turn off the spectrum analyzer.

**Note** The RS-232 interface allows only one device (either the printer or the plotter) to be connected to the spectrum analyzer.

2. Connect the plotter using an RS-232 cable.
3. Turn on the spectrum analyzer and the plotter.
4. Press (CONFIG), **More 1 of 3**.
5. To set the baud rate to 9600 baud, press **BAUD RATE**, 9600, (Hz). To set the baud rate to 1200 baud, press: **BAUD RATE**, 1200, (Hz).

**Note**

Some of the programs in this manual utilize 1200 baud. If your system uses the RS-232 handshake lines, you can use 9600 baud for all of the programs.

6. Press (CONFIG), `Plot Config`. You can choose a full-page, half-page, or quarter-page plot with the `PLTS/PG 1 2 4` softkey. Press `PLTS/PG 1 2 4` to underline the number of plots per page desired.
7. If two or four plots per page are chosen, a function is displayed that allows you to select the location on the paper of the plotter output. If two plots per page are selected, then the `PLT [ ] LOC _ _` function is displayed. If four plots per page are selected, then the `PLT □ _LOC _ _` is displayed. Press the softkey until the rectangular marker is in the desired section of softkey label. The upper and lower sections of the softkey label graphically represent where the plotter output will be located.

**Note**

For a multi-pen plotter, the pens of the plotter draw the different components of the screen as follows:

| Pen Number | Description |
|---|---|
| 1 | Draws the annotation and graticule. |
| 2 | Draws trace A. |
| 3 | Draws trace B. |
| 4 | Draws trace C and the display line. |
| 5 | Draws user-generated graphics and the lower-limit line. |
| 6 | Draws the upper-limit line. |

8. Press `Previous Menu`, `COPY DEV PRNT PLT` (so that PLT is underlined), then (COPY).

## Printing after Plotting or Plotting after Printing

Pressing (COPY) without changing `COPY DEV PRNT PLT` produces the function last entered (a print or a plot).

- To print after doing a plot, press (CONFIG), `COPY DEV PRNT PLT` (so that PRNT is underlined), then (COPY).
- To plot after printing, press (CONFIG), `COPY DEV PRNT PLT` (so that PLT is underlined), and (COPY).

## If There is a Problem

This section offers suggestions to help get your computer and spectrum analyzer working as a system. The test programs provided in this chapter let you know if the connection between the computer and the spectrum analyzer interconnection is working properly.

If the test program does not run, try the following suggestions:

1. You may need to modify the program syntax to work with your computer. Refer to your BASIC manual for correct syntax.
2. The program must be executed correctly. Refer to your computer manual for information about program execution.
3. Check your program for errors.

If the test program runs on the computer, but the spectrum analyzer does not respond, try the following suggestions:

1. Make sure the spectrum analyzer is turned on. If the spectrum analyzer has power, the green indicator light above the line switch is on.
2. Make sure the interface cable is connected securely. Check the interface cable for defects. Make sure the correct cable is used.
3. If you are using an HP-IB interface, the spectrum analyzer must be set to the correct address setting. Press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**.
4. If you are using the RS-232 interface, check the spectrum analyzer baud rate. Refer to Appendix C for information about setting the baud rate on the spectrum analyzer.
5. If a program in user memory is suspected of causing problems, use (CONFIG), **More 1 of 3**, **DISPOSE USER MEM**, **DISPOSE USER MEM**. (**DISPOSE USER MEM** requires a double key press.) **DISPOSE USER MEM** erases all user programs, variables, personalities (which are usually in the form of downloadable programs), and user-defined traces that are in spectrum analyzer memory.
6. If you wish to reset the spectrum analyzer configuration to the state it was in when it was originally shipped from the factory, use **DEFAULT CONFIG**. To access **DEFAULT CONFIG**, press (CONFIG), **More 1 of 3**, **DEFAULT CONFIG**, **DEFAULT CONFIG**. (**DEFAULT CONFIG** requires a double key press.)

If you suspect your computer is causing the problems, check it by running a program that you know works. If your system still has problems, contact your HP salesperson. Your salesperson will either be able to help solve the problem or refer you to someone who can.

2

# Writing a Program

## What You'll Learn in This Chapter

This chapter introduces spectrum analyzer programming. The first section of this chapter, "Writing Your First Program," helps you write your first spectrum analyzer program and introduces programming fundamentals. The second section, "Getting Information from the Spectrum Analyzer," shows how to get data out of the spectrum analyzer. A summary at the end of this chapter reviews the programming guidelines introduced.

If the computer is not connected to the spectrum analyzer, follow the instructions in Chapter 1, "Preparing for Use."

A general knowledge of the BASIC programming language and the spectrum analyzer is recommended before reading this chapter. Refer to your software documentation manuals for more information about BASIC. For reference, Chapter 5 of this manual provides spectrum analyzer commands in alphabetical order.

**Note** All programming examples in this chapter for the HP-IB interface are written in HP BASIC 4.0, using an HP 9000 Series 200 computer. For the RS-232 interface, examples are written in GW BASIC, using an HP Vectra personal computer or compatible controller.

# Writing Your First Program

When the spectrum analyzer has been connected to a computer via HP-IB or RS-232 interface, the computer can be used to send instructions to the spectrum analyzer. These instructions tell the spectrum analyzer such things as frequency span, resolution bandwidth, and sweep mode. If a properly selected sequence of instructions is sent to the spectrum analyzer, a measurement is made. Sequences of coded instructions are called programs.

## Composing the Program

Most spectrum analyzer programs contain several common statements, or "commands," that address the spectrum analyzer, preset it, and select its sweep mode. As an example, we will write a short program that executes only these common commands.

The following programs are for the HP-IB and the RS-232 interfaces. Note the quotation marks that contain spectrum analyzer commands in each line. Also note the semicolons at the end of each line, inserted at the end of each set of spectrum analyzer commands within the quotation marks. Using semicolons makes programs easier to read, prevents command misinterpretation, and is recommended by IEEE Standard 728.

**Note** In commands where quotation marks occur, the computer recognizes data as character data and not BASIC programming language commands.

## Program Example for the HP-IB Interface

```
05 !File:  "IBPROG1"
10 Analyzer=718
20 CLEAR Analyzer
30 OUTPUT Analyzer;"IP;"
40 OUTPUT Analyzer;"SNGLS;TS;"
50 LOCAL 7
60 END
```

Line 10 of our program assigns a variable called "Analyzer" to our spectrum analyzer at address 718. This instruction is followed by the HP BASIC CLEAR command, which resets the spectrum analyzer on the HP-IB. With these two program lines, we have set up a clear communication path between the computer and the spectrum analyzer.

Line 30 introduces the instrument preset (IP) command, which corresponds to the (PRESET) key on the spectrum analyzer. The IP command sets all of the analog parameters of the spectrum analyzer to known values and provides a good starting point for every measurement.

**Note** All softkey functions on the spectrum analyzer have corresponding programming commands. As you continue programming, you will learn the command names that correspond to the front-panel keys and softkeys.

Line 40 activates the single-sweep mode. Most remotely controlled measurements require control of the sweep. Once SNGLS has activated the single-sweep mode, take sweep (TS) starts and completes one full sweep. TS maintains absolute control over the sweep, which is necessary for accurate computer data transfer and reduced program execution time.

Before we end the program, we return the spectrum analyzer to front-panel control with line 50, `LOCAL 7`. The LOCAL command corresponds to the (CONFIG) (LOCAL) key on the front panel of the spectrum analyzer. (`LOCAL 7` commands everything on the bus to go to local mode.)

## Description

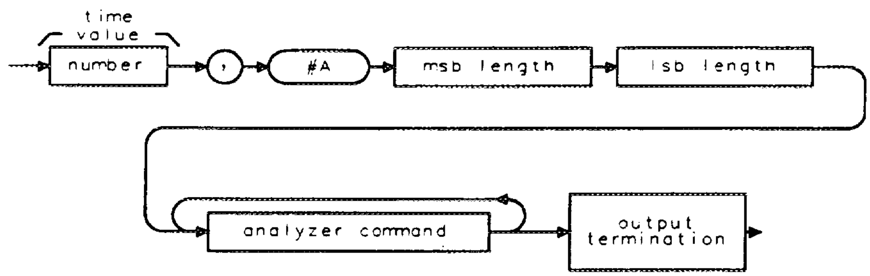
The ONCYCLE command performs the list of spectrum analyzer commands

periodically. In contrast, the ONDELAY command performs the list of spectrum analyzer commands once after the elapsed time interval. After the ONCYCLE function has been created, the first execution of the spectrum analyzer commands does not occur until the time value has elapsed.

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONCYCLE definition:** IP clears the ONCYCLE definition. You can use the DISPOSE command to clear the ONCYCLE definition also.

## Query Response

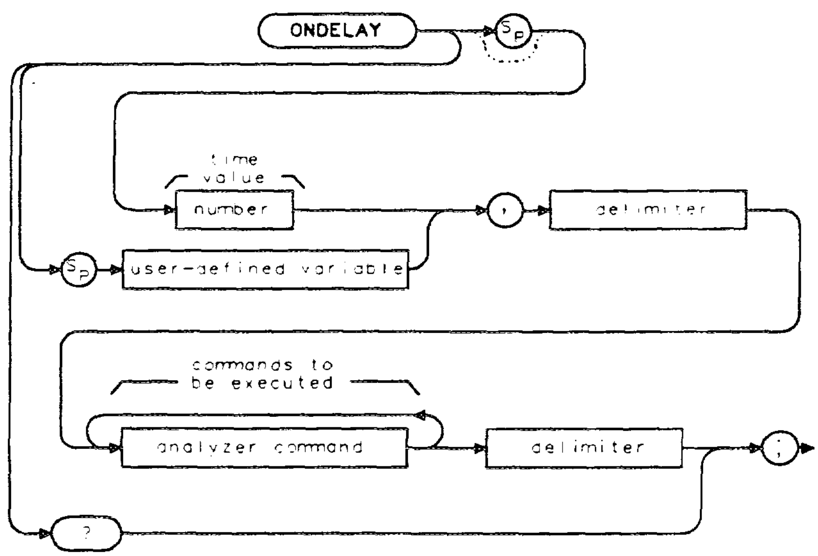



QONCYCLE

# ONDELAY
# On Delay

Executes the list of analyzer commands after the time value has elapsed.

## Syntax




XONDELAY

| Item | Description/Default | Range |
|---|---|---|
| Number | A valid number. | 0 to 2,147,483 seconds |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ` \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command. | |

Related Commands: CAT, DISPOSE, ERASE, IP, ONCYCLE, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME.

## Example

`OUTPUT 718;"ONDELAY 000030,!CF 1.2GHZ;!;"` *Changes the center frequency after 30 seconds.*

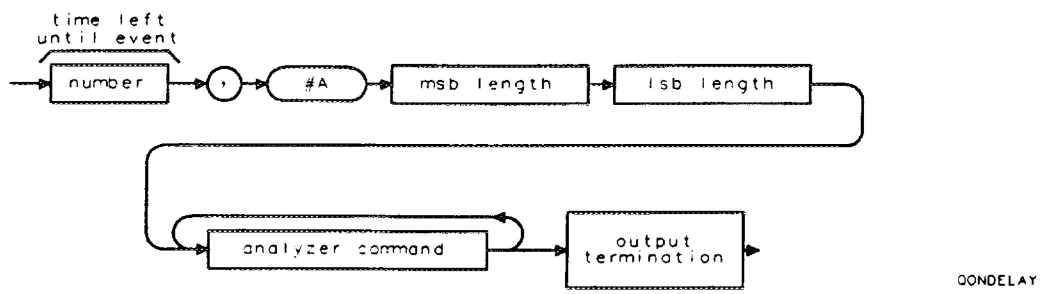
## Description

The ONDELAY command performs the list of spectrum analyzer commands once after the elapsed time interval; the ONCYCLE command performs the list of spectrum analyzer commands periodically.

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONDELAY definition:** IP clears the ONDELAY definition. You can use the DISPOSE command to clear the ONDELAY definition also.

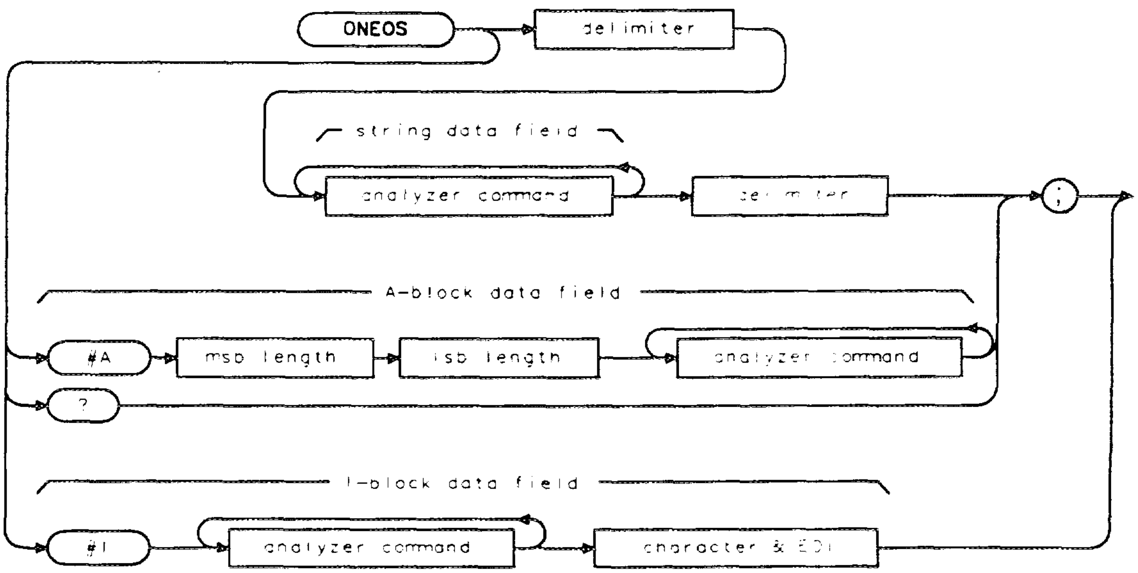
## Query Response



# ONEOS
# On End of Sweep

Executes the contents of the data field after the end of the sweep.

## Syntax




XONEOS

| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ` \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command except TS. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Character & EOI | Any valid character and END. | |

Related Commands: CAT, DISPOSE, ERASE, IP, ONSWP.

## Example

OUTPUT 718;"ONEOS!CF 100MHZ;!" *Center frequency is changed at the end of the sweep.*

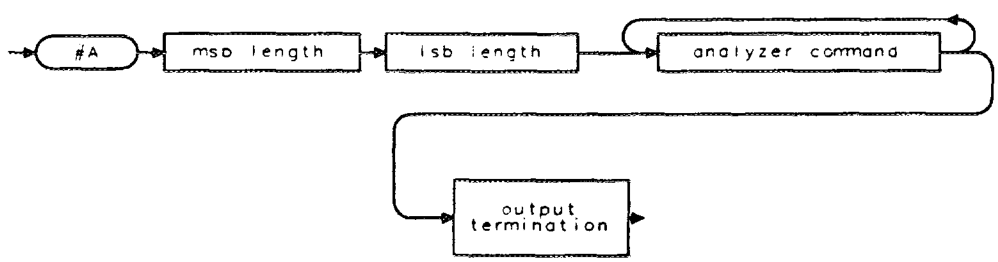
## Description

**Restrictions:** The list of analyzer commands should not include a take sweep (TS). Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

The #A, msb length, LSB length, and character data form a A-block data field. The A-block data field is used when the length of the character data is known. The #I, character data, and EOI (END) form and I-block data field. The I-block data field is used when the length of the character data is unknown. The I-block data field is available for HP-IB interface only.

**Clearing the ONEOS definition:** IP clears the ONEOS definition. You can use the DISPOSE command to clear the ONEOS definition also.

## Query Response

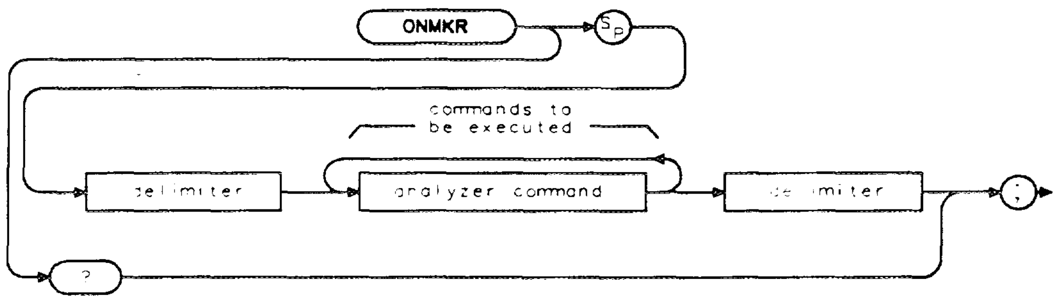



QONEOS

# ONMKR
# On Marker

Performs the list of spectrum analyzer commands when the sweep reaches the marker position.

## Syntax




XONMKR

| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command. | |

Related Commands: CAT, DISPOSE, ERASE, IP, ONCYCLE, ONDELAY, ONEOS, ONSRQ, ONSWP, ONTIME.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"ONMKR !PU,PA 100,100;TEXT@CONNECT CAL
OUT TO INPUT@;!;"
```

*The text is displayed on the spectrum analyzer screen when the sweep reaches the marker position.*

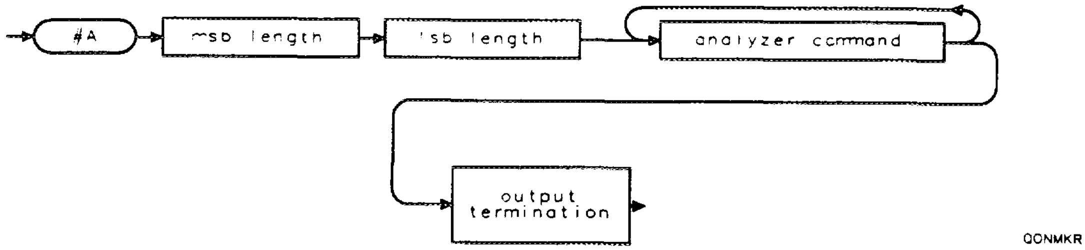
## Description

The ONMKR command performs the list of spectrum analyzer commands when the sweep reaches the marker. The sweep resumes after the list of spectrum analyzer commands is executed, provided the list of spectrum analyzer commands does not halt execution.

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONMKR definition:** IP clears the ONMKR definition. You can use the DISPOSE command to clear the ONMKR definition also.

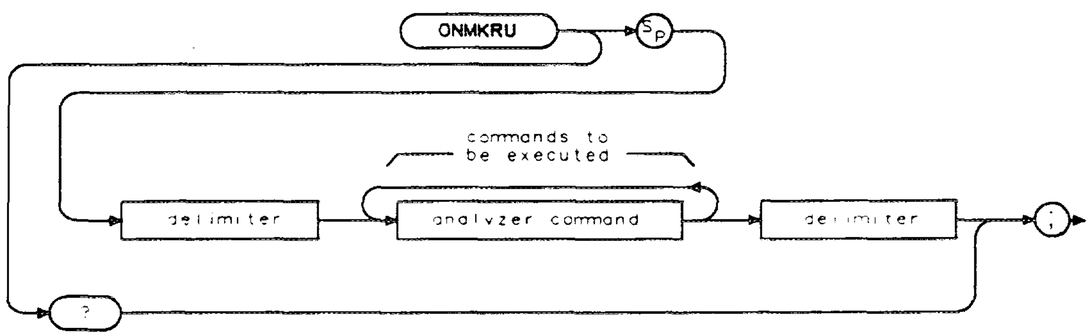
## Query Response



# ONMKRU
# On Marker Update

Executes the list of spectrum analyzer commands whenever the value or the units of the active marker are changed.

## Syntax




XONMKRU

Related Commands: DISPOSE, IP.

## Example

The following example uses ONMKRU to display the marker's amplitude in watts.

| | |
|---|---|
| `150 ASSIGN @Sa TO 718` | *Assigns the IO path to spectrum analyzer.* |
| `160 !` | |
| `170 OUTPUT @Sa;"VARDEF T_EMP,0;";` | *Defines a variable called T_EMP.* |
| `180 !` | |
| `190 OUTPUT @Sa;"ONMKRU$";` | *Starts the ONMKRU definition.* |
| `200   OUTPUT @Sa;"EXP T_EMP,MA,10;"` | *Changes the marker's amplitude value to milliwatts and places it in T_EMP.* |
| `210   OUTPUT @Sa;"MPY T_EMP,T_EMP,1000;";` | *Changes the value of T_EMP to μwatts.* |
| `220   OUTPUT @Sa;"MOV DA,0;";` | *Changes the display address to 0 to reset the display list.* |
| `230   OUTPUT @Sa;"PUPA10,101;";` | *Positions the pen.* |
| `240   OUTPUT @Sa;"TEXT^Power:^;";` | *Displays a label for the results.* |
| `250   OUTPUT @Sa;"DSPLY T_EMP,9.4;";` | *Displays the results.* |
| `260   OUTPUT @Sa;"TEXT^ uW^;";` | *Displays the units.* |
| `270 OUTPUT @Sa;"$;";` | *Ends the ONMKRU definition.* |
| `280 !` | |
| `290 OUTPUT @Sa;"CF300MZ;"` | *Sets the center frequency to the calibration signal.* |
| `300 OUTPUT @Sa;"SP1MZ;"` | *Changes the span to 1 MHz.* |
| `310 OUTPUT @Sa;"RL -20DM;"` | *Sets the reference level.* |
| `320 OUTPUT @Sa;"RB30KZ;"` | *Sets the resolution bandwidth.* |
| `330 OUTPUT @Sa;"SNGLS;TS;"` | *Takes a sweep.* |
| `340 OUTPUT @Sa;"MKN;"` | *Activates a normal marker.* |
| `350 !` | |

```
360    END
```

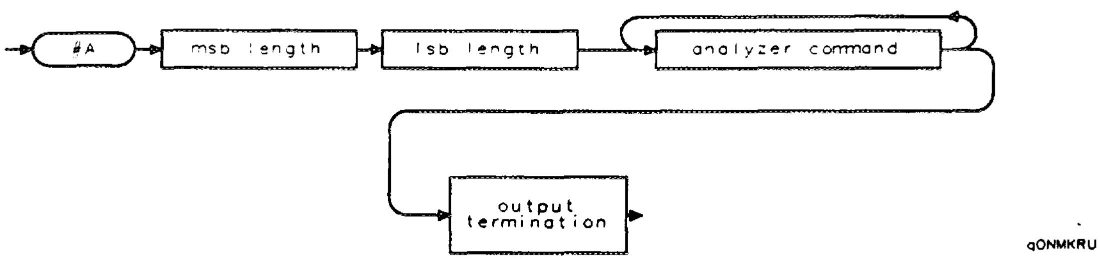
## Description

ONMKRU executes the specified user-defined function whenever the value or units of a marker are changed. While ONMKR executes the function when the marker is encountered, ONMKRU executes the function at the end of the sweep (when the marker data is updated), when the marker is moved, or if the units are changed with AUNITS. Executing any of the marker commands (for example, MKA, MKF, or MKNOISE) also executes the function.

**Restrictions:** The user-defined function should not include a take sweep (TS).

**Clearing the ONMKRU definition:** IP clears the ONMKRU definition. You can use the DISPOSE command to clear the ONMKRU definition also.

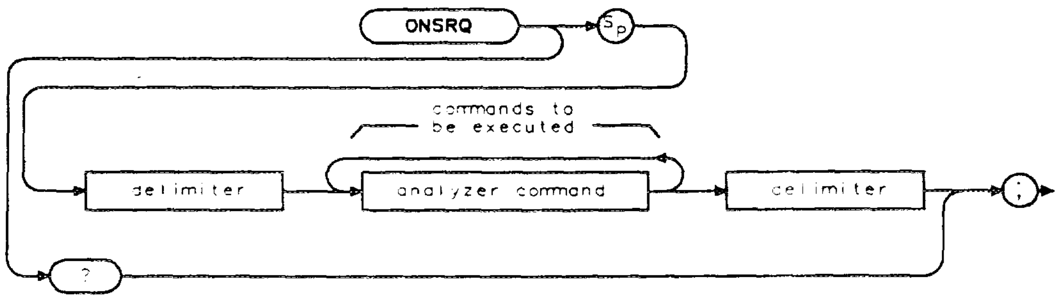
## Query Response



# ONSRQ
# On Service Request

Executes the list of analyzer commands whenever a service request occurs.

## Syntax




XONSRQ

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any spectrum analyzer command.</td><td></td></tr>
</table>

Related Commands: CAT, DISPOSE, ERASE, IP, ONDELAY, ONEOS, ONMKR, ONSWP, ONTIME, SRQ.

## Example

```
OUTPUT 718;"ONSRQ !PU;PA 100,100;TEXT @SRQ OCCURRED@;!;"
```

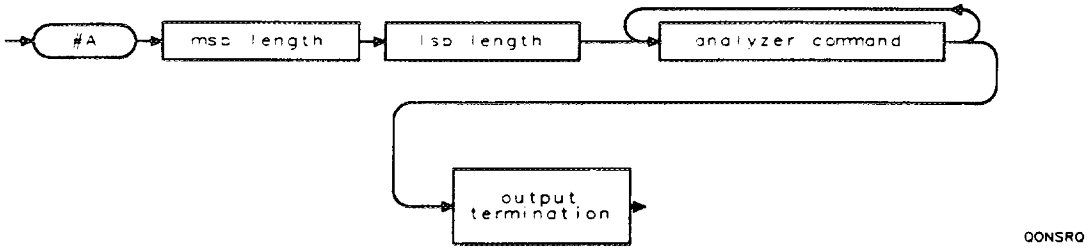
*"SRQ OCCURRED" is displayed on the spectrum analyzer screen if an SRQ is encountered.*

## Description

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONSRQ definition:** IP clears the ONSRQ definition. You can use the DISPOSE command to clear the ONSRQ definition also.

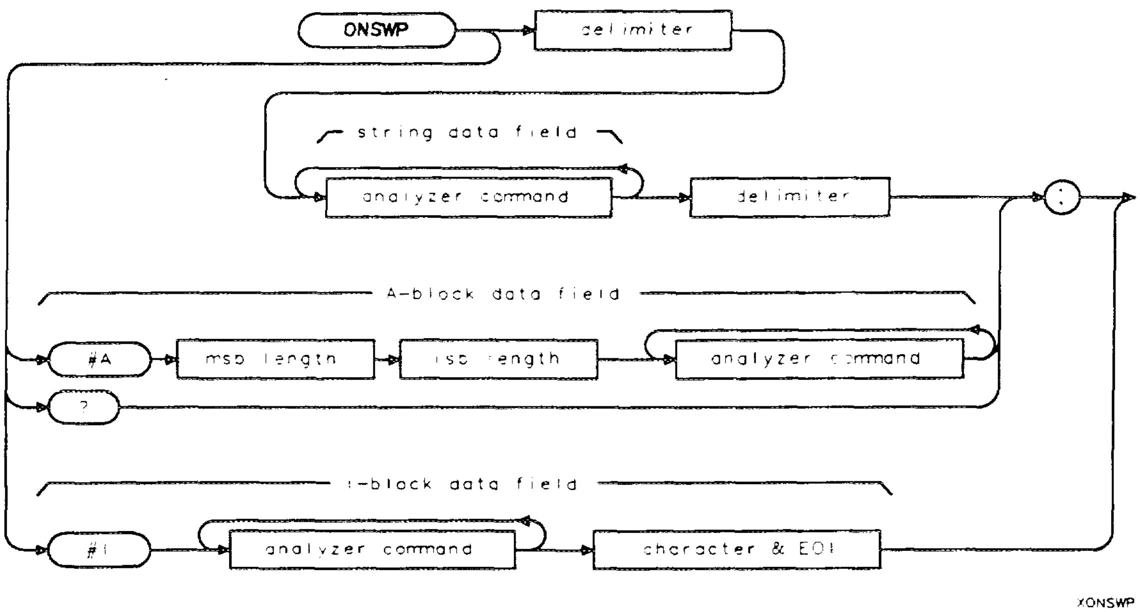
## Query Response



# ONSWP
# On Sweep

Executes the list of spectrum analyzer commands at the beginning of the sweep.

## Syntax




<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any spectrum analyzer command except TS.</td><td></td></tr>
<tr><td>Msb length</td><td>Most significant byte of a two-byte word that describes the number of bytes transmitted.</td><td></td></tr>
<tr><td>Lsb length</td><td>Least significant byte of a two-byte word that describes the number of bytes transmitted.</td><td></td></tr>
<tr><td>Character & EOI</td><td>Any valid character and END.</td><td></td></tr>
</table>

Related Commands: CAT, DISPOSE, ERASE, IP, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP.

## Example

`OUTPUT 718;"ONSWP!CF 100MHZ;!"` *The center frequency is changed to 100 MHz at the beginning of the sweep.*

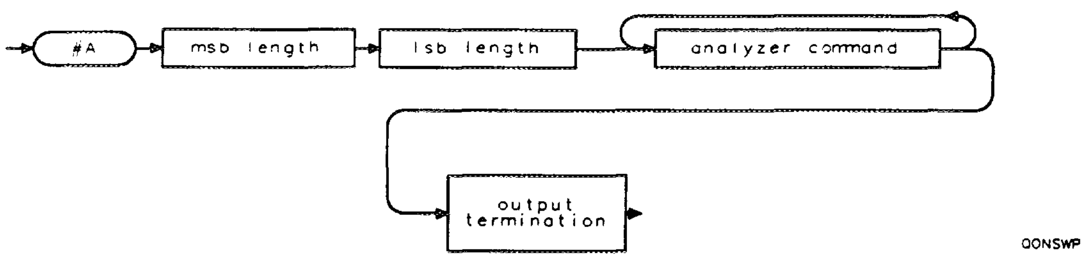
## Description

The list of analyzer commands should not include a take sweep (TS). Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

The #A, msb length, lsb length, and character data form an A-block data field. The A-block data field is used when the length of the character data is known. To use the A-block data format, #A must precede the msb length and lsb length. The msb length and lsb length represent the length of the character data. The #I, character data, and EOI (END) form an I-block data field. The I-block data field is used when the length of the character data is unknown. The I-block data field is available for the HP-IB interface only.

**Clearing the ONSWP definition:** IP clears the ONSWP definition. You can use the DISPOSE command to clear the ONSWP definition also.

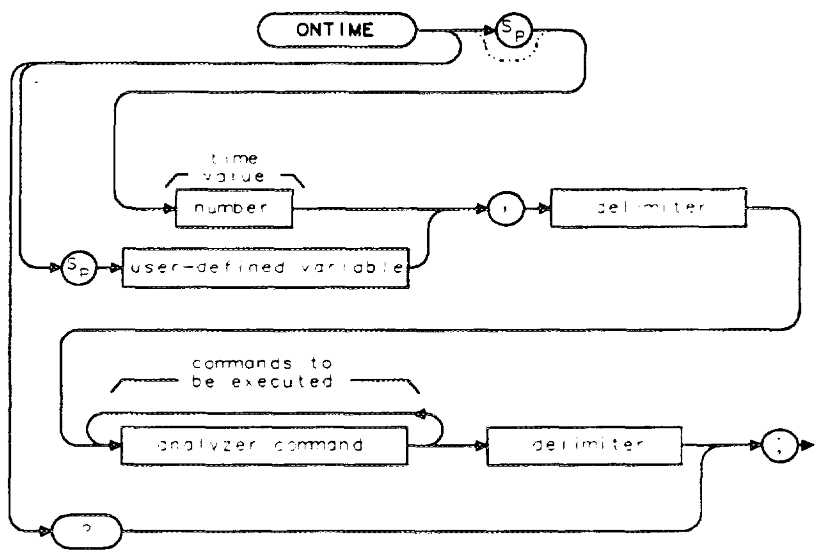
## Query Response



# ONTIME
# On Time

Executes the list of spectrum analyzer commands at the specified time.

## Syntax




XONTIME

| Item | Description/Default | Range |
|---|---|---|
| Number | A valid number in the YYMMDDHHMMSS (24 hour) format. | A valid year, month, day, and time. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command. | |

Related Commands: DISPOSE, ERASE, IP, ONDELAY, ONEOS, ONMKR, ONSWP, ONSRQ.

## Example

`OUTPUT 718;"ONTIME 890212080000,!CF 600MHZ;!;"` *Changes the center frequency on 12 February 1989, at 8 AM.*

`OUTPUT 718;"ONTIME 080000,!CF 600MHZ;!;"` *If the YYMMDD is omitted from the time value parameter, the command list is executed at the next occurrence of the time value given.*

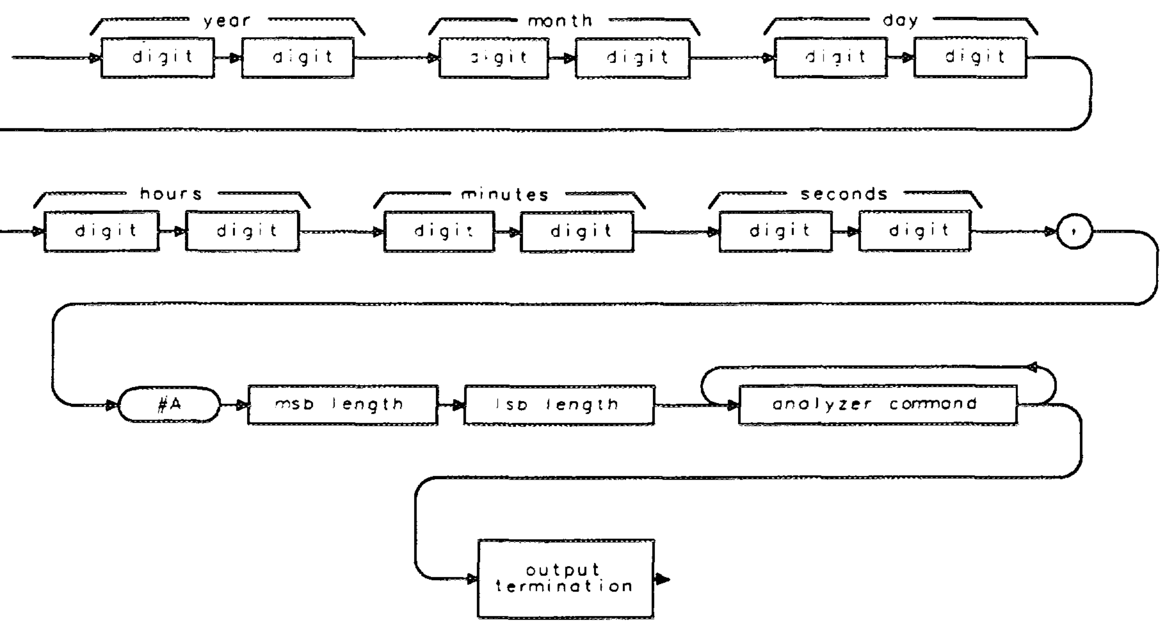
`OUTPUT 718;"ONTIME 890212150000,!CF 600MHZ;!;"` *Changes the center frequency on 12 February 1989, at 3 PM.*

## Description

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONTIME definition:** IP clears the ONTIME definition. You can use the DISPOSE command to clear the ONTIME definition also.

## Query Response




QONTIME

# OP
# Output Parameter

Returns parameter values P1 and P2, which represent the $x$ and $y$ coordinates of the lower-left and upper-right spectrum analyzer display.

## Syntax


XOP

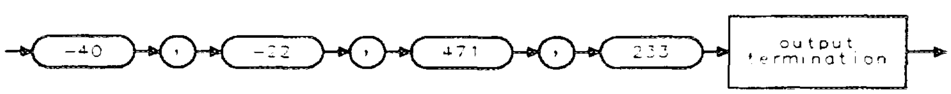
## Example

| | |
|---|---|
| `10 DIM A$[20]` | *Allocates memory space for result.* |
| `30 OUTPUT 718;"OP?;"` | *Gets the lower-left and the upper-right coordinates of the spectrum analyzer display.* |
| `40 ENTER 718;A$` | *Moves result to the computer.* |
| `50 DISP A$` | *Displays the result.* |
| `60 END` | |

## Description

The values returned represent $x$ and $y$ screen coordinates of the spectrum analyzer display. The screen coordinates designate the total on-screen area. The values returned are the minimum $x$ coordinate, the minimum $y$ coordinate, the maximum $x$ coordinate, and the maximum $y$ coordinate.

## Query Response

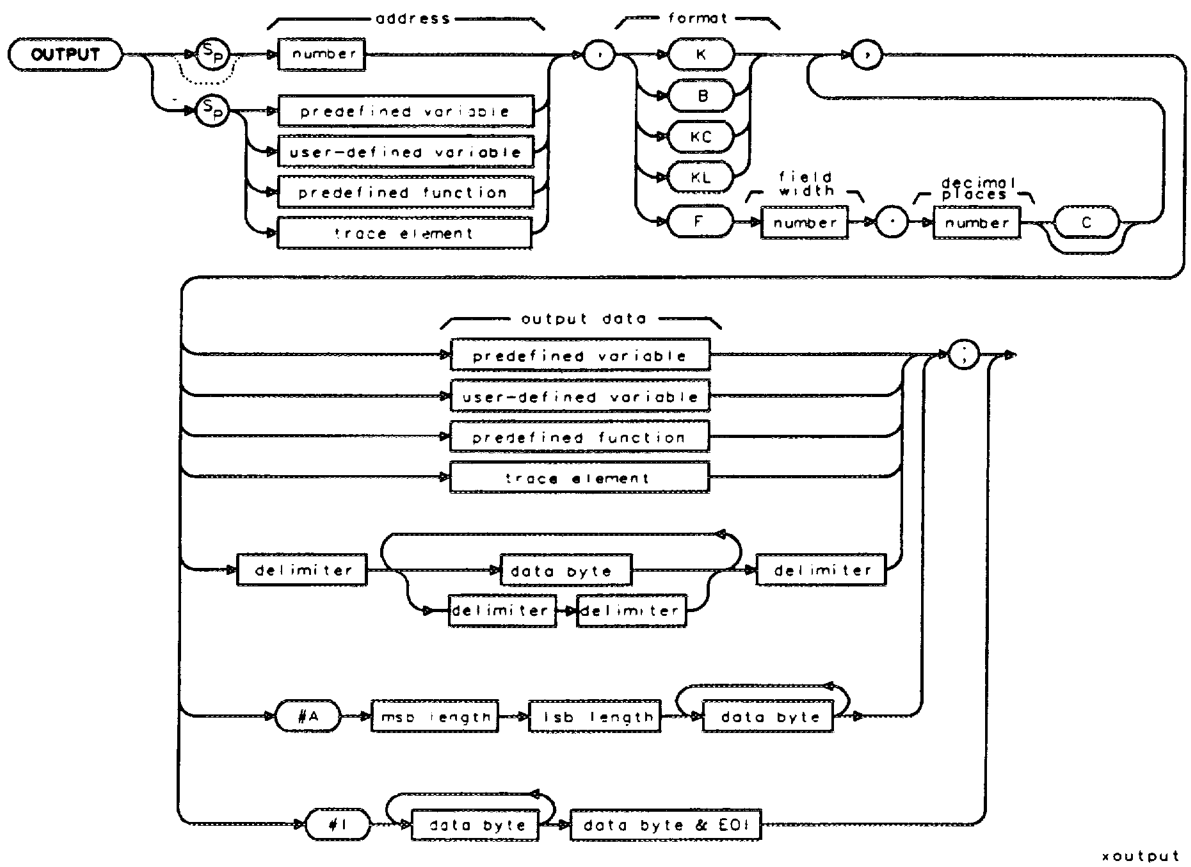



QOP

# OUTPUT
# Output to HP-IB

Allows the spectrum analyzer to send data to other devices on the HP-IB.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | An integer number. | 0 to 30. |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Data byte | 8-bit byte containing numeric or character data. | |
| Data byte & EOI | 8-bit byte containing numeric or character data followed by END. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.

Related Commands: ENTER, RELHPIB.

## Example

This example assumes that the plotter is at address 5 and the spectrum analyzer is at address 18. (The program is only valid for HP 9000 Series 200 and 300 computers.)

The following example uses the spectrum analyzer to send the ASCII code for OP; (output parameter) to the plotter. The ENTER command is then used to receive the coordinates from the plotter. Program lines 110 to 140 display the coordinates on the spectrum analyzer screen. Softkey 1 is programmed to display the plotter coordinates. Softkey 1 can be accessed by pressing (MEAS/USER), **User Menus** .

**Note**

Disconnect the computer before pressing softkey 1 or execute ABORT 7, LOCAL 7 from the computer. The execute the P_OP function, the spectrum analyzer must be the only controller on the HP-IB.

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF P_ONEX,1,VARDEF P_ONEY,1;"` | *Declares the variables used to hold the plotter coordinates.* |
| `20 OUTPUT 718;"VARDEF P_TWOX,1;VARDEF P_TWOY,1;"` | *Declares the variables used to hold the plotter coordinates.* |
| `30 OUTPUT 718;"FUNCDEF P_OP,@";` | *Defines a function called P_OP.* |
| `40 OUTPUT 718;"OUTPUT 5,B,79;";` | *Sends ASCII code for "O".* |
| `50 OUTPUT 718;"OUTPUT 5,B,80;";` | *Sends ASCII code for "P".* |
| `60 OUTPUT 718;"OUTPUT 5,B,59;";` | *Sends ASCII code for ";".* |
| `70 OUTPUT 718;"ENTER 5,K,P_ONEX;";` | *Gets plotter coordinates from plotter.* |
| `80 OUTPUT 718;"ENTER 5,K,P_ONEY;";` | *Gets Y coordinate from plotter.* |
| `90 OUTPUT 718;"ENTER 5,K,P_TWOX;";` | *Gets X coordinate from plotter.* |
| `100 OUTPUT 718;"ENTER 5,K,P_TWOY;";` | *Gets Y coordinate from plotter.* |
| `110 OUTPUT 718;"PU;PA 200,190;DSPLY P_ONEX,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `120 OUTPUT 718;"PU;PA 200,180;DSPLY P_ONEY,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `130 OUTPUT 718;"PU;PA 200,170;DSPLY P_TWOX,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `140 OUTPUT 718;"PU;PA 200,160;DSPLY P_TWOY,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `150 OUTPUT 718;"RELHPIB;";` | *Releases spectrum analyzer control of the HP-IB.* |
| `160 OUTPUT 718;"@;"` | *Marks the end of the function, P_OP.* |
| `170 OUTPUT 718;"KEYDEF 1,P_OP,!DSP OP;!;"` | *Assigns the P_OP function to softkey 1.* |
| `180 END` | |

## Description

Use OUTPUT to send data or instructions to an HP-IB device using the following output formats.

**K** Outputs in free-field ASCII format with no terminator.

**B** Outputs in a free-field format with no terminator, but in a single 8-bit bytes.

**KC** Outputs in free-field ASCII with a carriage return and line feed terminator.

**KL** Outputs in free-field ASCII with a line feed and an EOI terminator.

**F** Outputs an ASCII number with the field width and decimal places specified. For example, a number displayed as 13.3 has a field width of 13 and a decimal place of three. If a "C" follows the ASCII number, a carriage return and line feed will terminate the output.

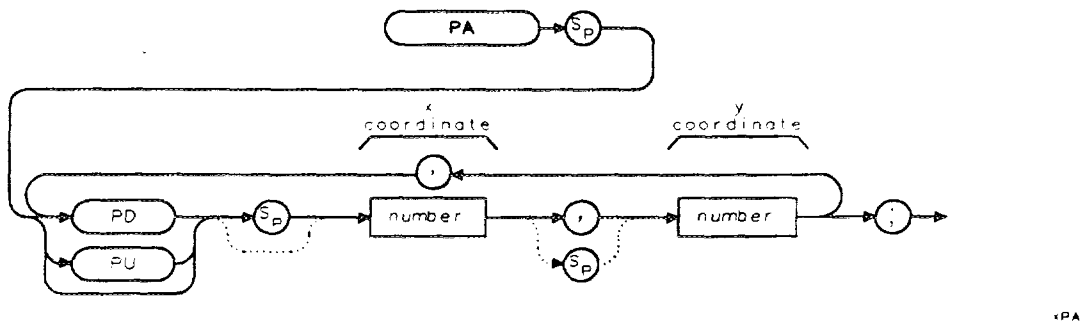
Because HP-IB allows only one controller on the HP-IB, OUTPUT must be synchronized with a controller operation or else incorporated into user-defined functions that are executed with softkeys when the spectrum analyzer is under manual control. If another controller is detected on the HP-IB, the OUTPUT function is aborted.

Execute RELHPIB (RELEASE HP-IB) to discontinue spectrum analyzer control of HP-IB.

# PA
# Plot Absolute

Moves the pen to a vector location on the spectrum analyzer screen relative to the reference coordinates (0,0) in display units.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | Within screen or graticule coordinates. |

Related Commands: CLRDSP, DSPLY, TEXT, PD, PLOT, PR, PRINT, PU.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;BLANK TRA;"` | *Initializes the spectrum analyzer and blanks trace A.* |
| `OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Clears the spectrum analyzer screen.* |
| `OUTPUT 718;"PU;"` | *Pen up.* |
| `OUTPUT 718;"PA 100,100;PD 100,150;"` | *PU and PA commands prevent an initial vector from being drawn before the pen is positioned at (100, 100). PD draws a vector to (100, 150).* |
| `OUTPUT 718;"150,150,150,100,100,100;"` | *Draws the last three sides of the rectangle.* |

## Description

The vector is drawn on the screen if the pen-down (PD) command is in effect. If the pen-up (PU) command is in effect, the vector does not appear on the screen.

Display units are the scaling units of the spectrum analyzer display for on screen graphics commands such as PA or PR. One display unit is the distance between two points along an the $x$ or $y$ axis. For the HP 8590 Series spectrum analyzer, there are a maximum of 511 display units (−40 to 471) along the $x$ axis and 255 display units (−22 to 233) along the $y$ axis. See Figure 5-1.

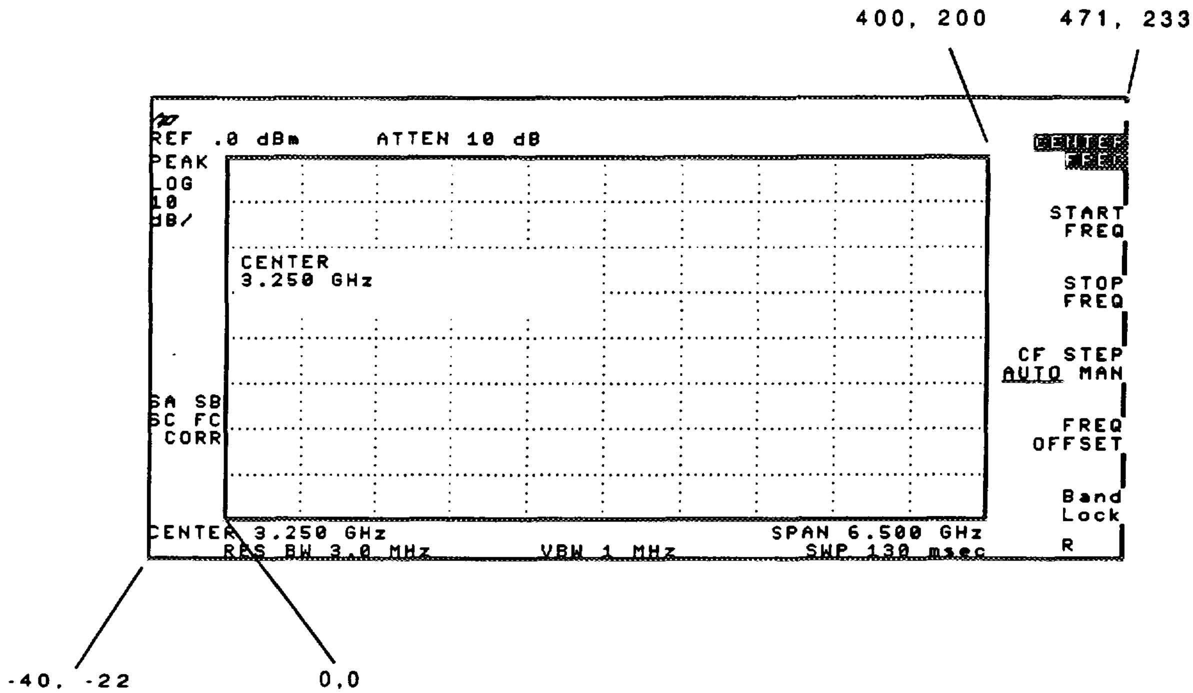



**Figure 5-1. Display Units**

The coordinates of the lower left screen corner of the screen are −40,−22 and the upper right screen corner of the screen are 471,233. For the graticule area, the coordinates of the lower left corner of the graticule are 0,0 and the coordinates of the upper right graticule area are 400,200. For example, you could execute "PU;PA 0,0;PD;PA 0,200,400,200,400,0,0,0;" to draw a box around the graticule area.

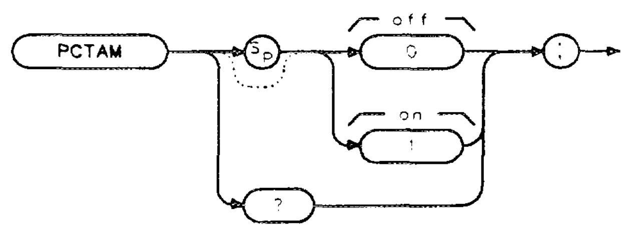
Because PA is an active function, executing PA causes the active function area on the spectrum analyzer screen to blank. To prevent the text following PA from being written in the active function area, execute hold (HD) after PA.

PU should be executed before the first PA command, and PA should be executed before executing TEXT, PD, or DSPLY commands.

# PCTAM
# Percent AM

Turns on or off the percent AM measurement.

## Syntax




Equivalent Softkey: `% AM ON OFF`.
Related Commands: MKPX, PCTAMR, TH.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV PCTAM,1;"` | *Turns on the percent AM measurement.* |
| `OUTPUT 718;"PCTAMR?;"` | *Queries PCTAMR. PCTAMR contains the results of the percent AM measurement.* |
| `ENTER 718;Percent` | *Stores the value of PCTAMR in the variable Percent.* |
| `PRINT "Percent AM is ",Percent` | *Prints the results.* |
| `OUTPUT 718;"MOV PCTAM,0;"` | *Turns off the percent AM measurement.* |

## Description

Setting PCTAM to 0 turns off the percent AM function. Setting PCTAM to 1 turns on the percent AM function. When the percent AM function is turned on, the spectrum analyzer finds the signal with the highest amplitude, and then finds two signals (with lower amplitudes) on either side of the highest signal. The highest on-screen signal is assumed to be the carrier, and the adjacent signals are assumed to be the sidebands. The amplitude levels of all three signals are measured, and the percent AM is calculated using the carrier level and the sideband with the higher amplitude level. Percent AM is calculated as follows:

$$Percent\ AM = 200 \times \frac{Level_{Carrier}}{Level_{Sideband}}$$

The percent AM measurement is repeated at the end of every sweep (PCTAM uses the ONEOS command) until you turn off the percent AM measurement. You must query PCTAMR to determine the percent AM.

PCTAM can perform the percent AM measurement only if there are three on-screen signals that have the characteristics of a carrier with two sidebands. Also, to be considered a signal, the levels of the carrier and sideband signals must be greater than the peak excursion above the threshold. If there are not three signals that fit the characteristics of a carrier with two sidebands, the value of PCTAMR will be −100.

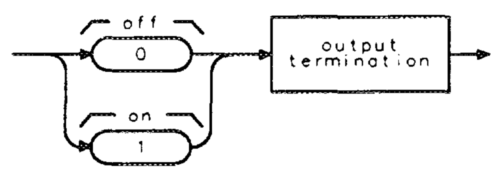
You can execute the PCTAM command two different ways. You can either execute the PCTAM command directly (for example, "PCTAM 1;") or use the MOV command to move the 1 or 0 into the PCTAM command (for example, "MOV PCTAM,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

**Restrictions**

Turning on the PCTAM function turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW).

You should turn off the percent AM measurement (set PCTAM to 0) when you are done with the percent AM measurement.

## Query Response

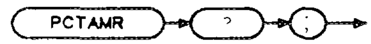



QPCTAM

# PCTAMR
## Percent AM Response

Returns the percent AM measured by the percent AM measurement (PCTAM).

### Syntax




XPCTAMR

Related Commands: MKPX, PCTAM, TH.

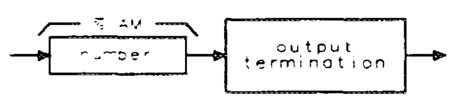
### Example

| | |
|---|---|
| `OUTPUT 718;"MOV PCTAM,1;"` | *Turns on the percent AM measurement.* |
| `OUTPUT 718;"PCTAMR?;"` | *Queries PCTAMR. PCTAMR contains the results of the percent AM measurement.* |
| `ENTER 718;Percent` | *Stores the value of PCTAMR in the variable Percent.* |
| `PRINT "Percent AM is ",Percent` | *Prints the results.* |
| `OUTPUT 718;"MOV PCTAM,0;"` | *Turns off the percent AM measurement.* |

### Description

PCTAMR returns a −100 if the PCTAM function has not been turned on, or if the on-screen signal is not valid or is not present. PCTAM can perform the percent AM measurement only if there are three on-screen signals that have the characteristics of a carrier and two sidebands. Also, to be considered a signal, the levels of the carrier and sideband signals must be greater than the peak excursion above the threshold.

### Query Response




QPCTAMR

# PD
# Pen Down

Instructs the spectrum analyzer to plot vectors on the spectrum analyzer screen until a PU command is received.

## Syntax

XPD

Related Commands: DSPLY, PA, PLOT, PR, PU, TEXT.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;BLANK TRA;"` | *Initializes the spectrum analyzer and blanks trace A.* |
| `OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Clears the spectrum analyzer screen.* |
| `OUTPUT 718;"PU;"` | *Pen up.* |
| `OUTPUT 718;"PA 100,100;PD 100,150;"` | *PU and PA commands prevent an initial vector from being drawn before the pen is positioned at (100, 100). PD draws a vector to (100, 150).* |
| `OUTPUT 718;"150,150,150,100,100,100;"` | *Draws the last three sides of the rectangle.* |

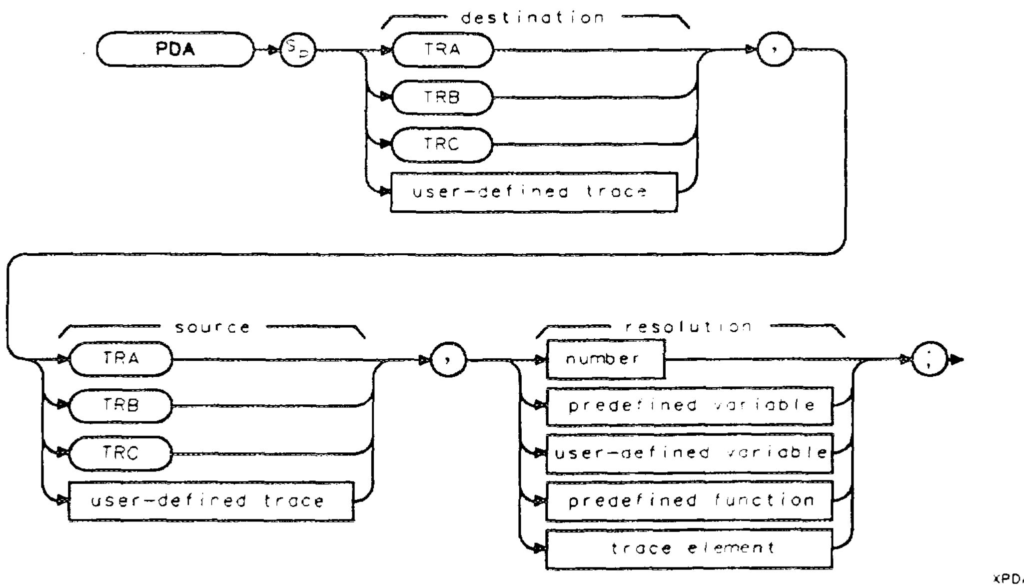
## Description

The command PD is used to enable drawing of all vectors specified by the commands PA (plot absolute), or PR (plot relative). It remains in effect until a PU command is received. PD does not need to be executed before using the TEXT or DSPLY commands.

# PDA
# Probability Distribution of Amplitude

Sums the probability distribution of amplitude in the destination trace with the amplitude distribution function of the source trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: PDF, RMS, STDEV.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer and activates the single-sweep mode.* |
| `OUTPUT 718;"VB 10KHZ;HD;TS;"` | *Changes video bandwidth, updates trace.* |
| `OUTPUT 718;"MOV TRB,0;"` | *Replaces trace B data with all zeros.* |
| `OUTPUT 718;"PDA TRB,TRA,1;"` | *Determines the distribution of trace A and sums results into trace B.* |
| `OUTPUT 718;"MPY TRB,TRB,5;"` | *Multiplies values in trace B by 5 to make the results more visible.* |

```
OUTPUT 718;"VIEW TRB;"
```
*Displays the result.*

## Description

The PDA command takes the data in the source trace on a point-by-point basis. Each amplitude value is divided by 100 times resolution value, and the result of the division is rounded to an integer. If the result falls within the range of the buckets of the destination trace, the content of the corresponding destination trace element is increased by one. For example, to show the distribution of amplitudes on a trace with values ranging from 0 to 8000, a resolution value of 1 dB would result in 81 buckets ((8000/(1 × 100))+ 1). Amplitude values ranging from 0 to 99 would go to bucket 1, values from 100 to 199 would go into bucket 2, and so forth. Finally, values from 7900 to 7999 would go to bucket 400. An amplitude value of 8000 would fall into bucket 81.

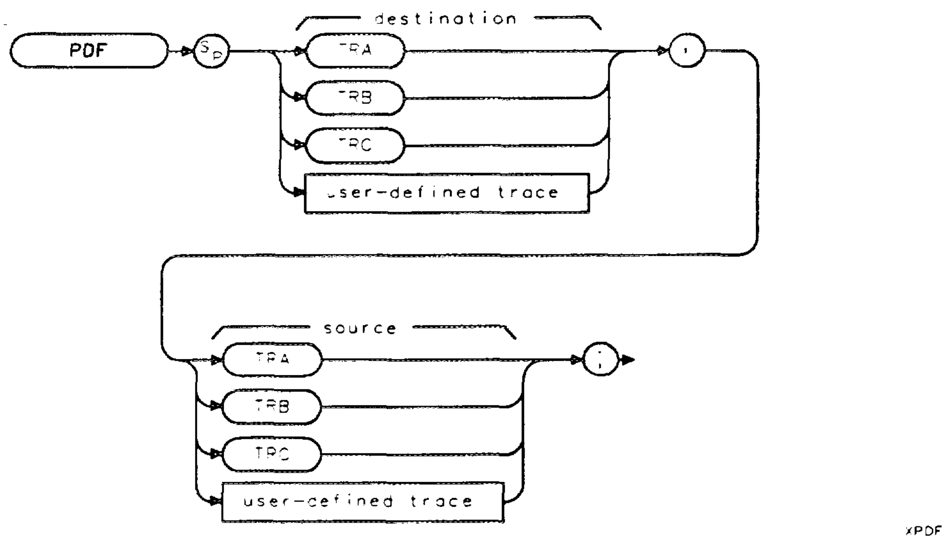
Due to the summing nature of the PDA command, the destination trace should always be initialized to all zeros.

The PDA function is similar to the probability density function in statistics. The probability density function has the *y*-axis as the probability of an occurrence, where the PDA function of the HP 8590 Series spectrum analyzer has the number of occurrences as its *y*-axis. The PDA could be converted to a probability density function by dividing, in an external controller, the value of each bucket by the total number of source elements. Note that performing the divide inside the spectrum analyzer would not be appropriate because the result is less than 1, which would be truncated to 0.

# PDF
# Probability Distribution of Frequency

Increments an element of the destination trace whenever the corresponding element of the source trace exceeds a threshold. This is useful for constructing a frequency probability density function.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |

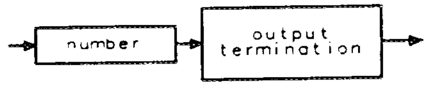
Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: PDA, TH.

## Example

This example finds the portions of the frequency band where no signals above −50 dBm are observed in an hour time frame.

| | |
|---|---|
| `10 OUTPUT 718;"IP;";` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SP 100MZ;CF 300MZ;"` | *Changes the span and center frequency.* |
| `30 OUTPUT 718;"TH -50 DM;TS;"` | *Activates the threshold level, take a sweep.* |
| `40 OUTPUT 718;"VIEW TRB;CLRW TRA;MOV TRB,0;"` | *Sets trace B to zeros.* |
| `50 OUTPUT 718;"ST?;"` | *Gets the sweep time.* |
| `60 ENTER 718;Sweep_time` | *Returns the sweep time to the controller.* |
| `70 Swp_retrace = Sweep_time+.1` | *Calculates the total sweep time, including the retrace time.* |
| `80 Num_sweeps = 3600/Swp_retrace` | *Calculates the number of sweeps in one hour.* |

## Query Response

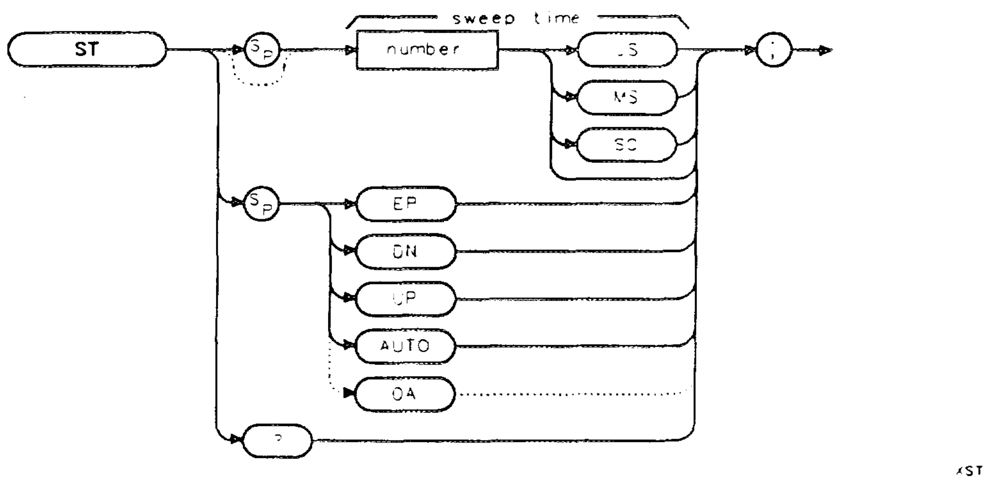



QQ1

# ST
# Sweep Time

Specifies the time in which the spectrum analyzer sweeps the displayed frequency range.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | Within the sweep time range of the spectrum analyzer. |

Equivalent Softkey: **SWP TIME AUTO MAN**.
Sweep Time Range in Zero Span: 15 ms to 100s.
Sweep Time Range in Zero Span, Option 101 only: 20 $\mu$s to 100s.
Sweep Time Range in Non-zero Span: 20 ms to 100 s.
Step Increment: 2, 3, 5, 7.5, 10, 15 sequence.
Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: AUTO, CONTS, HNLOCK, HNUNLK, RB, SNGLS, SP, SRCPSWP, TS.

## Example

`OUTPUT 718;"ST 100MS;"` *Sets the sweep time to 100 milliseconds.*

## Description

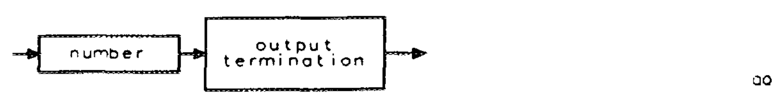
When used as a predefined variable, ST returns the sweep time as a real number in seconds.

| | |
|---|---|
| `40 ENTER 718 USING "K";Mk_freq` | *Puts the spectrum analyzer response in the computer variable, Mk_freq.* |
| `50 OUTPUT 718;"MKA?;"` | *Returns the amplitude of the marker.* |
| `60 ENTER 718 USING "K";Mk_amp` | *Puts the spectrum analyzer response in the computer variable, Mk_amp.* |
| `70 OUTPUT 718;"SS ";Mk_freq;"HZ"` | *Changes the step size to the marker frequency.* |
| `80 OUTPUT 718;"CF UP;TS;MKPK HI;MKA?;"` | *Increases the center frequency, takes sweep, puts the marker on the highest peak and returns the amplitude of the marker.* |
| `90 ENTER 718;Mk_ampl` | *Puts the spectrum analyzer response in the computer variable, Mk_ampl.* |
| `100 PRINT "THE FUNDAMENTAL IS ";Mk_amp-Mk_ampl` | *Outputs the result.* |
| `110 PRINT "dB ABOVE THE SECOND HARMONIC"` | |
| `120 END` | |

## Description

The AUTO parameter removes SS as an active function but does not have an effect on its value.

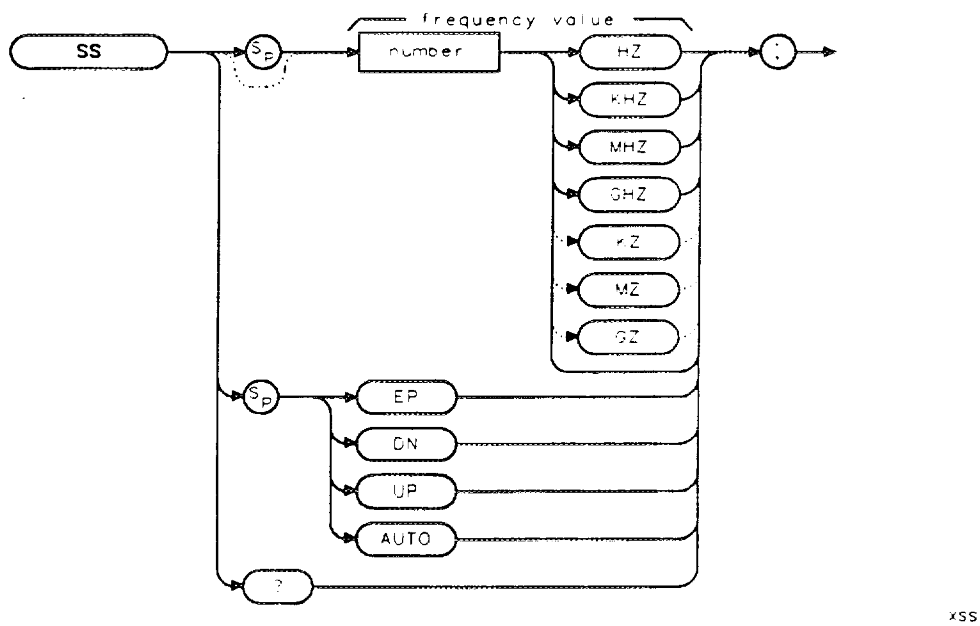
## Query Response



# SS
# Center Frequency Step Size

Specifies center frequency step size.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency range of the spectrum analyzer. |

Equivalent Softkey: **CF STEP AUTO MAN** .
Preset State: 100 MHz.
Step Increment: 1, 2, 5, 10 sequence.
Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: AUTO, CF, FOFFSET, SP.

## Example

| | |
|---|---|
| `10 CLEAR 718` | *Clears the HP-IB.* |
| `20 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes the spectrum analyzer, activates single-sweep mode, changes the center frequency, span, takes sweep.* |
| `30 OUTPUT 718;"MKPK HI;MKRL;TS;MKF?;"` | *Finds the highest peak, changes the reference level to the marker, takes sweep, returns the frequency of the marker.* |

**SRQ Force Service Request**

## Interface Differences

As implemented on the HP-IB interface, an spectrum analyzer service request asserts the SRQ control line on the HP-IB.

On the RS-232 interface, the spectrum analyzer does not have a way of signaling the interrupt condition to a controller. In this case, the controller must operate in a polled mode if it requires interrupt information (see "Polled Mode of Operation" below for a discussion of the polled mode).

**Interrupt-Related Commands Common to All Interfaces:**

- CLS Clear status byte, without read.
- RQS Request mask.
- SRQ Force service request.
- STB Read then clear status byte.

The HP-IB interface supports interface commands to read the status byte.

On HP-IB in HP 9000 Series 200 or 300 BASIC, the statement SPOLL (Device_address) can be used to read the status byte.

## Polled Mode of Operation

The polled mode of operation is probably most applicable to an RS-232 interface user. Because there is no interrupt signal to the RS-232 controller, the user must periodically ask the spectrum analyzer, via the "STB?" command, for the contents of its status register. For example, the RS-232 controller could periodically check for the hardware-broken condition by executing the "STB?" command and reading the results.

Table 5-9. Spectrum Analyzer Status Byte

| Bit Number | Decimal Equivalent | Spectrum Analyzer State | Description |
|---|---|---|---|
| 5 | 32 | Set when an illegal command is present. | SRQ 140 appears on the spectrum analyzer screen. |
| 4 | 16 | Set when any command is completed. | It is triggered by EOI at the end of a command string or the completion of a print or plot. |
| 3 | 8 | Indicates hardware broken condition. | SRQ 110 appears on the spectrum analyzer screen. |
| 2 | 4 | Indicates end of sweep. | SRQ 104 appears on the spectrum analyzer screen. If you send any RQS value that contains mask value 4, another sweep will be taken. |
| 1 | 2 | Indicates a units key was pressed. | SRQ 102 appears on the spectrum analyzer screen. If you activate the units key bit, it will remain active until you activate "EE" and press a units key. (See "EE.") |

Bit numbers **0** (LSB), **6**, and **7** are not used.

The spectrum analyzer screen numbers 102, 104, and 110 are the octal values corresponding to the status register values; that is, SRQ 102 = bit 6 = octal 100 and bit 2 = octal 2 are both true.

Generally, you must set the bit mask using the RQS command. However, the "hardware broken" and "illegal remote command" conditions are automatically enabled after presetting or sending the IP command. Pressing (PRESET) or sending the IP command, then, produces the same interrupt bit mask as sending "RQS 40;" (decimal 40 is the sum of the assigned values of these two interrupt bits, 32 = bit 5 and 8 = bit 3).

For most conditions, the RQS mask bit stays set until the next instrument preset (IP), or RQS command is executed. The only condition to which this does not apply is the Units Key Pressed bit. When this bit (bit 1) is set in the RQS mask, a Units Key Pressed interrupt occurs if EE (enable entry mode) is executed and a front-panel units key such as Hz, kHz, MHz, or GHz is pressed.

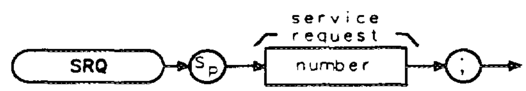
When a units key is pressed, the interrupt occurs and the Units Key Pressed bit in the RQS mask is reset. To reenable the Units Key Pressed interrupt, you must send a new RQS mask. See "RQS" for detailed information.

As mentioned, you can simulate a service request condition. Choose the desired interrupt conditions from the RQS command table (see "RQS"), and sum their assigned values. Use the RQS command with this value to set the bit mask. By setting the corresponding bits in the SRQ command and sending the SRQ command to the spectrum analyzer, the desired interrupt occurs. This allows the user to verify proper operation of software routines designed to handle infrequent or unlikely interrupts.

# SRQ
# Force Service Request

The SRQ command is used by an external controller to simulate interrupts from the spectrum analyzer.

## Syntax




XSRQ

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 2 to 126. |

Related Commands: CLS, EE, RQS, STB.

## Example

`OUTPUT 718;"RQS 8;SRQ 8;"` *Sets bit mask for a hardware broken service request, generates a hardware broken interrupt.*

**Note**

A program can respond to the interrupt in the same way it would under a true service request condition.

## Description

The service request condition is also displayed on the spectrum analyzer screen with the annotation `SRQ XXX`, where XXX is a three-digit octal number.

The conditions that can generate a service request are as follows:

32 = Illegal command
16 = Command complete
8 = Hardware broken
4 = End of sweep
2 = Units key pressed

A service request is generated only if the proper request mask bit has been set (see "RQS"), and either the condition itself or the Force Service Request is sent. To set the request mask, choose the desired interrupt conditions and sum their assigned values. Executing the RQS command with this value sets the bit mask. After setting the bit mask, only the chosen conditions can produce an interrupt.

Each bit in the status byte is defined as shown in the following table.

# SRCTKPK
# Source Tracking Peak

Automatically adjusts the tracking of source output with spectrum-analyzer sweep.

## Syntax


XSRCTKPK

Option Required: Option 010 or 011.

Equivalent Softkey: **TRACKING PEAK** .

Related Commands: Commands that change bandwidth, such as RB, VB, ST, and commands that change frequency, such as SP, CF, FA, FB, SP, FS, SRCTK.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

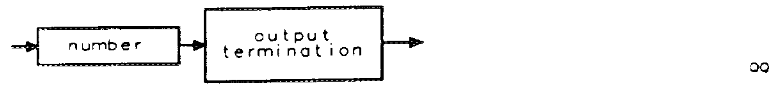
| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Activates the stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DB;"` | *Turns on the power at the source output to its current setting.* |
| `OUTPUT 718;"SP 1MHZ;"` | *Sets measurement range.* |
| `OUTPUT 718;"RB 1KHZ;"` | |
| `OUTPUT 718;"TS;"` | *Takes sweep.* |
| `OUTPUT 718;"SRCTKPK;"` | *Automatically adjusts the tracking.* |

## Description

The SRCTKPK command adjusts the tracking of the tracking-generator source output automatically to maximize responses for measurements made with resolution bandwidths less than 300 kHz.

SRCTKPK maximizes the amplitude of the displayed active trace.

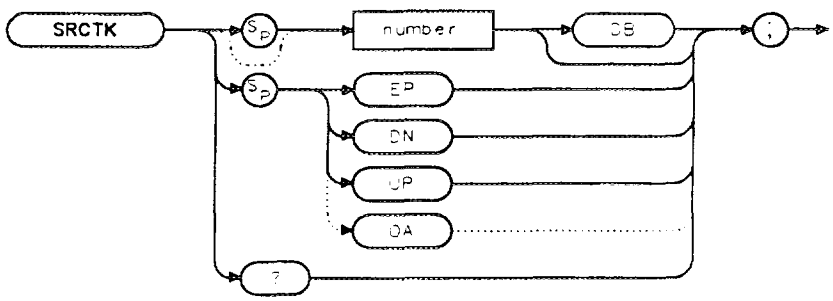
## Query Response



# SRCTK
# Source Tracking

Adjusts the tracking of the source output with the spectrum analyzer sweep.

## Syntax




XSRCTK

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 0 to 16,383. |

Option Required: Option 010 or 011.
Equivalent Softkey: **MAN TRK ADJUST**.
Step Increment: 1.
Related Commands: Commands that change bandwidth, such as RB, VB, ST, and commands that change frequency, such as SP, CF, FA, FB, SP, FS, SRCTKPK.

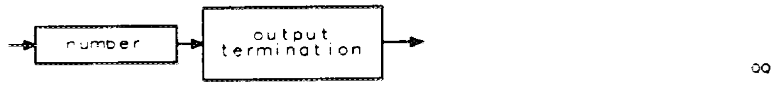
## Example

```
OUTPUT 718;"MEASURE SR;"      Activates the stimulus-response mode.
OUTPUT 718;"SRCPWR -20DB;"    Turns on the power at the source output.
OUTPUT 718;"SP 1MHZ;"         Sets measurement range.
OUTPUT 718;"RB 1KHZ;"
OUTPUT 718;"TS;"              Takes sweep.
OUTPUT 718;"SRCTK EP;"        Allows entry of from front-panel keys to adjust tracking.
```

## Description

The SRCTK command adjusts the tracking of the tracking-generator output relative to the center frequency of the spectrum-analyzer. SRCTK is used typically for bandwidths less than 300 kHz. Bandwidths greater than 300 kHz do not require tracking adjustment. Use SRCTK to improve amplitude accuracy and maximize signal response. Use SRCTKPK to adjust tracking automatically. See "SRCTKPK."

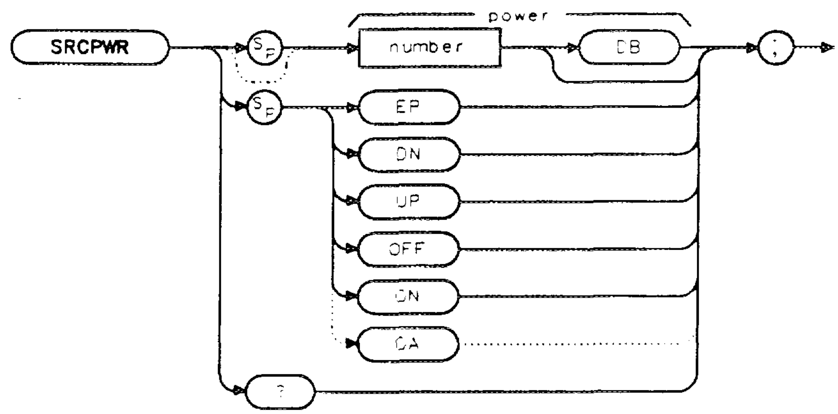
## Query Response



# SRCPWR
# Source Power

Selects the source power level.

## Syntax




ᶜSRCPWR

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is the current amplitude unit. | Actual range is hardware dependent. |

Option Required: Option 010 or 011.
Equivalent Softkey: **SRC PWR ON OFF** .
Step Increment: Set by SRCPSTP.
Related Commands: SRCAT, SRCPSTP, SRCPSWP.
Preset State: −10 dBm.

## Example

Use SRCPWR to turn on the source and adjust its power level.

| | |
|---|---|
| `OUTPUT 718;"SRCPWR -20DB;"` | *Changes power level to −20 dBm.* |
| `OUTPUT 718;"AUNITS DBMV;"` | *Changes the current amplitude unit.* |
| `OUTPUT 718;"SRCPWR 37;"` | *The source power is now 37 dBmV.* |

## Description

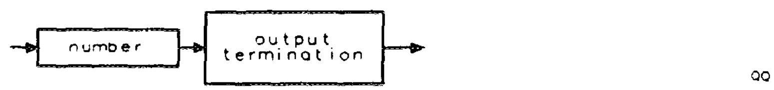
The SRCPWR command turns the source off or on and sets the power level of the source. The source is turned on automatically whenever its value is specified with SRCPWR. Also see "SRCPSTP."

**SRCPSWP Source Power Sweep**

**Note** Power is swept from low to high.

The minimum sweep time is limited to 20 ms when performing a source power sweep, even if the spectrum analyzer has an Option 101 installed in it.

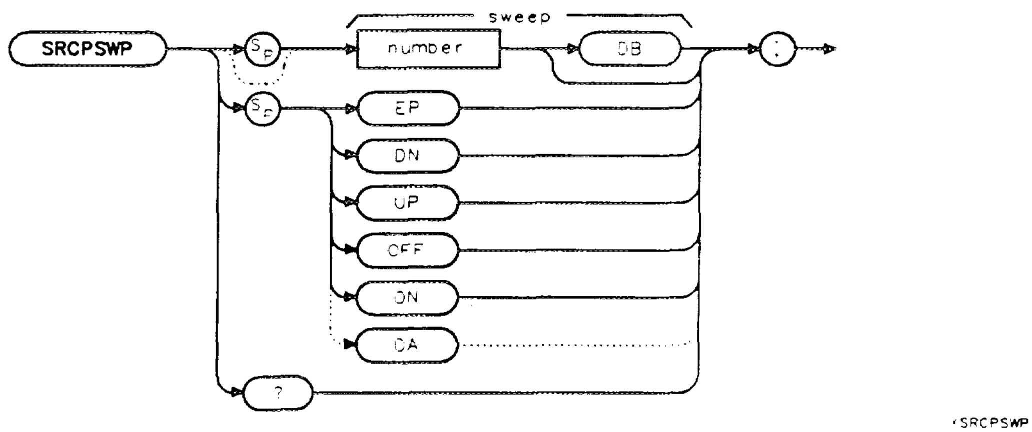
## Query Response



# SRCPSWP
# Source Power Sweep

Selects the sweep range of the source output.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | |

Option Required: Option 010 or 011.
Equivalent Softkey: **PWR SWP ON OFF**.
Step Increment: Determined by SRCPSTP.
Related Commands: SRCPSWP, SRCPOFS, SRCPSTP.
Preset State: SRCPSWP OFF.

## Example

Use SRCPSWP to sweep the power level of the source output.

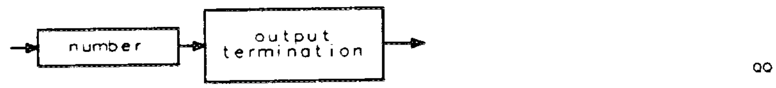
```
OUTPUT 718;"MEASURE SR;"      Activates stimulus-response mode.
OUTPUT 718;"SRCPWR -10DB;"    Sets power level of source output to -10 dBm.
OUTPUT 718;"SP 0;"            Sets span to 0 Hz.
OUTPUT 718;"SRCPSWP 10DB;"    Sweeps source output from -10 dBm to 0 dBm.
```

## Description

The SRCPSWP command works in conjunction with the SRCPWR (source power) command to sweep the amplitude level of the source output. The SRCPWR setting determines the amplitude level at the beginning of the sweep. The SRCPSWP command determines the change in amplitude level of the sweep.

For example, if SRCPWR and SRCPSWP are set to −15 dBm and 4 dB respectively, the source sweeps from −15 dBm to −11 dBm.

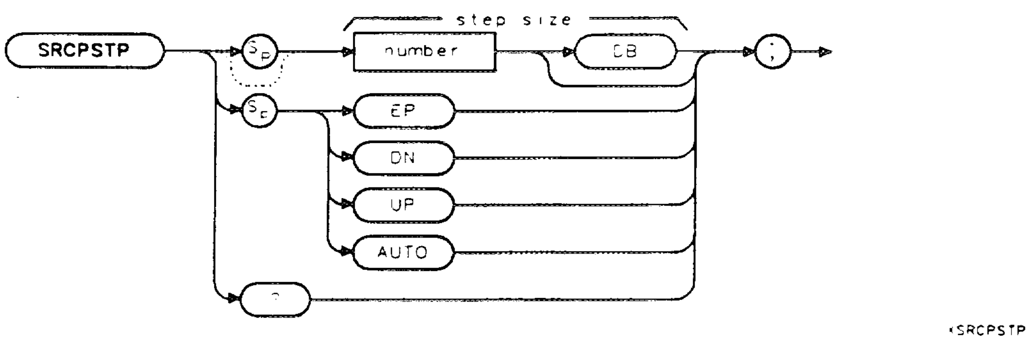
## Query Response



# SRCPSTP
# Source Power-Level Step Size

Selects the source-power step size.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | |

Option Required: Option 010 or 011.
Equivalent Softkey: **SRC PWR STP SIZE**.
Step Increment: 0.1 dB.
Related Commands: SRCPWR, SRCPOFS, SRCPSWP.
Preset State: SRCPSTP AUTO (one major vertical scale division).

## Example

Select incremental changes of power effected by "SRCPWR UP;", "SRCPWR DN;" commands, or the step keys.

| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Activates stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DB;"` | *Turns on the source output.* |
| `OUTPUT 718;"SRCPSTP .3DB;"` | *Sets power-level step size to 0.3 dB.* |
| `OUTPUT 718;"SRCPWR UP;"` | *Increases the power level.* |

## Description

The SRCPSTP command selects the step size for the following source commands:

- Power offset (SRCPOFS).
- Power sweep (SRCPSWP).
- Power (SRCPWR).

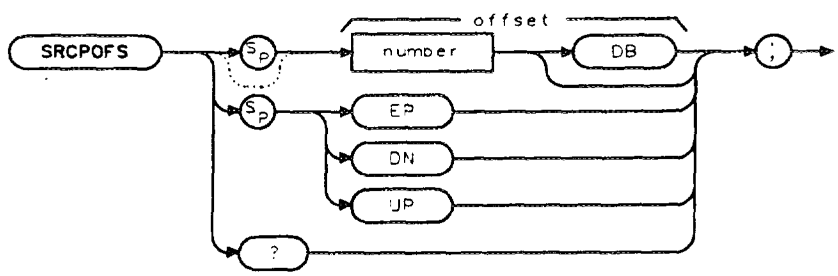
Use SRCPSTP to set the step size to a specific value.

"SRCPSTP AUTO;" sets the step size to one vertical scale division.

# SRCPOFS
# Source Power Offset

Offsets the source power level readout.

## Syntax




XSRCPOFS

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | |

Option Required: Option 010 or 011.
Equivalent Softkey: **SRC PWR OFFSET**.
Related Commands: SRCPWR, SRCPSWP.
Step Increment: Determined by SRCPSTP.
Preset State: 0 dB.

## Example

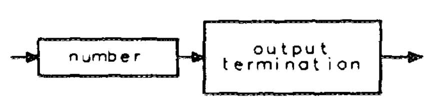
Use SRCPOFS to offset the power-level readout for the tracking-generator source.

```
OUTPUT 718;"MEASURE SR;"       Sets spectrum analyzer to stimulus-response mode.
OUTPUT 718;"SRCPWR -10DB;"     Turns on source output.
OUTPUT 718;"SRCPOFS 13DB;"     Offsets power-level readout for source by 13 dB.
```

## Description

The SRCPOFS command offsets the displayed power of the built-in tracking generator. This function may be used to take into account system losses (for example, cable loss) or gains (for example, preamplifier gain) reflecting the actual power delivered to the device under test.

## Query Response



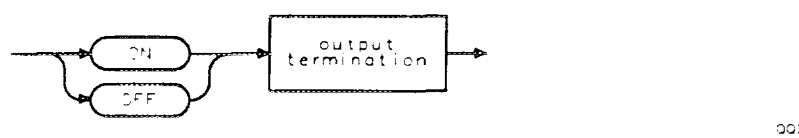

QQ1

## Description

The SRCNORM command subtracts trace B from trace A, point by point, adds the display line value to the difference, and sends the difference to trace A. The SRCNORM function remains in effect until it is turned off by executing "SRCNORM OFF;".

A common use of trace subtraction is to normalize one trace with respect to another. For example, traces are frequently subtracted to normalize the spectrum analyzer response when a tracking generator is used. In such applications, amplitude units in dBm should be subtracted. To accomplish this, the display line should be set to 0 dBm using DL as shown in the example. Also see example 2 and 3 in "AMB" for comparison.

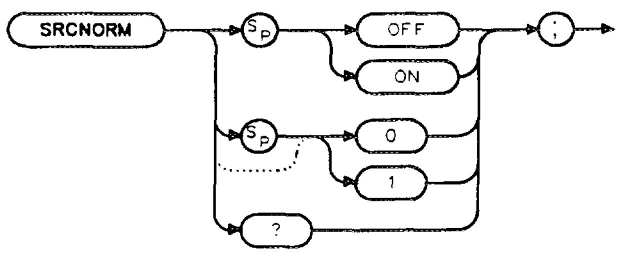
## Query Response



# SRCNORM
# Source Normalization

Subtracts trace B from trace A, adds the display line value to the difference, and sends the result to trace A during every sweep of the spectrum analyzer.

## Syntax



XSRCNORM

Equivalent Softkey: **NORMLIZE ON OFF**.

Preset State: SRCNORM OFF.

Related Commands: AMB, CONTS, CLRW, DL, MXMH, SNGLS, TS, VAVG, VIEW.

## Example

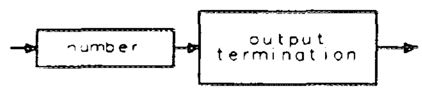
| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;RL 20DB;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 OUTPUT 718;"MOV TRA,5000;"` | *Sets trace A to 5000 measurement units, which is equal to −10 dBm.* |
| `30 OUTPUT 718;"VIEW TRA;"` | |
| `40 OUTPUT 718;"MOV TRB,4000;"` | *Sets trace B to 4000 measurement units, which is equal to −20 dBm.* |
| `50 OUTPUT 718;"VIEW TRB;"` | |
| `60 OUTPUT 718;"DL ODM;"` | *Sets display line to 0 dBm, which is at 6000 measurement units.* |
| `70 OUTPUT 718;"SRCNORM ON;"` | *Performs trace A − trace B + display line. The result is 5000 − 4000 + 6000 = 7000 or 10 dBm. Note that this has resulted in a subtraction of amplitude in dBm, −10 dBm −(−20 dBm) = 10 dBm.* |
| `80 OUTPUT 718;"BLANK TRB;VIEW TRA;"` | |
| `90 END` | |

## Description

The SRCAT command attenuates the output level of the source. Use SRCAT to attenuate the power level of the source manually, from 0 to 60 dB in 10 dB steps for an HP 8591E, from 0 to 56 dB in 8 dB steps for an HP 8593E, HP 8594E, HP 8595E, or HP 8596E.

"SRCAT AUTO;" automatically adjusts the attenuator to yield the source amplitude level specified by the SRCPWR command.

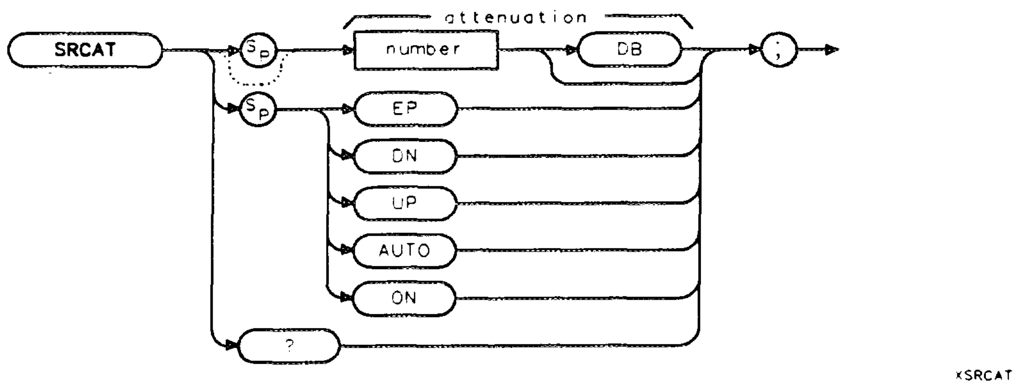
## Query Response



# SRCAT
# Source Attenuator

Attenuates the source output level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number (HP 8591E only) | Any real or integer number, specified in multiples of 10 dB. | 0 to 60 dB. |
| Number (HP 8593E, HP 8594E, HP 8595E, or HP 8596E only) | Any real or integer number, specified in multiples of 8 dB. | 0 to 56 dB. |

Equivalent Softkey: **SRC ATN MAN AUTO** .

Option Required: Option 010 or 011 installed in an HP 8591E. Option 010 installed in an HP 8593E, HP 8594E, HP 8595E, or HP 8596E.

Coupling: Coupled to power level of the source output (SRCPWR) when set to auto (SRCAT AUTO).

Related Commands: SRCPSTP.

Preset State: SRCAT AUTO.

## Example

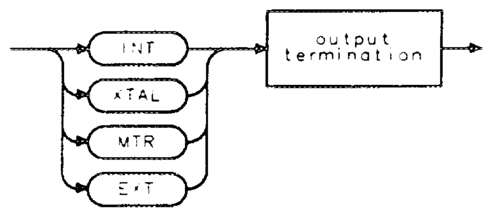
The following example uses the SRCAT command to attenuate the source output. This value specified for SRCAT (20 dB) applies to an HP 8591E only.

| | |
|---|---|
| `OUTPUT 718;"SRCAT AUTO;"` | *Activates source-attenuation coupling.* |
| `OUTPUT 718;"SRCPWR -20DB;"` | *Activates source output.* |
| `OUTPUT 718;"SRCAT 20DB;"` | *Sets attenuator to 20 dB. This decouples the attenuator from the source power-level setting.* |

When used as a predefined variable, SRCALC returns a number from 0 to 2. The value that is returned by SRCALC depends on the SRCALC parameter, as shown in the following table.

| Parameter setting | Value returned |
|---|---|
| INT | 0 |
| XTAL or EXT | 1 |
| MTR | 2 |

## Query Response

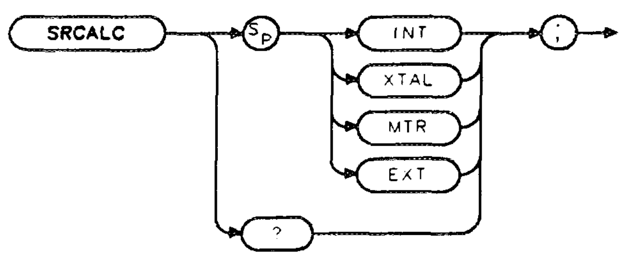



ESRCALC

# SRCALC
# Source Leveling Control

Selects internal or external leveling for use with the built-in tracking generator.

## Syntax




Option Required: Option 010 or 011.
Preset State: SRCALC INT.
Related Commands: CF, FA, FB, FS, HNLOCK, SP.

## Example

```
OUTPUT 718;"SRCALC XTAL;"
```

## Description

**For the HP 8590D or HP 8591E:** Option 010 or 011 for the HP 8590D and HP 8591E provide internal (INT), crystal (XTAL), and meter (MTR) leveling.

- SRCALC INT activates internal leveling.
- SRCALC XTAL activates external leveling. The external leveling input (EXT ALC INPUT) is located on the rear panel of the spectrum analyzer. Positive- or negative-polarity detectors are supported. External leveling increases the amplitude accuracy by improving the effective source match.
- SRCALC MTR narrows loop bandwidth so Hewlett-Packard power meters can be used for external leveling.

*For the HP 8590D and HP 8591E only:* The functions of SRCALC and **ALC MTR INT XTAL** are identical.

**For the HP 8593E, HP 8594E, HP 8595E, or HP 8596E:** Option 010 for the HP 8593E, HP 8594E, HP 8595E, or HP 8596E provide internal (INT) and external (EXT) leveling.

- SRCALC INT activates internal leveling.
- SRCALC EXT is for external leveling. The external leveling input (EXT ALC INPUT) is located on the rear panel of the spectrum analyzer. Only negative-polarity detectors are supported. External leveling increases the amplitude accuracy by improving the effective source match.

*For the HP 8593E, HP 8594E, HP 8595E, and HP 8596E only:* The functions of SRCALC and **ALC INT EXT** are identical.

## Example

`OUTPUT 718;"SQR SP,1E8;"` *Changes the span to 10 kHz.*

## Description

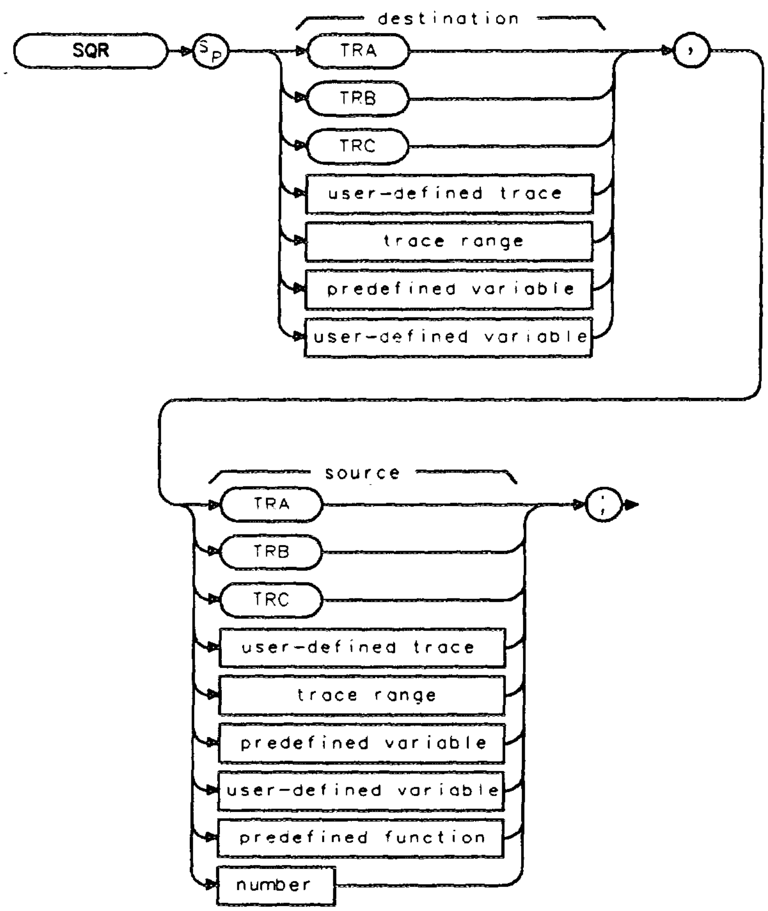
If the source is negative, the square root of the absolute value will be returned.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# SQR
# Square Root

Places the square root of the source into the destination.

## Syntax




XSQR

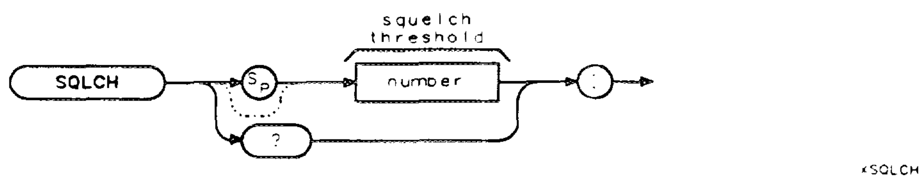
| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: PDA, PDF, STDEV.

# SQLCH
# Squelch

Sets the squelch threshold by setting the squelch level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 0 to 100. |

Equivalent Softkey: SQUELCH .
Option Required: Option 102, 103, or 301.
Preset Value: 0.
Related Commands: DEMOD, FMGAIN, SPEAKER.

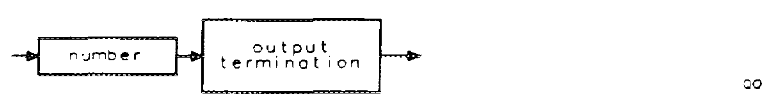
## Example

```
OUTPUT 718;"SQLCH 100;"
```

## Description

SQLCH mutes weak signals and passes strong signals.

## Query Response



# SPZOOM
# Span Zoom

Places a marker on the highest on-screen signal (if an on-screen marker is not present), turns on the signal track function, and activates the span function.

## Syntax


XSPZOOM

Equivalent Softkey: **SPAN ZOOM**.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"IP;CF 300MZ;TS;"
OUTPUT 718;"SPZOOM;"
```

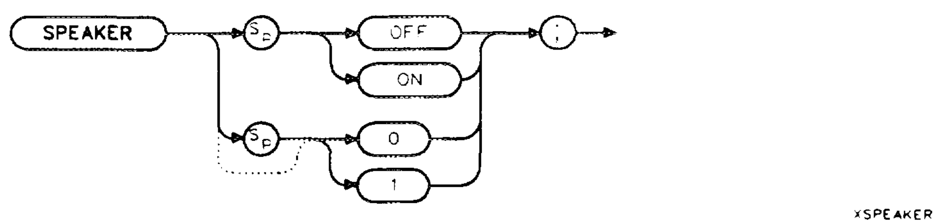
## Description

If a marker is present before SPZOOM is executed, SPZOOM turns on the signal track function and activates the span function.

# SPEAKER
# Speaker

Turns on or off the internal speaker.

## Syntax




Option Required: Option 102, Option 103, or Option 301.
Preset State: SPEAKER ON.
Related Commands: DEMOD, FMGAIN, SQLCH.

## Example

```
OUTPUT 718;"SPEAKER OFF;"
```

**SP Span**

## Description

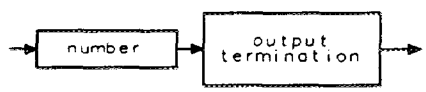
The frequency span readout refers to the displayed frequency range. Dividing the readout by 10 yields the frequency span per division.

If resolution and video bandwidths are coupled to the span width, the bandwidths change with the span width to provide a predetermined level of resolution and noise averaging. Likewise, the sweep time changes to maintain a calibrated display, if coupled. All of these functions are normally coupled, unless RB, VB, or ST have been executed.

Because span is affected by frequency, change the frequency before changing span (see "HNLOCK"). For the HP 8592D and HP 8593E, the span can be set to include band 0 and band 1 except in single-sweep mode.

Specifying 0 Hz enables zero-span mode, which configures the spectrum analyzer as a fixed-tuned receiver.

## Query Response

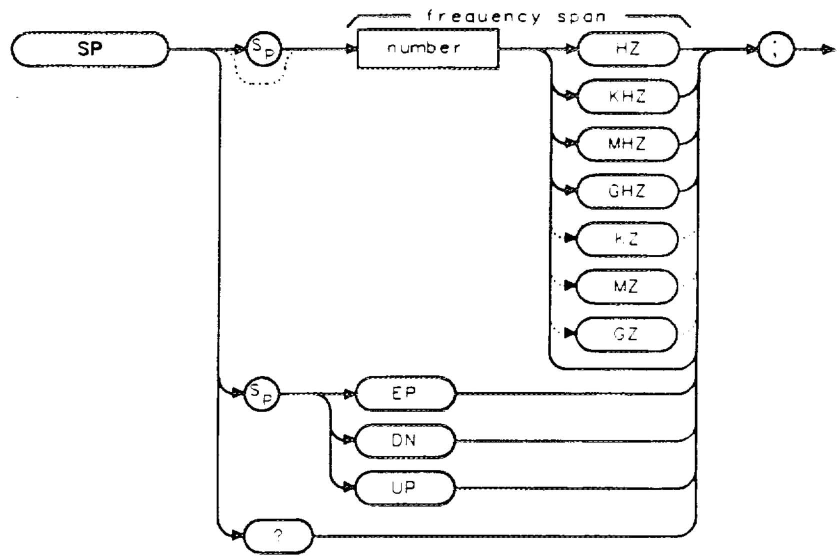



001

# SP
# Span

Changes the total displayed frequency range symmetrically about the center frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency span of the spectrum analyzer. |

Equivalent Softkey: **SPAN** .

Step Increment: 1, 2, 5, 10 sequence (up to the stop frequency of the spectrum analyzer).

Related Commands: CF, FA, FB, FOFFSET, FS, HNLOCK, HNUNLK, RB, ST, VB.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;SP 20MHZ;"` | *Initializes spectrum analyzer, changes frequency span.* |
| `OUTPUT 718;"SP?;"` | *Gets the span value from the spectrum analyzer.* |
| `ENTER 718;Span` | *Puts the spectrum analyzer response in the computer variable, Span.* |
| `PRINT Span` | *Displays the span value.* |

# SNGLS
# Single Sweep

Sets the spectrum analyzer to single-sweep mode.

## Syntax


XSNGLS

Equivalent Keys: (SGL SWP) or **SWEEP CONT SGL** (SGL is underlined).

Related Commands: CLRW, CONTS, TM, TS.

## Example

```
OUTPUT 718;"SNGLS;"
```

## Description

Each time TS (take sweep) is sent, one sweep is initiated, as long as the trigger and data entry conditions are met.

*For the HP 8592D or the HP 8593E only:* The frequency span that can be viewed with a single-sweep is bounded by the instrument range only; therefore, band 0 can be included in a multiband sweep in single sweep mode. This allows a 0 GHz to 22 GHz span with an HP 8592D or HP 8593E (also see "TS").

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep mode, takes a sweep.* |
| `30 OUTPUT 718;"VIEW TRA;"` | *Stores results of trace A.* |
| `40 OUTPUT 718;"SMOOTH TRA,10;"` | *Smooths trace A.* |
| `50 OUTPUT 718;"VIEW TRA;"` | *Displays the result.* |
| `60 END` | |

## Description

Each point value is replaced with the average of the values (in measurement units) of the given number of points centered on it. Increasing the number of points increases smoothing at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the size of SOURCE, then the size of SOURCE is used (unless size of SOURCE is even, in which case the size of SOURCE minus one is used). Smoothing decreases at the endpoints.

The purpose of this function is to perform a spatial video averaging as compared to the temporal version supplied by the video-average (VAVG) command. The functions of SMOOTH and VAVG are not interchangeable however. Unlike VAVG, SMOOTH averages values that occur before and after the data point in time. This can cause some display irregularities at the start and stop frequencies. Use low values for the SMOOTH parameter to avoid signal distortion.

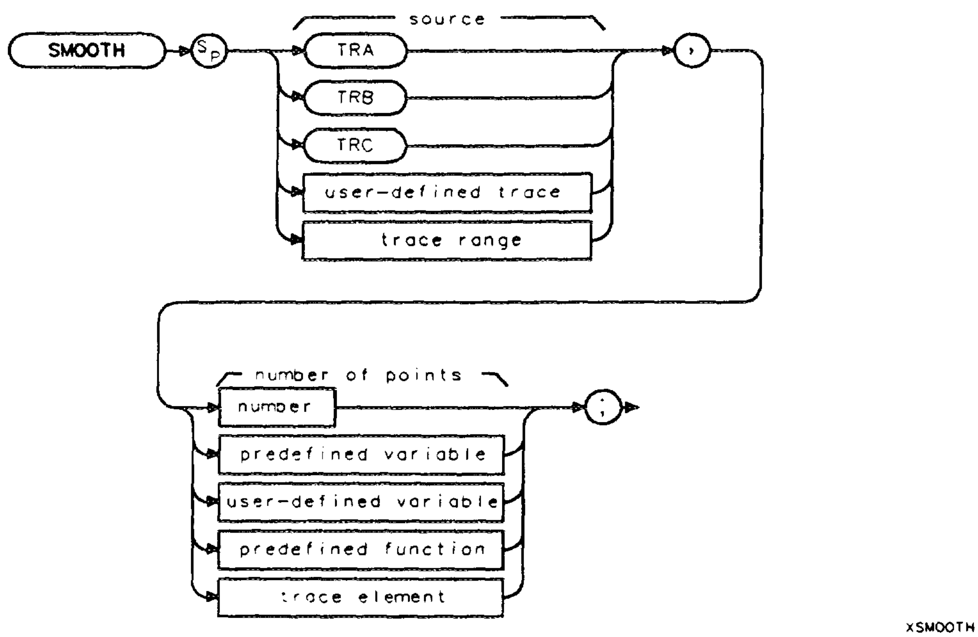
By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in video noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time. As such, it does result in a reduction of frequency resolution. Also, signal peaks are reduced with large smoothing values, and this can cause the amplitude to appear to be low.

This command requires user memory for its execution. Memory is not permanently allocated, so the largest amount of memory is available for the functions that are used in a particular application. When the command is complete, memory is returned to the free user memory.

# SMOOTH
# Smooth Trace

Smooths the trace according to the number of points specified for the running average.

## Syntax



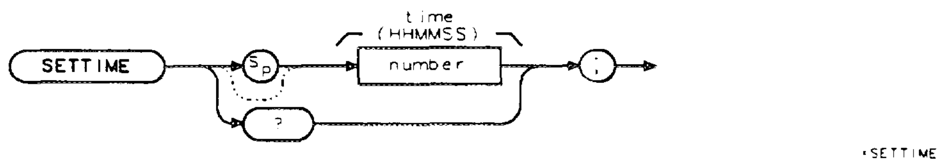

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: SNGLS, TS, VAVG.

# SETTIME
# Set Time

Allows you to set the time of the real-time clock of the spectrum analyzer.

## Syntax



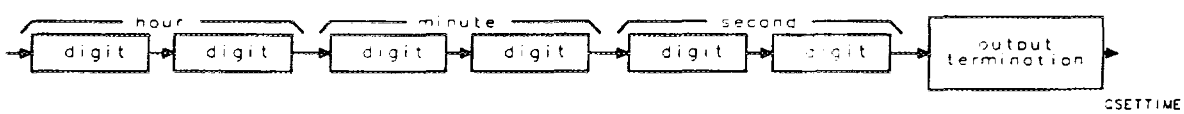

| Item | Description/Default | Range |
|---|---|---|
| Number | A number in the HHMMSS (24 hour) format. | 0 to 235959. |

Equivalent Softkey: **SET TIME**.
Related Commands: SETDATE, TIMEDATE, TIMEDSP.

## Example

`OUTPUT 718;"SETTIME 135501;"` *Sets the time to 1:55:01* P.M.

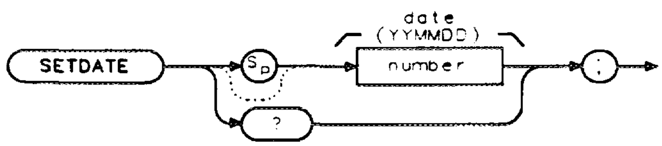
## Query Response



# SETDATE
# Set Date

Allows you to set the date of the real-time clock of the spectrum analyzer.

## Syntax




XSETDATE

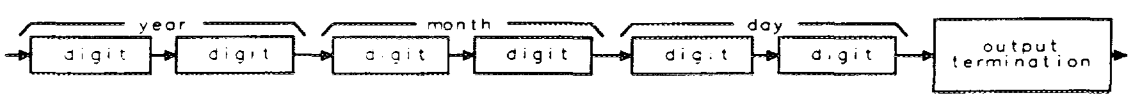
| Item | Description/Default | Range |
|---|---|---|
| Number | A number in the YYMMDD format. | Valid year, month, and day. |

Equivalent Softkey: SET DATE .
Related Commands: SETTIME, TIMEDATE, TIMEDSP.

## Example

`OUTPUT 718;"SETDATE 890212;"` *Sets the date to February 12, 1989.*

## Query Response

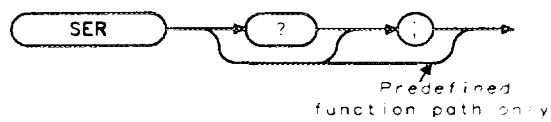



QSETDATE

# SER
# Serial Number

Returns the serial number suffix of the spectrum analyzer.

## Syntax




XSER

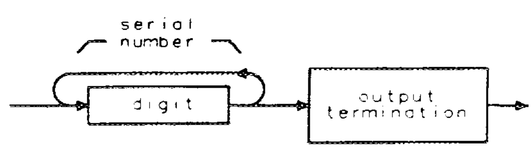
Related Commands: ID, REV.

## Example

| | |
|---|---|
| `DIM Serial$[24]` | *Reserves memory space for a string.* |
| `OUTPUT 718;"SER;"` | *Gets the serial number from the spectrum analyzer.* |
| `ENTER 718;Serial$` | *Puts the spectrum analyzer response in the computer variable.* |
| `DISP Serial$` | *Displays the serial number on the computer screen.* |

## Query Response

The last five digits of the serial number are returned.




QSER

**SENTERT Segment Entry for Sweep Time Limit Lines**

**Note** If the current limit line table contains lines based on frequency (as opposed to a limit line based on the sweep time), executing SENTERT will clear the current frequency limit line table.

The three segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all sweep times between the two points. If the amplitude values of the two segments differ, the limit-line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all sweep times between the two points.
- POINT specifies a limit value for the coordinate point, and no other sweep time points, so that a POINT segment specifies a limit value for a single sweep time. For an upper limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the top of screen. For a lower limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the bottom of screen. The POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is automatically used. If a visible POINT segment at the right-hand edge of the display is not desired, add an explicit last point segment to the limit-line table that is higher in sweep time than the current sweep time of the spectrum analyzer.

Segments are sorted as they are entered according to starting sweep time. A maximum of 20 segments can be defined using SENTERT.

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. For amplitude, the default unit is dBm. For sweep time, the default unit is seconds. | The range for the amplitude varies with ROFFSET. The range for the sweep time is the sweep time range of the spectrum analyzer. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Related Commands: LIMIMODE, LIMIREL, LIMISEGT, SEGDEL, SENTER.

## Example 1

This example enters limit-line values into the upper and lower limit-line tables.

| | |
|---|---|
| `OUTPUT 718;"RL -10DB;"` | *Sets the reference level to −10 dB.* |
| `OUTPUT 718;"LIMIDEL;"` | *Erases any the current limit line table.* |
| `OUTPUT 718;"LIMIFT TIME;"` | *Sets the limit lines to be based on sweep time.* |
| `OUTPUT 718;"LIMIMODE UPLOW;LIMIREL ON;"` | *Specifies the upper and lower limit-line table as relative.* |
| `OUTPUT 718;"SENTERT 10MS,-10DB,-50DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTERT 0MS,-15DB,-60DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"LIMITEST ON;TS;"` | *Turns on the limit-line testing.* |

## Example 2

| | |
|---|---|
| `OUTPUT 718;"LIMIFT TIME;"` | *Sets the limit lines to be based on sweep time.* |
| `OUTPUT 718;"LIMIMODE DELTA;LIMIREL OFF;"` | *Specifies the mid and delta table format and fixed type.* |
| `OUTPUT 718;"SENTERT 10MS,-20DB,10DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTERT 0MS,-30DB,20DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"LIMITEST ON;TS"` | *Turns on the limit-line testing.* |

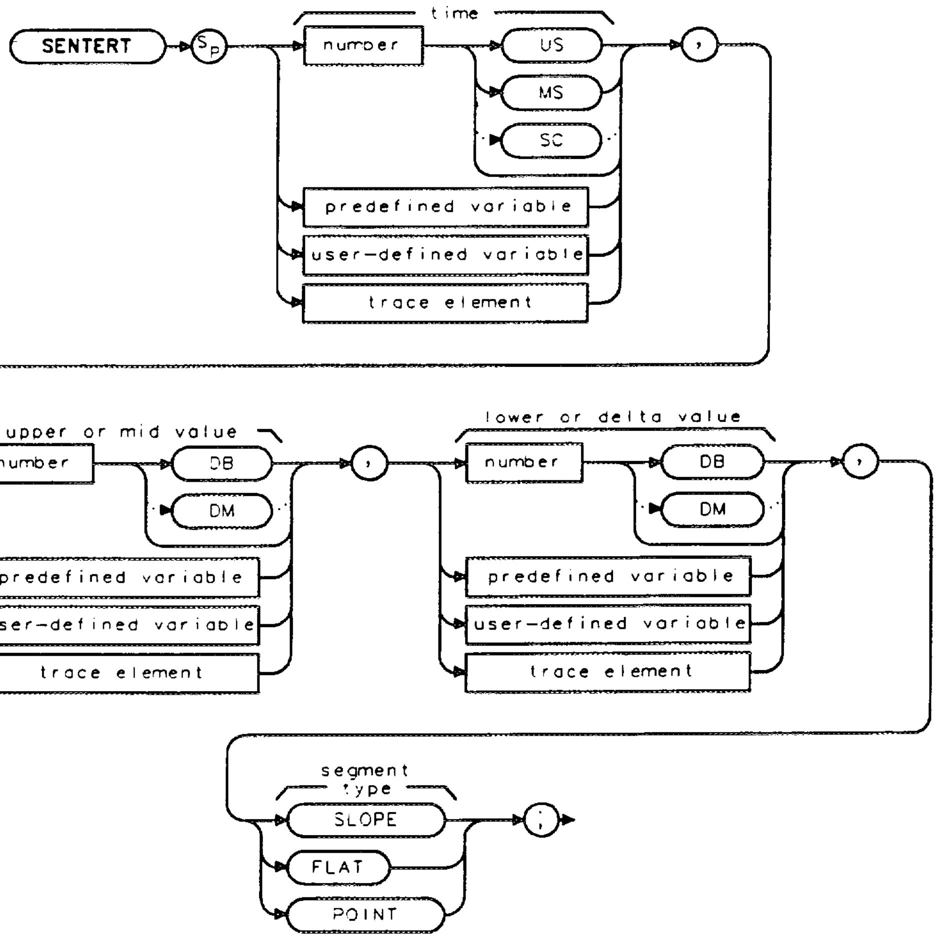
## Description

Each limit-line segment is specified with a starting sweep time, an upper or median amplitude value, a lower or delta amplitude value, and a segment type. The segment type defines how the line segment is to extend from its starting point to the next segment.

# SENTERT
## Segment Entry for Sweep Time Limit Lines

Enters the limit-line data in either the upper and lower limit-line table or the mid and delta table for limit lines based on sweep time.

### Syntax




XSENTERT

top of screen. For a lower limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the bottom of screen. The POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is automatically used. If a visible POINT segment at the right-hand edge of the display is not desired, add an explicit last point segment to the limit-line table that is higher in frequency than the stop frequency.

Segments are sorted as they are entered according to starting frequency. A maximum of 20 segments can be defined using SENTER. When the type is omitted, the last type given (or SLOPE if no previous type has been given) is used.

**SENTER Segment Entry for Frequency Limit Lines**

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | Varies with FOFFSET and ROFFSET. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Related Commands: LIMIMODE, LIMIREL, LIMISEG, SEGDEL, SENTERT.

## Example 1

This example enters limit-line values into the upper and lower limit-line tables.

| | |
|---|---|
| `OUTPUT 718;"LIMIFT FREQ;"` | *Sets the limit lines to be based on frequency.* |
| `OUTPUT 718;"LIMIMODE UPLOW;LIMIREL OFF;"` | *Specifies the upper and lower limit-line table as fixed.* |
| `OUTPUT 718;"SENTER 300MHZ,-10DB,-50DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTER 350MHZ,-15DB,-60DB,FLAT;"` | *Enters in values for a segment.* |

## Example 2

| | |
|---|---|
| `OUTPUT 718;"LIMIFT FREQ;"` | *Sets the limit lines to be based on frequency.* |
| `OUTPUT 718;"LIMIMODE DELTA;LIMIREL OFF;"` | *Specifies the mid and delta table format and fixed type.* |
| `OUTPUT 718;"SENTER 300MHZ,-20DB,10DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTER 350MHZ,-30DB,20DB,FLAT;"` | *Enters in values for a segment.* |

## Description

Each limit-line segment is specified with a starting frequency, an upper or median amplitude value, a lower or delta amplitude value, and a segment type. The segment type defines how the line segment is to extend from its starting point to the next segment.

**Note** If the current limit line table contains lines based on sweep time (as opposed to a limit line based on the frequency), executing SENTER will clear the current sweep time limit line table.

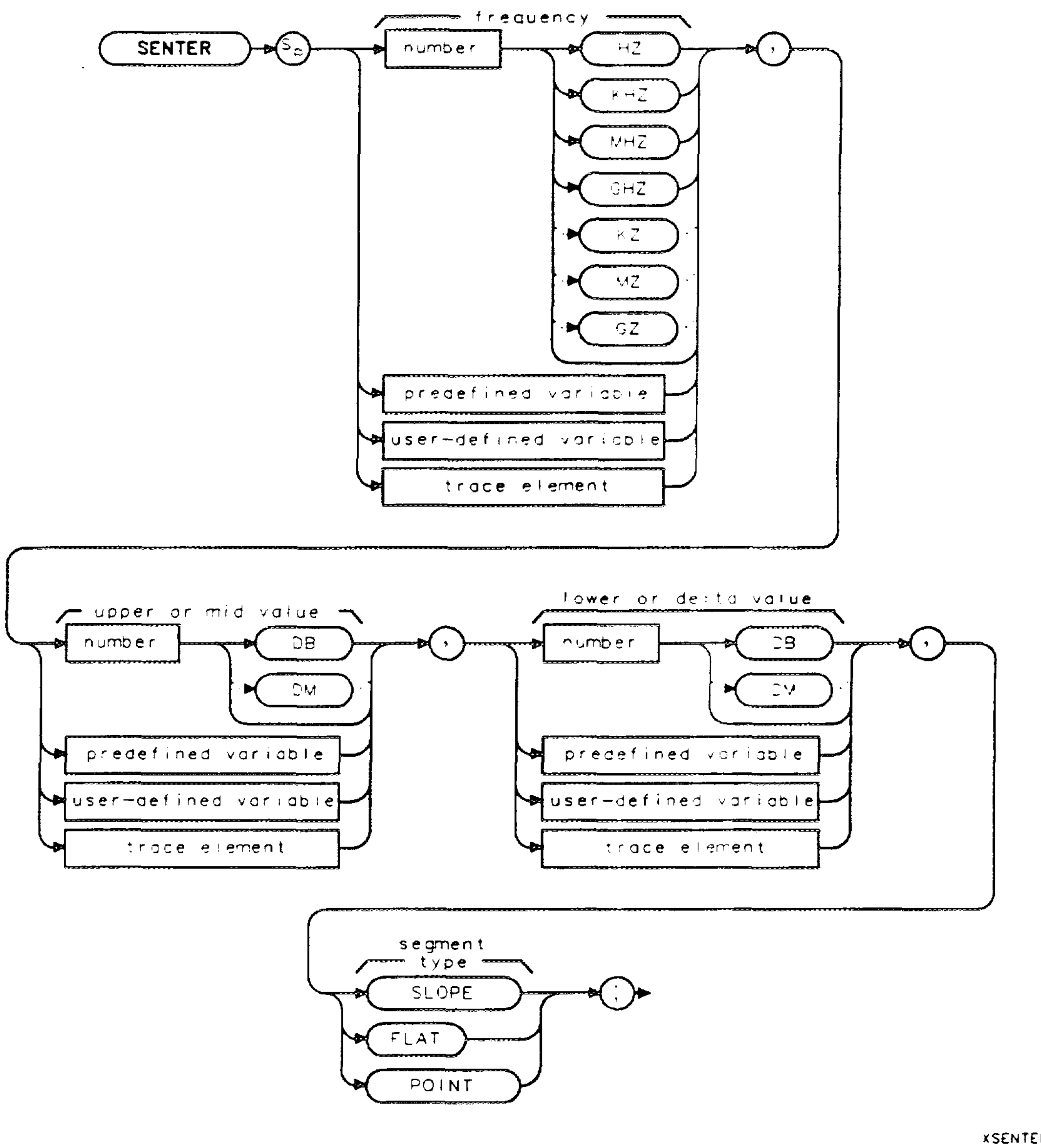
The three segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all frequencies between the two points. If the amplitude values of the two segments differ, the limit-line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all frequencies between the two points.
- POINT specifies a limit value for the coordinate point, and no other frequency points, so that a POINT segment specifies a limit value for a single frequency. For an upper limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the

# SENTER
# Segment Entry for Frequency Limit Lines

Enters the limit-line data in the upper and lower limit-line table or the mid and delta table for limit lines based on frequency.

## Syntax



**SEGDEL Segment Delete**

```
50 OUTPUT 718;"LIMISEG 300MHZ,-70DB,FLAT;"
60 OUTPUT 718;"LIMIMODE UPLOW;"
70 OUTPUT 718;"SEGDEL 1;"
80 END
```

| | |
|---|---|
| 50 OUTPUT 718;"LIMISEG 300MHZ,-70DB,FLAT;" | *Enters a segment into the lower limit-line table.* |
| 60 OUTPUT 718;"LIMIMODE UPLOW;" | *Specifies both the upper and lower limit-line tables.* |
| 70 OUTPUT 718;"SEGDEL 1;" | *Deletes the segment from the upper and lower limit-line tables.* |
| 80 END | |

## Description

The result of SEGDEL depends on the setting of the LIMIMODE command as shown in the following table.

| LIMIMODE Setting | Result of SEGDEL |
|---|---|
| LIMIMODE UPPER | Deletes specified segment from the upper limit-line table. |
| LIMIMODE LOWER | Deletes specified segment from the lower limit-line table. |
| LIMIMODE UPLOW | Deletes specified segment from the upper and lower limit-line table. |
| LIMIMODE DELTA | Deletes specified segment from the mid and delta limit-line table. |

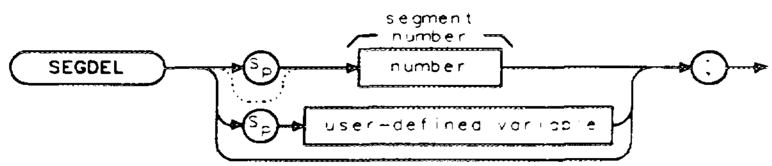
You may want to query LIMIMODE before using SEGDEL if you are unsure of the LIMIMODE setting.

To determine the number of each segment, you can use the softkeys accessed by **Edit Limit** to display the limit-line table. (Limit-line entries are sorted according to frequency or time.)

# SEGDEL
# Segment Delete

Deletes the specified segment from the limit-line tables.

## Syntax




xSEGDEL

Related Commands: LIMIMODE, LIMISEG, LIMISEGT, SENTER, SENTERT.

## Example

## Example 1

This example uses LIMIMODE for entering segments into the upper limit-line table, then entering a segment into the lower limit-line table (upper and lower limit lines are treated as separate tables). Line 60 demonstrates the effect of deleting a segment when the upper and lower limit-line tables are treated separately.

| | |
|---|---|
| `10 OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| `20 OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `25 OUTPUT 718;"LIMIFT FREQ;"` | *Limit lines to be based on frequency.* |
| `30 OUTPUT 718;"LIMISEG 300MHZ,-30DB,FLAT;"` | *Enters a segment into the upper limit-line table.* |
| `40 OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| `50 OUTPUT 718;"LIMISEG 300MHZ,-70DB,FLAT;"` | *Enters a segment into the lower limit-line table.* |
| `60 OUTPUT 718;"SEGDEL 1;"` | *Deletes the segment from the lower limit-line table.* |
| `70 END` | |

## Example 2

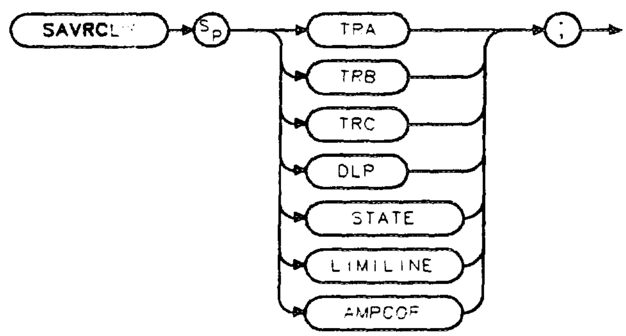
With the addition of line 60, the upper and lower limit-line tables are no longer treated as separate tables, but as one table. The segment is deleted from the upper and lower limit-line tables (for the given frequency).

| | |
|---|---|
| `10 OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table.* |
| `20 OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `25 OUTPUT 718;"LIMIFT FREQ;"` | *Limit lines to be based on frequency.* |
| `30 OUTPUT 718;"LIMISEG 300MHZ,-30DB,FLAT;"` | *Enters segment into the upper limit-line table.* |
| `40 OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |

# SAVRCLW
# Save or Recall Data

Specifies the data to be transferred: trace A, trace B, trace C, program, amplitude correction factors, limit line, or state.

## Syntax




XSAVRCLW

Related Commands: MSI, PREFX, RCLS, RCLT, SAVES, SAVET, SAVRCLF, SAVRCLN.

## Example

This example allows the current spectrum analyzer state to be saved on a RAM card.

| | |
|---|---|
| `OUTPUT 718;"SAVRCLF SAVE;"` | *Specifies a save operation.* |
| `OUTPUT 718;"SAVRCLW STATE;"` | *Specifies the source as the current spectrum analyzer state.* |
| `OUTPUT 718;"MSI CARD;"` | *Specifies the card as the mass storage device.* |
| `OUTPUT 718;"PREFX %FRED%;"` | *Specifies the prefix to store the state data under.* |
| `OUTPUT 718;"SAVRCLN 34;"` | *Appends the register number 34 to the prefix and initiates the data transfer.* |

The RAM card now has a file called sFRED_34 that contains the instrument state.

## Description

SAVRCLW is used to save or recall data in spectrum analyzer memory or on a RAM card. See "SAVRCLN" for the sequence of commands to initiate a data transfer.

The SAVRCLW parameters correspond to the type of data transferred as shown in the following table.

| Parameter | Type of Data Transferred |
|---|---|
| TRA | Trace A. |
| TRB | Trace B. |
| TRC | Trace C. |
| DLP | Downloadable programs. |
| STATE | Instrument state. |
| LIMILINE | Limit lines. |
| AMPCOR | Amplitude correction factors. |

3. Specify a RAM card or spectrum analyzer memory as the mass storage device with MSI.
4. When saving to or recalling from a RAM card, specify the prefix to be used with PREFX. The prefix is ignored when saving or recalling from spectrum analyzer memory.
5. Enter the number to append to the prefix and initiate the data transfer with SAVRCLN.

When saving trace data, amplitude correction factors, or limit-line tables in spectrum analyzer memory, specify a number within the trace register number range (0 to TRCMEM − 1). When saving state data in spectrum analyzer memory, specify a number within the state number range (1 to 8).

When saving data on a RAM card, the number plus the number of characters in the prefix must not exceed eight characters.

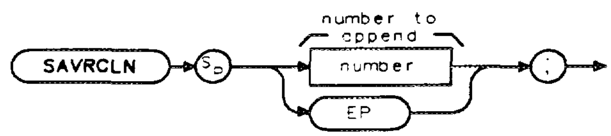
**Note**

With the memory card reader, the spectrum analyzer can read from either a RAM (random-access memory) card or a ROM (read-only memory card). To write to a memory card, the memory card must be a RAM card. The spectrum analyzer cannot write to a ROM card.

# SAVRCLN
# Save or Recall Number

Specifies the number to append to the prefix for a save or recall operation, and initiates the transfer of data.

## Syntax




XSAVRCLN

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | Dependent on mass storage device. |

Related Commands: MSI, PREFX, RCLS, SAVES, SAVRCLF, SAVRCLW.

## Example

This example allows trace A to be saved on a RAM card.

| | |
|---|---|
| `OUTPUT 718;"SAVRCLF SAVE;"` | *Specifies a save operation.* |
| `OUTPUT 718;"SAVRCLW TRA;"` | *Specifies the source as trace A.* |
| `OUTPUT 718;"MSI CARD;"` | *Specifies the card as the mass storage device.* |
| `OUTPUT 718;"PREFX %FRED%;"` | *Specifies the prefix to store the trace data under.* |
| `OUTPUT 718;"PU;PA 0,160;TEXT%ENTER TEST NUMBER%;"` | *Prompts the user for the number to append to the prefix.* |
| `OUTPUT 718;"SAVRCLN EP;"` | *After the user enters the number, the number is appended to the prefix and the data transfer is initiated.* |

## Description

SAVRCLN is used to save or recall data from spectrum analyzer memory or from a RAM card. SAVRCLN is useful if you want to write a program that allows the spectrum analyzer operator to save data in spectrum analyzer memory or on a RAM card. The SAVRCLN command uses the SAVRCLF flag information, SAVRCLW information, prefix, and mass storage device when transferring data.

Because the SAVRCLN command initiates the transfer of data, it should be the last command specified in the sequence to save or recall data.

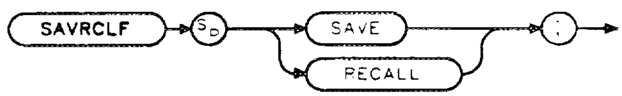
The sequence to save or recall data is as follows:

1. Specify either a save or recall operation with SAVRCLF.
2. Indicate the type of data to be saved or recalled using SAVRCLW.

# SAVRCLF
# Save or Recall Flag

Indicates a save or recall operation.

## Syntax




XSAVRCLF

Related Commands: MSI, PREFX, RCLS, RCLT, SAVES, SAVET, SAVRCLN, SAVRCLW.

## Example

This example allows trace A to be saved on a RAM card.

| | |
|---|---|
| `OUTPUT 718;"SAVRCLF SAVE;"` | *Specifies a save operation.* |
| `OUTPUT 718;"SAVRCLW TRA;"` | *Specifies the source as trace A.* |
| `OUTPUT 718;"MSI CARD;"` | *Specifies the card as the mass storage device.* |
| `OUTPUT 718;"PREFX %FRED%;"` | *Specifies the prefix to store the trace data under.* |
| `OUTPUT 718;"PU;PA 0,160;TEXT%ENTER TEST NUMBER%;"` | *Prompts the user for the number to append to the prefix.* |
| `OUTPUT 718;"SAVRCLN EP;"` | *After the user enters the number, the number is to appended to the prefix and the data transfer is initiated.* |

The RAM card now contains a file called tFRED_(register number).

**SAVET Save Trace**

## Description

The trace data is saved in the specified register if the state registers have not been locked by PSTATE ON (see "SAVES"). Use AMPCOR to save amplitude correction factors, LIMILINE to save limit-line tables.

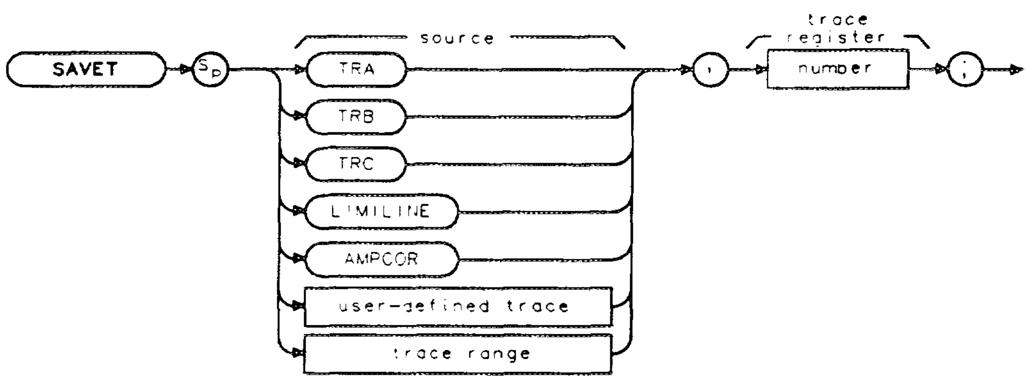
**Note** The TS and VIEW commands should be executed prior to saving trace data.

The SAVET command saves trace data, amplitude correction factors, or limit-line tables in spectrum analyzer memory. See "STOR" or "SAVRCLN" to save data on a RAM card.

# SAVET
# Save Trace

Saves the selected trace data and state information, amplitude correction factors, or limit-line tables in spectrum analyzer memory.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command with a length of 401 elements. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 0 to TRCMEM − 1. |

Equivalent Softkey: **Trace -> Intrnl** .

Prerequisite Commands: TRDEF when using a user-defined trace.

Related Commands: CAT, CLRW, PSTATE, RCLT, SNGLS, TS, VIEW.

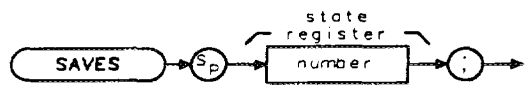
## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes spectrum analyzer, changes the center frequency and span.* |
| `OUTPUT 718;"VIEW TRA;SAVET TRA,1;"` | *Puts trace A in the view mode, saves spectrum analyzer state and trace A data in register 1.* |
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"RCLT TRA,1;VIEW TRA;"` | *Recalls spectrum analyzer state, trace data.* |

# SAVES
# Save State

Saves the currently displayed instrument state in spectrum analyzer memory.

## Syntax




XSAVES

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 1 to 8. |

Equivalent Softkey: **STATE -> INTRNL**.

Related Commands: OL, PSTATE, RCLS, SAVET, STOR.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"` | *Initializes spectrum analyzer, changes center frequency, span.* |
| `OUTPUT 718;"SAVES 1;"` | *Saves spectrum analyzer state in register 1.* |

## Description

The state data is saved in the specified state register if the state registers have not been locked by the PSTATE command.

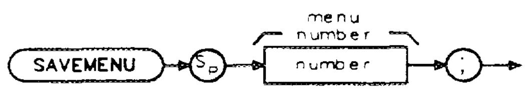
Only state registers 1 through 8 are available for saving the instrument state. State register nine contains the previous state data, state register zero contains the current state.

**Note** The SAVES command saves state data in spectrum analyzer memory. See "STOR" or "SAVRCLN" to save state data on a RAM card.

# SAVEMENU
# Save Menu

Saves menu 1 under the specified menu number.

## Syntax




XSAVEMENU

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 1, 101 to 200. |

## Example

```
OUTPUT 718;"MENU 1;"              Displays menu 1.
OUTPUT 718;"SAVEMENU 101;"        Copies the key functions from menu 1 into menu 101.
OUTPUT 718;"KEYCLR;"              Erases the key functions of menu 1.
PAUSE
OUTPUT 718;"MENU 101;"            Displays menu 101.
```

## Description

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 is can be accessed by pressing (MEAS/USER), **User Menus** .

Menus 101 through 200 as well as menu 1 can be accessed using the MENU command. See "MENU" for more information about accessing softkeys and menus.

**RQS Service Request Mask**

**0** (LSB), **6**, and **7** are not used.

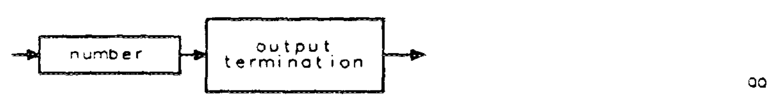
The spectrum analyzer screen numbers 102, 104, and 110 are the octal values corresponding to the status register values; that is, SRQ 102 = bit 6 = octal 100 and bit 2 = octal 2 are both true.

A service request is generated only if the proper request mask bit has been set, and either the condition itself or the Force Service Request (see "SRQ") is sent. To set the request mask, choose the desired interrupt conditions and sum their assigned values. Executing the RQS command with this value sets the bit mask. After setting the bit mask, only the chosen conditions can produce an interrupt. Generally, you must set the bit mask using the RQS command. However, the "hardware broken" and "illegal remote command" conditions are automatically enabled after presetting or sending the IP command. Pressing (PRESET) or sending the IP command, then, produces the same interrupt bit mask as sending "RQS 40;" (decimal 40 is the sum of the assigned values of these two interrupt bits, 32 = Bit 5 and 8 = Bit 3).

For most conditions, the RQS mask bit stays set until the next IP or RQS command is executed. The only condition in which this does not apply is the Units Key Pressed bit. When this bit (bit 1) is set in the RQS mask, a Units Key Pressed interrupt occurs if EE (enable entry mode) is executed and a front-panel units key such as Hz, kHz, MHz, or GHz is pressed.

When a units key is pressed, the interrupt occurs and the Units Key Pressed bit in the RQS mask is reset. To reenable the Units Key Pressed interrupt, you must send a new RQS mask.

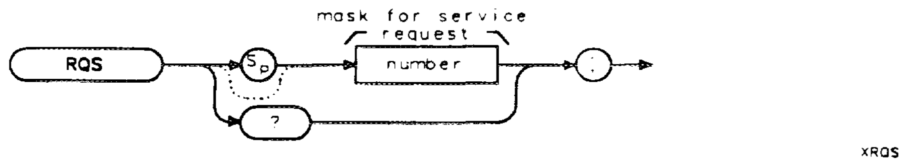
## Query Response



# RQS
# Service Request Mask

Sets a bit mask for service requests (see "SRQ").

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 0 to 62. |

Related Commands: SRQ, STB.

## Example

`OUTPUT 718;"RQS 12;"` *Sends a mask bit for hardware broken and end of sweep.*

## Description

Assignment of values for the mask is as follows:

32 = Illegal command (bit 5)
16 = Command complete (bit 4)
8 = Hardware broken (bit 3)
4 = End of sweep (bit 2)
2 = Units key pressed (bit 1)

As shown in the example, a mask with hardware broken and end of sweep is equal to 12 (8 + 4). The mask also disables command complete and illegal command interrupts.

To activate all conditions in the mask, the mask value is equal to 62 (32 + 16 + 8 + 4 + 2). To set the service request mask for all conditions, execute `OUTPUT 718;"RQS 62;"`.

Each bit in the status byte is defined as follows:

**1** Indicates that the units key was pressed. `SRQ 102` appears on the spectrum analyzer screen. If you activate the units key bit, it will remain active until you activate "EE" and press a units key. (See "EE.")

**2** Indicates end of sweep. `SRQ 104` appears on the spectrum analyzer screen. If you send any RQS value that contains mask value 4, another sweep will be taken.

**3** Indicates broken hardware. `SRQ 110` appears on the spectrum analyzer screen.

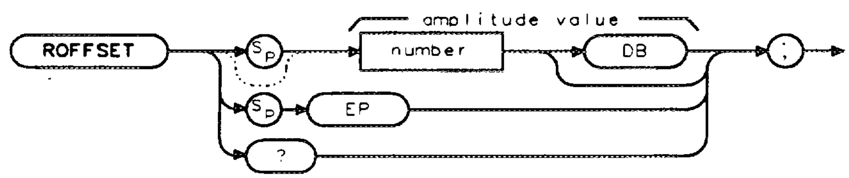
**4** Indicates completion of a command. It is triggered by EOI at the end of a command string or the completion of a print or plot.

**5** Indicates an illegal spectrum analyzer command was used. `SRQ 140` appears on the spectrum analyzer screen.

# ROFFSET
# Reference Level Offset

Offsets all amplitude readouts without affecting the trace.

## Syntax




XROFFSET

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dB. | −200 dB to +200 dB. |

Equivalent Softkey: **REF LVL OFFSET** .
Preset State: 0 dB.
Related Commands: AT, RL.

## Example

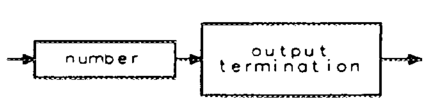
| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"RL −20DB;" | *Changes the reference level.* |
| 30 OUTPUT 718;"ROFFSET −10;" | *Changes spectrum analyzer reference offset value.* |
| 40 OUTPUT 718;"RL?;" | *Gets the reference value from spectrum analyzer.* |
| 50 ENTER 718;Ref | *Puts the spectrum analyzer response in the computer variable, Ref.* |
| 60 DISP "THE NEW REFERENCE LEVEL IS ",Ref | *Displays −30 as the new reference level.* |
| 70 END | |

## Description

Once activated, the ROFFSET command displays the amplitude offset in the active function block. And, as long as the offset is in effect, the offset is displayed on the left side of the screen.

Entering ROFFSET 0 or presetting the spectrum analyzer eliminates an amplitude offset.

## Query Response

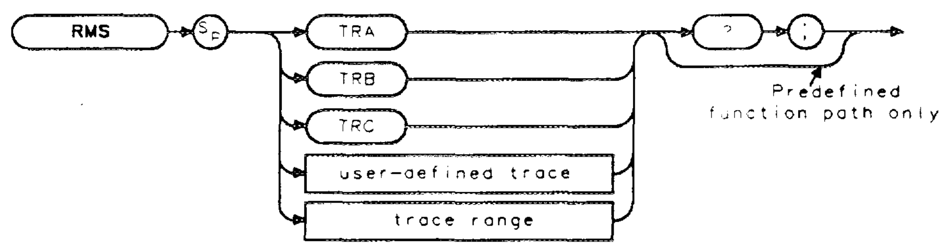



QQ1

# RMS
# Root Mean Square Value

Returns the root mean square value of the trace in measurement units.

## Syntax




XRMS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, PDA, PDF, STDEV, VARIANCE.

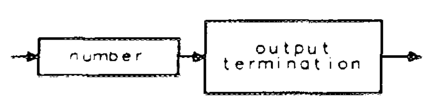
## Example

```
OUTPUT 718;"IP;SNGLS;TS;"
OUTPUT 718;"RMS TRA?;"
ENTER 718;Number
DISP Number
```

## Description

Trace data, user-defined trace data, and trace range data are treated as 16-bit integers.

## Query Response

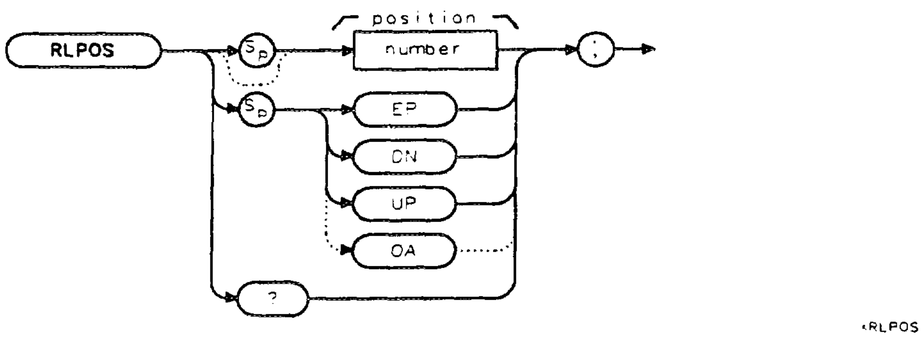



QQ1

# RLPOS
# Reference-Level Position

Selects the position of the reference level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 0 to 8. |

Step Increment: 1.
Related Commands: IP, MEASURE, NRL, RL.
Preset State: RLPOS 8.

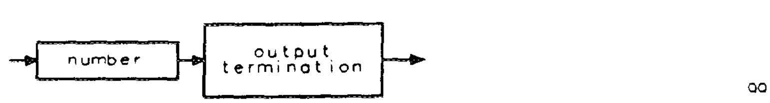
## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"MEASURE NRM;"` | *Changes the measurement mode to normalized.* |
| `OUTPUT 718;"AMBPL ON;"` | *Activates trace normalization.* |
| `OUTPUT 718;"RLPOS 7;"` | *Positions the reference level at the seventh major graticule division.* |

## Description

The RLPOS command changes the position of the reference level during log display mode. The top and bottom graticule lines correspond to 8 and 0, respectively. RLPOS must be used with MEASURE NRM or MEASURE SR, and AMBPL ON or AMB ON. Arrows appear on the left and right side of the screen graticule when the reference level position is changed.

## Query Response



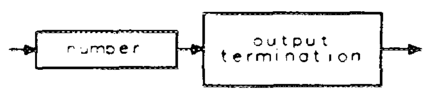
## Description

The reference level and input attenuator are coupled to prevent gain compression. Signals with peaks at or below the reference level are not affected by gain compression.

**Caution** Signal levels above +30 dBm will damage the spectrum analyzer.

RL may affect the attenuation value.

## Query Response

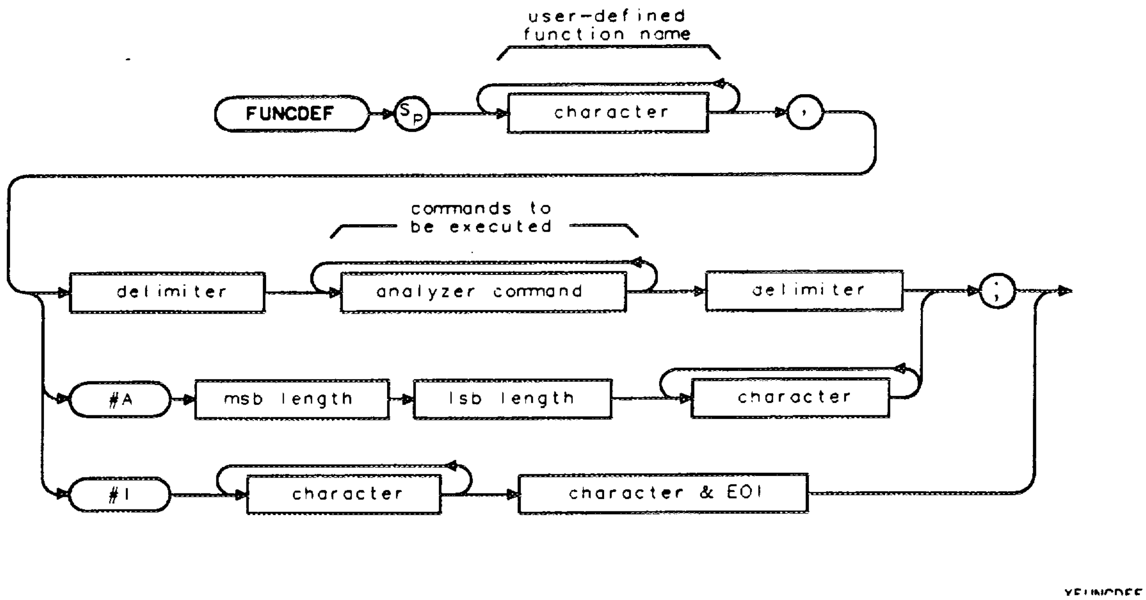



001

# FUNCDEF
# Define Function

Defines a routine consisting of spectrum analyzer commands, assigns the routine a label, and stores the routine and its label in the user memory.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character (function name) | Any valid character. | 2 to 11 characters long, A through Z and the underscore (the underscore should be used as the second character of the label). |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any valid spectrum analyzer command. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Character (data) | Any valid character. | |
| Character & EOI | Any valid character and END. | |

Restriction: User-defined function name cannot be a reserved word (see Table 5-2).
Related Commands: ABORT, DISPOSE, KEYDEF, RETURN.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"VARDEF H_SPAN,0;"` | *Defines user-defined variable with an initial value of 0.* |
| `30 OUTPUT 718;"FUNCDEF S_HIFT,@";` | *Creates user-defined function, called S_HIFT. Shift divides the span by two and adds the results to the center frequency. The "@" delimits the definition.* |
| `40 OUTPUT 718;"DIV H_SPAN,SP,2;";` | *Puts half of span value into H_SPAN.* |
| `50 OUTPUT 718;"ADD CF,CF,H_SPAN;";` | *Adds H_SPAN to CF.* |
| `60 OUTPUT 718;"@;"` | *Marks the end of the FUNCDEF declaration.* |
| `70 OUTPUT 718;"KEYDEF 1,S_HIFT,%SHIFT_UP%;"` | *Assigns the function S_HIFT to the user-defined softkey, called SHIFT_UP.* |
| `80 OUTPUT 718;"CF 300MHZ;"` | *Displays the calibrator signal.* |
| `90 OUTPUT 718;"SP 1MHZ;";` | |
| `100 LOCAL 718` | *Returns control to local mode.* |
| `110 END` | |

The semicolons at the end of lines 30, 40, and 50 in the example suppress BASIC's carriage return and line feed. Adding the semicolons at the end of the lines of a FUNCDEF declaration saves memory (because the carriage returns and line feeds are suppressed).

## Description

The FUNCDEF command can be used to create a user-defined function (also called a DLP). To use the FUNCDEF command, you must specify the function label and the list of commands it executes. Once a user-defined function is created, it is stored in spectrum analyzer memory. The user-defined function can be executed by invoking the function name within the definition of a user-defined softkey, another user-defined function, or a computer program. To delete the function from spectrum analyzer memory, use the DISPOSE command. (See Chapter 4 for more information about creating and using a DLP).

The ABORT, IF/THEN/ELSE/ENDIF, REPEAT/UNTIL, or RETURN commands are useful commands for altering the user-defined function's operation.

The following are general rules and limitations of FUNCDEF:

- Do not use existing function names or secondary keywords (reserved words) as labels for user-defined functions. See Table 5-2 for a list of reserved words.
- Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.
- The maximum number of nested FUNCDEF declarations is 40. (Nested FUNCDEF declarations is when one FUNCDEF calls another FUNCDEF.) See the programming example for the ABORT command for an example of nesting FUNCDEF declarations.
- Some programming commands cannot be used within a DLP. The commands that cannot used within a DLP are as follows:

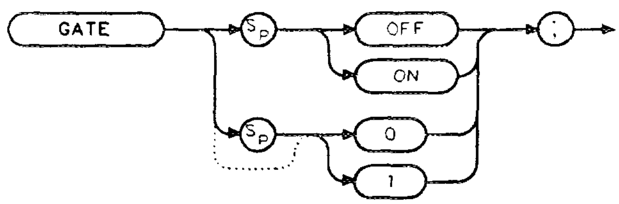
| Command | Description | Comments |
|---|---|---|
| DISP | The BASIC command for displaying a variable | Use the DSPLY command. See "Creating and Executing a DLP" in Chapter 4 for more information about displaying a variable. |
| ENTER | The BASIC command statement | |
| EP | The spectrum analyzer's enter parameter command. | Use the ACTDEF command instead. |
| PLOT | The spectrum analyzer's command for plotting the display. | Use the GETPLOT command instead. |
| PRINT | The spectrum analyzer's command for printing the display. | Use the GETPRNT command instead. |

- Avoid using the POWERON LAST, SAVE STATE, and RECALL STATE programming commands within the function. These commands save and recall a state that, within a user-defined function, may only partially recall the saved state.
- Define all variables and user-defined traces at the beginning of the program, do not define the variables or user-defined traces within a user-defined function. See "Creating and Executing a DLP" in Chapter 4 for more information.

# GATE
# Gate

Turns on or off the time-gating.

## Syntax




XGATE

Equivalent Softkey: **GATE ON OFF** .

Option Required: Option 105.

Preset State: GATE OFF.

Related Commands: GATECTL, GD, GDRVUTIL, GL, GP.

## Example

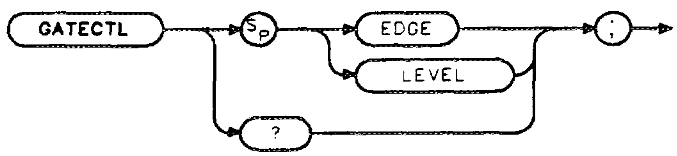
Connect the HI SWEEP IN/OUT connector to the GATE TRIGGER INPUT. Connect the CAL OUT to the spectrum analyzer input.

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"IP;"` | *Performs an instrument preset.* |
| 20 | `OUTPUT 718;"CF 300MHZ;SP 0HZ;ST 200MS;"` | *Sets the center frequency, span, and sweep time.* |
| 30 | `OUTPUT 718;"GD 66MS;GL 66MS;"` | *Sets the gate delay and gate length.* |
| 40 | `OUTPUT 718;"GATECTL EDGE;"` | *Sets the gate triggering for the edge of the trigger input signal.* |
| 50 | `OUTPUT 718;"GP POS;"` | *Triggers on the positive edge of the trigger input signal.* |
| 60 | `OUTPUT 718;"GATE ON;"` | *Turns on the gating.* |
| 70 | `END` | |

# GATECTL
# Gate Control

Selects between the edge and the level mode for Option 105, the time-gated spectrum analysis capability.

## Syntax




XGATECTL

Equivalent Softkey: **GATE CTL EDGE LVL**.
Option Required: Option 105.
Preset State: GATECTL EDGE.
Related Commands: GATE, GD, GL, GP.

## Example

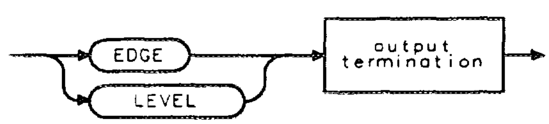
```
OUTPUT 718;"GATECTL LEVEL;"
```

## Description

In the edge mode, a trigger input starts the delay timer that triggers the gate timer. The gate polarity (GP), gate delay time (GD), and gate time length (GL) are operational in the edge mode, but not in the level mode. In the level mode, the gate follows the trigger input level.

When used as a predefined variable, GATECTL returns a "0" if GATECTL has been set to EDGE, a "1" if GATECTL has been set to LEVEL.

## Query Response




QGATECTL

# GC
# Gate Preset

Presets Option 105, the time-gated spectrum analysis capability.

## Syntax


XGC

Option Required: Option 105.
Related Commands: GATE, GATECTL, GD, GL, GP.

## Example

```
OUTPUT 718;"GC;"
```

## Description

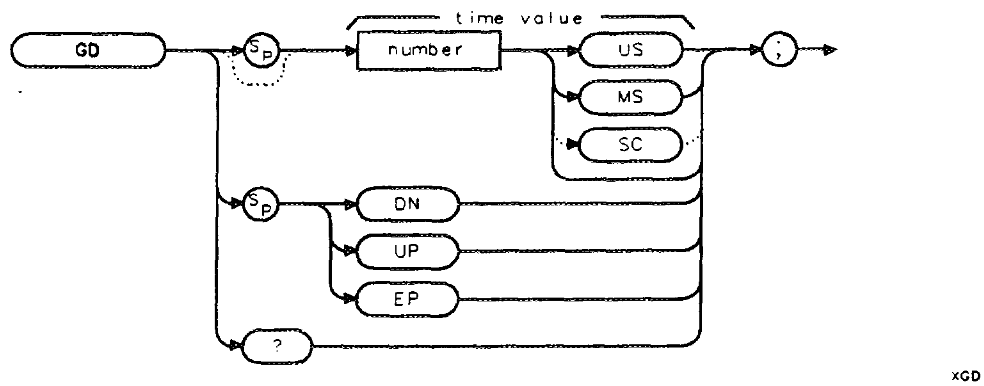
The GC command sets the following time-gated spectrum analysis functions:

- GATE to OFF.
- GATECTL to EDGE.
- GP to POS.
- The gate delay (GD) and gate length (GL) time values are set to 1 μs.

# GD
# Gate Delay

Sets the delay time from when the gate trigger occurs to when the gate opens.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 μs to 65.5 ms |

Equivalent Softkey: **GATE DELAY** .
Option Required: Option 105.
Preset State: 1 μs.
Related Commands: GATE, GATECTL, GC, GL.

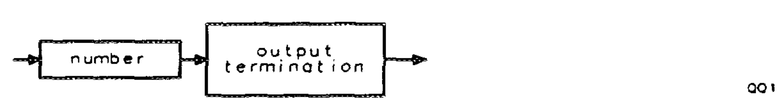
## Example

```
OUTPUT 718;"GD 1US;"
```

## Description

GD applies only if GATECTL is set to EDGE.

## Query Response



## GDRVCLPAR
## Clear Pulse Parameters

Clears the pulse parameters (pulse width, pulse repetition interval, and reference edge) for a time-gate measurement by setting the pulse parameters to 0.

### Syntax


XGDRVCLPAR

Equivalent Softkey: **CLEAR PARAM**.
Option Required: Option 105. Option 101 is recommended.
Related Commands: GDRVPWID, GDRVPRI, GDRVREFE, GDRVST, GDRVVBW, GDRVRBW.

### Example

`OUTPUT 718;"GDRVCLPAR;"` *Clears all the pulse parameters.*

### Description

GDRVPWID, GDRVPRI, GDRVREFE are the programming commands that can be used to set the pulse width, pulse repetition interval, and reference edge, respectively.

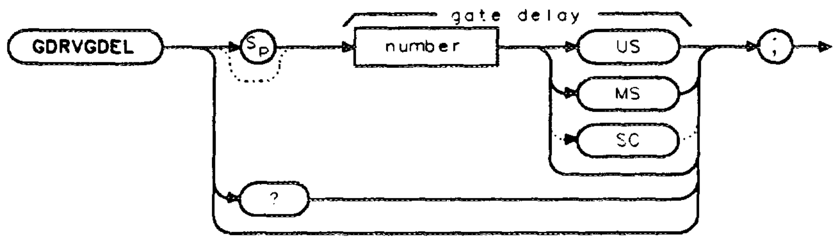
GDRVCLPAR also turns off the resolution bandwidth to pulse width coupling, video bandwidth to gate length coupling, and sweeptime to pulse repetition interval coupling.

The GDRVCLPAR command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

# GDRVGDEL
# Gate Delay for the Frequency Window

For the frequency window only, GDRVGDEL sets the time delay from when the gate trigger occurs to when the gate is opened.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 μs to 65 ms. |

Equivalent Softkey: GDRVGDEL is equivalent to **GATE DELAY** when using the gate utility (**GATE UTILITY**) functions.
Option Required: Option 105. Option 101 is recommended.
Preset Value: 1 μs
Related Commands: GDRVUTIL, GDRVGLEN, GD, GL.

## Example

`OUTPUT 718;"MOV GDRVGDEL,1US;"` *Sets the gate marker delay to 1 μs.*

## Description

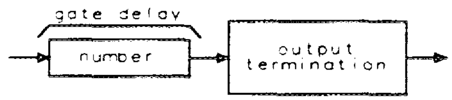
If the frequency window is currently the active window, GDRVGDEL updates the gate position markers and the position of the gate. If the time window is currently active, only the gate position markers are updated.

You can execute the GDRVGDEL command two different ways. You can either execute the GDRVGDEL command directly (for example, "GDRVGDEL 1MS;") or use the MOV command to move the value for the time delay into the GDRVGDEL command (for example, "MOV GDRVGDEL,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVGDEL command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVGDEL? returns the last value entered for GDRVGDEL. To determine the current gate delay, query the gate delay (GD) command.

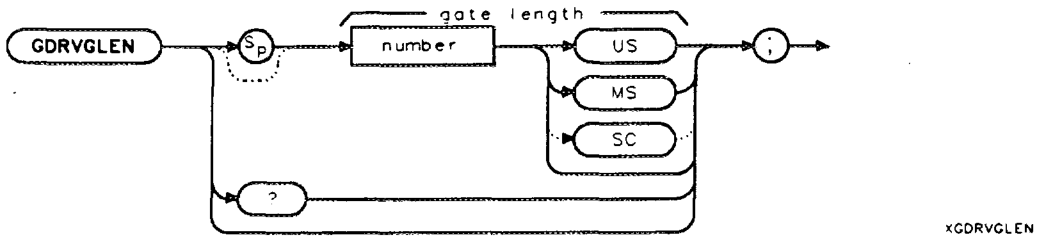



QGDRVGDEL

# GDRVGLEN
# Gate Length for the Frequency and Time Windows

Adjusts the gate length in both the time and frequency windows.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 $\mu$s to 65 ms. |

Equivalent Softkey: GDRVGLEN is equivalent to **GATE LENGTH** when using the gate utility (**GATE UTILITY**) functions.
Option Required: Option 105. Option 101 is recommended.
Preset Value: 1 $\mu$s.
Related Commands: GDRVUTIL, GDRVGDEL, GD, GL.

## Example

`OUTPUT 718;"MOV GDRVGLEN,1US;"` *Sets the gate marker to a length of 1 $\mu$s.*

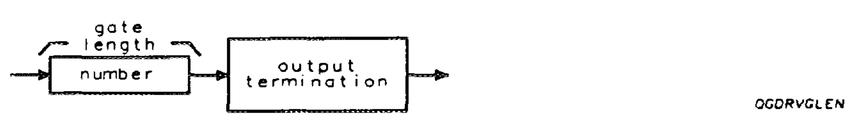
## Description

You can execute the GDRVGLEN command two different ways. You can either execute the GDRVGLEN command directly (for example, "`GDRVGLEN 1MS;`") or use the MOV command to move the value for the gate length delay into the GDRVGLEN command (for example, "`MOV GDRVGLEN,1MS;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVGLEN command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

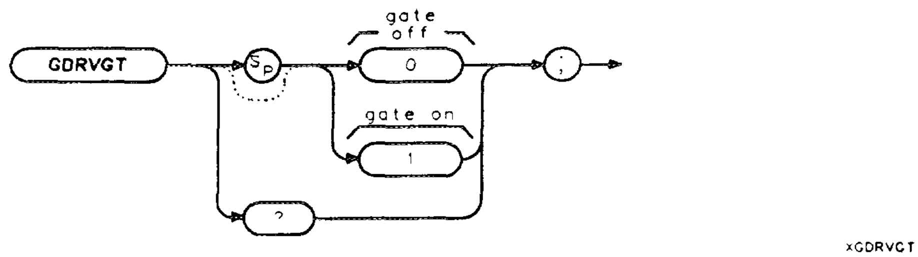
GDRVGLEN? returns the last value entered for GDRVGLEN. To determine the current gate time length, query the gate length (GL) command.



# GDRVGT
# Window Gate Control

Turns on or off the gate in the frequency window.

## Syntax




Equivalent Softkey: GDRVGT is equivalent to **GATE ON OFF** when using the gate utility (**GATE UTILITY**) functions.
Option Required: Option 105. Option 101 is recommended.
Related Commands: GDRVUTIL, GATE.

## Example

`OUTPUT 718;"MOV GDRVGT,1;"` *Turns on the gate in the frequency window.*

## Description

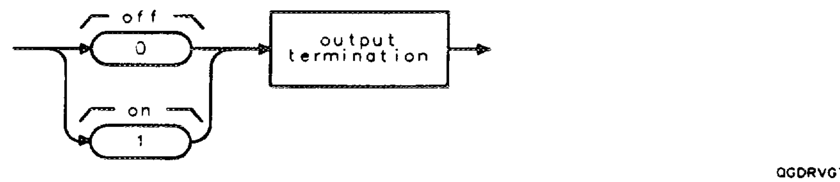
Before executing GDRVGT, you should do the following:

1. Ensure there is a trigger pulse connected to the GATE TRIGGER INPUT connector on the rear panel of spectrum analyzer. The gate utility functions do not work if there is not a trigger input.
2. Ensure that the GATE OUTPUT connector and the EXT TRIG INPUT connector are connected together.

If the time window is the active window, turning on the gate with GDRVGT makes the frequency window the active window. The GDRVGT command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

You can execute the GDRVGT command two different ways. You can either execute the GDRVGT command directly (for example, `"GDRVGT 1;"`) or use the MOV command to move the 1 or 0 into the GDRVGT command (for example, `"MOV GDRVGT,1;"`). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response

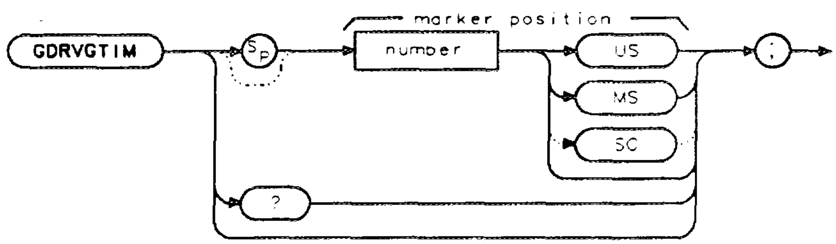


# GDRVGTIM

## Gate Trigger to Marker Position for Time Window

Activates the gate trigger marker, and then places it at the given value in the time window. The trigger marker readout shows the time between the gate trigger edge and the current marker position.

### Syntax



XGDRVGTIM

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 0 to the sum of the sweep time and sweep delay (GDRVSWDE). |

Equivalent Softkey: GDRVGTIM is similar to **TRIG MKR ON OFF** .
Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVUTIL.

### Example

`OUTPUT 718;"MOV GDRVGTIM,10MS;"` *Places the gate trigger marker 10 ms after the start of the sweep.*

### Description

If the frequency window is the active window, executing GDRVGTIM makes the time window the active window.

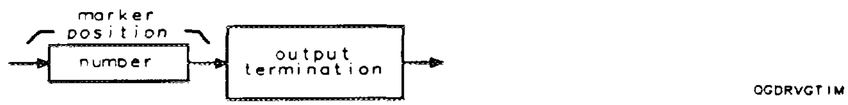
Once you enter a value into GDRVGTIM, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVGTIM.

You can execute the GDRVGTIM command two different ways. You can either execute the GDRVGTIM command directly (for example, `"GDRVGTIM 1MS;"`) or use the MOV command to move the value for the time delay into the GDRVGTIM command (for example, `"MOV GDRVGTIM,1MS;"`). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVGTIM command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

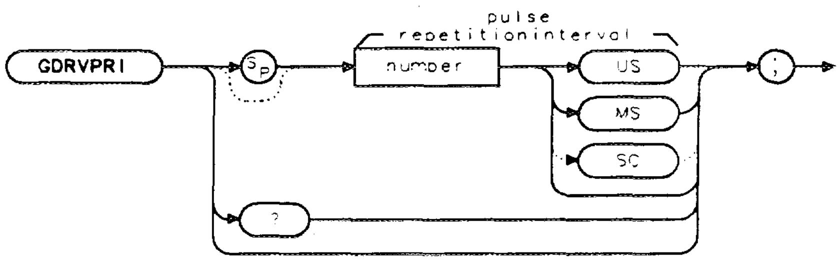
GDRVGTIM? returns the last value entered for GDRVGTIM. If you want the current value for the gate trigger marker, make the marker active with MKACTV, and then use MKF?.



# GDRVPRI
## Pulse Repetition Interval

Enters the specified value as the pulse repetition interval.

### Syntax



XGDRVPRI

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | Range is from the sweep delay (GDRVSWDE) to the sweep time plus the sweep delay. |

GDRVPRI is equivalent to **ENTER PRI**.

Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVCLPAR, GDRVST.

### Example

`OUTPUT 718;"MOV GDRVPRI,1MS;"` *Sets the pulse repetition interval to 1 ms.*

### Description

When the pulse repetition interval is entered, the approximate gate trigger position will be indicated on screen by either a "↑"for a positive trigger, or a "↓" for a negative trigger. Unlike **ENTER PRI**, GDRVPRI does not make the marker function active or display the **Pulse Param** softkeys.

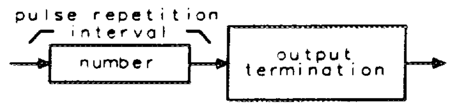
Once you enter a value into GDRVPRI, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVPRI.

You can execute the GDRVPRI command two different ways. You can either execute the GDRVPRI command directly (for example, "`GDRVPRI 1MS;`") or use the MOV command to move the value for the time delay into the GDRVPRI command (for example, "`MOV GDRVPRI,1MS;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVPRI command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

GDRVPRI returns the current value for the pulse repetition interval.

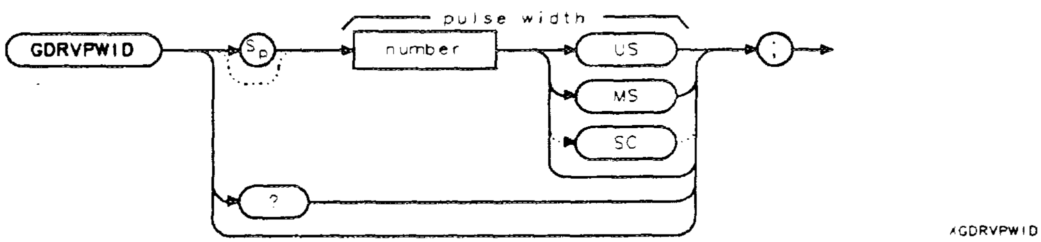



QGDRVPRI

# GDRVPWID
# Pulse Width

Enters the specified value as the pulse width.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is μs. | Range is from the sweep delay (GDRVSWDE) plus the sweep time to the sweep delay. |

Equivalent Softkey: **ENTER WIDTH**.
Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVCLPAR, GDRVRBW.

## Example

`OUTPUT 718;"MOV GDRVPWID,1MS;"` *Sets the pulse width to 1 ms.*

## Description

Unlike **ENTER WIDTH**, GDRVPWID does not make the marker function active or display the **Pulse Param** softkeys.

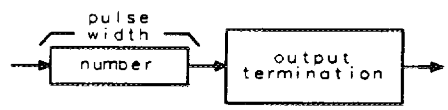
Once you enter a value into GDRVPWID, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVPWID.

You can execute the GDRVPWID command two different ways. You can either execute the GDRVPWID command directly (for example, "GDRVPWID 1MS;") or use the MOV command to move the value for the pulse width into the GDRVPWID command (for example, "MOV GDRVPWID,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVPWID command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVPWID returns the current value for the pulse width.

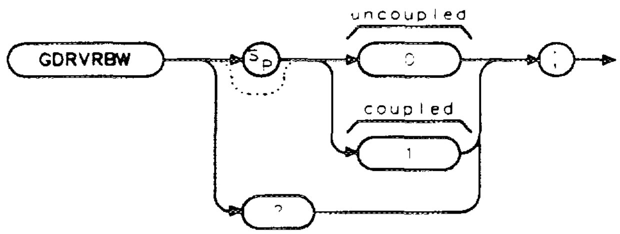



QGDRVPWID

# GDRVRBW
## Couple Resolution Bandwidth to Pulse Width

Couples or uncouples the resolution bandwidth to the specified pulse width.

### Syntax




XGDRVRBW

Equivalent Softkey: **CPL RBW ON OFF**.

Option Required: Option 105. Option 101 is recommended.
Preset Value: Uncoupled.
Related Commands: GDRVPWID, GDRVVBW, GDRVST.

### Example

`OUTPUT 718;"MOV GDRVRBW,1;"` *Couples the resolution bandwidth to the pulse width.*

### Description

Before coupling the resolution bandwidth to the pulse width, you should enter the pulse width into GDRVPWID. Coupling the resolution bandwidth to the pulse width updates the trace display in the active window. If the resolution bandwidth and the pulse width are uncoupled, the setting of the resolution bandwidth does not change.

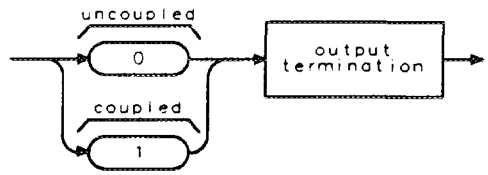
The resolution bandwidth is at least three times $\frac{1}{PulseWidth}$ when coupled. The resolution bandwidth is updated to the coupled value when the window is next active.

You can execute the GDRVRBW command two different ways. You can either execute the GDRVRBW command directly (for example, "GDRVRBW 1;") or use the MOV command to move the 1 or 0 into the GDRVRBW command (for example, "MOV GDRVRBW,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVRBW command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVRBW returns a "1" if the resolution bandwidth is coupled to the pulse width, or a "0" if it is not coupled.

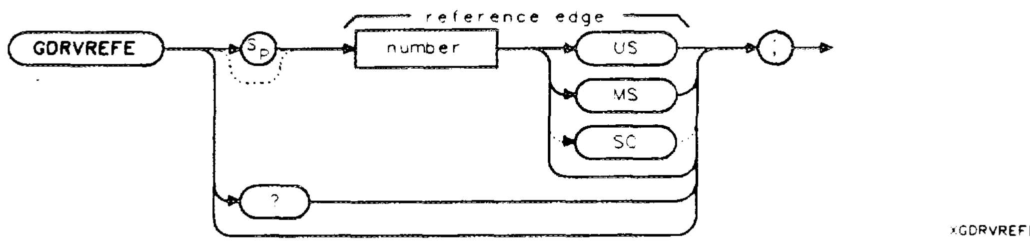



QGDRVRBW

## GDRVREFE
## Enter Reference Edge

Allows you to enter the position (in time) for a reference edge.

### Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is μs. | Range is from the sweep delay (GDRVSWDE) plus the sweep time to the sweep delay. |

Equivalent Softkey: **ENTER REF EDGE** .

Option Required: Option 105. Option 101 is recommended.
Initial Value: 0 s.
Related Commands: GDRVUTIL.

### Example

```
OUTPUT 718;"MOV GDRVREFE,1MS;"
```

### Description

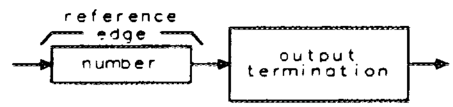
Unlike **ENTER REF EDGE** , GDRVREFE does not make the marker function active or display the **ENTER REF EDGE** softkeys.

Once you enter a value into GDRVREFE, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVREFE.

You can execute the GDRVREFE command two different ways. You can either execute the GDRVREFE command directly (for example, "GDRVREFE 1MS;") or use the MOV command to move the value into the GDRVREFE command (for example, "MOV GDRVREFE,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVREFE command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

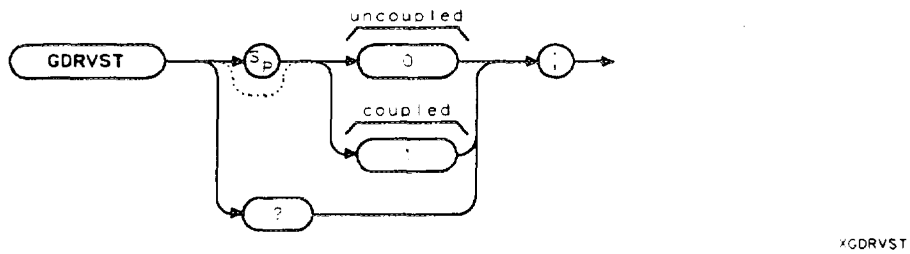



QGDRVREFE

## GDRVST
## Couple Sweep Time to Pulse Repetition Interval

Couples or uncouples the sweep time to the pulse repetition interval.

### Syntax




Equivalent Softkey: **CPL SWP ON OFF**.
Option Required: Option 105. Option 101 is recommended.
Preset Value: Uncoupled.
Related Commands: GDRVPRI.

### Example

`OUTPUT 718;"MOV GDRVST,1;"` *Couples the sweep time to the pulse repetition interval.*

### Description

Before coupling the sweep time to the pulse repetition interval, you should enter the pulse repetition interval into GDRVPRI. Coupling the sweep time to the pulse repetition interval updates the trace display in the active window. If the sweep time and the pulse repetition interval are uncoupled, the setting of the sweep time does not change.

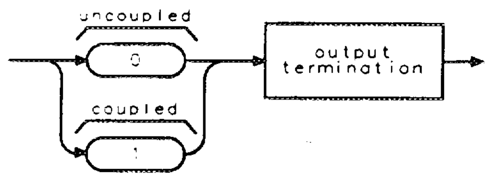
The sweep time is 401 times the pulse repetition interval when coupled. The sweep time is updated to the coupled value when the window is next active.

You can execute the GDRVST command two different ways. You can either execute the GDRVST command directly (for example, "GDRVST 1;") or use the MOV command to move the 1 or 0 into the GDRVST command (for example, "MOV GDRVST,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVST command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVST returns a "1" if the sweep time is coupled to the pulse repetition interval, or a "0" if it is not coupled.




QGDRVST

# GDRVSWAP
## Update the Time or Frequency Window

Makes the window (either the time or frequency window) that is currently not the active window, the active window.

### Syntax


XGDRVSWAP

Equivalent Softkey: GDRVSWAP is equivalent to **UPDATE TIMEFREQ** , or pressing (NEXT).
Option Required: Option 105. Option 101 is recommended.
Related Commands: GDRVUTIL.

### Example

```
OUTPUT 718;"GDRVSWAP;"
```

### Description

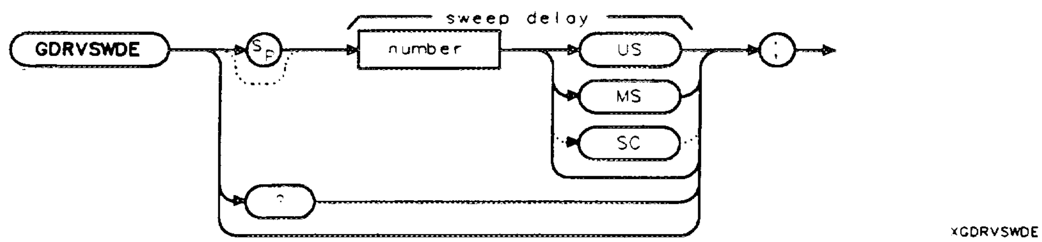
Whenever the window is made active, the trace and gate position are updated. GDRVSWAP also couples the resolution bandwidth, video bandwidth, and sweep time to the current pulse width and pulse repetition interval values, if the pulse values have been entered and coupling is active. (See "GDRVRBW," "GDRVVBW," and "GDRVST" for more information about coupling resolution bandwidth, video bandwidth, and sweep time to the current pulse width and pulse repetition interval.)

The GDRVSWAP command is a gate utility function (see "GDRVUTIL" command for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

# GDRVSWDE
# Delay Sweep for Time Window

Allows you to specify the delay from the edge of the gate trigger until the sweep is started in the time window.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is second. | 1 $\mu$s to 65 ms. |

Equivalent Softkey: **SWEEP DELAY**.
Option Required: Option 105. Option 101 is recommended.
Initial Value: 1 $\mu$s.
Related Commands: GDRVUTIL, GD.

## Example

`OUTPUT 718;"MOV GDRVSWDE,1US;"` *Sets the time delay to 1 $\mu$s.*

## Description

When using GDRVSWDE, the gate zone markers shown in the time window are updated to the value of GDRVSWDE.

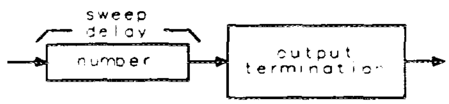
Once you enter a value into GDRVSWDE, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVSWDE.

You can execute the GDRVSWDE command two different ways. You can either execute the GDRVSWDE command directly (for example, `"GDRVSWDE 1MS;"`) or use the MOV command to move the value for the time delay into the GDRVSWDE command (for example, `"MOV GDRVSWDE,1MS;"`). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVSWDE command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

GDRVSWDE? returns the last value entered into GDRVSWDE. To determine the current value of the sweep time delay, query the gate delay (GD) command.

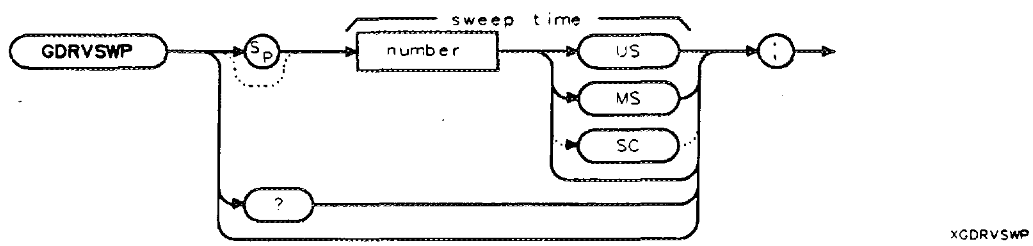



QGDRVSWDE

# GDRVSWP
# Sweep Time for the Time Window

Specifies the sweep time for the time domain window of the gate utility.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is second. | 0 to 65 ms. |

Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVUTIL, ST.

## Example

`OUTPUT 718;"MOV GDRVSWP,1MS;"` *Sets the time delay to 1 ms.*

## Description

The positions of the gate markers and the gate trigger markers are updated to the new value of the sweep time.

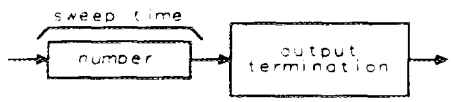
Once you enter a value into GDRVSWP, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVSWP.

You can execute the GDRVSWP command two different ways. You can either execute the GDRVSWP command directly (for example, `"GDRVSWP 1MS;"`) or use the MOV command to move the value for the sweep time into the GDRVSWP command (for example, `"MOV GDRVSWP,1MS;"`). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVSWP command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

GDRVSWP? returns the last value entered into GDRVSWP. To determine the current value of the sweep time in the time window, query the sweep time (ST).

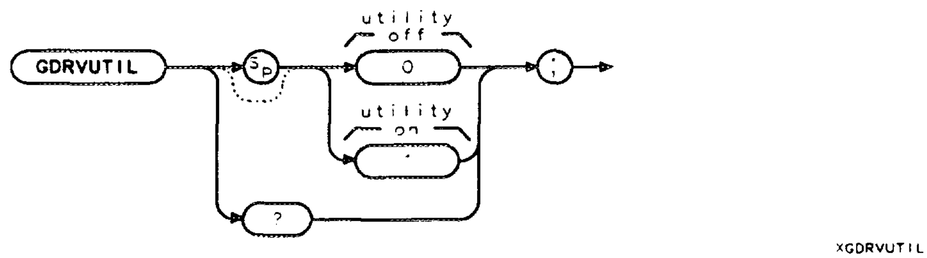



QGDRVSWP

# GDRVUTIL
# Gate Utility

Turns on or off the gate utility.

## Syntax




Equivalent Softkey: **GATE UTILITY** .

Option Required: Option 105. Option 101 is recommended.

## Example

`OUTPUT 718;"MOV GDRVUTIL,1;"` *Turns on the gate utility.*

## Description

When the gate utility is turned on, the spectrum analyzer screen displays two windows. The upper window displays the input signal in the time domain, and the lower window displays the input signal in the frequency domain. If the spectrum analyzer is in zero span when the gate utility is turned on, the frequency span of the lower window will be set to a nonzero frequency span.

Before executing GDRVUTIL, you should do the following:

1. Ensure there is a trigger pulse connected to the GATE TRIGGER INPUT connector on the rear panel of spectrum analyzer. The gate utility functions do not work if there is not a trigger input.
2. Ensure that the GATE OUTPUT connector and the EXT TRIG INPUT connector are connected together.
3. Set the center frequency of the analyzer to the signal's center frequency.
4. Set the reference level of the analyzer so that the signal's peak is within the first graticule.

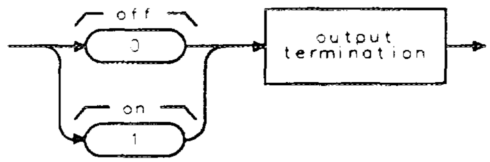
The spectrum analyzer cannot turn on the gate utility if the spectrum analyzer is not properly triggered. Once the gate utility has been turned on, you can use the commands that begin with "GDRV" to make the time-gate measurement. Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

**Restrictions**

Executing GDRVUTIL exits the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), or power menu measurements (ACP, ACPE, CHP, and OBW).

You should turn off the gate utility (set GDRVUTIL to 0) when you are done with the gate utilities.

## Query Response

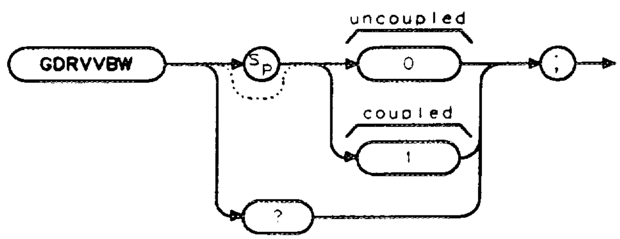



QGDRVUTIL

# GDRVVBW
# Couple Video Bandwidth to Gate Length

Couples or uncouples the video bandwidth to the gate length.

## Syntax




XGDRVVBW

Equivalent Softkey: **CPL VBW ON OFF**.
Option Required: Option 105. Option 101 is recommended.
Preset Value: Uncoupled.
Related Commands: GDRVGLEN.

## Example

`OUTPUT 718;"MOV GDRVVBW,1;"` *Couples the video bandwidth to the gate length.*

## Description

Before coupling the video bandwidth to the gate length, you should enter the gate length into GDRVGLEN. Coupling the video bandwidth to the gate length updates the trace display in the active window. If the video bandwidth and the gate length is uncoupled, the setting of the video bandwidth does not change.

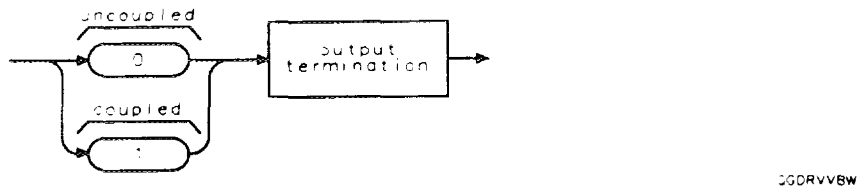
The video bandwidth is at least equal to the inverse of the gate length when coupled. The video bandwidth is updated to the coupled value when the window is next active.

You can execute the GDRVVBW command two different ways. You can either execute the GDRVVBW command directly (for example, "GDRVVBW 1;") or use the MOV command to move the 1 or 0 into the GDRVVBW command (for example, "MOV GDRVVBW,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVVBW command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

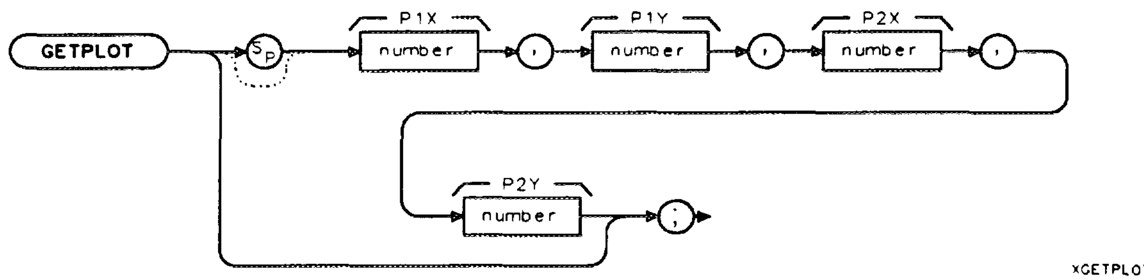
GDRVVBW returns a "1" if the resolution bandwidth is coupled to the pulse width, or a "0" if it is not coupled.



# GETPLOT
# Get Plot

Initiates output of the spectrum analyzer display to a plotter. GETPLOT is meant to be used within a downloadable program.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Number within the plotter coordinates. |

Related Commands: FUNCDEF, GETPRNT, SNGLS, TS.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example for the HP-IB Interface

This example illustrates how you can use a softkey to plot the spectrum analyzer display, and then have the plotter perform a page feed. (Not all plotters support the page feed command, however.) This example assumes that the plotter is at address 5 and the spectrum analyzer is at address 18. (This example is only valid for HP 9000 series 200 and 300 computers.)

| | |
|---|---|
| `OUTPUT 718;"FUNCDEF P_LOT,%";` | *Creates a user-defined function called P_LOT.* |
| `OUTPUT 718;"GETPLOT;";` | *P_LOT performs the GETPLOT command to plot the spectrum analyzer screen.* |
| `OUTPUT 718;"OUTPUT 5,B,80;";` | *P_LOT then sends the ASCII code for "P" to the plotter.* |
| `OUTPUT 718;"OUTPUT 5,B,71;";` | *P_LOT then sends the ASCII code for "G" to the plotter.* |
| `OUTPUT 718;"OUTPUT 5,B,59;";` | *P_LOT then sends the ASCII code for a semicolon to the plotter.* |
| `OUTPUT 718;"%;"` | *Ends the FUNCDEF declaration.* |
| `OUTPUT 718;"KEYDEF 1,P_LOT,%PLOT PG\|FEED  %;"` | *Assigns P_LOT to softkey number 1. Softkey number 1 can be accessed by pressing* (MEAS/USER), **User Menus**. |
| `LOCAL 718` | |

## Description

The GETPLOT command transfers the trace data, graticule, and annotation of the spectrum analyzer screen to a plotter via the spectrum analyzer interface (softkey labels excluded). The data is transferred in ASCII, HPGL format.

Before executing the downloadable program that contains GETPLOT, you should do one of the following:

- Disconnect the computer from the spectrum analyzer.

  Or,

- Send the following BASIC commands:

  ```
  ABORT 7
  LOCAL 7
  ```

  ABORT 7 instructs the computer to release control of the HP-IB, and LOCAL 7 allows you to control the spectrum analyzer from the front panel.

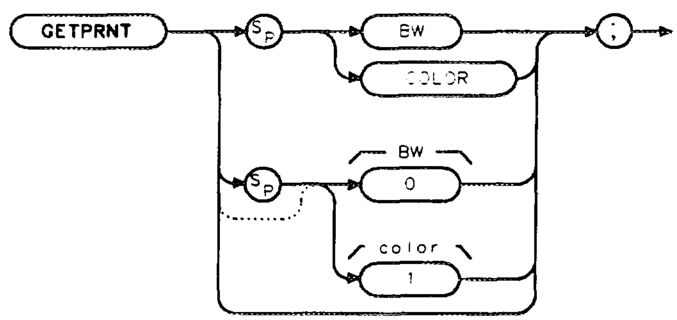
When using the PLOT command, the scaling points (P1x, P1y; P2x, P2y) can be specified. These scaling points specify the (x,y) coordinates, which determine the size of the plot. (P1x,P1y) refers to the lower-left plotter coordinates. (P2x,P2y) refers to the upper-right plotter coordinates.

**Note** The HP 7470A plotter does not support 2 plots per page. If you use an HP 7470A plotter with an HP 8590 Series spectrum analyzer, you can select one plot per page or four plots per page but not 2 plots per page.

# GETPRNT
# Get Print

Initiates output of the spectrum analyzer display to a printer. GETPRNT is meant to be used within a downloadable program.

## Syntax




XGETPRNT

Related Commands: FUNCDEF, GETPLOT.

## Example for the HP-IB Interface

This example illustrates how you can use a softkey to print the spectrum analyzer display, and then have the printer perform a page feed. This example assumes that the printer is at address 1 and the spectrum analyzer is at address 18. (This example is only valid for HP 9000 series 200 and 300 computers.)

| | |
|---|---|
| `OUTPUT 718;"FUNCDEF P_RINT,%";` | *Creates a user-defined function called P_RINT.* |
| `OUTPUT 718;"GETPRNT;";` | *P_RINT performs the GETPRNT command to print the spectrum analyzer screen.* |
| `OUTPUT 718;"OUTPUT 1,B,10;";` | *P_RINT then sends the ASCII code for a carriage return to the printer.* |
| `OUTPUT 718;"OUTPUT 1,B,13;";` | *P_RINT then sends the ASCII code for a line feed to the printer.* |
| `OUTPUT 718;"OUTPUT 1,B,12;";` | *P_RINT then sends the ASCII code for a form feed to the printer.* |
| `OUTPUT 718;"%;"` | *Ends the FUNCDEF declaration.* |
| `OUTPUT 718;"KEYDEF 2,P_RINT,%PRINT\|FRM FEED%;"` | *Assigns P_RINT to softkey number 2. Softkey number 2 can be accessed by pressing* (MEAS/USER), **User Menus**. |
| `LOCAL 718` | *Allows you to control the spectrum analyzer from the front panel.* |

## Description

The data is output in HP raster graphics format. Executing "GETPRNT;", "GETPRNT 0;", or "GETPRNT BW;" produces a monochrome printout. Executing "GETPRNT 1;" and "GETPRNT COLOR;" produces a "color format" output for an HP PaintJet printer. Execute "MENU 0;" before printing to blank the softkeys.

Before executing the downloadable program that contains GETPRNT, you should do one of the following:

- Disconnect the computer from the spectrum analyzer.

  Or,

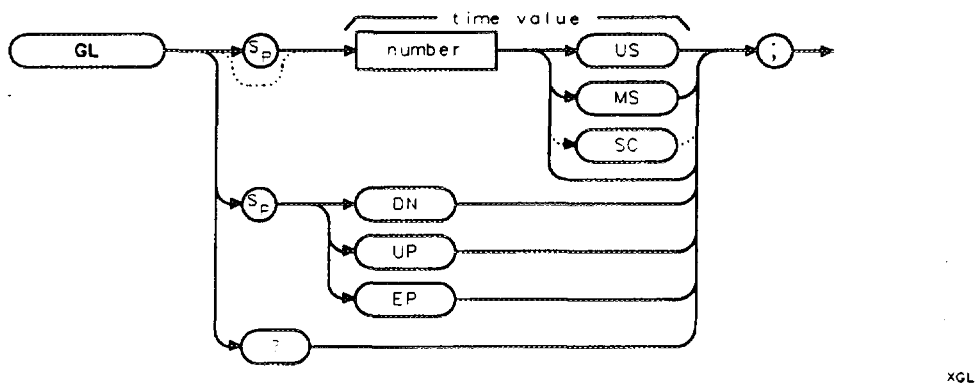
- Send the following BASIC commands:
  ```
  ABORT 7
  LOCAL 7
  ```

  ABORT 7 instructs the computer to release control of the HP-IB, and LOCAL 7 allows you to control the spectrum analyzer from the front panel.

# GL
# Gate Length

Sets the length of time the gate is open.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 $\mu$s to 65.5 ms |

Equivalent Softkey: **GATE LENGTH**.
Option Required: Option 105.
Preset State: 1 ms.
Related Commands: GATE, GATECTL, GC, GD.

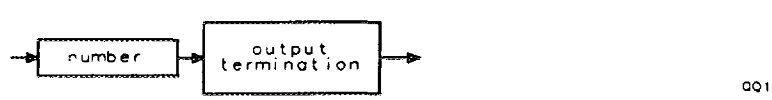
## Example

```
OUTPUT 718;"GL 1US;"
```

## Description

GL applies only if GATECTL is set to EDGE.

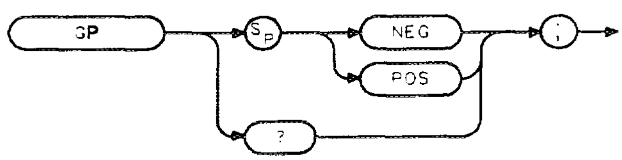
## Query Response



# GP
# Gate Polarity

Sets the polarity (positive or negative) for the gate trigger.

## Syntax




XGP

Equivalent Softkey: **EDGE POL POS NEG**.
Option Required: Option 105.
Preset State: GP POS.
Related Commands: GATE, GATECTL, GD, GL.

## Example

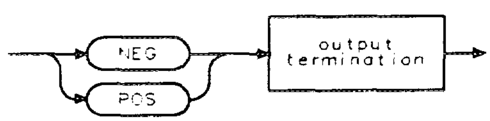
```
OUTPUT 718;"GP POS;"
```

## Description

GP applies only if GATECTL is set to EDGE.

When used as a predefined variable, GP returns a "0" if GP has been set to NEG, a "1" if GP has been set to POS.

## Query Response

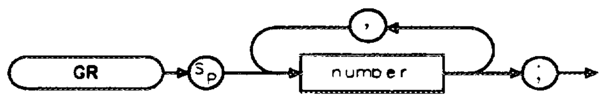



QGP

# GR
# Graph

Graphs the given $y$ coordinate while incrementing the $x$ coordinate by 1.

## Syntax




XGR

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | −22 to 233. |

Related Commands: CLRDSP, DA.

## Example

This example graphs a diagonal line on the spectrum analyzer display.

```
OUTPUT 718;"BLANK TRA;"
OUTPUT 718;"PU;PA 0,0;GR;"   Positions the pen.
FOR I = 0 TO 400             I represents the Y value in graticule coordinates.
OUTPUT 718;I DIV 2           Graphs the Y values, incrementing the X value by 1.
NEXT I
```

## Description

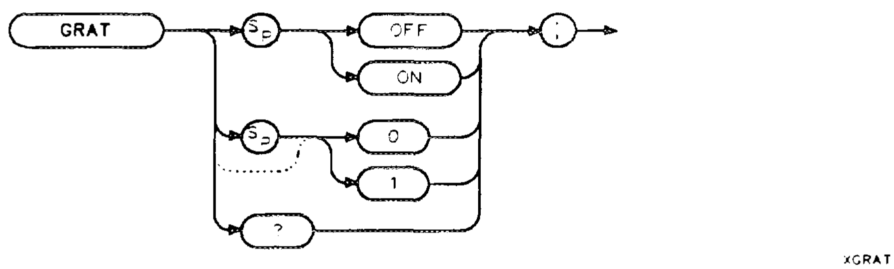
The GR command plots a graph at the amplitude point indicated by the next $y$ coordinate. The $y$ coordinates are specified in display units, with −22 at the bottom of the spectrum analyzer display and 233 at the top of the spectrum analyzer display. See "PA" for more information about display units. The $x$ coordinate is always incremented by 1; it cannot be decremented.

The GR command also places the graph in the display list. See "DA" for more information about the display list.

# GRAT
# Graticule

Turns on or off the graticule.

## Syntax

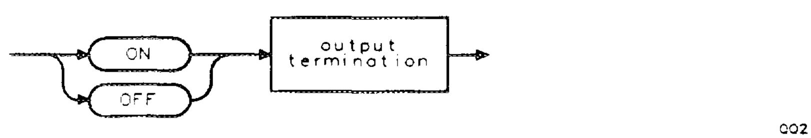



Equivalent Softkey: **GRAT ON OFF** .
Preset State: GRAT ON.
Related Commands: ANNOT.

## Example

```
OUTPUT 718;"GRAT OFF;"   Turns off the graticule.
OUTPUT 718;"GRAT?;"      Queries graticule status.
ENTER 718;Grat$          Gets response from the spectrum analyzer.
DISP Grat$               Displays OFF on the computer screen.
```

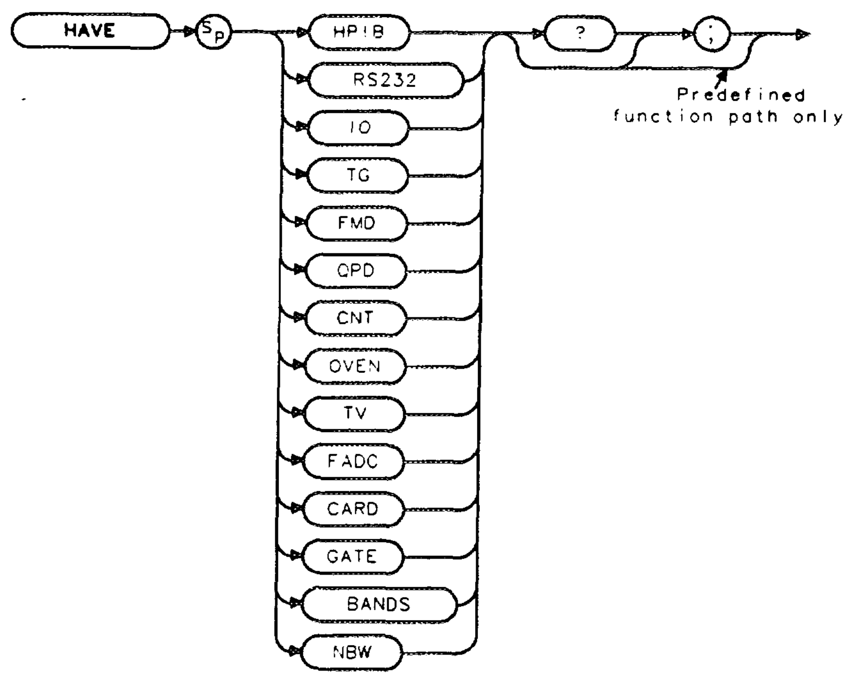
## Query Response



# HAVE
# Have

Returns a "0" if the specified option or device is *not* installed.

## Syntax




YHAVE

## Example

| | |
|---|---|
| `OUTPUT 718;"HAVE HPIB;"` | *Queries whether Option 021 is installed.* |
| `ENTER 718;A` | *Receives response from spectrum analyzer.* |
| `DISP A` | *Displays response.* |

## Description

The parameters are:

| | |
|---|---|
| HPIB | HP-IB interface, Option 021. |
| RS232 | RS-232 interface, Option 023. |
| IO | Either the HP-IB interface (Option 021) or RS-232 interface (Option 023). |
| TG | Tracking generator, Option 010 or 011. |
| FMD | FM demodulator, Option 102, 103, or 301. |
| QPD | Quasi-peak detector, Option 103. |

**HAVE Have**

| | |
|---|---|
| CNT | Counter-lock. (The frequency counter is standard for an HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E; it is available as Option 013 for an HP 8590D.) |
| OVEN | Precision frequency reference, Option 004. |
| TV | TV synch trigger, Option 102 or 301. If the TV synch trigger option is installed in the spectrum analyzer and in use, "HAVE TV?;" returns a "2." |
| FADC | Fast ADC, Option 101 or 301. |
| CARD | Memory card reader. (The memory card reader is Option 003 for the HP 8590D or HP 8592D. The memory card reader is standard for the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E.) |
| GATE | Time-gated spectrum analyzer capability, Option 105. |
| BANDS | Returns the number of frequency bands that the spectrum analyzer has. See the following description. |
| NBW | Narrow bandwidths, Option 130. |

BANDS returns the number of frequency bands that the spectrum analyzer has, as shown in the following table.

| Model Number | Value HAVE BANDS Returns |
|---|---|
| HP 8590D, HP 8591E, or HP 8594E | 1 |
| HP 8595E | 2 |
| HP 8592D or HP 8593E | 5 |
| HP 8596E | 3 |

"HAVE CARD;" returns additional information about the memory card. By checking the bit status of the byte returned from "HAVE CARD;", you can determine the information shown in the following table.

| Bit Position | Bit Status = 0 | Bit Status = 1 |
|---|---|---|
| 0 | Memory card reader is not installed. | Memory card reader is installed. |
| 1 | Memory card is write protected. | Memory card is not write protected. |
| 2 | Memory card is a random access card (RAM). | Memory card is a read only memory card (ROM). |
| 3 | Memory card not inserted into memory card reader. | Memory card is inserted into memory card reader. |

You can use the BIT or BITF command to determine the status of the bits. For example,

| | |
|---|---|
| `OUTPUT 718;"VARDEF R_ESULT,0;"` | *Stores the bit status in R_ESULT.* |
| `OUTPUT 718;"BIT R_ESULT,HAVE CARD,3;"` | *Checks the status of bit 3.* |
| `OUTPUT 718;"R_ESULT?;"` | *Gets the result.* |
| `ENTER 718;A` | |
| `DISP A` | *Displays the bit status of bit 3.* |

# HD
# Hold Data Entry

Disables data entry via the spectrum analyzer numeric keypad, knob, or step keys. The active function readout is blanked, and any active function is deactivated.

## Syntax


XHD

Equivalent Key: **HOLD** (for the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E) or (HOLD) (for the HP 8590D or HP 8592D).
Related Commands: Any active function. See the description below for a list of the active functions.

## Example

| | |
|---|---|
| `OUTPUT 718;"HD;"` | *Disables the active function and clears the active function block area on the spectrum analyzer screen.* |
| `OUTPUT 718;"CF 600MHZ;HD;700MHZ;"` | *This will leave the center frequency at 600 MHz, because HD deactivates any current function.* |

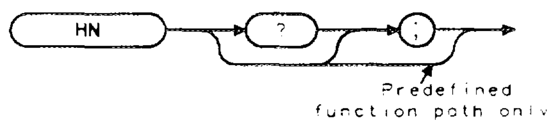
## Description

The active functions are ACPBW, ACPSP, AT, BAUDRATE, CF, COUPLE, CRTHPOS, CRTVPOS, DA, DL, DOTDENS, FA, FB, FFTSTOP, FMGAIN, FOFFSET, GATECTL, GD, GL, GP, INZ, LG, MKA, MKD, MKFC, MKFCR, MKN, MKPAUSE, MKPX, ML, MODE, NDB, NRL, PREAMPG, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCAT, SRCPOFS, SRCPSTP, SRCPSWP, SRCPWR, SRCTK, SS, ST, TH, TIMEDATE, TVLINE, VAVG, VB, VBR, ZMKSPAN, ZMKCNTR and user-defined active function specified by the ACTDEF command.

# HN
# Harmonic Number

Returns the harmonic number of the current harmonic band in which the spectrum analyzer is tuning.

## Syntax




XHN

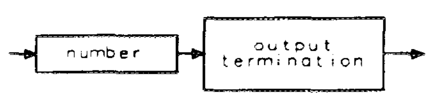
Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.
Related Commands: FS, HNLOCK, HNUNLK.

## Example

```
OUTPUT 718;"HN?;"    Queries harmonic band of spectrum analyzer.
ENTER 718;Number     Gets response from the spectrum analyzer.
DISP Number          Displays the result on computer screen.
```

## Query Response

The HN command returns the number of the harmonic band, if the spectrum analyzer is sweeping single-band. A "−1" is returned if the spectrum analyzer is sweeping multiband.

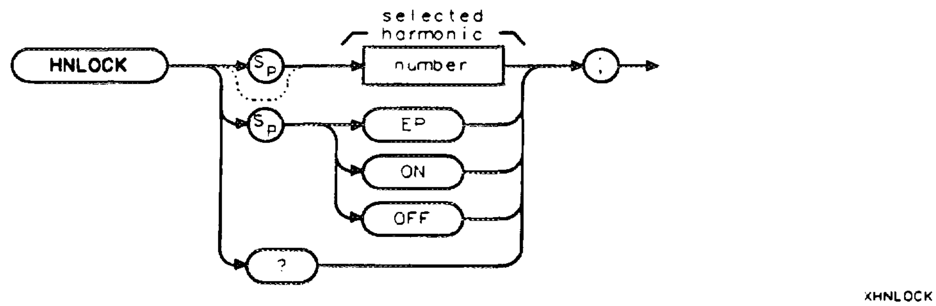



QQT

# HNLOCK
# Harmonic Number Lock

Forces the spectrum analyzer to use only the selected harmonic band.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 0 to 4 (for HP 8592D, HP 8593E, or HP 8596E), 0 to 3 (HP 8596E only), 0 to 1 (for HP 8595E). |

Equivalent Softkey: The HNLOCK command and the softkeys under the **Band Lock** menu are identical.
Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.
Preset State: HNLOCK OFF.
Related Commands: CF, FA, FB, FOFFSET, HN, HNUNLK, SNGLS, SP.

## Example

```
INPUT "SELECT THE DESIRED FREQUENCY BAND",Harm   Gets harmonic band from user.
OUTPUT 718;"HNLOCK ";Harm;";"                   Locks harmonic band.
```

## Description

HNLOCK ON locks onto the harmonic band that is appropriate for the current center frequency, lowering the span, if necessary, due to the limits of the harmonic band.

HNLOCK <number>, where <number> is an integer, locks onto harmonic band <number> and automatically selects the settings shown in the following table.

| Remote Commands | Equivalent Softkey | Frequency Settings | |
|---|---|---|---|
| HNLOCK 0 | BAND 0 | Center frequency 1.450 GHz | Span 2.900 GHz |
| HNLOCK 1 | BAND 1 | Center frequency 4.638 GHz | Span 3.600 GHz |
| HNLOCK 2 | BAND 2 | Center frequency 9.400 GHz | Span 6.800 GHz |
| HNLOCK 3 | BAND 3 | Center frequency 15.90 GHz | Span 7.000 GHz |
| HNLOCK 4 | BAND 4 | Center frequency 20.55 GHz | Span 2.900 GHz |

**HNLOCK Harmonic Number Lock**

Once HNLOCK is set, only frequencies and spans that fall within the frequency band of the current harmonic may be entered. The span is reduced automatically to accommodate a center frequency specified near the end of the band range.

**Note** Before changing the frequency range to another harmonic, unlock the band with the harmonic unlock command, "HNLOCK OFF;" or "HNUNLK;".

## BAND LOCK ON (HNLOCK ON)

### Start Frequency

If a start frequency is entered that is outside of the current band boundaries, it will be set to the nearest band edge instead. If a start frequency that is greater than the current stop frequency is entered, the (possibly modified) start frequency is used for both the start and the stop frequency; therefore, the span will be set to zero. If the start and stop frequencies specify too large a span, they will be modified. (Also see "FA.")

### Stop Frequency

If a stop frequency is entered that is outside of the current band boundaries, it will be set to the nearest band edge instead. If a stop frequency that is less than the current start frequency is entered, the (possibly modified) stop frequency will be used for both the start and stop frequency; therefore, the span will be set to zero. (Also see "FB.")

### Center Frequency

The span will be modified if necessary to get the center frequency specified without crossing the band edges. (Also see "CF.")

### Span

The span will be limited as necessary to keep the start and stop frequencies within the band edges without changing the center frequency. The maximum span allowed is 2.943 GHz in band 0, 3.600 GHz in band 1, 6.957 GHz in band 2, and 7 GHz in higher bands. (Also see "SP.")

## BAND LOCK OFF (HNLOCK OFF)

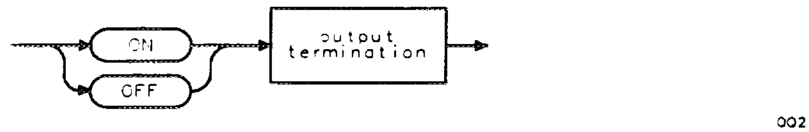
The start and stop frequencies are bounded by the range of the instrument.

The frequency not specified will be bounded by the following scheme:

Continuous Sweep Mode: If the specified frequency is in band 0, the values will be contained by the bounds of band 0. If the value is in the harmonic band range, the values will be bounded by the top of the instrument range and the lower end of band 1. (Also see "CONTS.")

Single Sweep Mode: The values are bounded by the instrument range only; therefore, band 0 can be included in a multiband sweep in single mode. (Also see "SNGLS.")

## Query Response



# HNUNLK
# Unlock Harmonic Number

*Unlocks the harmonic band.*

## Syntax


XHNUNLK

Equivalent Softkey: HNUNLK is equivalent to HNLOCK OFF and **BND LOCK ON OFF** (OFF is underlined).
Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.
Related Commands: CF, FA, FB, FOFFSET, FS, HN, HNLOCK, SP.

## Example

```
OUTPUT 718;"HNUNLK;"
```

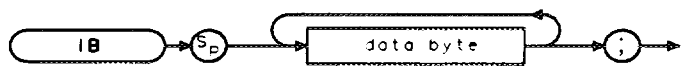
## Description

The HNUNLK command allows you to select frequencies and spans outside the range of a single harmonic band.

# IB
# Input B

Provides a method for putting values into trace B. The spectrum analyzer expects 401 two-byte integers. The data values can represent the range of integer numbers.

## Syntax




XIB

| Item | Description/Default | Range |
|---|---|---|
| Data byte | 8-bit byte containing numeric or character data. | |

## Example

| | |
|---|---|
| 10 ASSIGN @Sa TO 718;FORMAT ON | |
| 20 ASSIGN @Sa_bin TO 718;FORMAT OFF | |
| 30 INTEGER Binary(1:401) | *Dimensions an array called "Binary."* |
| 40 OUTPUT @Sa;"CF 300MZ;CLRW TRB;BLANK TRA;SP 10MZ;SNGLS;TS;" | *Takes a measurement sweep.* |
| 50 OUTPUT @Sa;"TDF B;MDS W;TB;" | *Outputs trace B (in binary) to computer.* |
| 60 ENTER @Sa_bin;Binary(*) | *Stores trace data in array.* |
| 70 OUTPUT @Sa;"CF 100MZ;RB 30KZ;SP 1MZ;TS;" | *Changes the spectrum analyzer settings.* |
| 80 DISP "PRESS CONTINUE WHEN READY" | |
| 90 PAUSE | |
| 100 OUTPUT @Sa;"IB"; | *Prepares spectrum analyzer to receive trace B data stored in array.* |
| 110 OUTPUT @Sa_bin;Binary(*) | *Sends trace B data to spectrum analyzer.* |
| 120 OUTPUT 718;"VIEW TRB;" | |
| 130 END | |

## Description

The IB command sends trace B data as binary data only; IB is independent of the measurement data size (MDS) command. The IB command expects 802 data bytes (401 data points, two bytes each).

# ID
# Identify

Returns the spectrum analyzer model number to the controller (for example, "HP8593E").

## Syntax

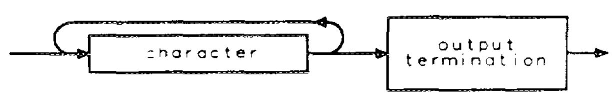

XID

Equivalent Softkey: **SHOW OPTIONS** .
Related Commands: REV, SER.

## Example

| | |
|---|---|
| `10 ALLOCATE A$[50]` | *Allocates string to hold model number.* |
| `20 OUTPUT 718;"ID;"` | *Gets model number.* |
| `30 ENTER 718;A$` | *Transfers number to computer.* |
| `40 DISP A$` | *Displays model number.* |
| `50 END` | |

## Query Response

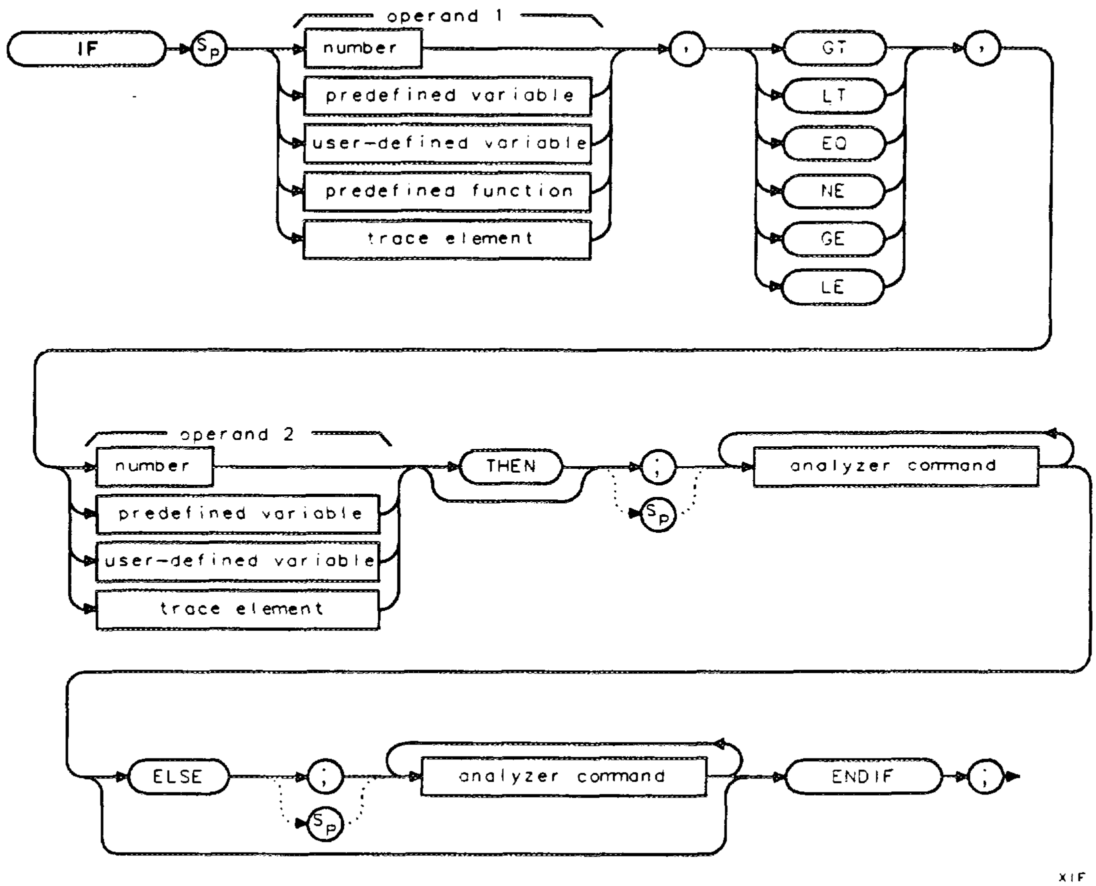



QID

# IF THEN ELSE ENDIF
# If Then Else Endif

The IF/THEN/ELSE/ENDIF commands form a decision and branching construct.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Analyzer command | Any spectrum analyzer command. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: REPEAT/UNTIL.

## Example

The following example uses the IF/THEN/ELSE/ENDIF command to pick a center frequency.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"TH -35DM;"` | *Sets threshold level.* |
| `30 OUTPUT 718;"TS;MKPK HI;MA;"` | *Finds highest peak.* |
| `40 OUTPUT 718;"IF MA,GT,TH THEN;"` | *Compares peak to threshold.* |
| `50   OUTPUT 718;"CF 20MHZ;"` | *Changes center frequency to 20 MHz if peak amplitude is greater than the threshold.* |
| `60 OUTPUT 718;"ELSE;"` | *This line is executed if peak is less than or* |
| `70   OUTPUT 718;"CF 100MHZ;TS;MKPK HI;"` | *equal to the threshold level.* |
| `80 OUTPUT 718;"ENDIF;"` | *End of IF/THEN/ELSE/ENDIF.* |
| `90 END` | |

The example below does not include the ELSE portion of the IF/THEN/ELSE/ENDIF command. This example lowers any signal positioned above the spectrum analyzer screen.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;MKPK HI;MA;"` | *Finds peak of trace.* |
| `30 OUTPUT 718;"IF MA,GT,RL THEN;"` | *Compares peak amplitude and reference level.* |
| `40   OUTPUT 718;"MKRL;"` | *Performs line 40 if the marker amplitude is greater than the reference level.* |
| `50 OUTPUT 718;"ENDIF;"` | *Ends IF/THEN/ENDIF structure.* |
| `60 END` | |

## Description

The IF portion compares operands 1 and 2 with the operators shown in the following table.

| Operator | Description |
|---|---|
| GT | Greater than. |
| LT | Less than. |
| EQ | Equal to. |
| NE | Not equal to. |
| GE | Greater than or equal to. |
| LE | Less than or equal to. |

If the condition is true, the command list following the IF statement is executed and commands between ELSE and ENDIF are skipped. If the condition is false, the commands after the ELSE statement are executed. If there is no ELSE statement, program execution resumes after the ENDIF statement.

The "equal to" (EQ) operator is not recommended if value 1 or value 2 represents a real number. When checking for equality with real numbers, the difference between the numbers is useful. For example:

| | |
|---|---|
| `OUTPUT 718;"SUB T_EST,V_ARA,V_ARB;"` | *Places the difference of V_ARA and V_ARB into T_EST. V_ARA, V_ARB, and T_EST are user-defined variables.* |
| `OUTPUT 718;"ABS T_EST,T_EST;"` | *Finds the absolute value of T_EST.* |

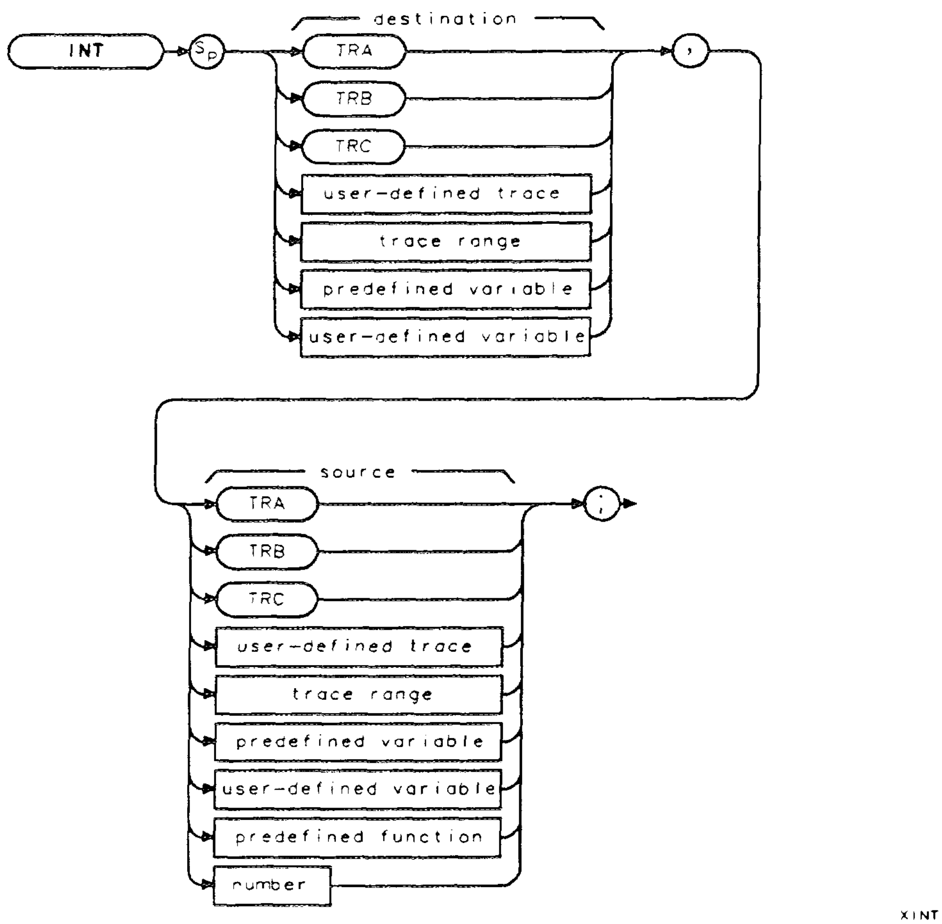
```
OUTPUT 718;"IF T_EST,LT,.01 THEN;"    Does a comparison.
OUTPUT 718;"CF UP;"
OUTPUT 718;"ENDIF;"
```

When used within a downloadable program (DLP), the maximum number of IF THEN ELSE ENDIF statements that can be nested is 20.

# INT
# Integer

Places the greatest integer that is less than or equal to the source value into the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: REPEAT/UNTIL.

## Example

`OUTPUT 718;"INT RL,3.75;"` *Resets the reference level using the integer value of 3.*

## Description

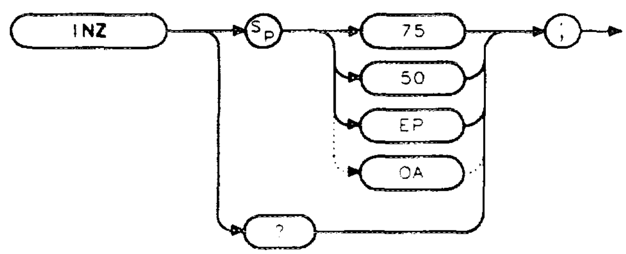
When the number of items in the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

When the spectrum analyzer is sweeping across more than one band, taking the integer value of the sweep time (ST) may yield a real number.

# INZ
# Input Impedance

Specifies the value of input impedance expected at the active input port.

## Syntax




XINZ

Equivalent Softkey: **INPUT Z 50Ω 75Ω**.

Preset Value: Returns impedance to the power-on value.
Related Commands: AUNITS.

## Example

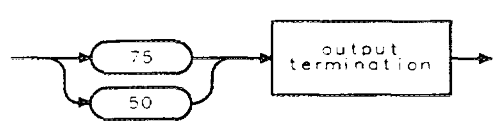
```
OUTPUT 718;"INZ 75;"        Changes input impedance to 75 ohms.
OUTPUT 718;"AUNITS V;"      Changes amplitude units to volts.
```

## Description

The actual impedance can be affected only by internal hardware. With the exception of Option 001 or 011 (HP 8590D or HP 8591E only), the spectrum analyzer hardware supports 50Ω only. The INZ command is used for computation purposes during power or voltage conversions.

The INZ command affects only the amplitude results that are reported in absolute relative power (dBm units or watts). (See "AUNITS.")

## Query Response




QINZ

# IP
# Instrument Preset

Performs an instrument preset.

## Syntax


Equivalent Softkey: (PRESET) is similar.

## Example

```
OUTPUT 718;"IP;"
```

## Description

The instrument preset command, IP, executes the following commands:

AMB: Turns off A − B mode.
AMBPL: Turns off A − B plus display line mode.
AMPCOR: Turns off amplitude correction factors.
ANLGPLUS: Turns off the Analog+ display mode.
ANNOT: Turns on annotation.
AT: Sets attenuation to 10 dB.
AUNITS: Loads the amplitude units from a configuration location in spectrum analyzer memory.
AUTO: Couples RB, AT, SS, ST, and VB. Turns off display line and threshold.
BLANK B, BLANK C: Blanks trace B and trace C.
CLRDSP: Erases user graphics.
CLRW A: Clears and writes trace A.
CONTS: Selects continuous sweep mode.
COUPLE: Selects ac coupling. (HP 8594E, HP 8595E, HP 8596E only.)
DA: Sets the display address to zero.
DET: Selects positive peak detection.
DL: Turns off the display line.
DOTDENS: Sets the dot density value to 15.
FMGAIN: Sets FM gain to 100 kHz. (Option 102 or 103 only.)
FOFFSET: Sets the frequency offset to 0 Hz.
GATE: Sets the gating to off. (Option 105 only.)
GATECTL: Sets the gate control to edge triggering. (Option 105 only.)
GD: Sets the gate delay to 1 μs. (Option 105 only.)
GDRVGDEL: Sets the gate delay to 1 μs. (Option 105 only.)
GDRVGLEN: Sets the gate length to 1 μs. (Option 105 only.)
GDRVRBW: Uncouples the resolution bandwidth and the pulse width. (Option 105 only.)
GDRVST: Uncouples the sweep time and the pulse repetition interval. (Option 105 only.)
GDRVVBW: Uncouples the video bandwidth and the gate length. (Option 105 only.)
GL: Sets the gate length to 1 ms. (Option 105 only.)
GP: Sets the gate trigger polarity to trigger on the positive edge. (Option 105 only.)
GRAT: Turns on the graticule.
HD: Hold (deactivates active function).

HNLOCK OFF: Unlocks harmonic band, allowing multiband sweeping. (HP 8592D, HP 8593E, HP 8595E, or HP 8596E only.)
GRAT: Turns on the graticule.
INZ: Loaded from a configurable location in spectrum analyzer memory.
LG: Selects 10 dB per division log scale.
LIMIDISP: Sets LIMIDISP to AUTO.
LIMIHI or LIMILO: Clears any limit-line trace specified by LIMIHI or LIMILO.
LIMITEST: Turns off limit-line testing.
MDS: Selects data size of one word, which is two 8-bit bytes.
MEASURE: Sets measurement to signal analysis.
MKDLMODE: Displays the marker amplitude values as relative to the reference level.
MKFCR: Marker counter resolution is set to AUTO, but a calculated value other than 0 may be returned if the marker counter resolution is queried. (HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or Option 013 with HP 8590D only.)
MKNOISE: Turns off noise markers.
MKOFF: Turns off all markers.
MKPAUSE: Turns off marker pause mode.
MKPX: Minimum excursion for peak identification is set to 6 dB.
MKREAD: Sets marker readouts to frequency.
MKTBL: Turns off the marker table.
MKTRACK: Turns off marker tracking.
MKTYPE: Sets the marker type as position type.
ML: Sets mixer level to −10 dBm.
MODE: Sets the operating mode to 0.
MSI: Selects the spectrum analyzer memory as the mass storage device.
NDB: Sets the number of dB for the NDBPNT measurement to −3 dB.
PD: Puts pen down at current position.
PKDLMODE: Displays all the signal peaks in the peak table.
PKSORT: Sorts the signal peaks in the peak table by decreasing amplitude.
PKTBL: Turns off the peak table.
PKZOOM: Sets the final span for the peak zoom routine to 1 MHz.
QPOFFSET: Sets the QPOFFSET to 20. (Option 103 only.)
RB: Sets the resolution bandwidth to 3 MHz.
RL: Sets reference level to 0 dBm.
RLPOS: Sets the reference level position to 8.
ROFFSET: Sets reference offset to 0.
RQS 40: Allows SRQ 110, SRQ 140 for illegal commands or broken hardware.
SPEAKER: Turns on the speaker. (Option 102, 103, or 301 only.)
SQLCH: Sets the squelch level to 0. (Option 102 or 103 only.)
SRCALC: Sets the source leveling control to internal. (Option 010 or 011 only.)
SRCNORM: Sets the source normalization to off. (Option 010 or 011 only.)
SRCPSWP: Sets the source power sweep to off. (Option 010 or 011 only.)
SRCPWR: Sets the source power level to −10 dBm. (Option 010 or 011 only.)
SS: Sets the center frequency step size to 100 MHz.
STATUS BYTE: Clear the status byte.
TH: One division above bottom graticule line, threshold line off.
TITLE: Clears the title from the spectrum analyzer screen.
TM: Selects free run trigger mode.
TDF: Selects parameter units output format.
TRB: Sets the trace values to 0.
TRC: Sets the trace values to 8000.
TVLINE: Sets TV line number to 17. (Options 101 and 102, or 301 only.)
TVSYNC: Triggers on negative polarity of the video modulation. (Options 101 and 102, or 301 only.)
VAVG: Turns off video averaging and sets the video averaging limit to 100.

VB: Sets the video bandwidth to 1 MHz.
VBR: Sets VBR to 0.300.

IP also clears all user graphics, all on-event algorithms, and turns off the windows display mode. (The on-event algorithms are ONCYCLE, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, and ONTIME.)

Instrument preset automatically occurs when you turn on the spectrum analyzer. IP is a good starting point for many measurement processes. When IP is executed remotely, the spectrum analyzer does not necessarily execute a complete sweep, however. You should execute a take sweep (TS) to ensure that the trace data is valid after an IP.

# KEYCLR
# Key Clear

Clears softkeys 1 through 6 of menu 1.

## Syntax


XKEYCLR

Related Commands: DISPOSE, KEYDEF, KEYEXC, KEYLBL, SAVEMENU.

## Example 1

```
OUTPUT 718;"MENU 1;"     Displays menu 1.
OUTPUT 718;"KEYCLR;"     Erases softkeys 1 through 6 of menu 1.
```

## Example 2

```
OUTPUT 718;"MENU 1;"          Displays menu 1.
OUTPUT 718;"SAVEMENU 101;"    Copies the softkey functions from menu 1 into menu 101.
OUTPUT 718;"KEYCLR;"          Erases the softkey functions of menu 1.
PAUSE
OUTPUT 718;"MENU 101;"        Displays menu 101.
```

## Description

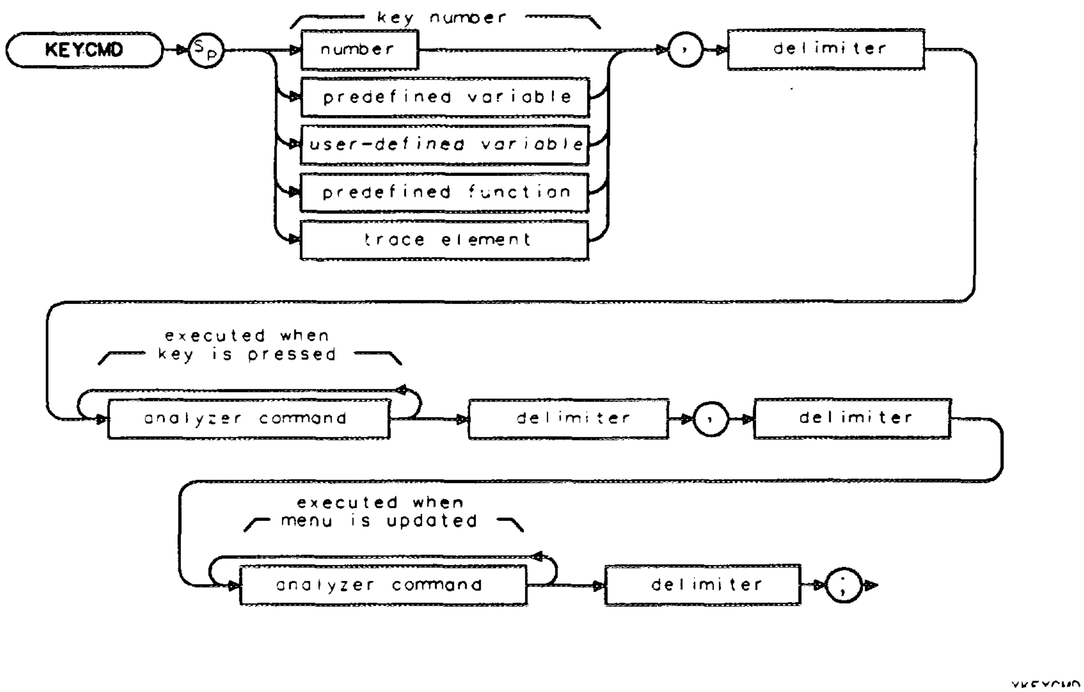
The KEYCLR command clears softkeys 1 through 6. Use the DISPOSE command to clear a single softkey.

Softkeys 1 through 6 can be displayed by executing "MENU 1;" or by pressing (MEAS/USER), **User Menus**.

# KEYCMD
# Key Command

Allows you define the function and label of a softkey. The softkey label is updated whenever a softkey is pressed.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 1 to 6, 601 to 1200 |
| Predefined variable | A command that act as a variable. Refer to Table 5-1. | |
| Analyzer command | Any valid spectrum analyzer command. | |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Related Commands: DISPOSE, ERASE, FUNCDEF, KEYENH, KEYEXC, KEYLBL.

## Example 1

This example defines softkey 1. Softkey 1 has the label "QSAD" until it is pressed. When softkey 1 is pressed, the following changes occur: center frequency changes to 105.3 MHz, span changes to 300 kHz, and the label for softkey 1 changes from "QSAD" to "KSAD." If softkey 1 is pressed again, the center frequency changes to 100.1 MHz and the label changes back to "QSAD."

```
10 OUTPUT 718;"IP;"                          Initializes spectrum analyzer.
20 !
30 OUTPUT 718;"VARDEF C_OUNTRY,1;"           Defines variable called C_OUNTRY.
40 !
50 OUTPUT 718;"KEYCMD 1,";                   Defines softkey 1.
60 OUTPUT 718;"%";
70 OUTPUT 718;"IF C_OUNTRY,EQ,
   1;THEN;";
80   OUTPUT 718;"CF 105.3MHZ;SP 300KHZ;";
90   OUTPUT 718;"MOV C_OUNTRY,0;";
100 OUTPUT 718;"ELSE;";
110   OUTPUT 718;"CF 100.1MHZ;SP 300KHZ;";
120   OUTPUT 718;"MOV C_OUNTRY,1;";
130 OUTPUT 718;"ENDIF;";
140 OUTPUT 718;"%,";
150 OUTPUT 718;"@";
160 OUTPUT 718;"IF C_OUNTRY,EQ,0 THEN;";
170   OUTPUT 718;"KEYLBL 1,%KSAD%;";
180 OUTPUT 718;"ELSE;";
190   OUTPUT 718;"KEYLBL 1,%QSAD%;";
200 OUTPUT 718;"ENDIF;";
210 OUTPUT 718;"@;";
220 END
```

## Example 2

Softkey 2 has a softkey label, "COUNTRY YES NO." If the value of the variable C_OUNTRY is 1, then YES is underlined and label of softkey 1 is "QSAD." Pressing softkey 2 moves the underline to NO and changes the label of softkey 1 to "KSAD."

```
10    OUTPUT 718;"IP;"
20    !
30    Ul$=CHR$(16)
40    Off$=CHR$(15)
50    !
60    OUTPUT 718;"VARDEF C_OUNTRY,1;"
70    !
80    OUTPUT 718;"KEYCMD 1,";
90    OUTPUT 718;"%";
100   OUTPUT 718;"IF C_OUNTRY,EQ,Q THEN;";
110     OUTPUT 718;"MOV CF 105.3MHZ;MOV SP,300KHZ;";
120     OUTPUT 718;"MOV C_OUNTRY,0;";
130   OUTPUT 718;"ELSE;";
140     OUTPUT 718;"MOV CF 100.1MHA;MOV SP,300KHZ;";
150     OUTPUT 718;"MOV C_OUNTRY,1;";
160   OUTPUT 718;"ENDIF;";
```

```
170   OUTPUT 718;"%,";
180   OUTPUT 718;"@";
190   OUTPUT 718;"IF C_OUNTRY,EQ,0 THEN;";
200     OUTPUT 718;"KEYLBL 1,%KSAD%;";
210   OUTPUT 718;"ELSE;";
220     OUTPUT 718;"KEYLBL 1,%QSAD%;";
230   OUTPUT 718;"ENDIF;";
240   OUTPUT 718;"@;";
250   !
260   OUTPUT 718;"KEYCMD 2,";
270   OUTPUT 718;"%";
280   OUTPUT 718;"IF C_OUNTRY,EQ,1 THEN;";
290     OUTPUT 718;"MOV CF,105.3MHZ;MOV SP,300KHZ;";
300     OUTPUT 718;"MOV C_OUNTRY,0;";
310   OUTPUT 718;"ELSE;";
320     OUTPUT 718;"MOV CF,100.1MHZ;MOV SP,300KHZ;";
330     OUTPUT 718;"MOV C_OUNTRY,1;";
340   OUTPUT 718;"ENDIF;";
350   OUTPUT 718;"%,";
360   OUTPUT 718;"@";
370   OUTPUT 718;"KEYENH 2,";
380   OUTPUT 718;"/";
390   OUTPUT 718;"COUNTRY|";Ul$;"YES";Off$;" NO";
400   OUTPUT 718;"/";
410   OUTPUT 718;",0,";
420   OUTPUT 718;"!";
430   OUTPUT 718;"IF C_OUNTRY,EQ,0";
440   OUTPUT 718;"!;";
450   OUTPUT 718;"@;";
460   !
470   END
```

## Description

The KEYCMD command updates the softkey label whenever the softkey is pressed (as shown in example 2).

The functions of KEYCMD and KEYDEF are similar. The advantage of KEYCMD is that the label of the softkey can change dependent on a conditional statement without the softkey itself being pressed. KEYCMD is useful for indicating the state of a function in the spectrum analyzer by changing the appearance of the softkey.

**Softkey numbers:** When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results.

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

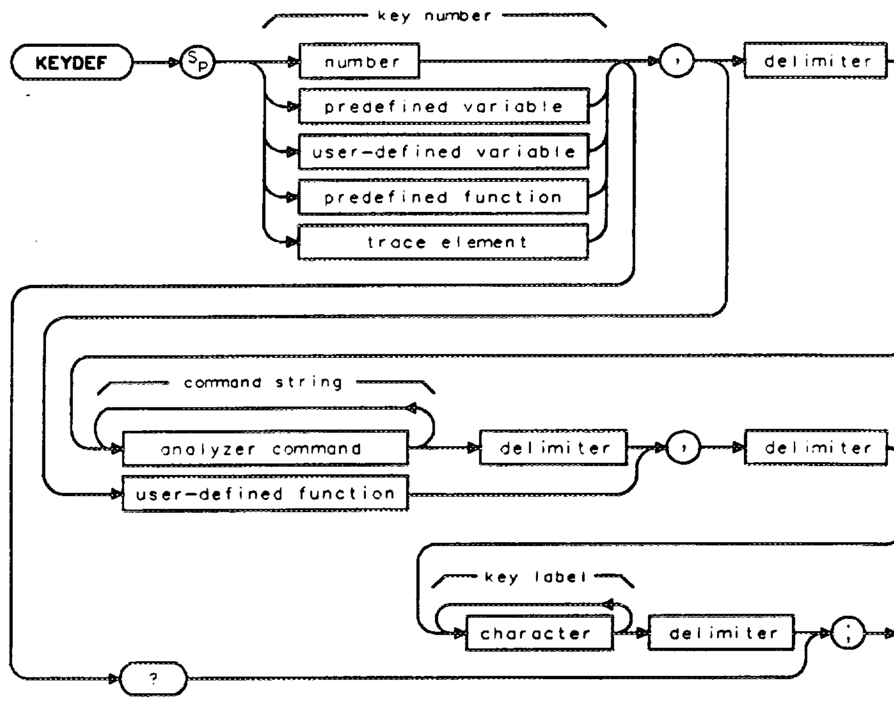
**KEYCMD Key Command**

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

# KEYDEF
# User-Defined Key Definition

Assigns a label and user-defined function to a softkey.

## Syntax




xkeydef

## KEYDEF User-Defined Key Definition

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>User-defined variable</td><td>A variable defined by VARDEF or ACTDEF commands.</td><td>Any valid variable name.</td></tr>
<tr><td>Predefined function</td><td>Function that returns a value. Refer to Table 5-1.</td><td>Any valid predefined function that returns a value within the softkey number range.</td></tr>
<tr><td>Trace element</td><td>An element of trace A, trace B, trace C, or a user-defined trace.</td><td></td></tr>
<tr><td>Number</td><td>Any valid integer.</td><td>1 to 6, 601 to 1200.</td></tr>
<tr><td>Predefined variable</td><td>A command that acts as a variable. Refer to Table 5-1.</td><td>Any valid predefined variable that returns a value within softkey number range.</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any valid spectrum analyzer command.</td><td></td></tr>
<tr><td>User-defined function</td><td>A subroutine defined by the FUNCDEF command.</td><td>Any valid function name.</td></tr>
<tr><td>Character</td><td>Any valid character. See "LB" for additional characters and label functions.</td><td>1 to 8 characters per label line, use the (|) symbol or blank spaces to separate softkey label lines.</td></tr>
</table>

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: DISPOSE, ERASE, FUNCDEF, KEYEXC, KEYLBL.

## Example 1

Connect CAL OUT to the spectrum analyzer input.

<table>
<tr><td><code>OUTPUT 718;"IP;"</code></td><td>Initializes spectrum analyzer.</td></tr>
<tr><td><code>OUTPUT 718;"FUNCDEF D_LP,@";</code></td><td>Defines a function called D_LP.</td></tr>
<tr><td><code>OUTPUT 718;"CF 300MHZ;";</code></td><td>Changes center frequency to measure the calibration signal.</td></tr>
<tr><td><code>OUTPUT 718;"SP 1MHZ;";</code></td><td>Measures the calibration signal in narrow span.</td></tr>
<tr><td><code>OUTPUT 718;"@;"</code></td><td>The "@" signifies the end of the function declaration.</td></tr>
<tr><td><code>OUTPUT 718;"KEYDEF 1,D_LP,%SHOW|CAL%;"</code></td><td>Softkey 1 will now have the "SHOW CAL" label and perform the function D_LP.</td></tr>
<tr><td><code>OUTPUT 718;"KEYEXC 1;"</code></td><td>Executes softkey 1.</td></tr>
</table>

## Example 2

To redefine the command string without changing the label, enter a single blank space for the command string parameter. If you want to delete the command string and the softkey label, enter two or more blank spaces for the softkey label parameter.

<table>
<tr><td><code>OUTPUT 718;"KEYDEF 2,%IP;CF 300MHZ;%,%MY KEY|LABEL%;"</code></td><td>Defines softkey 2.</td></tr>
<tr><td><code>OUTPUT 718;"KEYDEF 2, ,%MY KEY|LABEL%;"</code></td><td>Removes the command string functions, but the softkey label remains on screen.</td></tr>
</table>

```
OUTPUT 718;"KEYDEF 2, ,  ;"
```

*Removes the command string functions and the softkey label.*

## Description

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Softkey numbers:** When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results.

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

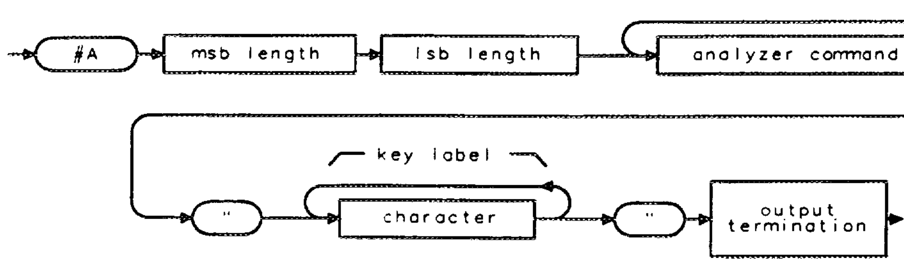
For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus**. Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

The softkey label and the command string can be deleted by entering blank spaces in the softkey label or command string. See example 2.

## Query Response

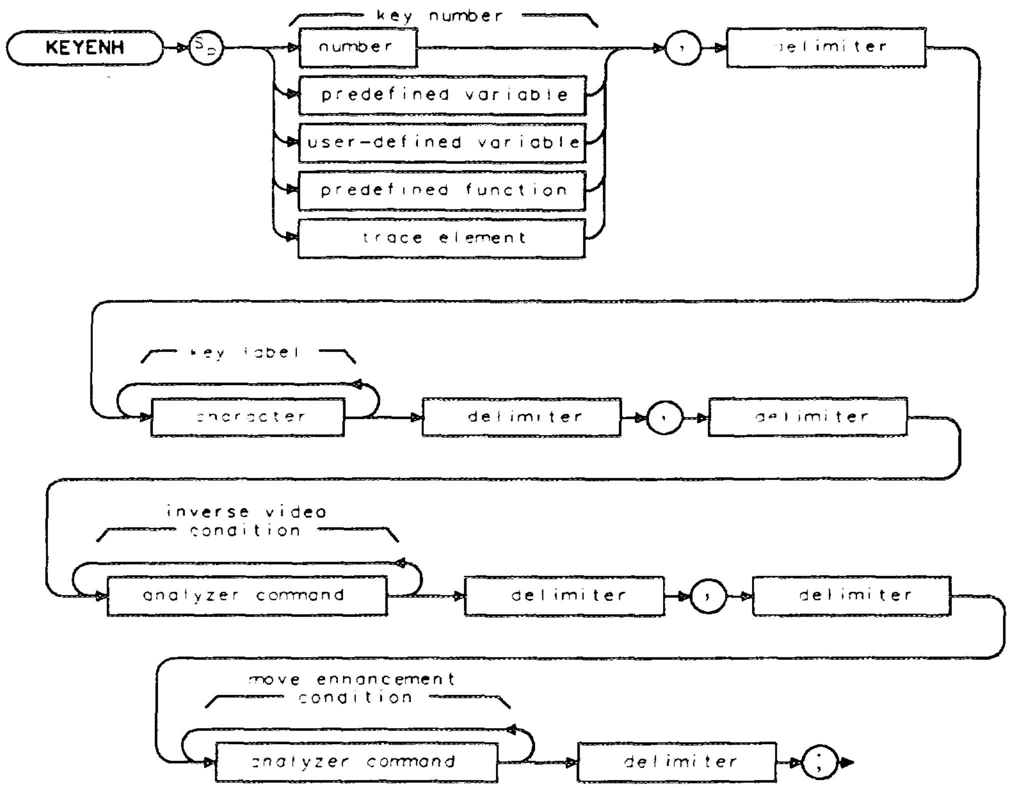



QKEYDEF

# KEYENH
# Key Enhance

*Allows you to activate inverse video mode or underline part or all of the softkey label.*

## Syntax




XKEYENH

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>User-defined variable</td><td>A variable defined by VARDEF or ACTDEF commands.</td><td>Any valid variable name.</td></tr>
<tr><td>Predefined function</td><td>Function that returns a value. Refer to Table 5-1.</td><td>Any valid predefined function that returns a value within the softkey number range.</td></tr>
<tr><td>Trace element</td><td>An element of trace A, trace B, trace C, or a user-defined trace.</td><td></td></tr>
<tr><td>Number</td><td>Any valid integer.</td><td>1 to 6, 601 to 1200.</td></tr>
<tr><td>Predefined variable</td><td>A command that act as a variable. Refer to Table 5-1.</td><td>Any valid predefined variable that returns a value within softkey number range.</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Character</td><td>Any valid character. See "LB" for additional characters and label functions.</td><td>1 to 8 characters per line, use the (|) symbol or blank spaces to separate softkey label lines.</td></tr>
<tr><td>Analyzer command</td><td>Any valid spectrum analyzer command.</td><td></td></tr>
</table>

Related Commands: DISPOSE, ERASE, FUNCDEF, KEYCMD, KEYEXC, KEYLBL.

## Example 1

The following program lines show two different ways of using KEYENH to underline "OFF" in the softkey label.

```
OUTPUT 718;"KEYENH 2,@ON ";CHR$(16);"OFF";
CHR$(15);"@,0,0;"
```

*Underlines the "OFF" section of the label. Notice that the move enhancement condition is false, and CHR$(16) and CHR$(15) control the "OFF" section of the softkey label.*

```
OUTPUT 718;"KEYENH 2,@";CHR$(16);"ON";
CHR$(15);" OFF@,0,1;"
```

*Underlines the "OFF" section of the label. Notice that the move enhancement condition is true, and CHR$(16) and CHR$(15) control the "ON" section of the softkey label.*

The following program lines show two different ways of using KEYENH to underline "ON" in the softkey label.

```
OUTPUT 718;"KEYENH 2,@";CHR$(16);"ON";CHR$(15);
" OFF@,0,0;"
```

*Underlines the "ON" section of the label.*

```
OUTPUT 718;"KEYENH 2,@ON";CHR$(16);" OFF";
CHR$(15);"@,0,1;"
```

*Underlines the "ON" section of the label.*

## Example 2

Use the KEYENH command to turn on inverse video for the upper label line of softkey number 1.

| | |
|---|---|
| `Ul$=CHR$(16)` | *Defines UL$ as the character to turn the underline on.* |
| `Off$=CHR$(15)` | *Defines OFF$ as the character to turn off inverse video and underlining.* |
| `OUTPUT 718;"VARDEF I_NV,0;"` | *The value of I_NV acts as a inverse video condition.* |
| `OUTPUT 718;"VARDEF M_OVENH,0;"` | *The value of M_OVENH acts as the move enhancement condition.* |
| `OUTPUT 718;"KEYENH 1,%MY KEY\|";Ul$;"ON";Off$;" OFF%,@IF 0, EQ,I_NV@,@IF 0,EQ,M_OVENH@;"` | *The MY KEY label line changes to inverse video, and OFF (in the lower label line) is underlined.* |

## Example 3

Changing the condition of the inverse video mode to false turns off the inverse video.

| | |
|---|---|
| `Ul$=CHR$(16)` | *Defines UL$ as the character to turn the underline on.* |
| `Off$=CHR$(15)` | *Defines OFF$ as the character to turn off inverse video and underlining.* |
| `OUTPUT 718;"MOV I_NV,0;"` | |
| `OUTPUT 718;"MOV M_OVENH,1;"` | *Changes the conditional value of M_OVENH.* |
| `OUTPUT 718;"KEYENH 1,%MY KEY\|";Ul$;"ON";Off$;" OFF%,@IF 0, EQ,I_NV@,@IF 0,EQ,M_OVENH@;"` | *The ON portion of the lower label is underlined, the MY KEY portion of the label is still in inverse video.* |

## Example 4

Omitting Ul$ and Off$ turns on inverse video for the upper and lower softkey label lines.

| | |
|---|---|
| `Ul$=CHR$(16)` | *Defines UL$ as the character to turn the underline on.* |
| `Off$=CHR$(15)` | *Defines OFF$ as the character to turn off inverse video and underlining.* |
| `OUTPUT 718;"MOV I_NV,0;"` | |
| `OUTPUT 718;"MOV M_OVENH,1;"` | |

```
OUTPUT 718;"KEYENH 1,%MY KEY|ON OFF%,@IF 0, EQ,I_NV@,@IF
0,EQ,M_OVENH@;"
```

*MY KEY and ON OFF are displayed in inverse video.*

## Description

The KEYENH command has two parameters (inverse video condition and move enhancement condition). Setting these parameters to true or false controls how the softkey label is displayed. The softkey label can be displayed with sections of the label in inverse video or underlined.

If the inverse video condition for the softkey label is true, the following occurs:

- The top line of the softkey label is displayed in inverse video (see example 2).
- If there are no enhancements embedded in the softkey label for the second line of the softkey label, the second line of the softkey label is displayed in inverse video. (See example 4). (See the following section, "Using Enhancements," for more information about enhancements.)

If the inverse video condition for the softkey label is false, the inverse video is not used and the softkey label appears as specified by the move enhancement condition.

If the move enhancement condition is true, the following occurs:

- If no enhancements are used in the softkey label, the last line of the softkey label is underlined.
- If enhancements are used in the softkey label, the enhancement (inverse video or underlining) is moved to the other side of the softkey label.

If the move enhancement condition for the softkey label is false, the softkey label appears as specified by the inverse enhancement condition.

## Using Enhancements

An alternate way to control underlining and inverse video is to use "codes" to separate sections of a softkey label.

- If you want to underline different sections of the softkey label, use code CHR$(16) (turns on underlining) and CHR$(15) (turns off the enhancements).
- If you want to use inverse video on different sections of the softkey label, use code CHR$(14) (turns on inverse video) and CHR$(15) (turns off enhancements).

Example 1 demonstrates that there are two ways to underline the "OFF" section of softkey label using enhancements.

The recommended convention for using inverse video and underlining is to use inverse video to indicate an active function and underlined labels to show a choice.

**Softkey numbers:** When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results. The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

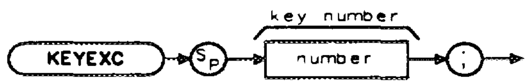
Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

# KEYEXC
# Key Execute

Executes the specified, previously defined softkey.

## Syntax




XKEYEXC

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer | 1 to 6, 601 to 1200. |

Related Commands: DISPOSE, ERASE, FUNCDEF, KEYDEF, KEYLBL.

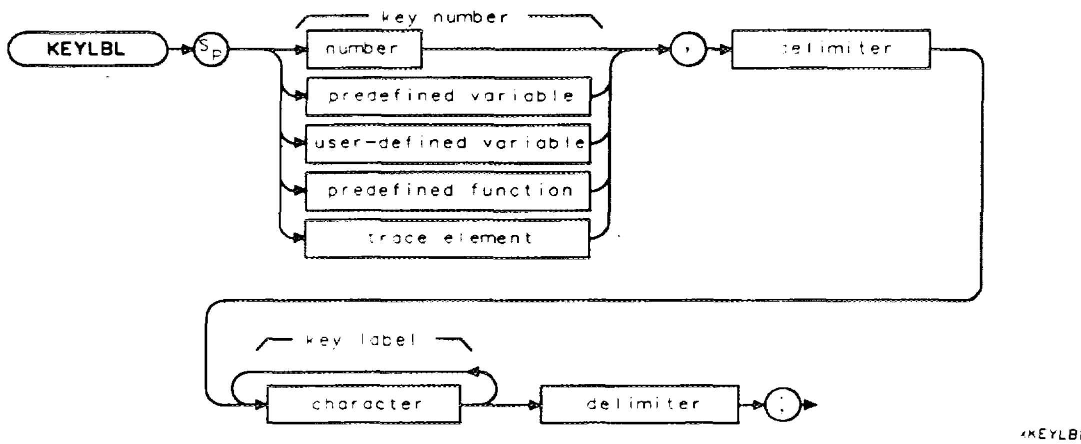
## Example

| | |
|---|---|
| `OUTPUT 718;"FUNCDEF D_LP,@";` | *Defines a function called D_LP.* |
| `OUTPUT 718;"CF 300MHZ;";` | *Changes center frequency to measure the calibration signal.* |
| `OUTPUT 718;"SP 1MHZ;";` | *Measures the calibration signal in narrow span.* |
| `OUTPUT 718;"@;"` | *The "@" signifies the end of the function declaration.* |
| `OUTPUT 718;"KEYDEF 1,D_LP,%SHOW CAL%;"` | *Softkey 1 will now have the "SHOW CAL" label and perform the function D_LP.* |
| `OUTPUT 718;"KEYEXC 1;"` | *Executes softkey 1.* |

# KEYLBL
# Key Label

Relabels a softkey without changing its function.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 1 to 6, 601 to 1200. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. See "LB" for additional characters and label functions. | 1 to 8 characters per label line, use the (\|) symbol or blank spaces to separate softkey label lines. |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: DISPOSE, ERASE, FUNCDEF, KEYDEF, KEYEXC, KEYLBL.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `10 OUTPUT 718;"FUNCDEF D_LP,@";` | *Defines a function called D_LP. The "@" symbol indicates the beginning of the function.* |
| `20 OUTPUT 718;"CF 300MHZ;";` | *Changes center frequency to measure the calibration signal.* |
| `30 OUTPUT 718;"SP 1MHZ;";` | *Measures the calibration signal in narrow span.* |

| | |
|---|---|
| `40 OUTPUT 718;"@;"` | *The "@" signifies the end of the function declaration.* |
| `50 OUTPUT 718;"KEYDEF 1,D_LP,%SHOW CAL%;"` | *Softkey 1 is now called "SHOW CAL" and performs the function D_LP.* |
| `60 OUTPUT 718;"KEYEXC 1;"` | *Executes softkey 1.* |
| `70 OUTPUT 718;"KEYLBL 1,%NEW NAME%;"` | *Softkey 1 is now labeled "NEW NAME", but performs the same function.* |
| `80 END` | |

## Description

When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results.

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

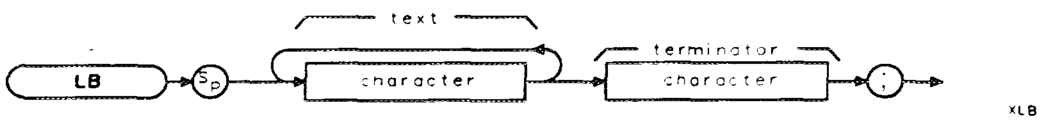
Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

# LB
# Label

Writes text (label) at the current pen position. The text consists of alphanumeric characters specified in the character field.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character (text) | Any valid character. See "LB" for additional characters available. | |
| Character (delimiter) | Any valid character declared as a delimiter by the DT command. | |

Prerequisite Command: DT.
Related Commands: TEXT, TITLE.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"BLANK TRA;ANNOT OFF;"` | *Clears trace and annotation from the spectrum analyzer screen.* |
| `30 OUTPUT 718;"DT@;"` | *Establishes @ as the termination of the label text.* |
| `40 OUTPUT 718;"PU;PA 75,175;LB LABEL@;"` | *Displays "LABEL" on the spectrum analyzer screen.* |
| `50 OUTPUT 718;"PU;PA 75,150;LB"; CHR$(36);"@;"` | *Displays the dollar sign "$" on the spectrum analyzer screen. The semicolons before and after CHR$(36) prevent the computer from performing a line feed.* |
| `60 OUTPUT 718;"PU;PA 75,125;LB";CHR$(16); "AN UNDERLINED LABEL";CHR$(15);"@;"` | *Underlines the text.* |
| `70 OUTPUT 718;"PU;PA 75,100;LB";CHR$(14); "A LABEL IN INVERSE VIDEO";CHR$(15);"@;"` | *Displays the text in inverse video.* |
| `80 END` | |

## Description

Each text character is specified by 8 bits in an 8 bit data byte, which immediately follows the LB command. Additional characters can be displayed using CHR$(code) where code represents the ASCII code (see line 50 of the example). Refer to the following tables for additional characters and label functions available.

LB displays the text at the current pen position. When using LB, the end of the text characters must be terminated. If the text is not terminated, instructions and other text following the actual label's statement are displayed on the spectrum analyzer screen. The label mode can always be terminated with an ASCII end-of-text code (decimal code 3), or with a character specified previously by the DT command. The terminator character itself must immediately follow the label.

To remove the text written by the LB command, write spaces over the text or use the CLRDSP command.

The LB command also enters the text into the display list. See "DA" for more information about the display list.

**Table 5-6. Character Set**

| Code | Char | Code | Char | Code | Char | Code | Char | Code | Char |
|---|---|---|---|---|---|---|---|---|---|
| 32 | (space) | 73 | I | 114 | r | 190 | ≥ | 237 | μ |
| 33 | ! | 74 | J | 115 | s | 191 | ˉ | 238 | ν |
| 34 | " | 75 | K | 116 | t | 192 | ∠ | 239 | o |
| 35 | # | 76 | L | 117 | u | 193 | A | 240 | π |
| 36 | $ | 77 | M | 118 | v | 194 | ∫ | 241 | θ |
| 37 | % | 78 | N | 119 | w | 195 | ¢ | 242 | ϱ |
| 38 | & | 79 | O | 120 | x | 196 | ∇ | 243 | σ |
| 39 | ' | 80 | P | 121 | y | 199 | g | 244 | τ |
| 40 | ( | 81 | Q | 122 | z | 200 | h | 245 | υ |
| 41 | ) | 82 | R | 123 | { | 201 | ↑ | 246 | |
| 42 | * | 83 | S | 125 | } | 204 | L | 247 | ω |
| 43 | + | 84 | T | 126 | ~ | 205 | n | 248 | Γ |
| 44 | , | 85 | U | 160 | ∧ | 206 | n | 249 | δ |
| 45 | – | 86 | V | 162 | ˉ | 207 | ° | 250 | Ω |
| 46 | . | 87 | W | 163 | ≠ | 208 | p | 251 | σ |
| 47 | / | 88 | X | 164 | £ | 209 | ∞ | 252 | Λ |
| 48 | 0 | 89 | Y | 165 | ∝ | 210 | r | 253 | ϒ |
| 49 | 1 | 90 | Z | 166 | ⊕ | 211 | s | 254 | Ξ |
| 50 | 2 | 91 | [ | 167 | · | 212 | T | | |
| 51 | 3 | 92 | \ | 168 | ← | 213 | Δ | | |
| 52 | 4 | 93 | ] | 169 | → | 214 | ∨ | | |
| 53 | 5 | 94 | ^ | 170 | § | 216 | + + = + + | | |
| 54 | 6 | 95 | _ | 171 | ± | 217 | " | | |
| 55 | 7 | 96 | ` | 172 | ↓ | 218 | | | |
| 56 | 8 | 97 | a | 173 | ⁻ | 219 | π | | |
| 57 | 9 | 98 | b | 174 | × | 220 | θ | | |
| 58 | : | 99 | c | 175 | ÷ | 221 | ψ | | |
| 59 | ; | 100 | d | 176 | ₀ | 222 | ϕ | | |
| 60 | < | 101 | e | 177 | ₁ | 224 | φ | | |
| 61 | = | 102 | f | 178 | ₂ | 225 | α | | |
| 62 | > | 103 | g | 179 | ₃ | 226 | β | | |
| 63 | ? | 104 | h | 180 | ⁻¹ | 227 | χ | | |
| 64 | @ | 105 | i | 181 | ² | 228 | Δ | | |
| 65 | A | 106 | j | 182 | ³ | 229 | ϵ | | |
| 66 | B | 107 | k | 183 | √ | 230 | ϕ | | |
| 67 | C | 108 | l | 184 | ~ | 231 | γ | | |
| 68 | D | 109 | m | 185 | ≃ | 232 | η | | |
| 69 | E | 110 | n | 186 | ‖ | 233 | L | | |
| 70 | F | 111 | o | 187 | ∴ | 234 | ζ | | |
| 71 | G | 112 | p | 188 | ≤ | 235 | κ | | |
| 72 | H | 113 | q | 189 | ≡ | 236 | λ | | |

### Table 5-7. Label Functions

| Code | Function | Description |
|---|---|---|
| 8 | back space | Positions the pen back one character width. |
| 10 | line feed | Positions the pen position down one character height. |
| 11 | vertical tab | Positions the pen up one character height. |
| 12 | form feed | Position the pen to the upper-left corner of the display. |
| 13 | carriage return | Positions the pen at the far left side of the display. |
| 14 | inverse video on | Turns on inverse video. |
| 15 | enhancements off | Turns off underlining or inverse video. |
| 16 | underlining on | Turns on underlining. |

# LF
# Base Band Instrument Preset

*Performs an instrument preset into base band (band 0).*

## Syntax


XLF

Model Required: HP 8592D, HP 8593E, HP 8595E, HP 8596E.
Related Commands: IP.

## Example

```
OUTPUT 718;"LF;"
```

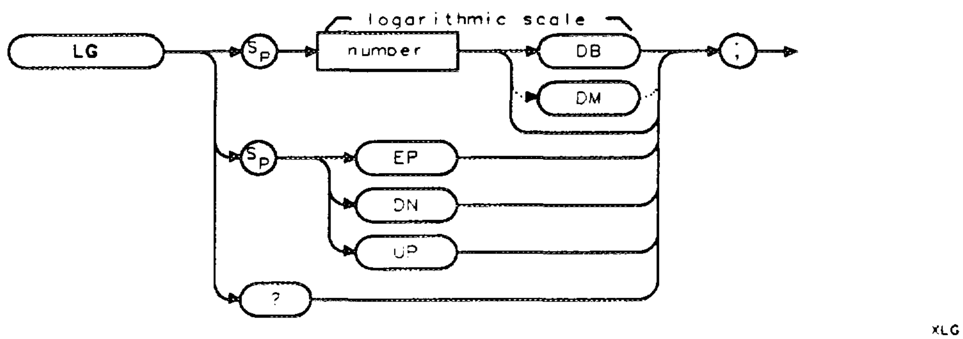
## Description

Use LF instead of instrument preset (IP) if harmonic band 0 is desired. Using LF instead of IP reduces the wear on an internal spectrum analyzer switch (the RF switch).

# LG
# Logarithmic Scale

Specifies the vertical graticule divisions as logarithmic units, without changing the reference level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default units are dB. | 0.1 to 20 dB. |

Equivalent Softkey: **SCALE LOG LIN** (when LOG is underlined).
Preset State: 10 dB.
Related Commands: LN.

## Example

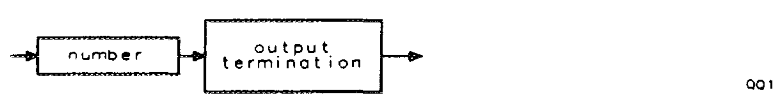
```
OUTPUT 718;"LG 1DB;"
```

## Description

The vertical scale can be specified (in tenths) from 0.1 to 0.9 dB, or in integers from 1 to 20 dB per graticule division.

If LG is used as the destination in a MOV command, it changes the log scale, but does not change the scale from linear to logarithmic.

## Query Response



# LIMIDEL
## Delete Limit-Line Table

Deletes all upper and lower segments in the current limit-line table.

### Syntax


XLIMIDEL

Equivalent Softkey: **PURGE LIMITS** .

Related Commands: LIMIFT, LIMIHI, LIMILO, LIMIREL, LIMISEG, LIMISEGT, SEGDEL, SENTER, SENTERT.

### Example

```
OUTPUT 718;"LIMIDEL;"
```

### Description

Use LIMIDEL before entering a new limit line.

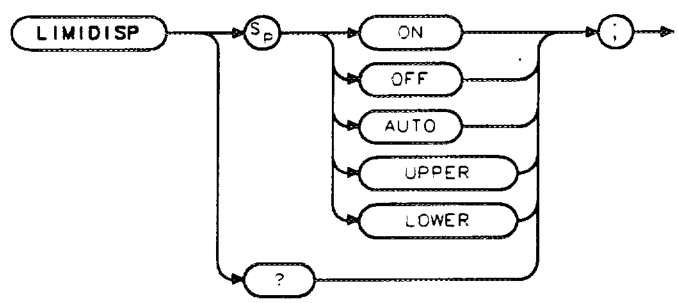
**Note** Use STOR, SAVET, or SAVRCLW if you want to save the current limit-line table. LIMIDEL does not affect stored limit-line data.

LIMIDEL sets LIMIREL OFF (specifies that the limit line is fixed) and LIMIFT FREQ (specifies that the limit line is based on frequency). See "LIMILINE" for more information about limit line construction.

# LIMIDISP
# Limit Line Display

Controls when the limit line (or limit lines) are displayed.

## Syntax




Equivalent Softkey: **LMT DISP Y N AUTO** .
Preset Value: AUTO.
Related Commands: ANLGPLUS, LIMILINE, LIMITEST.

## Example

`OUTPUT 718;"LIMIDISP ON;"` *Displays any portion of the limit lines that are currently within the spectrum analyzer screen boundaries.*

## Description

If a limit line is currently in spectrum analyzer memory, you can use LIMIDISP to control the display of the limit lines. The parameters of LIMIDISP do the following:

ON Turns on the limit line display.

OFF Turns off the limit line display.

AUTO Allows LIMITEST to control the display of the limit lines. If LIMITEST is on, the limit lines will be displayed. If LIMITEST is off, the limit lines will not be displayed.

UPPER Displays the upper limit line only.

LOWER Displays the lower limit line only.

**Note**

Turning on Analog+ display mode changes the way that LIMIDISP functions as follows:

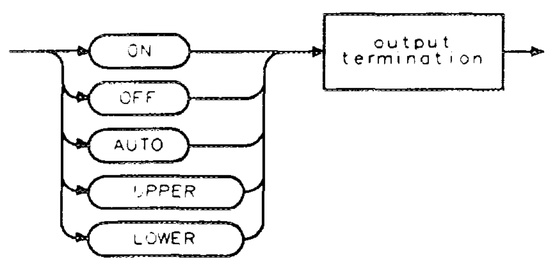
- LIMIDISP ON, LIMIDISP LOWER, and LIMIDISP UPPER do not work when the Analog+ display mode is turned on.
- LIMIDISP AUTO will still perform the limit line test if LIMITEST is on, but the limit lines will not be displayed.

**LIMIDISP Limit Line Display**

When used as a predefined variable, LIMIDISP returns a number from 0 to four, depending on the setting of the LIMIDISP parameter. The number corresponds to the LIMIDISP parameter as shown in the following table.

| LIMIDISP Parameter | Value Returned |
|---|---|
| OFF | 0 |
| UPPER | 1 |
| LOWER | 2 |
| ON | 3 |
| AUTO | 4 |

## Query Response

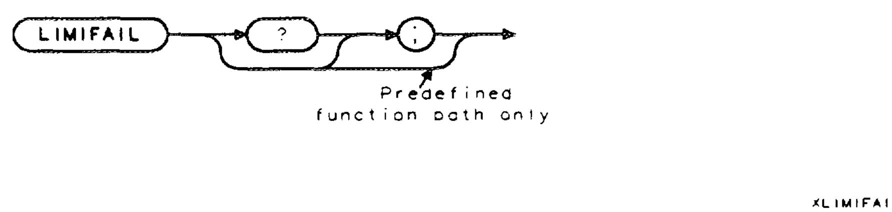



QLIMIDISP

# LIMIFAIL
# Limits Failed

Returns a "0" if the last measurement sweep of trace A is equal to or within the limit-line bounds.

## Syntax




Related Commands: LIMIHI, LIMILINE, LIMILO, LIMISEG, LIMISEGT, LIMITEST, SENTER, SENTERT.

## Example

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"IP;SNGLS;CF300MHZ;SP100MHZ;"` | *Initializes spectrum analyzer and changes the frequency and span settings.* |
| 20 | `OUTPUT 718;"LIMIDEL;"` | *Deletes any limit-line tables, sets the table type to fixed.* |
| 30 | `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| 40 | `OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Creates an entry for the upper limit-line table. Because the LIMISEG command is used, the limit-line will be based on the frequency.* |
| 50 | `OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| 60 | `OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| 70 | `OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| 80 | `OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| 90 | `OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| 100 | `OUTPUT 718;"LIMITEST ON;TS;"` | *Turns on limit-line testing.* |
| 110 | `OUTPUT 718;"LIMIFAIL?;"` | *Returns the status of the limit-line testing.* |
| 120 | `ENTER 718;A` | |
| 130 | `DISP A` | *Displays the result.* |
| 140 | `END` | |

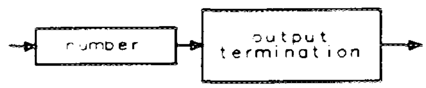
**LIMIFAIL Limits Failed**

## Description

LIMIFAIL returns one of the following values:

**0** indicates that the measurement sweep was within the limit-line bounds.
**1** indicates that the measurement sweep failed the lower limit.
**2** indicates that the measurement sweep failed the upper limit.
**3** indicates that the measurement sweep failed both the lower and upper limits.
**4** indicates that no test was performed. A "4" is returned if LIMITEST is set to OFF.

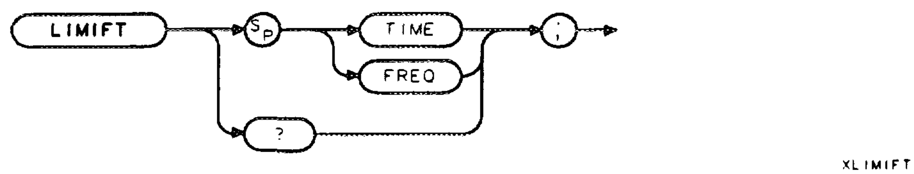
## Query Response



# LIMIFT
# Select Frequency or Time Limit Line

Selects how the limit-line segments are defined: according to frequency, or according to the sweep time setting of the spectrum analyzer.

## Syntax




Equivalent Softkey: LIMIFT is equivalent to **LIMITS FRQ TIME**.

Related Commands: LIMIDEL, LIMILINE, LIMIMODE, LIMIREL, LIMISEG, LIMISEGT, SEGDEL, SENTER, SENTERT.

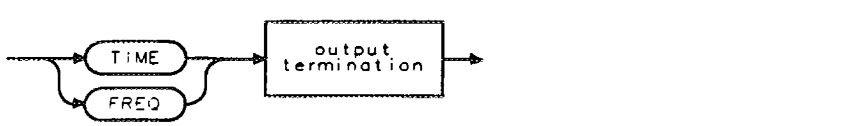
## Example

OUTPUT 718;"LIMIFT TIME;" *If the current limit-line table is a frequency limit-line table, it is purged. LIMIFT TIME places the limit-line segments on the spectrum analyzer display with respect to the sweep time of the spectrum analyzer.*

## Description

If you execute "LIMIFT TIME;", LIMISEGT, or SENTERT, the limit-line segments are placed on the spectrum analyzer display with respect to the sweep time setting of the spectrum analyzer. If you execute "LIMIFT FREQ;", LIMISEG, or SENTER, the limit-line segments are placed according to the frequency that is specified for each segment. If a limit line has already been defined, changing the LIMIFT setting clears the existing limit line.

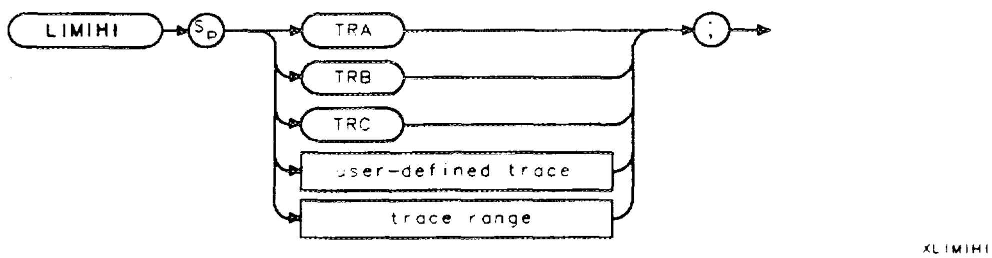
## Query Response



# LIMIHI
## Upper Limit

Allows you to specify a fixed trace as the upper limit line.

### Syntax




Related Commands: IP, LIMIDEL, LIMIFAIL, LIMILO, LIMISEG, LIMITEST, SENTER.

### Example

| | | |
|---|---|---|
| 10 | OUTPUT 718;"TRDEF M_ASK,401;" | *Defines a trace called "M_ASK."* |
| 20 | OUTPUT 718;"MOV M_ASK[1,100],1000;" | *Moves values into sections of the M_ASK trace.* |
| 30 | OUTPUT 718;"MOV M_ASK[101,200],2000;" | |
| 40 | OUTPUT 718;"MOV M_ASK[201,300],3000;" | |
| 50 | OUTPUT 718;"MOV M_ASK[301,401],4000;" | |
| 60 | OUTPUT 718;"LIMIHI M_ASK;" | *Specifies M_ASK as the upper limit line.* |
| 70 | OUTPUT 718;"LIMITEST ON;" | *Turns on limit-line testing.* |
| 80 | OUTPUT 718;"LIMIFAIL?;" | *Tests if trace A fails limit-line testing.* |
| 90 | ENTER 718;A | |
| 100 | DISP A | *Displays result of limit-line testing.* |
| 110 | END | |

### Description

Unlike specifying a limit line with LIMISEG, LIMISEGT, SENTER, or SENTERT, the limit line specified with LIMIHI is *not* updated if the center frequency, frequency span, sweep time, or reference level are changed.

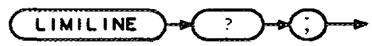
**Note** Executing IP, LIMIDEL, LIMISEG, LIMISEGT, SENTER, or SENTERT will delete the limit line specified with LIMILO or LIMIHI. Executing LIMILO or LIMIHI will delete the limit line specified with LIMISEG, LIMISEGT, SENTER, or SENTERT.

Use LIMITEST ON to display the limit line trace specified by LIMIHI. Use LIMITEST OFF to blank the limit line trace specified by LIMIHI.

# LIMILINE
# Limit Lines

Outputs the current limit-line table definitions.

## Syntax




XLIMILINE

Related Commands: LIMIFT, LIMIREL, LIMIMODE, LIMIREL, LIMISEG, LIMISEGT, LIMITEST, SAVRCLW, SENTER, SENTERT.

## Example

| | | |
|---|---|---|
| 10 | `DIM States$[2000]` | *Dimensions an array to store the limit-line information.* |
| 20 | `OUTPUT 718;"IP;CF300MHZ;SP100MHZ;"` | *Initializes spectrum analyzer.* |
| 30 | `OUTPUT 718;"LIMIDEL;"` | *Deletes any limit-line tables, sets the table type to fixed.* |
| 40 | `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| 45 | `OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| 50 | `OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Enters a value for the upper limit-line table. Because the LIMISEG command is used, the limit-line segment is for a limit-line based on frequency.* |
| 60 | `OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| 70 | `OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| 80 | `OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| 90 | `OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| 100 | `OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| 110 | `OUTPUT 718;"LIMILINE?;"` | *Gets the current limit-line table definitions.* |
| 120 | `ENTER 718 USING "#,-K";States$` | *Enters information into array.* |
| 130 | `PRINT States$` | *Prints the current limit-line table definitions.* |
| 140 | `END` | |

## Description

LIMILINE is used to query the current limit line. Executing LIMILINE returns an ASCII string containing the commands needed to create the limit line.

Use these commands (in the order given) to build a limit line:

1. Use LIMIDEL to clear the limit-line table.
2. Use LIMIFT to select a limit line that is either based on frequency or sweep time.
3. Use LIMIREL to determine whether the values of the limit line are absolute values or positioned relative to the reference-level and center-frequency settings.

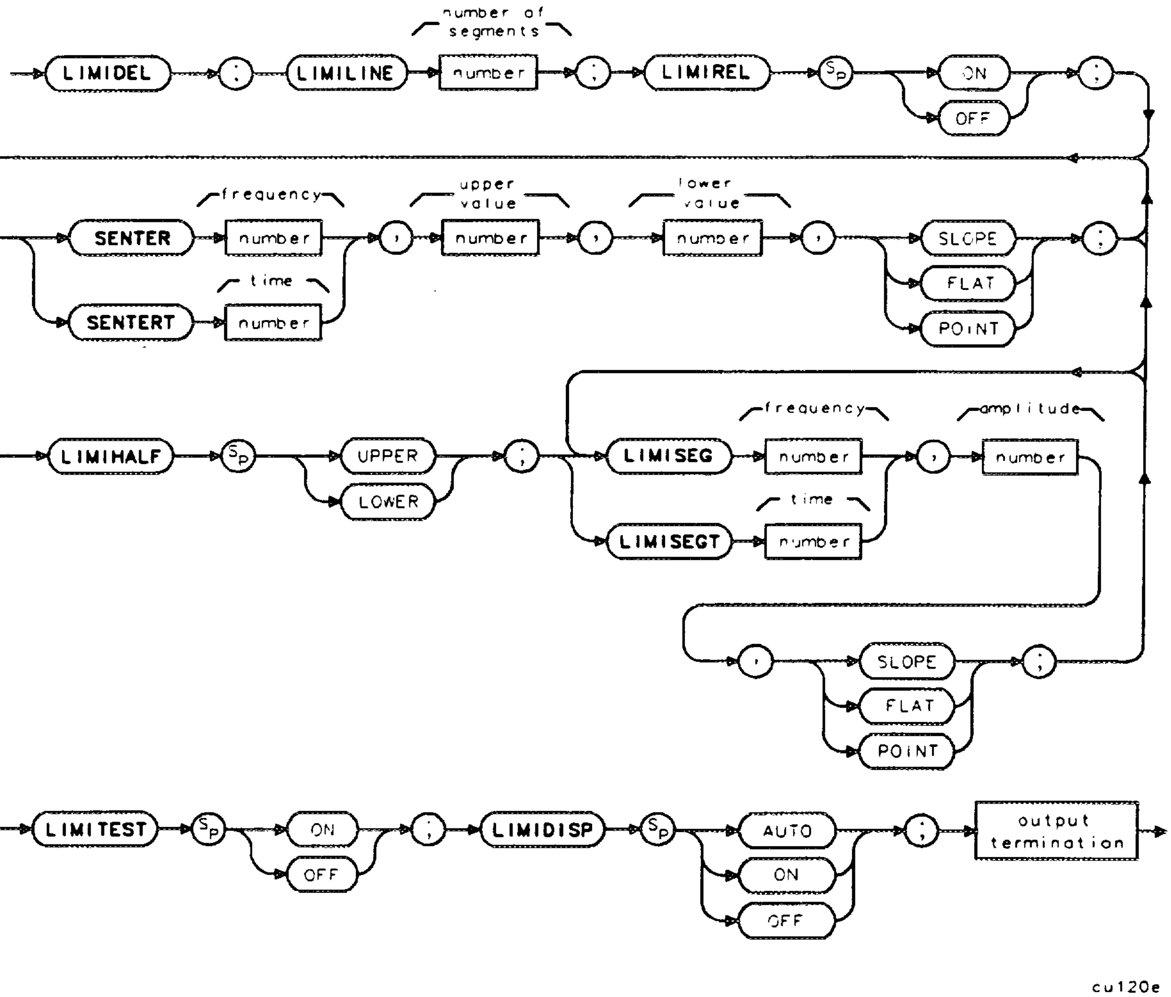
4. Use LIMIMODE, LIMISEG, LIMISEGT, SENTER, SENTERT to enter the limit-line segments. (Use LIMISEG or SENTER for a limit-line based on frequency; use LIMISEGT or SENTERT for a limit-line based on sweep time.)
5. Use the LIMIDISP command to select if the limit line is displayed or not.
6. Use the LIMITEST command to turn on limit-line testing.
7. Use the LIMIFAIL command to determine if the measurement sweep passed or failed the limit line boundaries.

**Enabling limit-line testing:** When limit testing is enabled, the segments in the current table are interpolated into the limit-line traces according to the current span and center frequency or sweep time of the spectrum analyzer. After the sweep, each value in trace A is compared to its corresponding value in the limit-line traces. If the current limit-line table is empty (for instance after using the command LIMIDEL) and limit testing is enabled, then the limit-line traces are blanked and set to out-of-range values. By using the SUB, MKPK HI, and MKF? commands, you can read the point of greatest difference between the trace and limit line. See "LIMITEST" for more information about limit-line testing.

**Saving the limit line table:** Once you have built the limit line, you can save the limit-line table on a memory card or in spectrum analyzer memory. Use the STOR or SAVRCLW commands to store the current limit-line table on the memory card. Use SAVET or SAVRCLW to store the limit-line table in spectrum analyzer memory.

## Query Response

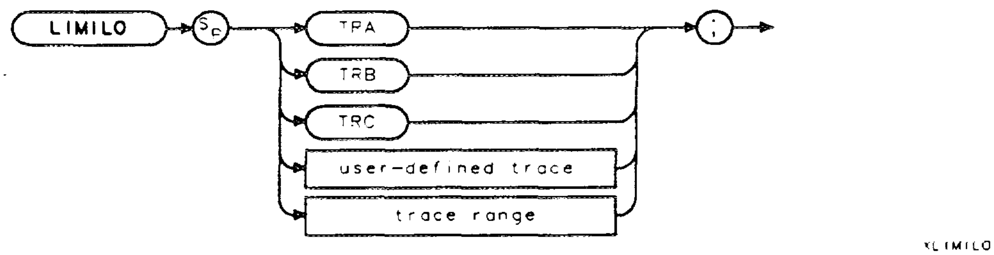
The query response is a character string consisting of LIMILINE, LIMIREL, LIMIMODE, LIMIHALF, LIMISEG, LIMISEGT, SENTER, or SENTERT commands. LIMIMODE returns the number of for the current limit-line table. (The LIMIHALF command is for backward compatibility; it is not used as an HP 8590 Series spectrum analyzer programming command.)


number of segments
LIMIDEL
:
LIMILINE
number
:
LIMIREL
Sp
ON
OFF
;
frequency
SENTER
number
time
SENTERT
number
upper value
,
number
lower value
,
number
,
SLOPE
FLAT
POINT
;
LIMIHALF
Sp
UPPER
LOWER
;
frequency
LIMISEG
number
time
LIMISEGT
number
amplitude
,
number
,
SLOPE
FLAT
POINT
;
LIMITEST
Sp
ON
OFF
;
LIMIDISP
Sp
AUTO
ON
OFF
;
output termination
cu120e

# LIMILO
# Lower Limit

Allows you to specify a fixed trace as the lower limit line.

## Syntax




Related Commands: IP, LIMIDEL, LIMIFAIL, LIMISEG, LIMITEST, SENTER.

## Example

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"TRDEF M_ASK,401;"` | *Defines a trace called "M_ASK."* |
| 20 | `OUTPUT 718;"MOV M_ASK[1,100],1000;"` | *Moves values into sections of the M_ASK trace.* |
| 30 | `OUTPUT 718;"MOV M_ASK[101,200],2000;"` | |
| 40 | `OUTPUT 718;"MOV M_ASK[201,300],3000;"` | |
| 50 | `OUTPUT 718;"MOV M_ASK[301,401],4000;"` | |
| 60 | `OUTPUT 718;"LIMILO M_ASK;"` | *Specifies M_ASK as the lower limit line.* |
| 70 | `OUTPUT 718;"LIMITEST ON;"` | *Turns on limit-line testing.* |
| 80 | `OUTPUT 718;"LIMIFAIL?;"` | *Tests if trace A fails limit-line testing.* |
| 90 | `ENTER 718;A` | |
| 100 | `DISP A` | *Displays result of limit-line testing.* |
| 110 | `END` | |

## Description

Unlike specifying a limit line with LIMISEG, LIMISEGT, SENTERT, or SENTER, the limit line specified with LIMILO is *not* updated if the center frequency, frequency span, sweep time, or reference level is changed.

**Note** Executing IP, LIMIDEL, LIMISEG, LIMISEGT, SENTERT, or SENTER will delete the limit line specified with LIMILO or LIMIHI. Executing LIMILO or LIMIHI will delete the limit line specified with LIMISEG or SENTER.

Use LIMITEST ON to display the limit line trace specified by LIMILO. Use LIMITEST OFF to blank the limit line trace specified by LIMILO.

# LIMIMIRROR
# Mirror Limit Line

Reflects the current definition about the amplitude axis at the largest frequency (for a limit line based on frequency) or the largest sweep time (for a limit line based on the sweep time) in the definition.

## Syntax


XLIMIMIRROR

Related Commands: LIMILINE, LIMISEG, LIMISEGT, SENTER, SENTERT.

## Example

| | | |
|---|---|---|
| 10 | OUTPUT 718;"IP;CF300MHZ;SP100MHZ;" | *Initializes spectrum analyzer, changes the frequency and span.* |
| 20 | OUTPUT 718;"LIMIDEL;" | *Deletes any limit-line tables, sets the table type to fixed.* |
| 30 | OUTPUT 718;"LIMIMODE UPPER;" | *Specifies the upper limit-line table.* |
| 35 | OUTPUT 718;"LIMIFT FREQ;" | *Selects a limit line based on frequency.* |
| 40 | OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;" | *Enters a value into the upper limit-line table.* |
| 50 | OUTPUT 718;"LIMISEG 290MHZ,-50DB,SLOPE;" | |
| 60 | OUTPUT 718;"LIMISEG 295MHZ,-15DB,SLOPE;" | |
| 70 | OUTPUT 718;"LIMISEG 300MHZ,-10DB,SLOPE;" | |
| 80 | OUTPUT 718;"LIMIMIRROR;" | *Mirrors the upper limit-line entries.* |
| 90 | OUTPUT 718;"LIMITEST ON;" | *Turns on the limit-line testing and displays the limit lines.* |
| 100 | END | |

The example results in the limit-line table shown in the following table.

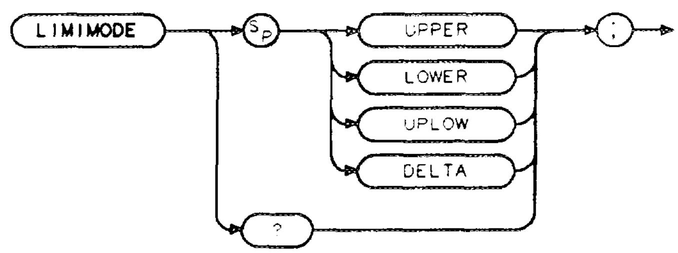
| SEG | START_FREQ | UPPER_AMP | TYPE |
|---|---|---|---|
| 1 | 250.0 MHz | −60.0 dBm | FLAT |
| 2 | 290.0 MHz | −60.0 dBm | SLOPE |
| 3 | 295.0 MHz | −15.0 dBm | SLOPE |
| 4 | 300.0 MHz | −10.0 dBm | SLOPE |
| 5 | 305.0 MHz | −15.0 dBm | SLOPE |
| 6 | 310.0 MHz | −50.0 dBm | POINT |
| 7 | 310.0 MHz | −60.0 dBm | FLAT |
| 8 | 350.0 MHz | −60.0 dBm | SLOPE |

You may notice that the LIMIMIRROR command may create more than one table entry for a frequency (for example, see segment 6 in the above table). The LIMIMIRROR command creates an extra segment so that the previous segment is explicitly ended at the correct amplitude.

# LIMIMODE
## Limit-Line Entry Mode

Determines whether the limit-line entries are treated as upper amplitude values, lower amplitude values, upper and lower amplitude values, or mid-amplitude and delta values.

### Syntax




XLIMIMODE

Related Commands: LIMILINE, LIMISEG, LIMISEGT, SEGDEL, SENTER, SENTERT.

### Example

This example uses LIMIMODE to enter segments into the upper limit-line table, and then to enter a segment into the lower limit-line table (upper and lower limit lines are treated as separate tables). Line 60 demonstrates entering a segment into a combined upper and lower limit-line table.

| | |
|---|---|
| `10 OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| `20 OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `30 OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| `40 OUTPUT 718;"LIMISEG 300MHZ,-30DB,SLOPE;"` | *Enters a segment into the upper limit-line table. Because the LIMISEG command is used, the limit-line table will be based on frequency.* |
| `50 OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| `60 OUTPUT 718;"LIMISEG 300MHZ,-70DB,SLOPE;"` | *Enters a segment into the lower limit-line table.* |
| `70 OUTPUT 718;"LIMIMODE UPLOW;"` | *Specifies the upper and lower limit-line tables.* |
| `80 OUTPUT 718;"SENTER 350MHZ,-30DB,-80DB,FLAT;"` | *Enters a segment into the upper and lower limit-line tables.* |
| `90 OUTPUT 718;"LIMIDISP ON;"` | *Displays the limit lines.* |
| `100 END` | |

## Description

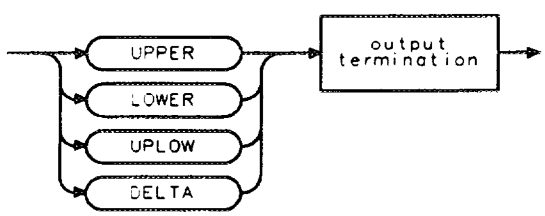
Use LIMIMODE in conjunction with LIMISEG, LIMISEGT, SENTER, or SENTERT. Specify LIMIMODE UPPER or LIMIMODE LOWER before using LIMISEG or LIMISEGT. Specify LIMIMODE UPLOW or LIMIMODE DELTA before using SENTER or SENTERT.

The LIMIMODE command determines whether the limit-line table entries are to be treated separately (upper or lower) or together (upper and lower) when deleting a segment with SEGDEL (see "SEGDEL"). If limit-line table entries are entered with LIMISEG or LIMISEGT, they are treated as entries to separate tables even if LIMIMODE UPLOW or LIMIMODE DELTA had been previously specified.

When used as a predefined variable, LIMIMODE returns a number from 0 to three, depending on the setting of the LIMIMODE parameter. The number corresponds to the LIMIMODE parameter as shown in the following table.

| LIMIMODE Parameter | Value Returned |
|---|---|
| UPLOW | 0 |
| DELTA | 1 |
| UPPER | 2 |
| LOWER | 3 |

## Query Response

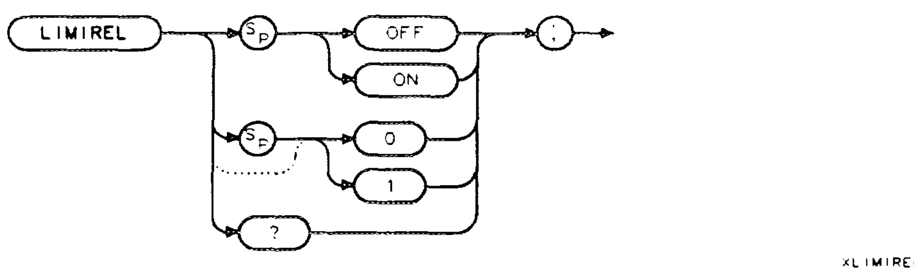



QLIMIMODE

# LIMIREL
# Relative Limit Lines

Specifies whether the current limit lines are fixed or relative.

## Syntax




Related Commands: LIMIDEL, LIMIFT, LIMILINE.

## Example

| | |
|---|---|
| `OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| `OUTPUT 718;"LIMIREL ON;"` | *Specifies that the limit line will be relative to the reference-level and center-frequency settings.* |

## Description

You should use LIMIFT to select whether the limit lines are based on frequency or sweep time before using LIMIREL, because changing between a frequency or sweep time limit line purges the current limit line table and sets LIMIREL to OFF.

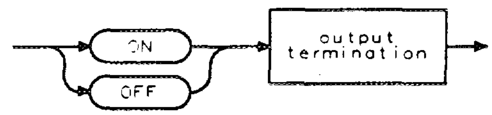
**LIMIREL and the reference level:** Regardless of whether the limit line is based on frequency or sweep time, LIMIREL determines if the amplitude parameter in a limit line table represents absolute values or relative values. If LIMIREL is set to OFF, the limit lines amplitude values are specified in absolute amplitude and do not depend on the reference level (RL) setting. If LIMIREL is set to ON, the limit line amplitude values are relative to the current reference level (RL) setting.

**For limit lines that are based on frequency:** The LIMIREL command determines whether the frequency parameter in a limit-line table represent absolute or relative values that are referenced to the center-frequency settings.

- Executing "LIMIREL OFF;" specifies that the frequency values in a limit-line table are fixed values, and the limit line is positioned accordingly. Fixed limit lines are specified in absolute frequency and do not depend upon the center frequency value.
- Executing "LIMIREL ON;" specifies that the frequency values in a limit-line table are relative values and positions the limit line relative to the center-frequency settings. Relative limit lines are specified in relative frequency and are positioned with respect to the current center frequency. When the current center frequency value is changed, the segment frequencies are converted according to the current center frequency value.

**For limit lines that are based on the sweep time:** Limit lines that are based on sweep time are always relative to the start time, and the horizontal position of the limit line is not affected by the setting of LIMIREL.

## Query Response

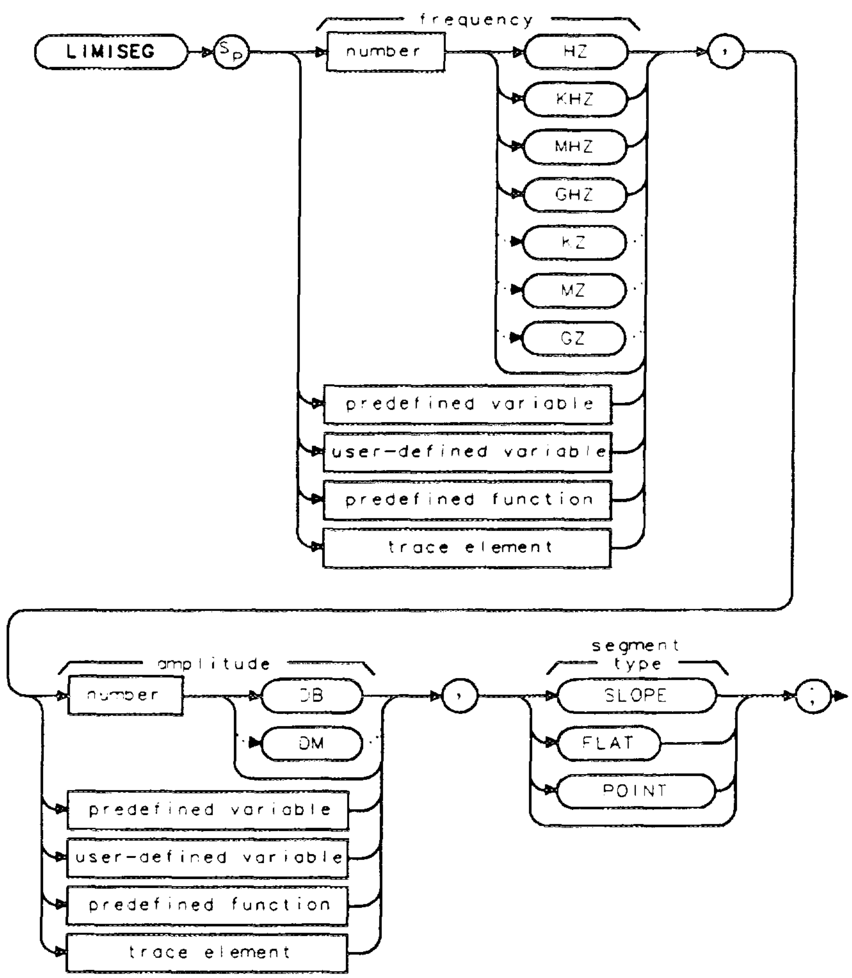



QQ2

# LIMISEG
## Enter Limit-Line Segment for Frequency

Adds new segments to the current frequency limit line in either the upper limit line or the lower limit line.

### Syntax




XLIMISEG

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | Varies with FOFFSET and ROFFSET. |

Related Commands: LIMIDEL, LIMILINE, LIMIMODE, LIMIREL, SEGDEL, SENTER.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;CF300MHZ;SP100MHZ;RB 3MHZ;"` | *Initializes spectrum analyzer, changes the frequency, span, and bandwidth.* |
| `20 OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| `30 OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `35 OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| `40 OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Adds segment to the upper limit-line table.* |
| `50 OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| `60 OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| `70 OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| `80 OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| `90 OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| `100 OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| `110 OUTPUT 718;"LIMISEG 250MHZ,-75DB,FLAT;"` | *Adds segment to the lower limit-line table.* |
| `120 OUTPUT 718;"LIMISEG 910MHZ,-75DB,FLAT;"` | |
| `130 OUTPUT 718;"LIMITEST ON;TS;"` | *Enables limit-line testing.* |
| `140 OUTPUT 718;"LIMIFAIL?;"` | *Returns the result of limit-line testing.* |
| `150 ENTER 718;A` | |
| `160 DISP A` | *Displays the result.* |
| `170 END` | |

## Description

If the current limit line table contains lines based on sweep time (as opposed to a limit line based on the frequency), executing LIMISEG will clear the current sweep time limit line table, and set LIMIREL to OFF.

Each limit-line segment is specified with a starting frequency, an amplitude, and a segment type. The segment type defines how the line segment is to extend from its starting point to the next segment. The segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all frequencies between the two points. If the amplitude values of the two segments differ, the limit line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all frequencies between the two points.
- POINT specifies a limit value for the coordinate point, and no other frequency points, so that a POINT segment specifies a limit value for a single frequency. For an upper limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the top of screen. For a lower limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the bottom of screen. The

POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is used automatically. If a visible POINT segment at the right edge of the display is not desired, add an explicit last point segment (higher in frequency than the stop frequency) to the limit-line table.

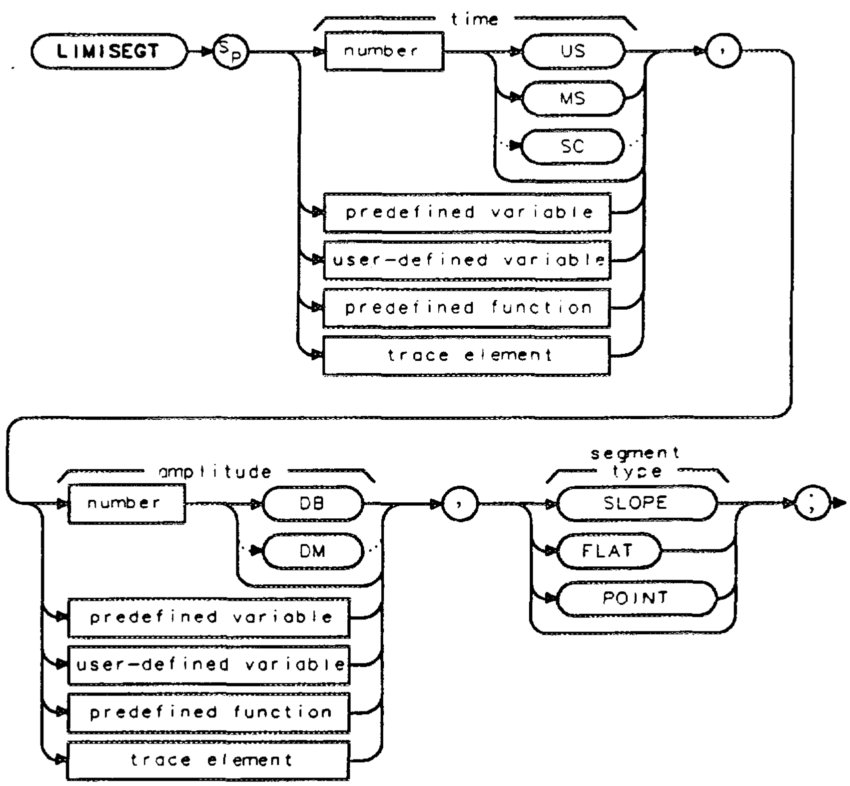
Segments are sorted according to starting frequency. A maximum of 20 segments can be defined in each of the upper and lower halves of a limit line. When the segment type is omitted, the last type given (or SLOPE if no previous type has been given) is used.

Use LIMISEG if you want to enter amplitude data in the upper or lower limit lines. If you want to enter amplitude data as upper and lower amplitude pairs or as mid and delta pairs, use the SENTER command instead of LIMISEG. Use LIMIMODE to specify entry into the upper limit-line table or the lower limit-line table (see line 30 of example).

# LIMISEGT
# Enter Limit-Line Segment for Sweep Time

Adds new segments to the current sweep time limit line in either the upper limit line or the lower limit line.

## Syntax




XLIMISEGT

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. For the sweep time, the default unit is seconds. For the amplitude value, the default unit is dBm. | The range of the sweep time is 0 to 100 s. The range of the amplitude varies with ROFFSET. |

Related Commands: LIMIDEL, LIMIFT, LIMILINE, LIMIMODE, LIMIREL, SEGDEL, SENTERT.

## Example

| | |
|---|---|
| `OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `OUTPUT 718;"LIMIFT TIME;"` | *Selects a limit line based on the sweep time.* |
| `OUTPUT 718;"LIMISEGT 0MS,-60DB,FLAT;"` | *Adds segment to the upper limit-line table.* |
| `OUTPUT 718;"LIMISEGT 6MS,-60DB,SLOPE;"` | |
| `OUTPUT 718;"LIMISEGT 8MS,-15DB,FLAT;"` | |
| `OUTPUT 718;"LIMISEGT 11MS,-20DB,SLOPE;"` | |
| `OUTPUT 718;"LIMISEGT 14MS,-60DB,FLAT;"` | |
| `OUTPUT 718;"LIMISEGT 20MS,-60DB,POINT;"` | |
| `OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| `OUTPUT 718;"LIMISEGT 0MS,-75DB,FLAT;"` | *Adds segment to the lower limit-line table.* |
| `OUTPUT 718;"LIMISEGT 20MS,-75DB,POINT;"` | |
| `OUTPUT 718;"LIMITEST ON;TS;"` | *Enables limit-line testing.* |
| `OUTPUT 718;"LIMIFAIL?;"` | *Returns the result of limit-line testing.* |
| `ENTER 718;A` | |
| `DISP A` | *Displays the result.* |

## Description

Each limit-line segment is specified with a starting sweep time, an amplitude, and a segment type.

**Note**

If the current limit line table contains limit lines based on frequency (as opposed to a limit line based on the sweep time), executing LIMISEGT will clear the current frequency limit line table, and set LIMIREL to OFF.

**Starting sweep time:** When you specify the starting sweep time, you are specifying the starting sweep time with respect to the sweep time of the spectrum analyzer. For example, if you specify a starting sweep time of 0, the limit-line segment will start at the left side of the spectrum analyzer display.

**Segment type:** The segment type defines how the line segment is to extend from its starting point to the next segment. The segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all sweep times between the two points. If the amplitude values of the two segments differ, the limit line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, interpolating amplitude values for all sweep times between the two points.
- POINT specifies a limit value for the coordinate point, and no other sweep time points, so that a POINT segment specifies an amplitude value for a single sweep time. For an upper limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the top of the graticule area. For a lower limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the bottom of the graticule area. The POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is used automatically. If a visible POINT segment at the right

edge of the display is not desired, add an explicit last point segment to (higher in sweep time than the current sweep time setting of the spectrum analyzer) the limit-line table.

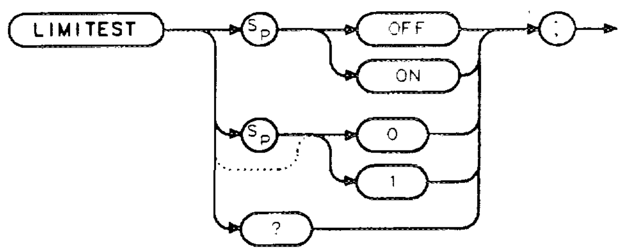
Segments are sorted according to starting sweep time. A maximum of 20 segments can be defined in each of the upper and lower halves of a limit line.

Use LIMISEGT if you want to enter amplitude data in the upper or lower limit lines. Use LIMIMODE to specify entry into the upper limit-line table or the lower limit-line table (see line 30 of example). If you want to enter amplitude data as upper and lower amplitude pairs or as mid and delta pairs, use the SENTERT command instead of LIMISEGT.

# LIMITEST
## Enable Limit Line Testing

Compares trace A with the current limit-line data.

### Syntax




XLIMITEST

Preset State: LIMITEST OFF.
Related Commands: LIMIFAIL, LIMIHI, LIMILO, LIMISEG, LIMISEGT, SENTER, SENTERT.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

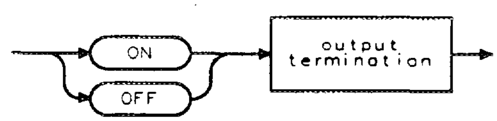
### Example

| | | |
|---|---|---|
| 10 | OUTPUT 718;"IP;SNGLS;CF300MHZ;SP100MHZ;" | *Initializes spectrum analyzer and changes the frequency and span settings.* |
| 20 | OUTPUT 718;"LIMIDEL;" | *Deletes any limit-line tables, sets the table type to fixed.* |
| 30 | OUTPUT 718;"LIMIMODE UPPER;" | *Specifies the upper limit-line table.* |
| 35 | OUTPUT 718;"LIMIFT FREQ;" | *Selects a limit line based on frequency.* |
| 40 | OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;" | *Creates an entry to the upper limit-line table.* |
| 50 | OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;" | |
| 60 | OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;" | |
| 70 | OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;" | |
| 80 | OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;" | |
| 90 | OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;" | |
| 100 | OUTPUT 718;"LIMITEST ON;TS;" | *Turns on limit-line testing.* |
| 110 | OUTPUT 718;"LIMIFAIL?;" | *Returns the status of the limit-line testing.* |
| 120 | ENTER 718;A | |
| 130 | DISP A | *Displays the result.* |
| 140 | END | |

## Description

A test is made of the data in TRA (trace A), and the result can be read, using LIMIFAIL, after each sweep.

## Query Response

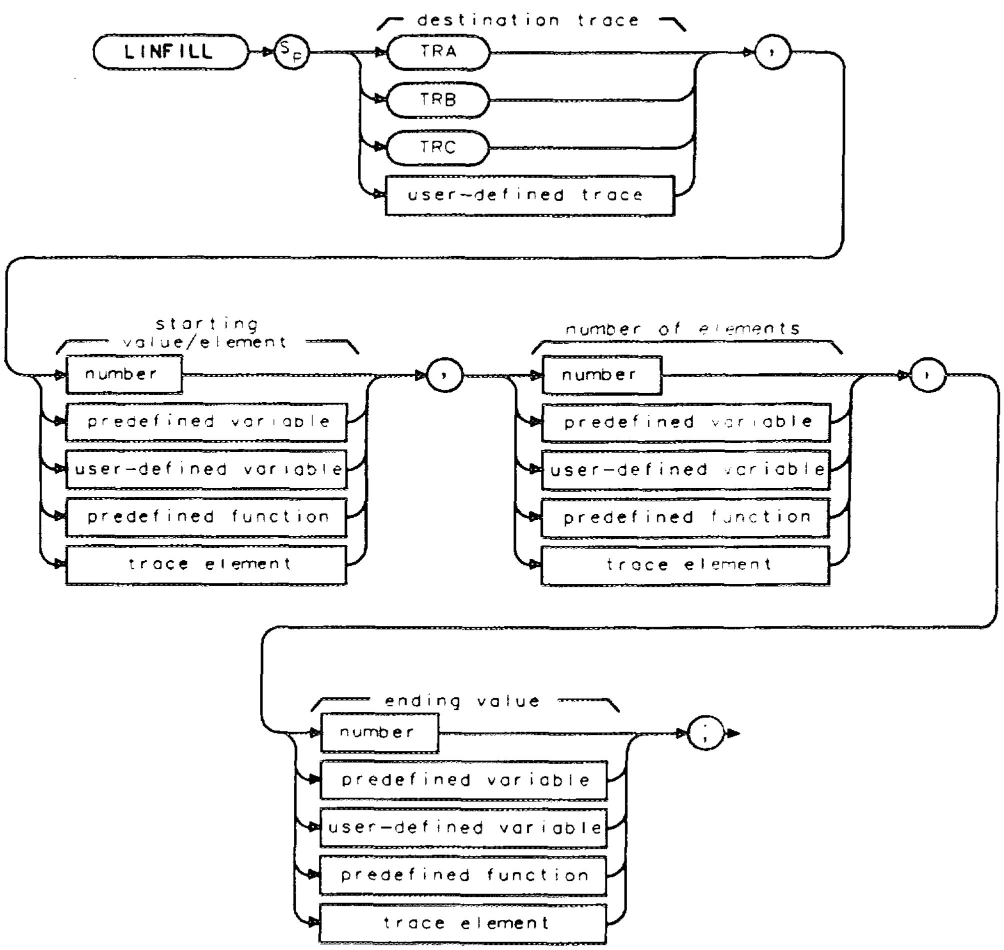



qq2

# LINFILL
# Line Fill

Fills linear interpolated data into the specified trace data points of a destination trace.

## Syntax



| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer number. | For the starting value or number of elements, the range of the number is 0 to the length of the trace minus 1. For the ending value, the range is −32,768 to +32,767. |

## Example

```
OUTPUT 718;"LINFILL TRC,0,0,0;"
```
*Initializes trace C.*

```
OUTPUT 718;"MOV TRC[1,10],TRA[1,10];"
```
*Moves the first 10 elements of trace A into trace C.*

```
OUTPUT 718;"LINFILL TRC,10,40,8000;"
```
*Uses the 10th element of trace C as the starting value, fills trace C elements 11 through 50 with the interpolated data, and places ending value (8000) into the 50th element of trace C.*

## Description

LINFILL uses the value of the starting value and the ending value to calculate the linear interpolation data (the values for ending value should be in measurement units). The "number of elements" field allows you to specify the number trace data points that are "filled in" with linear interpolation data. The number of elements field includes the starting element, so if the starting value is 10 and the number of elements is 40, the ending element will be 50.

The data will not be interpolated if the starting value is 0. If the starting value is 0, the ending value is copied into the first element of the destination trace. You may want to set the starting value to 0 to initialize a trace before using LINFILL to fill the trace with interpolated data. If the starting value and the number of elements exceed the length of the destination trace, the interpolation ends at the end of the trace array; the ending value is never reached.

# LN
# Linear Scale

*Specifies the vertical graticule divisions as linear units, without changing the reference level.*

## Syntax


XLN

Equivalent Softkey: **SCALE LOG LIN** (when LIN is underlined).

Related Commands: LG, RL.

## Example

```
OUTPUT 718;"LN;"             Selects linear mode.
OUTPUT 718;"LN;RL 30MV;"
```

## Description

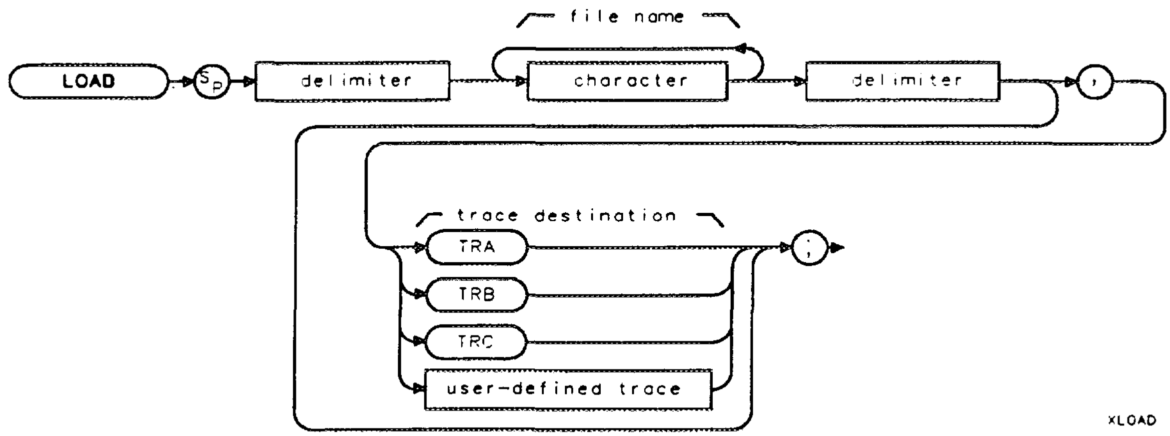
The LN command scales the amplitude (vertical graticule divisions) proportionally to the input voltage, without changing the reference level. The bottom graticule line represents a signal level of zero volts.

Voltage entries are rounded to the nearest 0.1 dB. Thus, 30.16 mV becomes −17.4 dBm for a 50Ω spectrum analyzer system.

# LOAD
# Load

Loads a file from the memory card.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | Any valid file name. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Equivalent Softkey: **LOAD FILE**.

Option Required: An HP 8590D or HP 8592D needs to have Option 003 installed in the spectrum analyzer to use the LOAD command to load a file from the memory card.

Related Commands: CAT, STOR.

## Example

```
OUTPUT 718;"LOAD %tMYTRA%,TRA;"
```
*Loads MYTRA from the memory card into trace A.*

```
OUTPUT 718;"LOAD %dM_YPROG%;"
```
*Loads a program from the memory card into spectrum analyzer memory.*

## Description

Be sure to insert the memory card into the spectrum analyzer's memory card reader before using the LOAD command.

To use the LOAD command, you must specify the file name of the file to be loaded from the memory card into spectrum analyzer memory, and, if you are loading trace data, you must also specify the trace destination.

**File name:** You must supply the file name of the file to be loaded. When specifying the file name, be sure to include the lowercase letter that indicates the data type, because the result of the LOAD operation is dependent on the data type. (For example, the "d" in "dM_YPROG" indicates the file type is for a downloadable program.) The lowercase letters correspond to the data type as shown in the following table.

| Lowercase Letter | File Description | Result |
|---|---|---|
| a | Amplitude correction factors | Loads the amplitude correction factors. |
| i | Display image file | Loads and displays the display image file. |
| d | Downloadable program | Loads the contents of the file that was stored with STOR. Because STOR stores a copy of user-memory in the file, more than one item may be retrieved when executing the LOAD command. |
| l | Limit lines | Loads the limit-line values into the current limit-line table. |
| s | Analyzer State | Loads the spectrum analyzer state, and changes the current spectrum analyzer state to the state that was loaded. |
| t | Trace | Loads the trace and state. The current spectrum analyzer trace and state is changed to the trace and state that was loaded. |

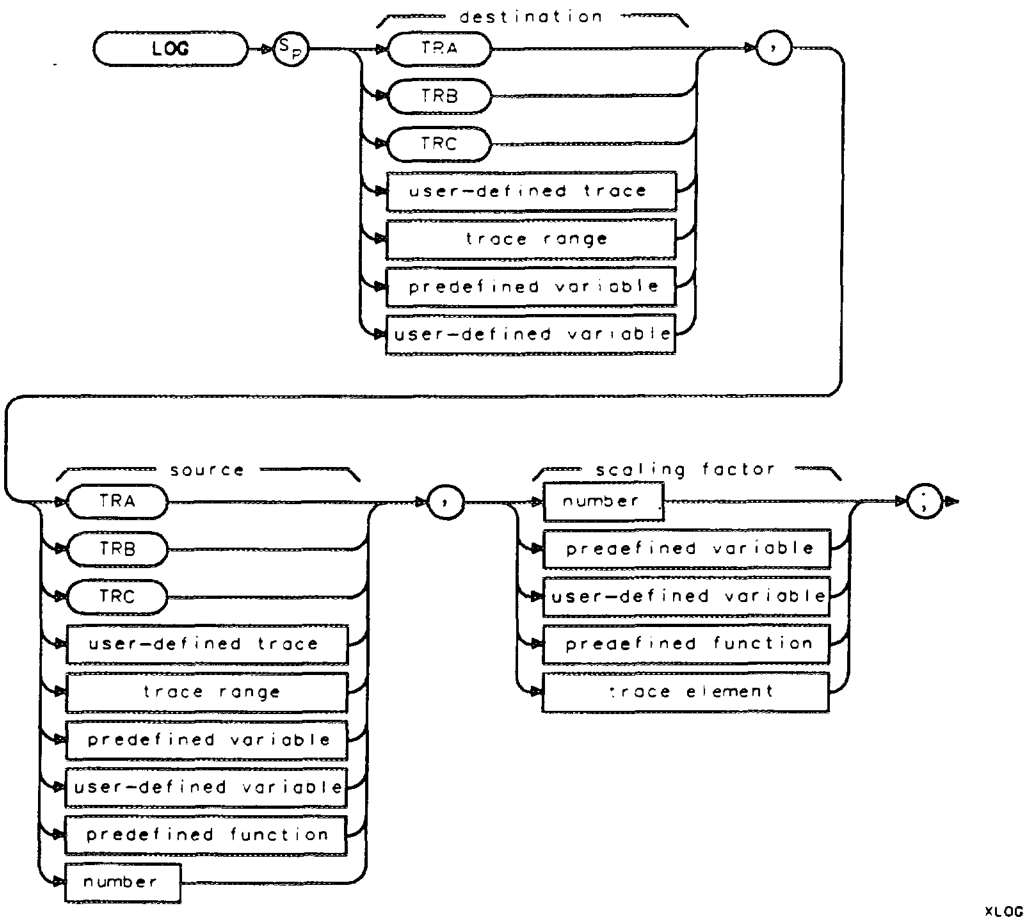
**Destination:** When recalling trace data, you need to specify either TRA, TRB, TRC, or a user-defined trace as the destination. Omit the destination parameter when recalling downloadable programs, states, limit-line tables, display image files, or amplitude correction factors.

**Note** The LOAD command recalls data from the memory card. See "SAVRCLN," "RCLT," or "RCLS" to recall data from spectrum analyzer memory.

# LOG
# Logarithm

Takes the logarithm (base 10) of the source, multiplies the result by the scaling factor, then stores it in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: EXP.

## Example 1

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"VARDEF P_OWER,0;"` | *Defines a user-defined variable, called P_OWER, and sets it equal to 0.* |
| `OUTPUT 718;"LOG P_OWER,5,10;"` | *P_OWER = 10 × LOG(5).* |
| `OUTPUT 718;"P_OWER?;"` | *Returns value to computer.* |
| `ENTER 718;N` | *Assigns value to computer variable.* |
| `DISP USING "D.DD,K";N;" dB"` | *Displays value on the computer screen.* |

## Example 2

This example finds the natural exponential of a number and uses the LOG function to return the original source value of the EXP function.

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF E_XP,0;"` | *Defines a variable called E_XP.* |
| `20 OUTPUT 718;"EXP E_XP,2,2.30259;"` | *Finds the natural exponential of 2.* |
| `30 OUTPUT 718;"E_XP?;"` | *Returns the natural exponential of 2.* |
| `40 ENTER 718;Value` | |
| `50 PRINT Value` | *Prints the value of the exponential.* |
| `60 OUTPUT 718;"LOG E_XP,E_XP,2.30259;"` | *Uses the log function on the exponential value.* |
| `70 OUTPUT 718;"E_XP?;"` | *The log of the exponential value is approximately 2.* |
| `80 ENTER 718;Logvalue` | |
| `90 PRINT Logvalue` | |
| `100 OUTPUT 718;"VARDEF E_XPY,0;"` | *Declares a variable called E_XPY.* |
| `110 OUTPUT 718;"EXP E_XPY,-5,2.30259;"` | *Finds the natural exponential of −5.* |
| `120 OUTPUT 718;"E_XPY?;"` | *Returns the value of the natural exponential of −5.* |
| `130 ENTER 718;Value2` | |
| `140 PRINT Value2` | *Prints the value of the exponential.* |
| `150 OUTPUT 718;"LOG E_XPY,E_XPY,2.30259;"` | *Uses the log function on the exponential value.* |
| `160 OUTPUT 718;"E_XPY?;"` | *The log of the exponential value is approximately −5.* |
| `170 ENTER 718;Logval` | |
| `180 PRINT Logval` | |
| `190 END` | |

## Description

The scaling factor may be used to improve numerical computations when calculating logarithms of integer trace data. For example, the log of a trace value of 8000 is 3.9, which would be stored as the value 4 in a trace.

The log of trace value of 1 is 0, so the log of a trace containing values from 1 to 8000 would be compressed to values 0, 1, 2, 3, 4. Computational accuracy can be improved by using the scaling factor to scale up the log values before they are stored. In this case, because 3.903 is the log of 8000 and the largest positive trace value is 32,767, a scaling factor of 32,767 divided by 3.903 or 8,395 may be applied to the data. Because EXP and LOG are inverse functions, the EXP command has a scaling factor that may be used to "undo" the scaling factor of the LOG command.

The LOG command can be used to calculate the natural logarithm by using 2.30259 as the scaling factor.

The LOG function returns an invalid result if the source is zero or a negative number.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# LSPAN
# Last Span

Changes the spectrum analyzer's span to the previous span setting.

## Syntax


Equivalent Softkey: **LAST SPAN** .
Related Commands: SP.

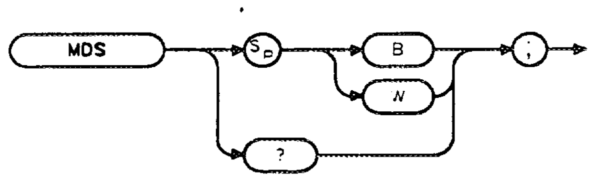
## Example

```
OUTPUT 718;"LSPAN;"
```

# MDS
# Measurement Data Size

Specifies measurement data size as byte or word.

## Syntax




XMDS

Related Commands: MKA, TDF, TRA.
Preset State: W.

## Example

These commands transfer trace A in binary, 2 bytes per word.

| | |
|---|---|
| `INTEGER TRACE_A (1:401)` | *Declares variable, Trace_A.* |
| `OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep, updates trace A.* |
| `OUTPUT 718;"TDF B;MDS W;TRA?;"` | *Reads trace A in "word" format.* |
| `ENTER 718 USING "#,401(W)";TRACE_A(*)` | *Formats trace A output using data size of one word.* |
| `PRINT TRACE_A(*)` | *Prints trace A.* |

## Description

The MDS command formats binary data in one of the following formats:

**B** selects a data size of one 8-bit byte. When transferring trace data, MDS B transfers trace data the faster than MDS W because only 401 bytes are transferred. Because MDS B combines two bytes into one byte, some resolution is lost.

**W** selects a data size of one word, which is two 8-bit bytes. When transferring trace data, MDS W transfers 802 bytes of trace data with no loss of resolution.

**How data is represented with MDS W:** When data is sent with MDS W, the trace data is converted into two bytes as follows:

1. The trace element's amplitude (in measurement units) is divided by 256. The binary representation of the result is placed in the most significant byte (MSB).
2. The binary representation of the remainder is placed in the least significant byte (LSB).

For example, a trace element that is at the reference level has the value of 8000 (in measurement units). The result of 8000 divided by 256 is 30, with a remainder of 120. For this data, the contents of the MSB would contain the binary representation for 30.

**Contents of the MSB**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

**MDS Measurement Data Size**

For this data, the contents of the LSB would contain the binary representation for 120.

**Contents of the LSB**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |

**How data is represented with MDS B:** When data is sent with MDS B, the trace data is converted into one byte as follows:

- The trace element's amplitude (in measurement units) is divided by 32. The binary representation of the result is placed into one byte.

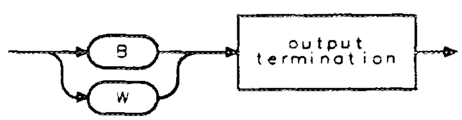
For example, a trace element that is at the reference level has the value of 8000 (in measurement units). The result of 8000 divided by 32 is 250. For this data, the contents of the byte would contain the binary representation for 250.

**Contents of Byte**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |

See "TDF" for information about using MDS for trace data transfers.

## Query Response:




QMDS

# MDU
# Measurement Data Units

Returns values for the spectrum analyzer baseline and reference level.

## Syntax


XMDU

Related Commands: TDF.

## Example

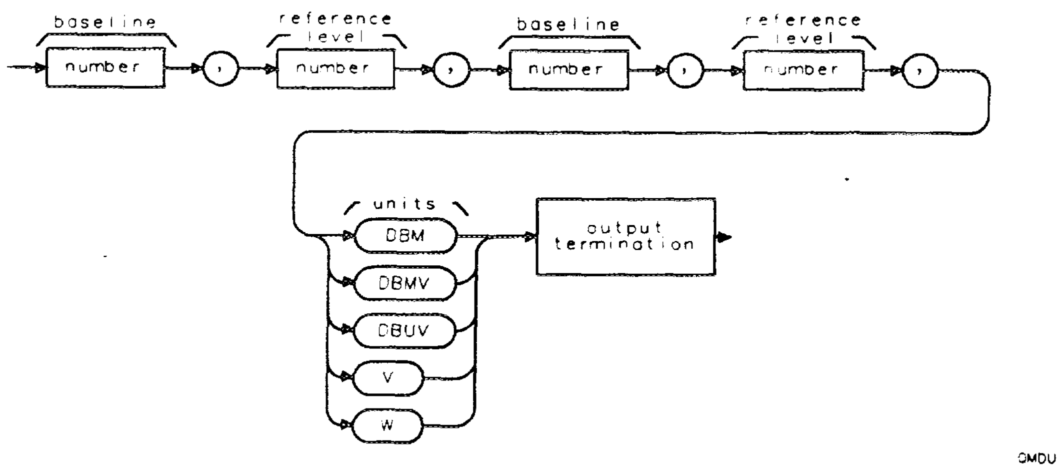
| | |
|---|---|
| `10 OUTPUT 718;"IP;TDF M;"` | *Initializes the spectrum analyzer and formats the trace data in measurement units.* |
| `20 OUTPUT 718;"RL -10DM;"` | *Changes the reference level to −10 dBm.* |
| `30 OUTPUT 718;"MDU?;"` | *Queries the position of the spectrum analyzer baseline and reference level.* |
| `40 ENTER 718;A,B,C,D,A$` | *Moves the spectrum analyzer response to the computer.* |
| `50 PRINT A,B,C,D,A$` | *Displays the results on the computer screen.* |
| `60 END` | |

The example returns the following to the controller: 0, 200, −90, −10 dBm. The first two numbers received indicate that the vertical scale spans from 0 to 200 plotter units. The third and fourth number received indicate that the baseline is at −90 dBm, and the reference level is at −10 dBm. So, the baseline value of −90 dBm is equal to 0 plotter units. The reference level of −10 dBm is equal to 200 plotter units.

## Description

The MDU command returns values for the spectrum analyzer baseline and reference level, in plotter units and measurement units.

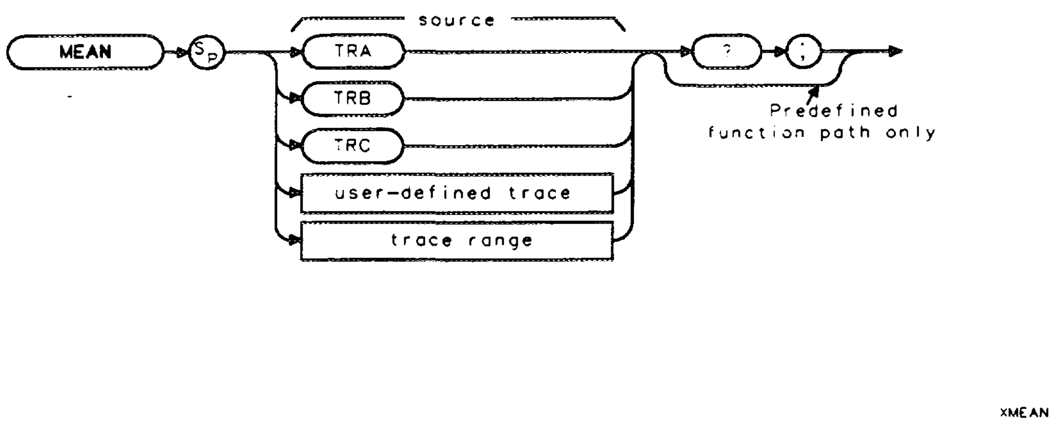
## Query Response



# MEAN
# Trace Mean

Returns the mean value of the given trace in measurement units.

## Syntax



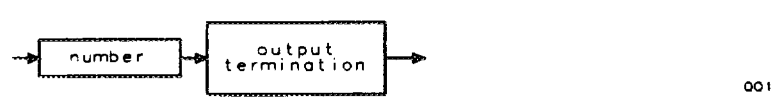

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command | Any valid trace name. |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEANTH, RMS, STDEV, VARIANCE.

## Example

```
10 OUTPUT 718;"IP;"                     Initializes spectrum analyzer.
20 OUTPUT 718;"SNGLS;"                  Activates the single-sweep mode.
30 OUTPUT 718;"CF 300MHZ;SP 1MHZ;"      Sets measurement range.
40 OUTPUT 718;"TS;"                     Sweeps trace A.
50 OUTPUT 718;"MEAN TRA?;"              Returns the mean value of trace A to the computer.
60 ENTER 718;Number                     Assigns value to computer variable, Number.
70 DISP "MEAN OF TRACE A IS ";Number    Displays result on the computer screen.
80 END
```

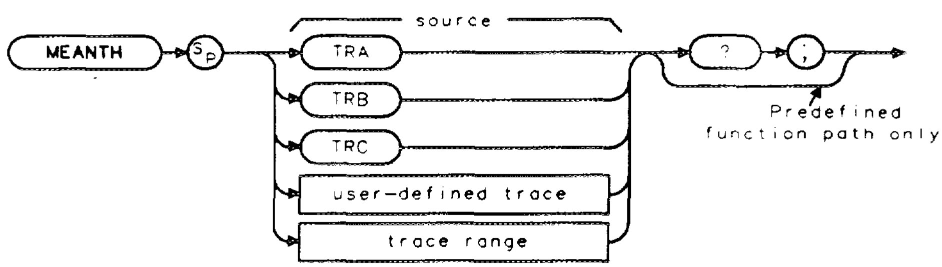
## Query Response



# MEANTH
# Trace Mean Above Threshold

Returns the mean value of the given trace above the threshold, in measurement units.

## Syntax




XMEANTH

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command | Any valid trace name. |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, RMS, STDEV, TH, VARIANCE.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

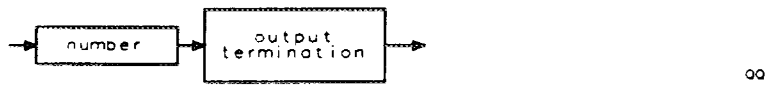
| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates the single-sweep mode.* |
| `30 OUTPUT 718;"CF 300MHZ;SP 1GHZ;"` | *Sets measurement range.* |
| `40 OUTPUT 718;"TH -40;"` | *Sets threshold level to −40 dB.* |
| `50 OUTPUT 718;"TS;"` | *Sweeps trace A.* |
| `60 OUTPUT 718;"MEANTH TRA?;"` | *Returns the mean value of trace A above the threshold to the computer.* |
| `70 ENTER 718;Number` | *Assigns value to computer variable, Number.* |
| `80 DISP "MEAN OF TRACE A ABOVE THE THRESHOLD IS ";Number` | *Displays result on the computer screen.* |
| `90 END` | |

## Description

MEANTH returns the mean value of the trace above the threshold; MEAN returns the mean value of the trace, regardless of the threshold level. MEANTH returns a "0" if there is not a signal above the threshold.

Use TH (threshold) to set the threshold level.

## Query Response



# MEASOFF
# Measurement Off

Turns off the current measurement, erases the display, and then displays the MEAS/USER menu.

## Syntax


MEASOFF

Equivalent Softkey: `MEAS OFF` .

Related Commands: ACP, ACPE, ACPGRAPH, CHP, OBW.

## Example

`OUTPUT 718;"MEASOFF;"` *Turns off the current measurement.*

## Description

If ACPPAR is set to automatic, executing MEASOFF returns the following spectrum analyzer settings back to their premeasurement settings:

- Frequency span, resolution bandwidth, video bandwidth, center frequency step size, and sweep time.
- Detector mode.
- Amplitude scale.

MEASOFF does *not* do any of the following:

- Change the values of the channel spacing (ACPSP) or the channel bandwidth (ACPBW).
- Restore the trace contents, trigger mode, amplitude units, and any trace math functions (see Table 5-4 for a list of the trace math functions) to their premeasurement state.

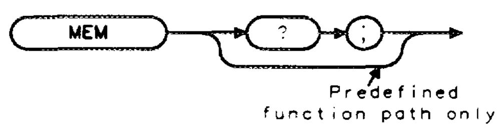
You should execute MEASOFF when you no longer want to use any of the power menu functions. (The power menu functions are ACP, ACPE, ACPGRAPH, CHP, and OBW).

MEASOFF may also turn off some other spectrum analyzer measurements. For example, MEASOFF also turns off FFTCONTS, FFTAUTO, FFTSNGLS, NDBPNT, PCTAM, GDRVUTIL, and TOI.

# MEM
# Memory Available

Returns the amount of spectrum analyzer memory available.

## Syntax




XMEM

Related Commands: ACTDEF, DISPOSE, ERASE, FUNCDEF, LOAD, ONDELAY, ONEOS, ONTIME, ONSRQ, ONSWP, TRCMEM, TRDEF, TRMATH, VARDEF.

## Example

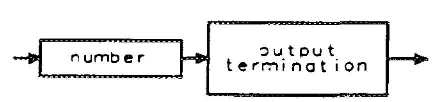
```
10 OUTPUT 718;"MEM?;"              Queries the amount of user-allotted memory available.
20 ENTER 718;How_much_memory       Sends response from spectrum analyzer to the computer.
30 DISP How_much_memory            Displays the amount of available memory.
40 END
```

## Description

Functions that affect the amount of user-allotted memory include: ACTDEF, FUNCDEF, ONDELAY, ONEOS, ONSRQ, ONSWP, ONTIME, TRDEF, TRMATH, VARDEF.

The MEM command returns the number of bytes of user-allotted spectrum analyzer memory to the controller.

## Query Response

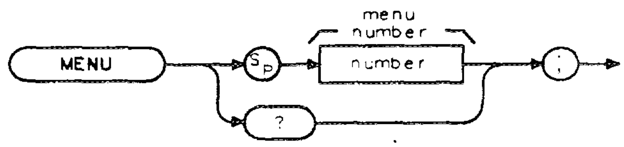



QQ1

# MENU
# Menu

Selects and displays the softkey menus on the spectrum analyzer screen.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 1, 101 to 200. |

Related Commands: DISPOSE, ERASE, KEYDEF, KEYLBL, SAVEMENU.

## Example 1

`OUTPUT 718;"MENU 1;"` *Displays menu 1 on the spectrum analyzer screen.*

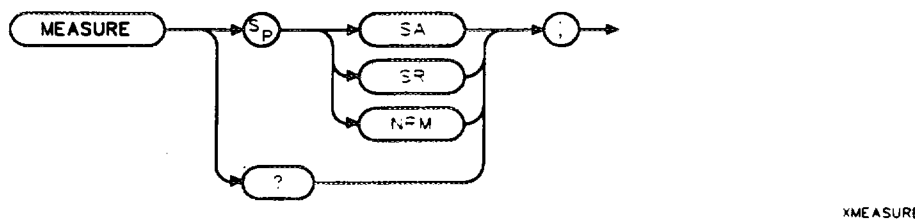
## Example 2

| | |
|---|---|
| `10 OUTPUT 718;"KEYDEF 1,!IP;CF 300MHZ;SP 100MHZ; MKPK HI;!,@SETUP\|#1@;"` | *Defines softkey 1.* |
| `20 OUTPUT 718;"KEYDEF 2,!IP;CF 600MHZ;SP 100MHZ; MKPK HI;!@SETUP\|#2@;"` | *Defines softkey 2.* |
| `30 OUTPUT 718;"KEYDEF 3,!IP;CF 900MHZ;SP 100MHZ; MKPK HI;!,@SETUP\|#3@;"` | *Defines softkey 3.* |
| `40 OUTPUT 718;"KEYDEF 4,!SNGLS;TS;MKPK HI;MKD;MKMIN;!,@FIND\|DELTA@;"` | *Defines softkey 4.* |
| `50 OUTPUT 718;"KEYDEF 5,!MKOFF ALL; CONTS;!,@RESUME\|SWEEP@;"` | *Defines softkey 5.* |
| `60 OUTPUT 718;"KEYDEF 6,!MENU 102! ,@MORE\|SETUPS@;"` | *Defines softkey 6.* |
| `70 OUTPUT 718;"KEYDEF 607,!FA 88MHZ;FB 108MHZ; MKPK HI;DEMOD ON;DEMOD FM;MENU 1;!,@FM \|DEMOD@;"` | *Defines softkey 607. Softkey 607 is accessed by executing MENU 102 (see programming line 60).* |
| `80 OUTPUT 718;"KEYDEF 608,!FA 10KHZ;FB 88MHZ; MKPK HI;DEMOD ON;DEMOD AM;MENU 1;!,@AM \|DEMOD@;"` | *Defines softkey 608. Softkey 608 is accessed by executing MENU 102 (see programming line 60).* |

# MEASURE
# Measure Mode

Determines what kind of measurements the spectrum analyzer makes: signal analysis, stimulus response, or signal normalization.

## Syntax




Option Required: Option 010 or 011.
Related Commands: Commands affecting amplitude, such as AUNITS, DL, INZ, LN, MKA, MKREAD, MKRL, RL, RLPOS, ROFFSET, TH.
Preset State: MEASURE SA.

## Example

Activate the tracking-generator source output.

| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Sets spectrum analyzer to stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DM;"` | *Makes the tracking generator source power the active function.* |

## Description

"MEASURE SA;" activates spectrum analysis and auto couples the spectrum analyzer functions. If AMB ON or AMBPL ON and RLPOS have been executed prior to MEASURE SA, MEASURE SA turns off the reference level position. When normalization is off, all amplitude units are specified in absolute values determined by:

- Amplitude units (AUNITS).
- Reference level (RL).
- Reference-level offset (ROFFSET).
- Input impedance (INZ).
- Logarithm scale (LG).
- Linear scale (LN).
- Amplitude Correction (AMPCOR).

"MEASURE SR;" activates stimulus-response measurements and uncouples the sweep time for faster sweep times. If AMB ON or AMBPL ON and RLPOS are executed, MEASURE SR activates the reference level position. When normalization is used, amplitude units are specified relative to the display level.

During this relative-amplitude mode, the following parameters are in dB:

- Trace data (TRA, TRB, TRC).
- Display line (DL).
- Threshold (TH).

- Marker amplitude (MKA).

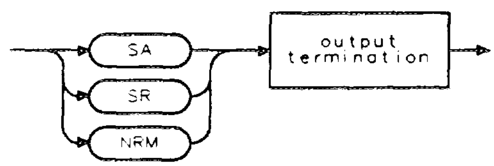
  "MEASURE NRM;" recouples the sweep time for accurate signal analysis measurements. If AMB ON or AMBPL ON and RLPOS are executed, MEASURE NRM activates the reference level position.

See "RLPOS" for more information about changing the reference level position.

When used as a predefined variable, MEASURE returns a value depending on the setting of the MEASURE parameter.

| LIMIMODE Parameter | Value Returned |
|---|---|
| SA | 0 |
| SR | 1 |
| NRM | 2 |

## Query Response




QMEASURE

## Description

When using the KEYDEF, KEYENH, or KEYCMD commands, you need to specify the softkey number. The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. The MENU command is a useful way to "link" softkey menus together. For example, example 2 shows how menu 1 (with softkeys 1 through 6) can be used to access menu 102 (with softkeys 607 and 608). Menu 1 can be accessed by pressing (MEAS/USER), **User Menus**.

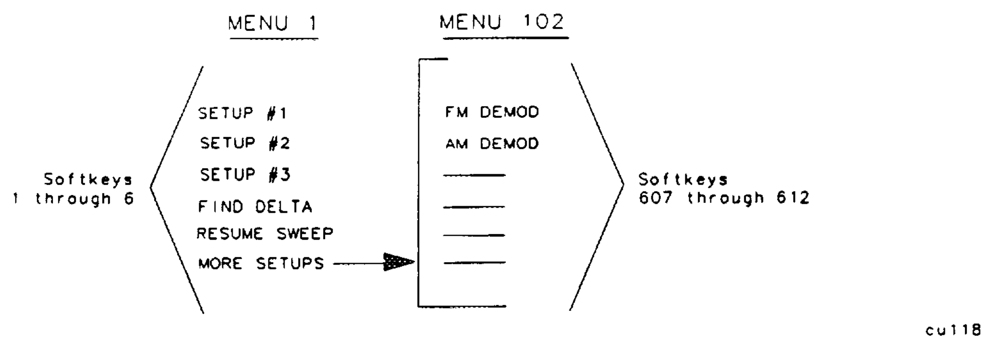
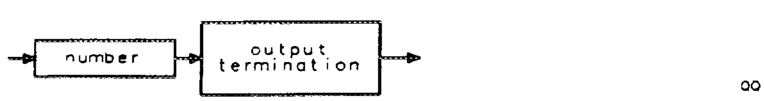



**Figure 5-7. Using the MENU Command**

The menu numbers 1 and 101 through 200 are the recommended menus available for the user to use.

Executing "MENU 0;" clears the softkey menu from the spectrum analyzer screen.

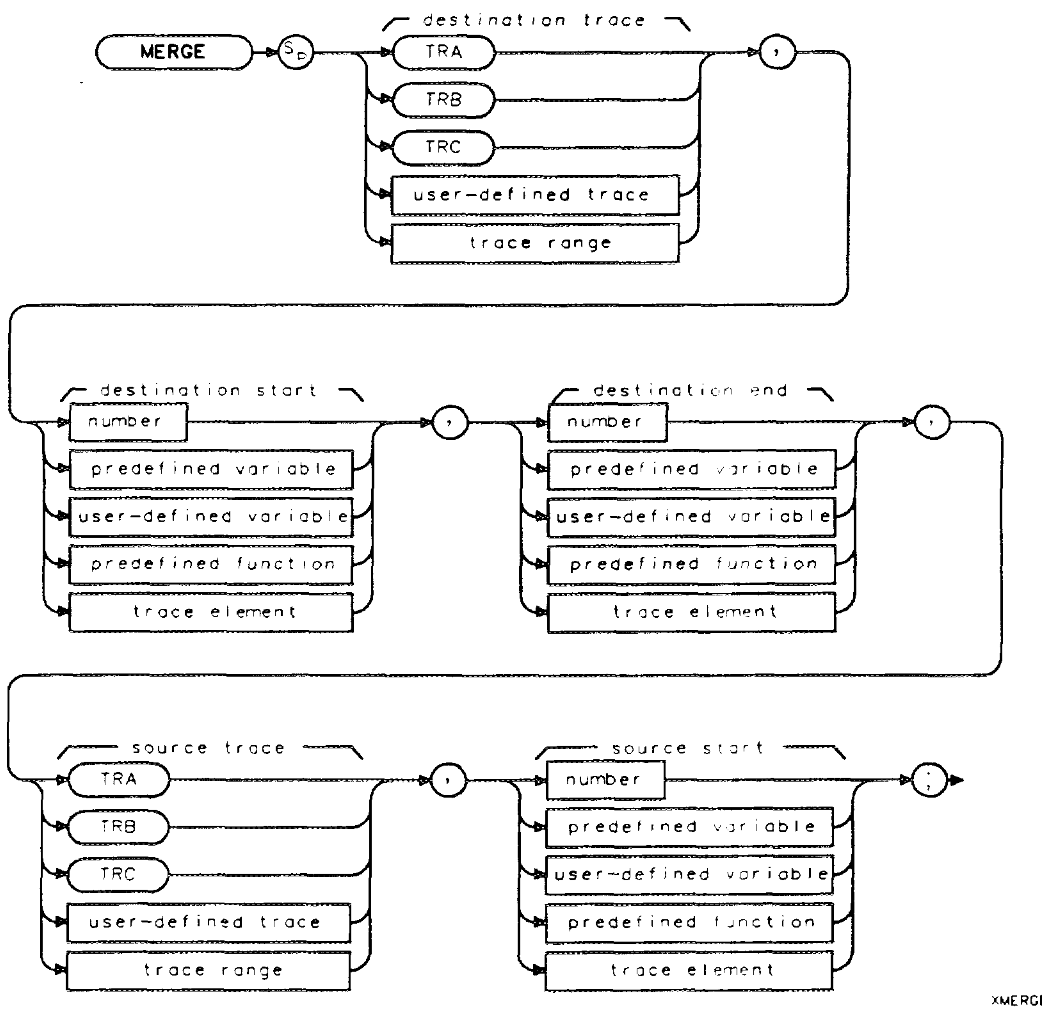
## Query Response



# MERGE
# Merge Two Traces

Merges the source trace into the specified area of the destination trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer number. | −32,768 to +32,767. |

Related Commands: All other trace math commands. See Table 5-4 for a list of trace math commands.

## Example

| | |
|---|---|
| `OUTPUT 718;"MERGE TRC,1,200,TRA,200;"` | *Merges trace A into trace C. The trace A elements 200 through 399 are merged into trace C elements 1 through 200.* |

## Description

MERGE copies the trace data from the source trace, starting at the specified trace element, into the specified trace elements of the destination trace. MERGE differs from CONCAT because MERGE does not need the trace range of the source to be specified. If the source is not a trace, its value is copied to the destination trace. If the destination segment is longer than the specified source segment, the last element of the source trace is repeated to fill the destination.

# MF
# Marker Frequency Output

Returns the frequency (or time) of the on-screen active marker.

## Syntax


XMF

Related Commands: MA, MKA, MKCF, MKD, MKF, MKN, MKPK, MKREAD.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `OUTPUT 718;"IP;SNGLS;"` | *Initializes the spectrum analyzer, activates single-sweep mode.* |
| `OUTPUT 718;"FA 280MHZ;FB 320MHZ;TS;"` | *Sets up the measurement range.* |
| `OUTPUT 718;"MKN;MKPK HI;"` | *Places marker on peak of calibrator signal.* |
| `OUTPUT 718;"MF;"` | *Takes frequency of marker.* |
| `ENTER 718;A` | *Returns frequency to the computer.* |
| `PRINT A` | *Prints the frequency on the computer screen.* |

## Description

The MF command returns the frequency of the active marker to the controller if the marker is on screen. In delta marker mode, nonzero span, "MF;" returns the frequency difference between the two markers. In zero span, "MF;" returns the marker time, or the delta marker time.

The data that is returned by "MF;" depends on many command conditions including TDF, MKREAD, and MDS.

If the trace data format P is used with MF, the result is one real value in time units or frequency units, depending on the marker readout format. (See "MKREAD.")

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF P;MKREAD FRQ;MF;"` | *This returns a frequency value (in Hz) if not in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD FRQ;MF;"` | *This returns a time value (in seconds) if in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD PER;MF;"` | *This returns the time value (in seconds) of 1/(marker frequency).* |
| `OUTPUT 718;"TDF P;MKREAD SWT;MF;"` | *This returns the marker time value (in seconds).* |
| `OUTPUT 718;"TDF P;MKREAD IST;MF;"` | *This returns the frequency value (in Hz) for 1/(marker time).* |
| `OUTPUT 718;"TDF P;MKREAD FFT;MF;"` | *This returns the frequency value (in Hz).* |

If the trace data format is used with trace data format A, the result depends on the setting of the MDS command.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF A;MDS B;MF;"` | *Returns one byte representing the marker position. The byte can assume values 1 to 101.* |
| `OUTPUT 718;"TDF A;MDS W;MF;"` | *Returns two bytes in a binary word format that has a value from 1 to 401.* |

If the trace data format is used with trace data format M, the result is the marker horizontal position value, from 1 to 401, in ASCII.

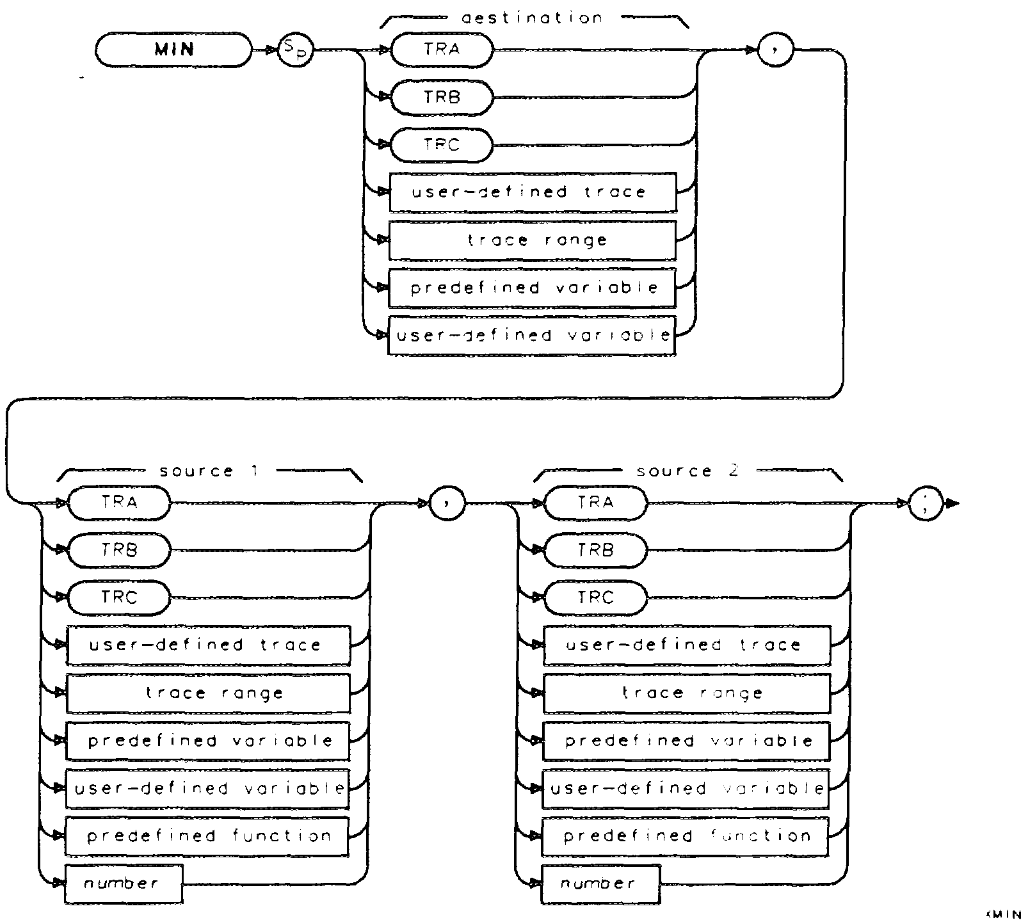
## Example

| | |
|---|---|
| `OUTPUT 718;"TDF M;MF;"` | *Returns marker horizontal position value in ASCII.* |

# MIN
# Minimum

Compares source 1 and 2, point by point, and stores the lesser of the two in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: MINPOS, MXM, TS.

## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"SNGLS;" | *Activates the single-sweep mode.* |
| 30 OUTPUT 718;"VARDEF M_INIMUM,0;" | *Defines variable with an initial value of 0.* |
| 40 OUTPUT 718;"TS;MKPK HI;"; | *Sweeps trace A and places the marker at the highest peak.* |
| 50 OUTPUT 718;"MIN M_INIMUM,MKA,-20;"; | *Compares the marker amplitude to −20 dBm. Stores the lesser of the two in M_INIMUM.* |
| 60 OUTPUT 718;"M_INIMUM?;" | *Returns the result to the computer.* |
| 70 ENTER 718;Number | *Puts the result in the computer variable, Number.* |
| 80 DISP Number | *Displays the result.* |
| 90 END | |

## Description

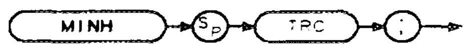
If one of the sources is a single value, it acts as a threshold, and all values equal to or less than the threshold pass to the destination. The values larger than the threshold are replaced by the threshold value in the destination.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MINH
# Minimum Hold

Updates trace C with the minimum level detected.

## Syntax




XMINH

Equivalent Softkey: **MIN HOLD C**.

Related Commands: BLANK, CLRW, MXMH, VAVG, VIEW.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"CLRW TRC;CONTS;"
OUTPUT 718;"MINH TRC;"
```

| | |
|---|---|
| OUTPUT 718;"CLRW TRC;CONTS;" | *Clears trace C and begin taking data.* |
| OUTPUT 718;"MINH TRC;" | *Updates trace C with the minimum level detected.* |

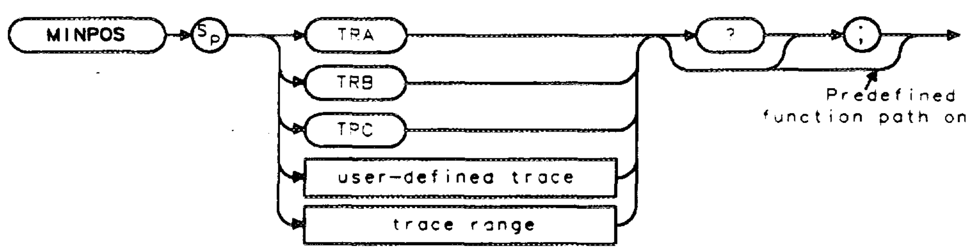
## Description

MINH updates trace C with a new value from a detector only if the new value is smaller than the previous trace data value.

# MINPOS
# Minimum Position

Returns a value, which is the $x$-axis position (in display units) of the minimum amplitude value in trace A, trace B, trace C, or user-defined trace.

## Syntax




XMINPOS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace ACTDEF. TS when using trace data.
Related Commands: MIN, MKMIN, PKPOS.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"MINPOS TRA;"` | *Finds the minimum value of trace A.* |
| `30 ENTER 718;Number` | *Returns value to the computer.* |
| `40 DISP Number` | *Displays result.* |
| `50 END` | |

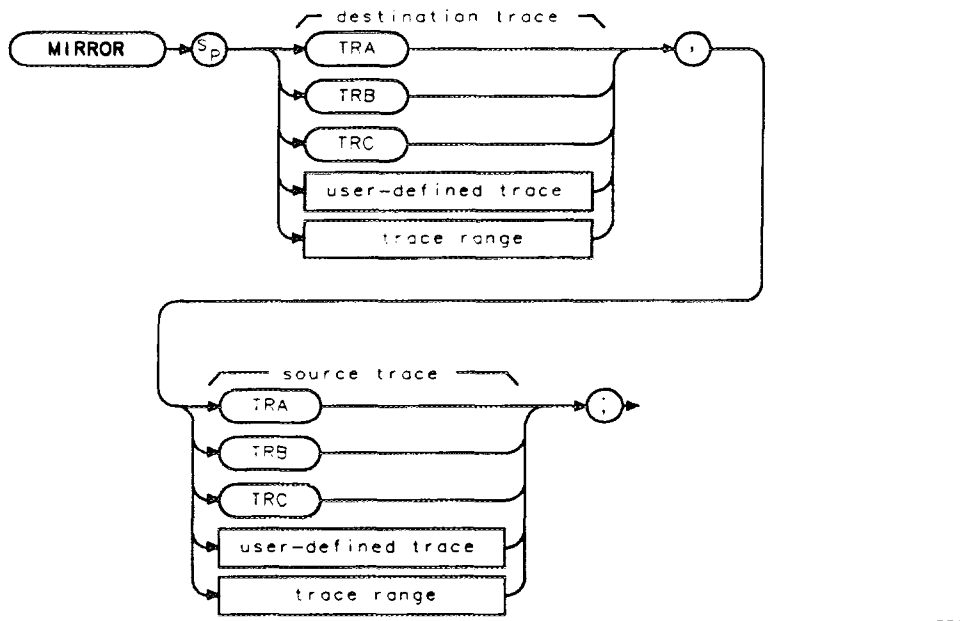
## Description

If a trace range is used with MINPOS, MINPOS returns a value relative to the first element of the trace range. For example, if a trace has a range of 150 to 300 elements, and the minimum value is element 200, MINPOS will return the value of 51.

# MIRROR
# Mirror Image

Displays the mirror image of the trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.

## Example

```
10 OUTPUT 718;"IP;"                  Initializes spectrum analyzer.
20 OUTPUT 718;"SNGLS;"               Activates the single-sweep mode.
30 OUTPUT 718;"TS;"                  Takes sweep.
40 OUTPUT 718;"BLANK TRA;"           Blanks trace A from spectrum analyzer screen.
50 OUTPUT 718;"MIRROR TRB,TRA;"      Moves the mirror image of trace A into trace B.
60 OUTPUT 718;"VIEW TRB;"            Displays the result.
70 END
```

## Description

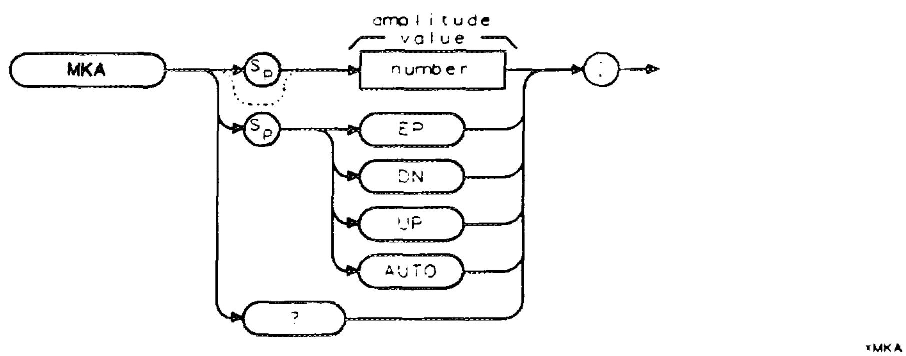
The MIRROR command stores the mirror image (with respect to the frequency axis) of a source trace in a destination trace.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MKA
# Marker Amplitude

Specifies the amplitude of the active marker in the current amplitude units when marker type is of fixed or amplitude type. When queried, MKA returns the marker amplitude independent of marker type.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Unit is current amplitude type. | Amplitude range of spectrum analyzer. |

Step Increment: by 1 dB.
Related Commands: AUNITS, AUTO, MA, MKD, MKN, MKTYPE, TDF.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `OUTPUT 718;"MKTYPE AMP;"` | *Changes the marker type to amplitude.* |
| `OUTPUT 718;"MKA -50;"` | *Places the marker at −50 dBm.* |

## Description

The MKA command specifies the amplitude of the active marker in current units when the marker is the fixed or amplitude type (see "MKTYPE"). If both the delta marker and active marker are on the screen, "MKA?;" returns the amplitude difference between the two markers. Specifying the marker amplitude moves the marker to the point of the trace closest to the given marker amplitude.

If the trace data format P (TDF P), is used with MKA, the result is one real value in the current amplitude units (AUNITS can be used to change the current amplitude units).

## Example

`OUTPUT 718;"TDF P;AUNITS DBM;MKA?;"` *This returns the amplitude value of the marker (amplitude unit is dBm).*

If the trace data format is used with trace data format A, the result depends on the setting of the MDS command.

## Example

`OUTPUT 718;"TDF A;MDS B;MKA?;"` *Returns one byte representing the marker vertical position (−32,768 to 32,767) divided by 32 and then ANDed with 255.*

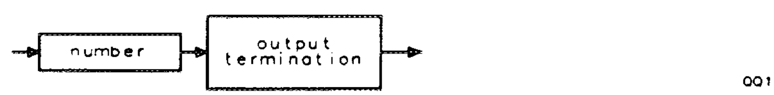
`OUTPUT 718;"TDF A;MDS W;MKA?;"` *Returns two bytes in a binary word format that has a value from −32,768 to 32,767. The value represents the binary trace amplitude value.*

Using the trace data format I is equivalent to the TDF A format. If the trace data format is used with trace data format M, the result is returned in ASCII measurement units (−32,768 to 32,767).

## Example

`OUTPUT 718;"TDF M;MKA?;"` *Returns one vertical position value in measurement units.*

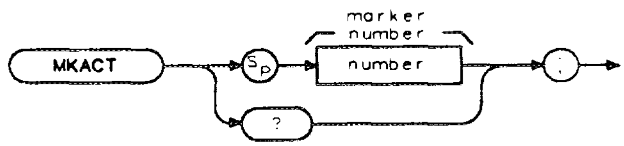
## Query Response



# MKACT
# Activate Marker

Specifies the active marker.

## Syntax




XMKACT

| Item | Description/Default | Range |
| --- | --- | --- |
| Number | Any valid integer. Default value is 1. | 1 to 4. |

Equivalent Softkey: `SELECT 1 2 3 4`.
Related Commands: MA, MKA, MKF.

## Example

`OUTPUT 718;"MKACT 4;"` *Marker 4 becomes marker 1.*

## Description

There can be four different markers, but only one marker can be active at any time.

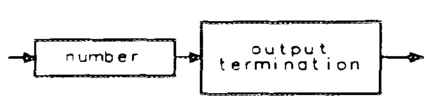
When this command is used, the following results occur:

- The marker number supplied by the command is made marker 1, the active marker.
- If the marker number is not already on, the marker is turned on with preset type (position), and the marker is placed at center screen. The trace chosen is the first displayed trace found: trace A, trace B, trace C.

**Note** Using MKACT replaces marker 1 with the new marker function. The amplitude and frequency for the previous marker are not saved.

## Query Response

"MKACT?;" returns the marker number.

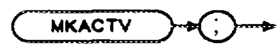



QQ1

# MKACTV
# Marker As the Active Function

Makes the current active marker the active function.

## Syntax




XMKACTV

Equivalent Softkey: MKACTV is equivalent to turning on a marker with **MARKER <number> ON OFF** (ON is underlined).

Related Commands: MKACT, MKN, MKTYPE.

## Example

| | |
|---|---|
| `OUTPUT 718;"MKACT 2;"` | *Makes marker number 2 the active marker.* |
| `OUTPUT 718;"MKACTV;"` | *Makes marker number 2 the active function.* |

## Description

If you have more than one marker displayed on the spectrum analyzer display, you need to make the desired marker the active function before you can manipulate the marker.

To make the marker the active function:

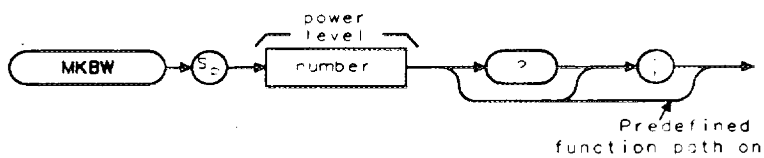
1. Select the desired marker with the MKACT command (MKACT makes the specified marker the active marker).
2. Execute MKACTV to make the active marker the active function.

If there is no active marker, executing MKACTV makes marker 1 the active marker and the active function. MKACTV makes the marker an active function according to its marker type (see "MKTYPE" for more information about marker type).

# MKBW
# Marker Bandwidth

Returns the bandwidth at the specified power level relative to an on-screen marker (if present) or the signal peak (if no on-screen marker is present).

## Syntax




XMKBW

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid negative integer. | 0 to the amplitude of the noise floor. |

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"CF 300MHZ;SP 100MHZ;SNGLS;"` | *Changes the center frequency and span, then activates the single-sweep mode.* |
| `OUTPUT 718;"TS;MKPK HI;"` | *Updates the sweep, places marker on signal peak.* |
| `OUTPUT 718;"MKBW -3;"` | *Uses the MKBW function to find the signal bandwidth at −3 dB below the marker.* |

## Description

The MKBW command also displays (in the message area) the bandwidth at the power level in dB below the current marker position or the current signal peak.

MKBW finds the bandwidth at the specified power level for one measurement sweep. If you want the spectrum analyzer to find the bandwidth at the specified power level during every measurement sweep, use the NDBPNT command instead of MKBW.

# MKCF
# Marker to Center Frequency

Sets the center frequency equal to the marker frequency and moves the marker to the center of the screen.

## Syntax


XMKCF

Equivalent Softkey: **MARKER -> CF** .

Related Commands: CF, MKF.

## Example

This example provides a quick way to center the desired frequency on the spectrum analyzer screen.

| | |
|---|---|
| `10 OUTPUT 718;"IP;SP 1MHZ;SNGLS;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 INPUT "ENTER IN DESIRED STATION FREQUENCY, IN MHZ",Freq` | |
| `30 OUTPUT 718;"CF ";Freq;"MHZ;"` | *Changes spectrum analyzer center frequency.* |
| `40 OUTPUT 718;"TS;MKPK HI;MKCF;TS;"` | *Updates the trace, places marker at the signal peak and centers it on screen.* |
| `60 END` | |

## Description

This command is performed only if an active marker is present on screen.

# MKCONT
# Marker Continue

Resumes the sweep after execution of a MKSTOP command.

## Syntax


XMKCONT

Related Commands: MKSTOP.

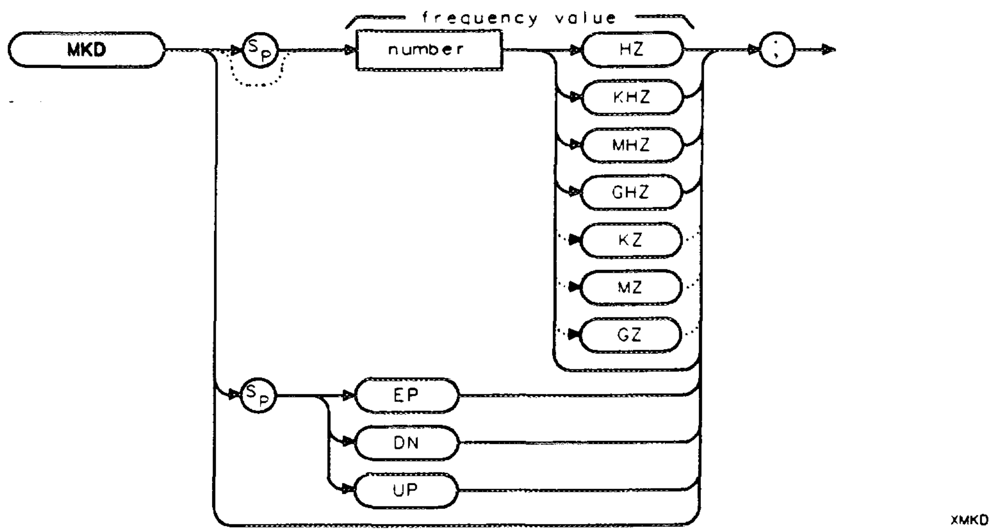
## Example

```
10 OUTPUT 718;"IP;TS;"      Initializes spectrum analyzer.
20 OUTPUT 718;"MKPK HI;"    Creates an active marker.
30 OUTPUT 718;"MKSTOP;"     Stops sweep at marker.
40 OUTPUT 718;"MKCONT;"     Resumes sweep.
50 END
```

# MKD
# Marker Delta

Activates the delta marker.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz, default value is value of the active marker. | Start frequency to stop frequency of spectrum analyzer. |

Equivalent Softkey: **MARKER Δ**.
Step Increment: by 1/10 of the frequency span.
Related Commands: AUTO, MA, MKCF, MKF, MKN, MKSP, MKSS, MKPK.

## Example

```
10 OUTPUT 718;"IP;"          Initializes spectrum analyzer.
20 OUTPUT 718;"MKMIN;"       Places a marker at the minimum amplitude of trace.
30 OUTPUT 718;"MKD;"         Activates marker delta.
40 OUTPUT 718;"MKPK HI;"     Places marker at highest amplitude of trace.
50 OUTPUT 718;"MKSP;"        Changes span to the values of the left and right markers.
60 END
```

## Description

The MKD command computes the frequency and amplitude difference of the active marker and a special marker, called the delta or differential marker. These values are displayed in the display readout.

The differential value of the frequency is equal to the active marker frequency minus the delta marker frequency. The differential value of the amplitude is equal to the active marker amplitude minus the delta marker amplitude.

If an active marker is not on the screen, MKD positions an active marker at center screen. If a delta marker is not on the screen, MKD places one at the specified frequency, or at the current active marker. If the active marker is in amplitude mode, the delta marker is placed at the same amplitude as the active marker (or a specified value).

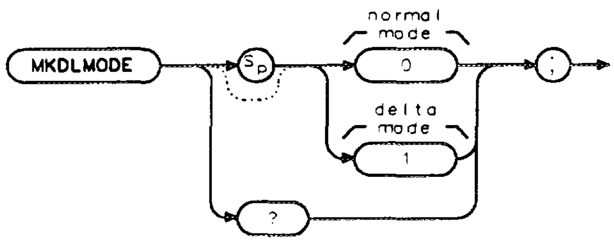
To read the amplitude, use MKA?. To read the frequency, use MKF? The results are displayed on the spectrum analyzer screen.

In linear mode, MKD computes the ratio of the amplitudes of the active and delta markers rather than the difference. This results in similar treatment for logarithmic and linear data because the delta of the difference of two logarithmically generated numbers results in the logarithmically generated value of the ratio of the two numbers. (You should not change amplitude units when making a marker delta measurement, however.)

# MKDLMODE
# Marker Delta Display Line Mode

When the marker table is turned on, MKDLMODE selects if the marker amplitude values are shown as relative to the reference level (normal mode) or relative to the display line (delta mode).

## Syntax




XMKDLMODE

Equivalent Softkey: **TABLE ΔDL NRM**.
Preset State: 0 (normal mode).
Related Commands: DL, MKTBL.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV MKTBL,1;"` | *Turns on the marker table.* |
| `OUTPUT 718;"DL -20;"` | *Sets the display line.* |
| `OUTPUT 718;"MOV MKDLMODE,1;"` | *Displays the marker amplitudes values relative to the display line.* |

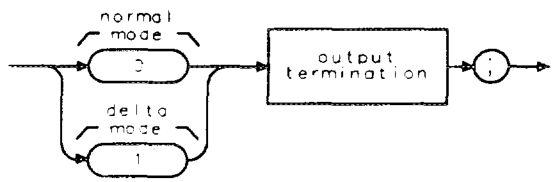
## Description

If MKDLMODE is set to 0, the spectrum analyzer displays absolute marker amplitudes or marker delta amplitudes (normal mode). If MKDLMODE is set to 1, the spectrum analyzer displays the marker amplitudes relative to the display line (delta mode). Setting MKDLMODE to 1 turns on the display line automatically. Use the DL command to place the display line.

MKDLMODE determines the way the marker amplitudes are displayed in the marker table only, it does not change the marker amplitude values that are returned remotely.

You can execute the MKDLMODE command two different ways. You can either execute the MKDLMODE command directly (for example, "MKDLMODE 1;") or use the MOV command to move the 1 or 0 into the MKDLMODE command (for example, "MOV MKDLMODE,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response

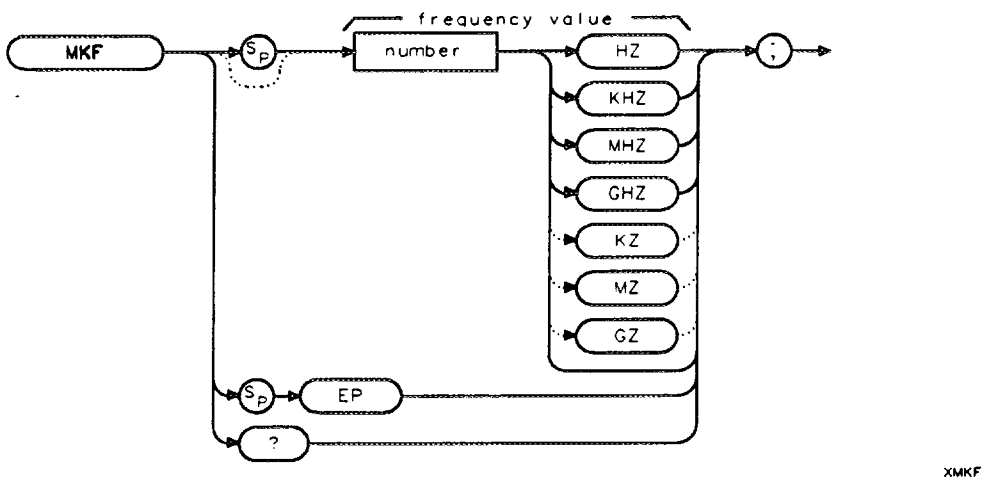



QMKDLMODE

# MKF
# Marker Frequency

Specifies the frequency value of the active marker.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Start frequency to stop frequency of spectrum analyzer. |

Related Commands: AUTO, MKA, MKD, MKCF, MKPK.

## Example

`OUTPUT 718;"MKF 600MHZ;"` *Places an active marker at 600 MHz.*

## Description

In nonzero frequency spans, MKF returns the active marker frequency as a real number when MKF is queried. In zero span, "MKF?;" returns the time value.

The data that is returned by MKF depends on many command conditions, including TDF, MKREAD, and MDS.

**MKF results with TDF set to P:** If the trace data format P is used with MKF, the result is one real value in time units or frequency units, depending on MKREAD.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF P;MKREAD FRQ;MKF?;"` | *This returns a frequency value (in Hz) if not in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD FRQ;MKF?;"` | *This returns a time value (in seconds) if in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD PER;MKF?;"` | *This returns the time value (in seconds) of 1/(marker frequency).* |
| `OUTPUT 718;"TDF P;MKREAD SWT;MKF?;"` | *This returns the marker time value (in seconds).* |
| `OUTPUT 718;"TDF P;MKREAD IST;MKF?;"` | *This returns the frequency value (in Hz) for 1/(marker time).* |
| `OUTPUT 718;"TDF P;MKREAD FFT;MKF?;"` | *This returns the frequency value (in Hz).* |

**MKF results with TDF set to A or I:** If the trace data format is used with trace data format A, the result depends on the setting of the MDS command.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF A;MDS B;MKF?;"` | *Returns one byte representing the marker position.* |
| `OUTPUT 718;"TDF A;MDS W;MKF?;"` | *Returns two bytes in a binary word format that has a value from 1 to 401.* |

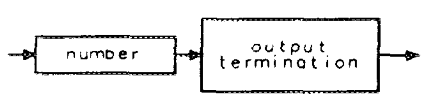
Using the trace data format I is equivalent to the TDF A format.

**MKF results with TDF set to M:** If the trace data format is used with trace data format M, the result is the marker horizontal position value, from 1 to 401, in ASCII.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF M;MKF?;"` | *Returns marker horizontal position value in ASCII.* |

## Query Response

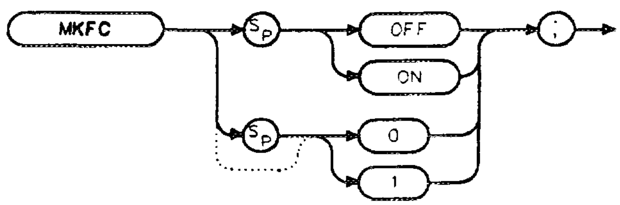



QQ1

# MKFC
# Marker Counter

Turns on or off the marker frequency counter.

## Syntax




XMKFC

Equivalent Softkey: **MK COUNT ON OFF** .

Model Required: HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or HP 8590D with Option 013.

Related Commands: MKFCR, MKN.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information. Not available with the marker table (MKTBL).

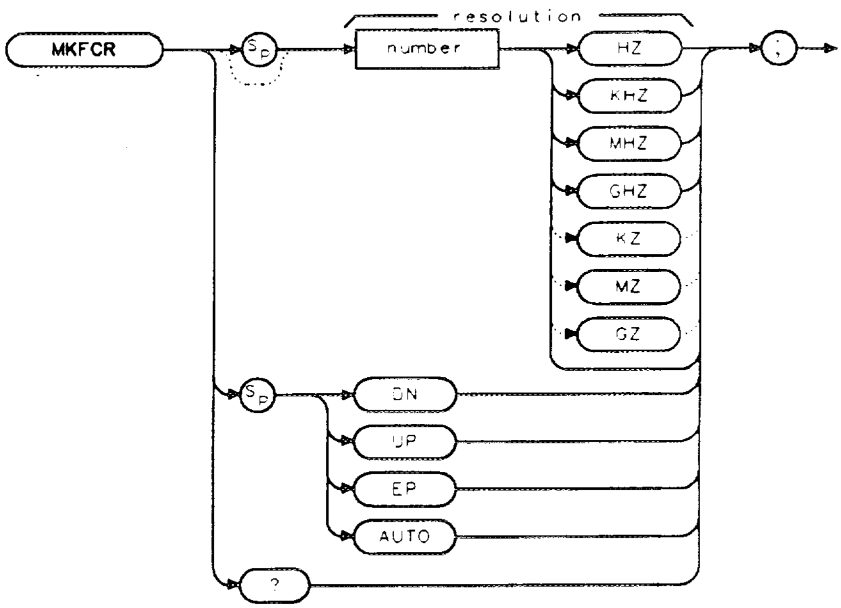
## Example

OUTPUT 718;"MKFC ON;" *Turns on the marker counter.*

# MKFCR
# Marker Counter Resolution

Sets the resolution of the marker frequency counter.

## Syntax




xMKFCR

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 0 Hz to 100 kHz. |

Equivalent Softkey: **CNT RES AUTO MAN** .

Model Required: HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or HP 8590D with Option 013.

Preset State: Marker counter resolution is set to AUTO. The calculated value for the marker counter resolution is returned if the MKFCR is queried.

Related Commands: AUTO, MKFC.

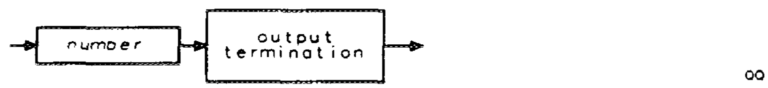
## Example

| | |
|---|---|
| `OUTPUT 718;"MKFCR 10KHZ;"` | *Sets the marker counter resolution to 10 kHz.* |
| `OUTPUT 718;"MKFCR?;"` | *Queries the marker counter resolution.* |
| `ENTER 718;A` | *Gets the query response.* |
| `DISP A` | *Displays the marker counter resolution.* |

## Description

Executing either "MKFCR 0;" or "MKFCR AUTO;" auto-couples the marker counter resolution to the frequency span.

## Query Response



# MKMIN
# Marker Minimum

Moves the active marker to the minimum value detected.

## Syntax


Related Commands: MKPK, SMOOTH, TH, VAVG.

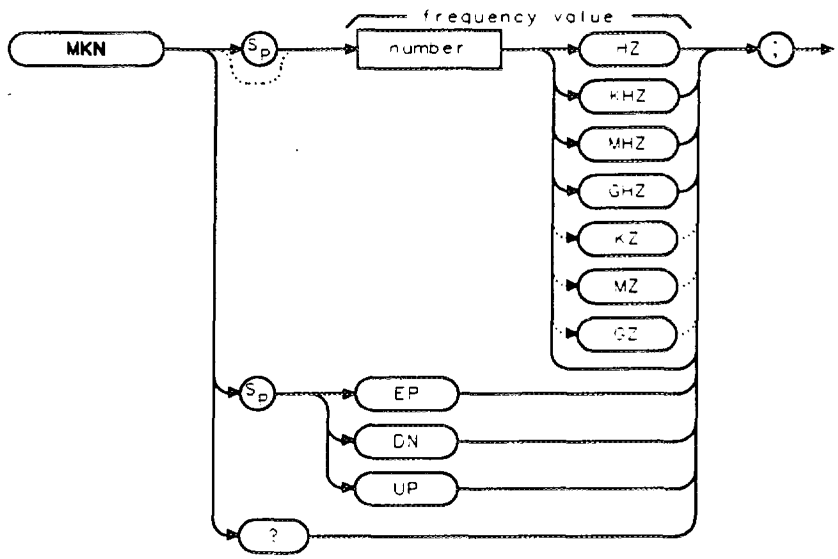
## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq` | |
| `30 INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq` | |
| `40 OUTPUT 718;"FA ";Start_freq;"MHZ"` | *Sets the start frequency.* |
| `50 OUTPUT 718;"FB ";Stop_freq;"MHZ"` | *Sets the stop frequency.* |
| `60 OUTPUT 718;"TS;MKPK HI;MKD;MKMIN;MKF?;"` | *Updates trace, finds trace peak, turns on marker delta function, finds the minimum value of trace, and return the frequency delta.* |
| `70 ENTER 718;Delta_freq` | *Gets the result from spectrum analyzer.* |
| `80 PRINT "DIFFERENCE IN FREQUENCY IS ", Delta_freq,"HZ"` | |
| `90 END` | |

# MKN
# Marker Normal

Activates and moves the marker to the specified frequency.

## Syntax




XMKN

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. Default value is the center frequency of the spectrum analyzer. | Start frequency to stop frequency of spectrum analyzer. |

Equivalent Softkey: **MARKER NORMAL**.
Step Increment: by 1/10 of the frequency span.
Related Commands: AUTO, DEMOD, MKA, MKD, MKF, MKPK.

## Example

| | |
|---|---|
| `10 INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq` | |
| `20 INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq` | |
| `30 OUTPUT 718;"IP;FA ";Start_freq;"MHZ"` | *Initializes spectrum analyzer and changes the start frequency.* |
| `40 OUTPUT 718;"FB ";Stop_freq;"MHZ"` | *Changes the stop frequency.* |
| `50 OUTPUT 718;"MKN EK;"` | *Enables the front-panel knob.* |
| `60 PRINT "PLACE MARKER ON THE DESIRED SIGNAL"` | |
| `70 PRINT "PRESS HOLD THEN PRESS CONTINUE"` | |
| `80 PAUSE` | |

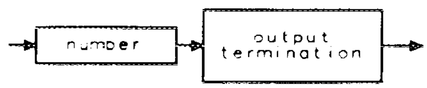
**MKN Marker Normal**

| | |
|---|---|
| `90 OUTPUT 718;"MKN?;"` | *Gets the frequency of the marker.* |
| `100 ENTER 718;Mkr` | *Puts the frequency value into the computer variable, Mkr.* |
| `110 PRINT "MARKER FREQUENCY IS ",Mkr,"Hz"` | *Prints the result.* |
| `120 END` | |

## Description

In nonzero span, "MKN?;" returns the frequency value. In zero span, "MKN?;" returns the time value.

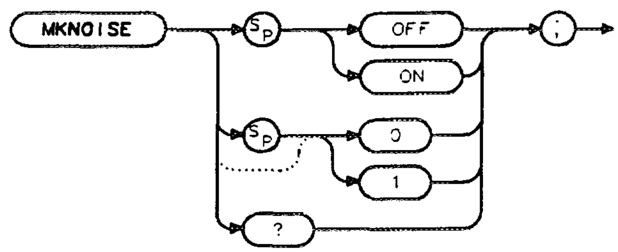
## Query Response



# MKNOISE
# Marker Noise

Displays the average noise level at the marker.

## Syntax




XMKNOISE

Restrictions: Not available with the marker table (MKTBL).
Equivalent Softkey: **MK NOISE ON OFF**.
Related Commands: MKA, MKF, MKMIN, MKN.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 300MHZ;SNGLS;"` | *Initializes spectrum analyzer, changes center frequency, activates single-sweep mode.* |
| `OUTPUT 718;"SP 10MHZ;DET SMP;TS;"` | *Changes span, activates sample detector, updates trace.* |
| `OUTPUT 718;"MKPK HI;MKA?;"` | *Places marker on highest point of trace, queries marker amplitude.* |
| `ENTER 718;Amp_one` | *Puts the spectrum analyzer response in the computer variable, Amp_one.* |
| `OUTPUT 718;"MKD UP;UP;MKNOISE ON;MKA?;"` | *Moves marker and turns on the marker noise function.* |
| `ENTER 718;Amp_two` | *Puts the spectrum analyzer response in the computer variable, Amp_two.* |
| `OUTPUT 718;"MKNOISE OFF;"` | *Turns off the marker noise function.* |
| `DISP Amp_two` | *Displays the result.* |
| `C_to_n=Amp_one - Amp_two` | *Calculates the carrier to noise ratio.* |
| `PRINT "CARRIER TO NOISE RATIO IN 1 HZ BANDWIDTH IS ";C_to_n` | *Outputs result.* |
| `PRINT " DB"` | |

## Description

The marker value is normalized to a 1-Hz bandwidth. Use "MKA?;" to read the noise marker value.

The noise marker averages 32 trace data values about the location of the marker on the frequency or time scale. The 32 values averaged, except for the first 15 or last 14 values in the trace, commence with the 16th point to the left of the marker, and end with the 15th point to the right of the marker. Note that the data values averaged are not exactly symmetrical with respect to marker position. At the trace end points, the spectrum analyzer uses the nearest 32 data values. So while the marker may be moved to trace position 1 to 15, the actual amplitude value returned will be the same value for any marker position from 1 to 15. A similar situation applies for markers at the end of the trace.

A nominal correction for equivalent noise bandwidths is made by the firmware based on a nominal 3 dB resolution bandwidth. The firmware assumes the noise bandwidth is 1.12 times the resolution bandwidth. This means the shape of the resolution bandwidth filters cause the noise power to be overstated by 1.12 times. The detection mode also affects the measurement. If in log mode, the log detector understates the noise response. To compensate, 2.5 dB is added to the measurement. If the detector is in linear mode, the firmware uses 1.05 dB as a correction value.

In log detector mode, the final reported value will then be, with the result reported in dBm in a 1-Hz bandwidth:

$$(\text{Averaged value over 32 values}) - 10 \times (\log[1.12 \times \text{Resolution bandwidth}]) + 2.5 \text{ dB}$$

In linear detector mode (dBm) units, the final reported value will then be, with the result reported in dBm in a 1-Hz bandwidth:

$$(\text{Averaged value over 32 values}) - 10 \times (\log[1.12 \times \text{Resolution bandwidth}]) + 1.05 \text{ dB}$$

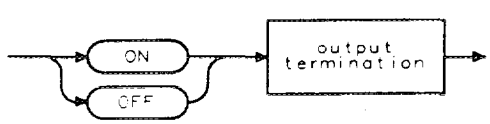
In linear detector mode with the normal display of voltage units, the noise marker voltage value will be related to the present marker voltage by this relation.

$$(V\_noise\_marker)^2 = (V\_average)^2 \times 1.12 \times \text{Resolution bandwidth} \times 0.7824$$

$$V\_noise\_marker = V\_average/(1.12 \times \text{Resolution bandwidth} \times 0.7824)^{0.5}$$

$$V\_noise\_marker = V\_average \times 1.06633/(\text{Resolution bandwidth})^{0.5}$$

## Query Response

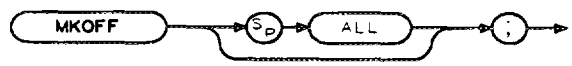



002

# MKOFF
# Marker Off

Turns off either the active marker or all the markers.

## Syntax




XMKOFF

Equivalent Softkey: **MARKER ALL OFF**.
Related Commands: MKA, MKACT, MKACTV, MKCF, MKD, MKF, MKN, MKPK.

## Example

`OUTPUT 718;"MKOFF ALL;"` *Turns off all the on-screen markers.*

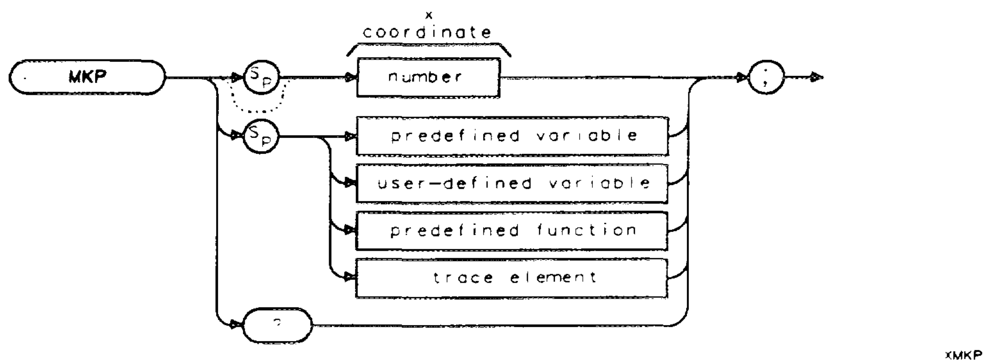
## Description

If the ALL parameter is omitted, only the active marker is turned off.

# MKP
# Marker Position

Places the active marker at the given $x$-coordinate.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | −401 to 401. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: MKA, MKCF, MKD, MKMIN.

## Example

```
OUTPUT 718;"IP;"         Initializes spectrum analyzer.
OUTPUT 718;"MKP 100;"    Moves the active marker to a element 100 of trace A.
```

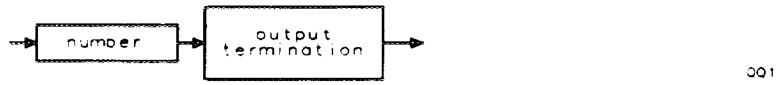
## Description

If no marker is active, the marker is turned on with preset type (position) and marker is placed at the given screen position. The marker is placed on the first displayed trace that is found (in order): trace A, trace B, or trace C.

If the marker delta mode is active, the value of the marker position is relative to the fixed marker, and therefore MKP can return a negative position.

Note that MKP and MKCF commands perform different functions. MKCF sets the center frequency equal to the marker frequency and moves the marker to the center of the screen. MKP places the marker to the position of the element specified.

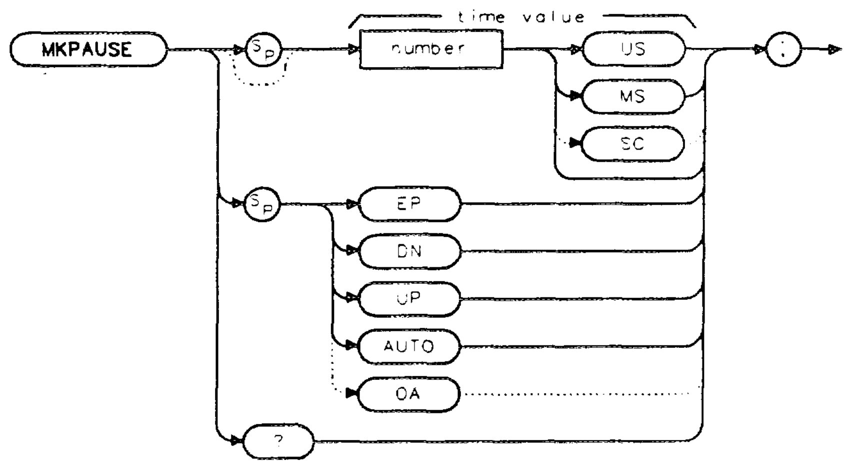
## Query Response



# MKPAUSE
# Marker Pause

Pauses the sweep at the active marker for the duration of the delay period.

## Syntax




xMKPAUSE

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 2 ms to 100 s. |

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information. Not available with negative peak detection.

Equivalent Softkey: **MK PAUSE ON OFF** .

Step Decrement: Time value divided by 2.

Step Increment: Time value multiplied by 2.

Related Commands: DEMOD, MKA, MKF, MKFC, MKN, MKOFF, ST.

## Example

`OUTPUT 718;"MKPAUSE 10SC;"` *Changes the marker pause time to 10 seconds.*

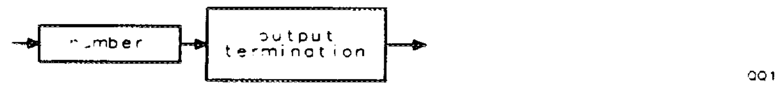
## Description

To turn MKPAUSE off, turn off markers or send "MKPAUSE 0;".

The MKPAUSE command requires a sweep time of 50 ms or longer. The sweep time is changed to 50 ms if MKPAUSE is used with a sweep time that is less than 50 ms.

After MKPAUSE is executed, the sweep must be completed before another command will be executed.

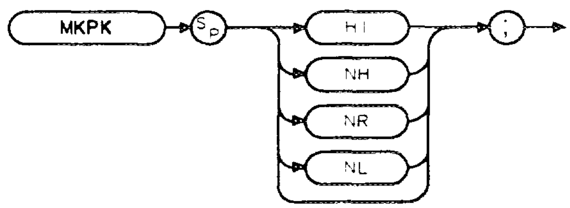
## Query Response



# MKPK
# Marker Peak

Positions the active marker on a signal peak.

## Syntax




xMKPK

Equivalent Softkey: **NEXT PEAK**, **NEXT PK RIGHT**, **NEXT PK LEFT**, and (PEAK SEARCH).
Related Commands: MKCF, MKF, MKOFF, MKPX, TH.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;MKPK HI;"` | *Places active marker on highest peak.* |
| `30 OUTPUT 718;"MKA?;"` | *Returns amplitude value of marker to the computer.* |
| `40 ENTER 718;A` | *Puts the spectrum analyzer response in the computer variable, A.* |
| `50 DISP A` | *Displays amplitude value.* |
| `60 END` | |

## Description

Executing MKPK HI, or simply MKPK, positions the active marker at the highest signal detected. If an active marker is on the screen, the MKPK parameters move the marker as follows:

**HI** (highest) moves the active marker to the highest peak.

**NH** (next highest) moves the active marker to the next signal peak of lower amplitude.

**NR** (next right) moves the active marker to the next signal peak of higher frequency.

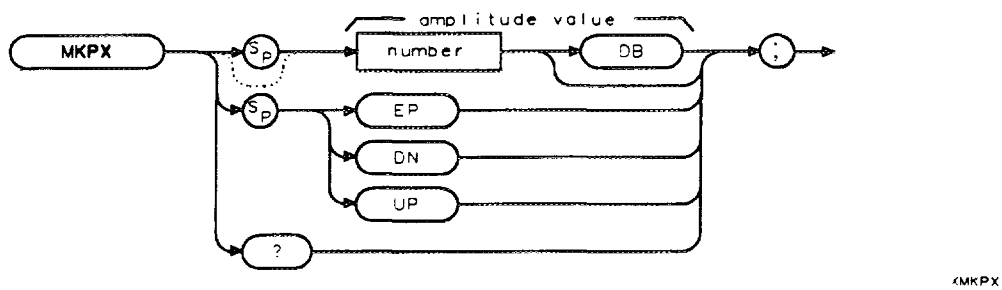
**NL** (next left) moves the active marker to the next signal peak of lower frequency.

**Note** This function is for use with the frequency markers only.

# MKPX
# Marker Peak Excursion

Specifies the minimum signal excursion for the spectrum analyzer's internal peak-identification routine.

## Syntax



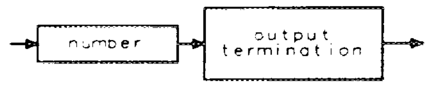

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dB. | 0 to 100 dB. |

Equivalent Softkey: **PEAK EXCURSN**.
Preset State: 6 dB.
Step Increment: by 1 dB.
Related Commands: MKPK, PEAKS.

## Example

```
10 OUTPUT 718;"IP;CF 300MHZ;SP 1GHZ;"              Initializes spectrum analyzer,
                                                    changes start and stop frequencies.
20 INPUT "ENTER IN PEAK EXCURSION, IN DB ",Excursion
30 OUTPUT 718;"MKPX ";Excursion;"DB;"              Changes peak excursion level.
40 OUTPUT 718;"TS;MKPK HI;MKPK NH;"                Searches for highest peaks
                                                    of trace.
50 OUTPUT 718;"MKF?;"                              Finds frequency difference
                                                    between peaks.
60 ENTER 718;Freq                                  Puts the spectrum analyzer
                                                    response in the computer
                                                    variable, Freq.
70 IF Freq <> 0 THEN                               Outputs results if marker
                                                    amplitude was not 0.
80 PRINT "PEAK FOUND"
90 ELSE                                            Prints "NO PEAKS FOUND"
                                                    if Freq = 0.
100 PRINT "NO PEAKS FOUND"
110 END IF
120 END
```

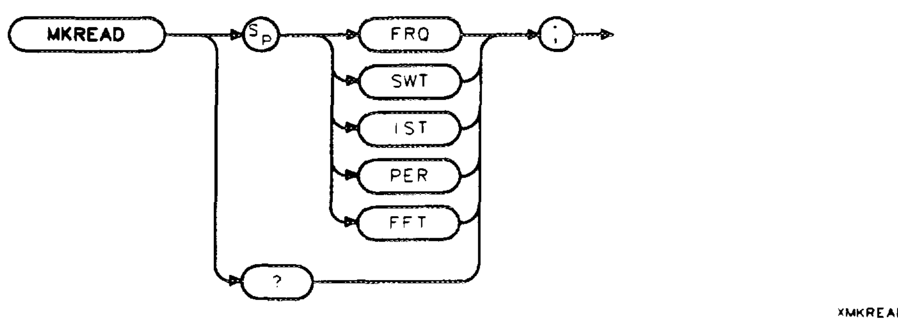
## Query Response



# MKREAD
# Marker Readout

Selects the type of active trace information displayed by the spectrum analyzer marker readout.

## Syntax




Equivalent Softkey: **MK READ F T I P** provides the marker readouts in the frequency, sweep time, inverse sweep time, and period. The fast Fourier transform readout is not available with the softkey, however.
Related Commands: FFT, MKF, MKTYPE.

## Example

```
OUTPUT 718;"MKREAD FFT;"
```

## Description

The MKREAD command can select the following types of active trace information:

**FRQ**: frequency.

**SWT**: sweep time.

**IST**: inverse sweep time.

**PER**: period.

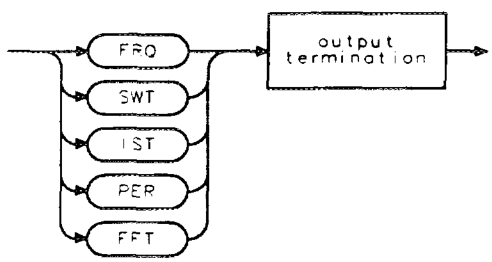
**FFT**: fast Fourier transform readout.

The results of the data depend on the MKREAD parameter, the frequency span, and if the marker delta function is used.

### MKREAD Marker Readout

| MKREAD Type | Non-Zero Span | Non-Zero Span Delta | Zero Span | Zero Span Delta |
|---|---|---|---|---|
| FRQ | Reads frequency | Reads delta frequency | Reads time | Reads delta time |
| SWT | Reads time since the start of sweep | Reads delta time between end points | Waveform measurements of detected modulation | Waveform measurements of detected modulation |
| IST | N/A | N/A | N/A | Computes frequency corresponding to delta of markers. Performs $1/(T_1 - T_2)$ |
| PER | Period of frequency | (Pulse measurement) delta time | N/A | N/A |
| FFT | N/A | N/A | Reads frequency corresponding the to FFT bucket | Reads delta frequency corresponding to delta FFT bucket |

## Query Response




QMKREAD

# MKRL
# Marker to Reference Level

Sets the reference level to the amplitude value of the active marker.

## Syntax


XMKRL

Equivalent Softkey: **MARKER -> REF LVL** .
Related Commands: MKOFF, RL.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;"` | *Initializes spectrum analyzer, changes center frequency and span.* |
| `20 OUTPUT 718;"TS;MKPK HI;MKRL;TS;"` | *Places a marker on trace peak, sets the reference level to the amplitude of the active marker, updates the sweep.* |
| `30 OUTPUT 718;"RL?;"` | *Gets the reference level.* |
| `40 ENTER 718 USING "K";Ref_level` | *Puts the spectrum analyzer response in the computer variable, Ref_level.* |
| `50 OUTPUT 718;"AUNITS?;"` | *Gets the current amplitude units.* |
| `60 ENTER 718;Aunits$` | |
| `50 PRINT "REFERENCE LEVEL IS",Ref_level,Aunits$` | |
| `60 END` | |

# MKSP
# Marker to Span

Sets the start and stop frequencies to the values of the delta markers.

## Syntax


XMKSP

Equivalent Softkey: **MKR Δ -> SPAN**.

Related Commands: MKD, SP.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"MKMIN;"` | *Places a marker at the minimum amplitude of trace.* |
| `30 OUTPUT 718;"MKD;"` | *Activates marker delta.* |
| `40 OUTPUT 718;"MKPK HI;"` | *Places marker at highest amplitude of trace.* |
| `50 OUTPUT 718;"MKSP;"` | *Changes span to the values of the left and right markers.* |
| `60 END` | |

## Description

The left marker specifies start frequency, and the right marker specifies stop frequency. If MKD is off, no operation is performed.

# MKSS
# Marker to Step Size

Sets the center-frequency step-size to the marker frequency.

## Syntax

XMKSS

Equivalent Softkey: **MARKER -> CF STEP** .

Related Commands: CF, MKA, MKCF, MKD, MKF, SS.

## Example

This example measures a harmonic of the CAL OUT signal.

| | |
|---|---|
| `10 DISP "CONNECT THE CAL OUT TO THE INPUT"` | |
| `20 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes spectrum analyzer, activates single-sweep mode, changes center frequency and span, updates trace.* |
| `30 OUTPUT 718;"MKPK HI;MKSS;MKD;CF UP;TS;MKPK HI;"` | *Places the marker on the highest point of the trace, changes the step size to the marker frequency, activates marker delta, increase center frequency, update trace, places the marker at highest point of the trace.* |
| `40 OUTPUT 718;"MKA?;"` | *Gets the amplitude of the marker.* |
| `50 ENTER 718;Delta_amp` | *Puts the spectrum analyzer response in the computer variable, Delta_Amp.* |
| `60 OUTPUT 718;"MKF?;"` | *Gets the frequency of the marker.* |
| `70 ENTER 718;Delta_freq` | *Puts the spectrum analyzer response in the computer variable, Delta_freq.* |

```
80 PRINT "DIFFERENCE IN AMPLITUDE IS ",Delta_amp,"dB"
90 PRINT "DIFFERENCE IN FREQUENCY IS ",Delta_freq,"Hz"
100 END
```

## Description

Sets the center-frequency step-size equal to the marker frequency. If in the delta mode, the step size is set to the delta frequency (absolute value).

# MKSTOP
# Marker Stop

Stops the sweep at the active marker.

## Syntax


MKSTOP

Related Commands: MKCONT.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

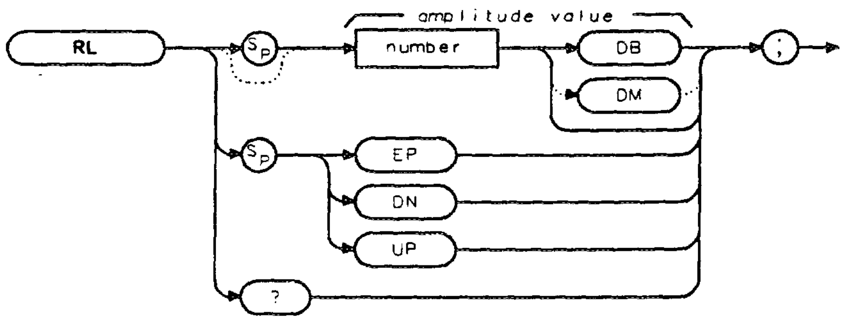
## Example

```
10 OUTPUT 718;"IP;TS;"          Initializes spectrum analyzer.
20 OUTPUT 718;"MKPK HI;"        Creates an active marker.
30 OUTPUT 718;"MKSTOP;"         Stops sweep at marker.
40 OUTPUT 718;"MKCONT;"         Resumes sweep.
50 END
```

# RL
# Reference Level

Specifies the amplitude value of the reference level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is the current amplitude unit. | Amplitude range of the spectrum analyzer. |

Equivalent Softkey: REF LVL .
Preset State: 0 dBm.
Step Increment: by 10 dBm.
Related Commands: AT, MKRL, ML, RESETRL, RLPOS.

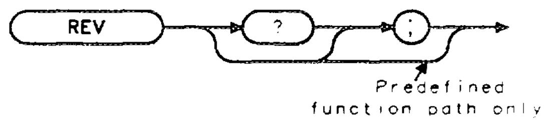
## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;" | *Initializes spectrum analyzer, activates single-sweep mode, changes center frequency, span.* |
| 20 OUTPUT 718;"TS;MKPK HI;MKRL;TS;" | *Takes sweep, places marker on signal peak, sets reference level to marker level.* |
| 30 OUTPUT 718;"RL?;" | *Queries reference level.* |
| 40 ENTER 718;Ref_level | *Puts the spectrum analyzer response in the computer variable, Ref_level.* |
| 50 PRINT "REFERENCE LEVEL IS",Ref_level,"DM" | |
| 60 END | |

# REV
# Revision

Returns the date code of the firmware revision date in YYMMDD format (for example, 860910 indicates 10 September 1986).

## Syntax




xREV

Equivalent Softkey: SHOW OPTIONS displays the firmware revision date.

Related Commands: ID, SER, TIMEDATE.

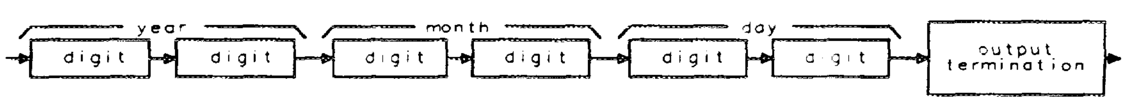
## Example

| | |
|---|---|
| `OUTPUT 718;"REV;"` | *Gets the firmware revision date of spectrum analyzer.* |
| `ENTER 718;A` | *Puts the spectrum analyzer response in the computer variable, A.* |
| `DISP A` | *Displays the firmware revision date on the computer screen.* |

## Description

The date of the firmware revision also appears when the instrument is first turned on, but it is displayed in the day, month, year format.

## Query Response




QREV

# RETURN
## Return

Stops the operation of a user-defined command and returns program operation to the point where the user-defined function was called.

### Syntax


XRETURN

Related Commands: ABORT, FUNCDEF, IF (IF/THEN/ELSE/ENDIF), REPEAT (REPEAT/UNTIL).

### Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"CLRDSP;"` | *Clears graphics from memory.* |
| `30 OUTPUT 718;"TRDSP TRA,OFF;"` | *Turns off trace A.* |
| `40 OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Blanks annotation and graticule.* |
| `50 OUTPUT 718;"VARDEF C_OUNT,0;"` | *Defines variable with the initial value of 0.* |
| `60 OUTPUT 718;"FUNCDEF D_LP,@";` | *Declares a user-defined function.* |
| `70 OUTPUT 718;"REPEAT;";` | *Begins repeat loop.* |
| `80 OUTPUT 718;"ADD C_OUNT,C_OUNT,100;";` | *Add 100 to C_OUNT.* |
| `90 OUTPUT 718;"PU;PA 100,100;PD;";` | |
| `100 OUTPUT 718;"DSPLY C_OUNT,4.0;";` | *Writes value of C_OUNT.* |
| `110 OUTPUT 718;"IF C_OUNT,EQ,300 THEN;RETURN;ENDIF;";` | *Executes return when C_OUNT is equal to 300.* |
| `120 OUTPUT 718;"UNTIL C_OUNT,EQ,400;";` | |
| `130 OUTPUT 718;"@;"` | *Marks end of D_LP.* |
| `140 !` | *Defines second user-defined* |
| `150 OUTPUT 718;"FUNCDEF S_HELL,@";` | *function called S_HELL.* |
| `160 OUTPUT 718;"CLRDSP;MOV C_OUNT,0;";` | *Reinitializes C_OUNT.* |
| `170 OUTPUT 718;"D_LP;TEXT!INSIDE S_HELL...!;@";` | *Executes D_LP and writes text on screen.* |
| `180 OUTPUT 718;"S_HELL;"` | *This line executes the S_HELL program, which in turn executes the program called D_LP.* |
| `190 END` | |

### Description

The example contains a user-defined function, called D_LP, nested within another function, called S_HELL. The innermost function, D_LP, contains RETURN. When RETURN is encountered, the D_LP operation is interrupted, then program operation resumes at the first spectrum analyzer command following the function call of D_LP in line 170.

# RESETRL
# Reset Reference Level

Resets the reference level to its instrument preset level.

## Syntax


XRESETRL

Related Commands: AUNITS, IP, ML, RL, RLPOS.

## Example

```
OUTPUT 718;"RESETRL;"
```

## Example

The following program lowers any off-screen signal.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;MKPK HI;"` | *Activates single-sweep mode, takes sweep, places marker on signal peak.* |
| `30 OUTPUT 718;"IF MA,GT,RL THEN;"` | *Performs lines 40, 50 and 60 if the marker amplitude is greater than the reference level.* |
| `40   OUTPUT 718;"REPEAT;"` | *Increases reference level, takes sweep, places* |
| `50     OUTPUT 718;"RL UP;TS;MKPK HI;"` | *marker on signal peak.* |
| `60   OUTPUT 718;"UNTIL MA,LE,RL;"` | *Does line 40 until peak amplitude is less than or equal to the reference level.* |
| `70 OUTPUT 718;"ENDIF;"` | *Ends the IF THEN construct.* |
| `80 OUTPUT 718;"CONTS;"` | |
| `70 END` | |

## Description

All commands following the REPEAT command are executed until the comparison specified after the UNTIL command is true.

The following are used for comparing the operands:

**GT** Greater than

**LT** Less than

**LE** Less than or equal to

**GE** Greater than or equal to

**EQ** Equal to

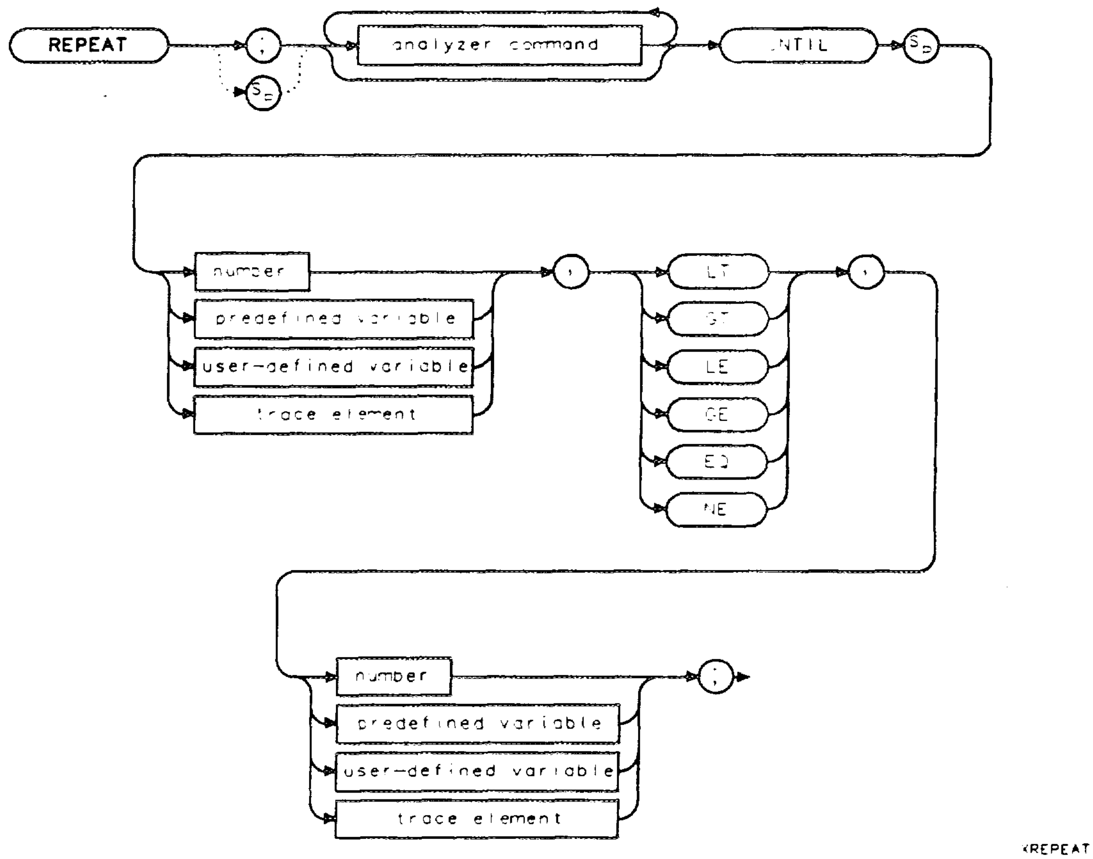
**NE** Not equal to

When used within a downloadable program (DLP), the number of REPEAT UNTIL statements that can be nested is limited to 20.

# REPEAT UNTIL
# Repeat Until

The REPEAT and UNTIL commands form a looping construct.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Analyzer command | Any valid complete spectrum analyzer command. | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Number | Any real or integer number. | Real number range. |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: FUNCDEF when using a user-defined function. ACTDEF or VARDEF when using a user-defined variable.
Related Commands: ABORT, IF (IF/THEN/ELSE/ENDIF).

# RELHPIB
# Release HP-IB

Releases spectrum analyzer control of the HP-IB.

## Syntax


XRELHPIB

Option Required: Option 021.
Related Commands: ENTER, OUTPUT.

## Example

OUTPUT 718;"RELHPIB;" *The spectrum analyzer releases control of HP-IB so that another device can control the bus.*

## Description

The RELHPIB command causes the device that is acting as the controller on the HP-IB (for example, the spectrum analyzer) to relinquish control of the bus.

## Description

The state and trace data are recalled when the trace destination is trace A, trace B, or trace C. When using a user-defined trace or a trace range for the trace destination, only the trace data is recalled.

When recalling frequency-amplitude correction data, you need to specify AMPCOR as the destination. When recalling limit line table data, specify LIMILINE as the destination.

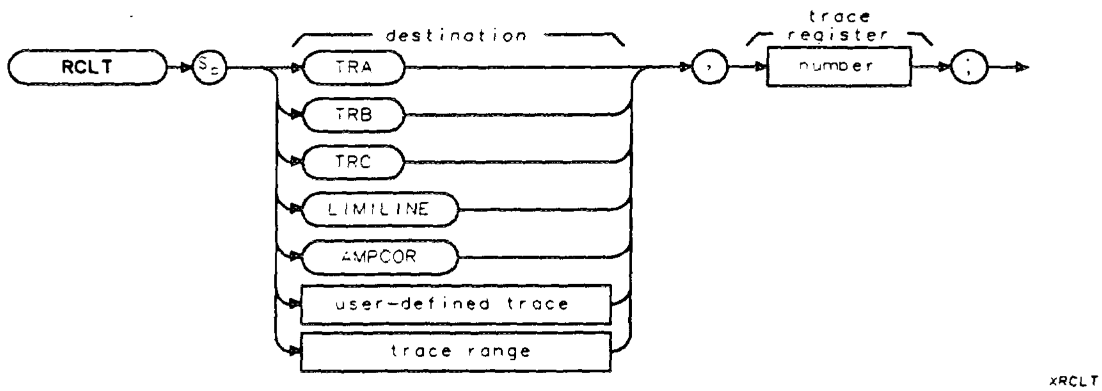
To avoid overwriting the recalled trace data, the VIEW command should be performed immediately after the RCLT command when recalling trace data (see line 40 in the example).

**Note** The RCLT recalls trace data from spectrum analyzer memory. See "LOAD" or "SAVRCLN" to recall trace data from the memory card.

# RCLT
# Recall Trace

Recalls previously saved trace data, amplitude factors, or limit-line data from the specified trace register in spectrum analyzer memory. Trace data is recalled with instrument state, date, and screen title.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 0 to TRCMEM − 1. |

Equivalent Softkey: The RCLT command and the VIEW commands are equivalent to **Internal -> Trace**.
Parameter Value: 0 to TRCMEM − 1.
Prerequisite Commands: TRDEF when using a user-defined trace.
Related Commands: CAT, CLRW, LOAD, SAVET, SNGLS, TRCMEM, TS, VIEW.

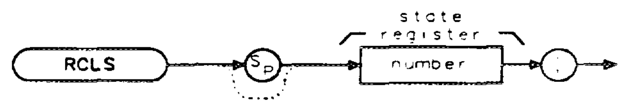
## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes spectrum analyzer, changes the center frequency and span.* |
| `20 OUTPUT 718;"SAVET TRA,1;"` | *Saves spectrum analyzer state and trace A data in register 1.* |
| `30 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `40 OUTPUT 718;"RCLT TRA,1;VIEW TRA;"` | *Recalls spectrum analyzer state, trace data; displays the result.* |
| `50 END` | |

# RCLS
# Recall State

Recalls spectrum analyzer state data from the specified state register in spectrum analyzer memory.

## Syntax




XRCLS

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 1 to 9 |

Equivalent Softkey: `INTERNAL -> STATE`.

Related Commands: LOAD, POWERON, RCLT, SAVES.

## Example

```
OUTPUT 718;"IP;CF 300MHZ;SP 1MHZ;"    Changes center frequency, span.
OUTPUT 718;"SAVES 3;"                 Saves state in register 3.
OUTPUT 718;"IP;"
OUTPUT 718;"RCLS 3;"                  Recalls the contents of register 3.
```

## Description

You can specify a state register number from one to nine. Registers one through eight are reserved for your use. Registers one through eight contain instrument state information if instrument state information has been stored in it with the SAVES command. State register nine contains the previous state data.

**Note** The RCLS recalls state data from spectrum analyzer memory. See "LOAD" or "SAVRCLN" to recall state data from the memory card.

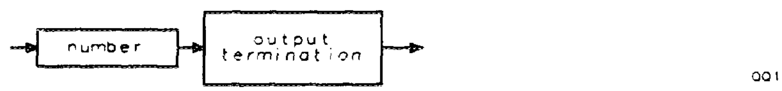
## Description

The coupling between sweep time and resolution bandwidth is terminated by this command. Execute RB AUTO to reestablish coupling. (Also see "AUTO.")

The 200 Hz, 9 kHz, and 120 kHz 6-dB resolution bandwidths (used for EMI testing) are available by specifying 200 Hz (for spectrum analyzers with Option 130 installed), 9 kHz, or 120 kHz as the frequency value; the front-panel knob, step increment keys, and auto-coupled settings provide the 1, 3, 10 resolution bandwidth sequence only. Frequencies are rounded to the nearest value in the 1, 3, 10 sequence if the frequency is other than 9 kHz, 120 kHz, 5 MHz, or in the 1, 3, 10 sequence.

The spectrum analyzer provides uncalibrated bandwidths of 300 Hz (10 Hz if the spectrum analyzer has Option 130 installed in it) and 5 MHz.

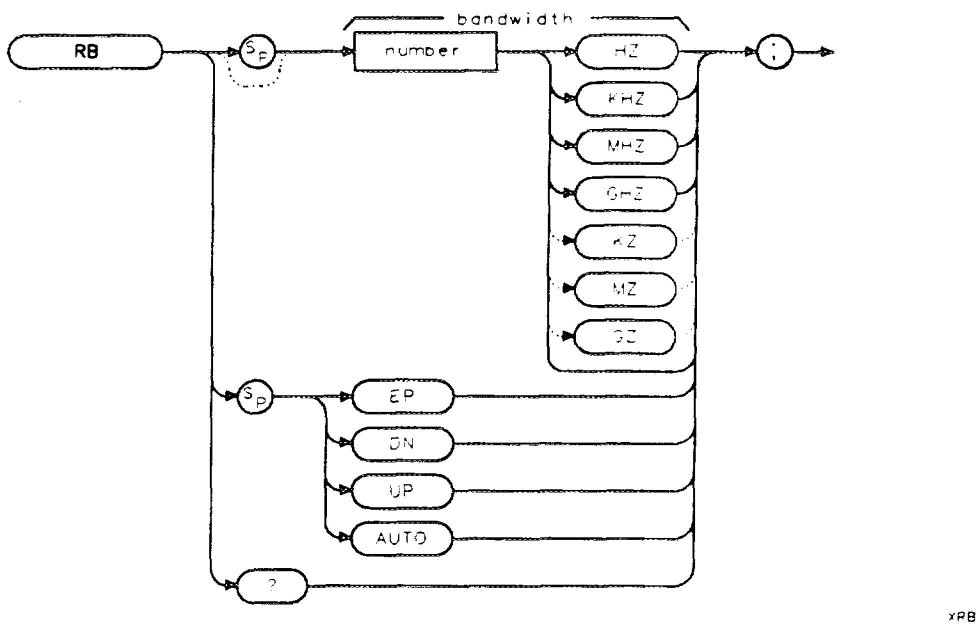
## Query Response



# RB
# Resolution Bandwidth

Specifies the resolution bandwidth.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | If Option 130 is installed, 30 Hz to 3 MHz, otherwise 1 kHz to 3 MHz. |

Equivalent Softkey: **RES BW AUTO MAN**.
Preset State: 3 MHz.
Step Increment: In a 1, 3, 10.
Related Commands: AUTO, SP, ST, VB, VBR.

## Example

`OUTPUT 718;"RB 1KHZ;"` *Sets the resolution bandwidth to 1 kHz.*

# PWRUPTIME
# Power Up Time

Returns the number of milliseconds that have elapsed since the spectrum analyzer was turned on.

## Syntax


## Example

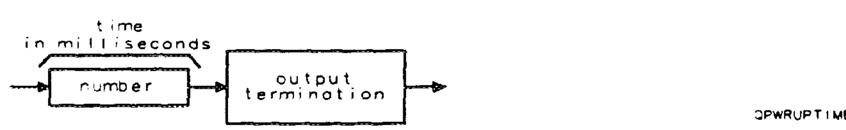
```
OUTPUT 718;"PWRUPTIME;"
ENTER 718;A
A = A/1000
PRINT "Minutes elapsed ",A/60
```

| | |
|---|---|
| `OUTPUT 718;"PWRUPTIME;"` | *Executes PWRUPTIME.* |
| `ENTER 718;A` | *Places the result of PWRUPTIME into A.* |
| `A = A/1000` | *Changes the milliseconds to seconds.* |
| `PRINT "Minutes elapsed ",A/60` | *Prints the number of minutes that have elapsed since the spectrum analyzer was turned on.* |

## Description

PWRUPTIME can count the number of milliseconds for up to $2^{32}$ milliseconds ($2^{32}$ milliseconds is equivalent to 49.7 days). If the spectrum analyzer is left on for more than 49.7 days, PWRUPTIME is reset to 0 and restarts the count.

## Query Response



## Example

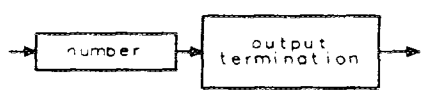
| | |
|---|---|
| `DISP "CONNECT CAL OUT TO INPUT"` | *Displays a user prompt.* |
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `OUTPUT 718;"CF 300MHZ;SP 1MHZ;RB 300KHZ;"` | *Changes center frequency, span, and bandwidth.* |
| `OUTPUT 718;"MXMH TRA;TS;TS;TS;TS;"` | *Activates the maximum hold of trace A, sweep 4 times.* |
| `OUTPUT 718;"PWRBW TRA, 99.0;"` | *Returns the 99% power bandwidth.* |
| `ENTER 718;P` | *Gets the result from the spectrum analyzer.* |
| `DISP "THE POWER BANDWIDTH AT 99 PERCENT IS";P/1.0E+3;"kHz"` | *Displays the frequency of the power bandwidth specified on the computer screen.* |

## Description

If trace A is the source, a delta marker is set at the start and stop frequencies.

If 100% is specified, the power bandwidth equals the frequency range of the screen display. If 50% is specified, trace elements are eliminated from either end of the array, until the combined power of the remaining signal responses equals half of the original power computed. The frequency span of these remaining trace elements is the power bandwidth returned.

## Query Response

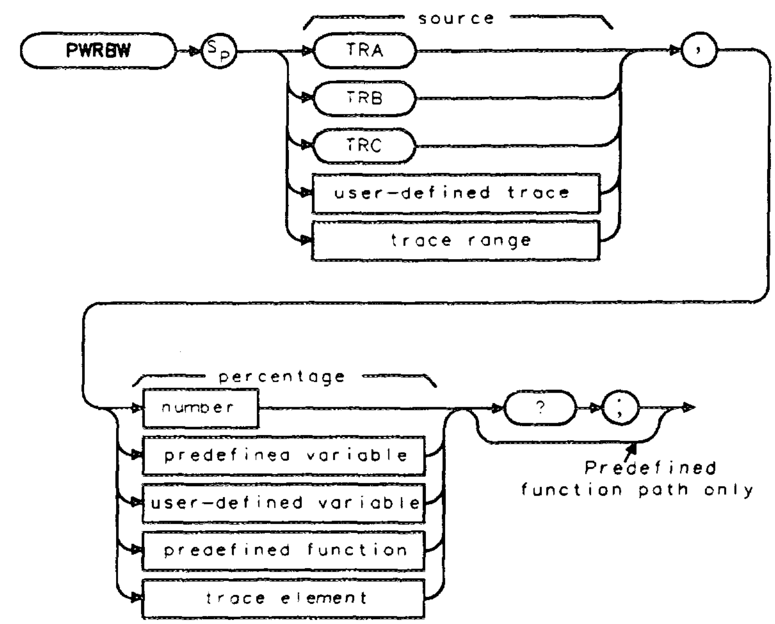



001

# PWRBW
# Power Bandwidth

Computes the bandwidth around the trace center, which includes signals whose total power is a specified percentage of the total trace signal power.

## Syntax




*PWRBW

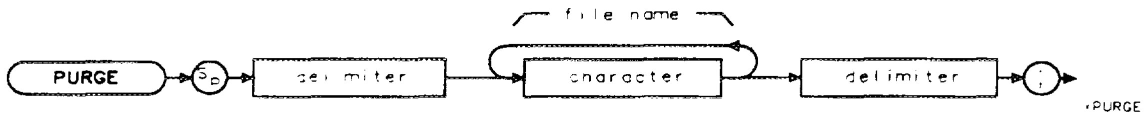
| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | 0 to 100. |

Parameter Values: The field used for the percentage must use a value between 0 and 100.
Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: RB, SP.

# PURGE
# Purge File

Deletes the specified file from the current mass storage device.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. | Any valid filename. |

Related Commands: MSI.

## Example

| | |
|---|---|
| `OUTPUT 718;"MSI CARD;"` | *Selects the memory card as the mass storage device.* |
| `OUTPUT 718;"PURGE %dMYFILE%;"` | *Deletes the file called "dMYFILE" from the memory card.* |

## Description

Use the MSI command to select the mass storage device (either the spectrum analyzer memory or a memory card) before using the PURGE command. When deleting a file from a RAM card, the RAM card files are repacked automatically after a PURGE command is executed.

# PU
# Pen Up

Instructs the spectrum analyzer not to plot vectors on the spectrum analyzer screen until a PD command is received.

## Syntax


xPU

Related Commands: DSPLY, PA, PD, PLOT, PR, TEXT.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;BLANK TRA;"` | *Initializes spectrum analyzer, blanks trace A.* |
| `OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Turns off annotation, graticule.* |
| `OUTPUT 718;"PU;"` | *Prevents initial vector from being drawn.* |
| `OUTPUT 718;"PA 100,100;PD 100,150;"` | *Positions pen, pen down.* |
| `OUTPUT 718;"150,150,150,100,100,100;"` | *Draws remaining 3 sides of rectangle.* |

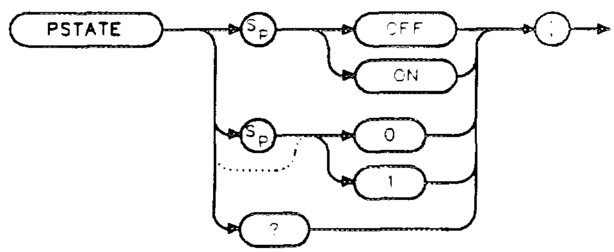
## Description

The PU command is used before the commands PA (plot absolute), or PR (plot relative), to suppress drawing while moving to the starting point of a vector. It remains in effect until a PD command is received.

# PSTATE
# Protect State

Protects all of the spectrum analyzer's user state and trace registers from being changed.

## Syntax



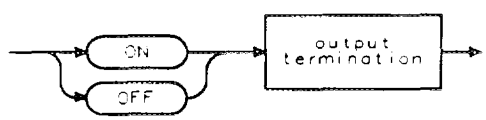

XPSTATE

Equivalent Softkey: **SAV LOCK ON OFF**.
Related Commands: ERASE, RCLS, SAVES.

## Example

```
OUTPUT 718;"PSTATE ON;"
```

## Query Response

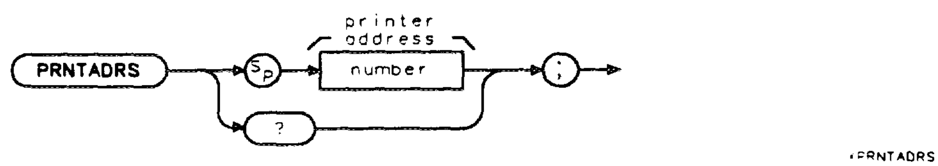



002

# PRNTADRS
# Print Address

Allows you to set the HP-IB address of the printer.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 0 to 30 |

Equivalent Softkey: `PRINTER ADDRESS` .

Option Required: Option 021.

## Example

```
10 OUTPUT 718;"VARDEF L_OC,1;MOV L_OC,12;"
```
*Defines a variable called L_OC, and then moves 12 into L_OC.*

```
20 OUTPUT 718;"PRNTADRS 1;"
```
*Sets the HP-IB address of the printer to 1.*

```
:
```
*You can insert programming commands here.*

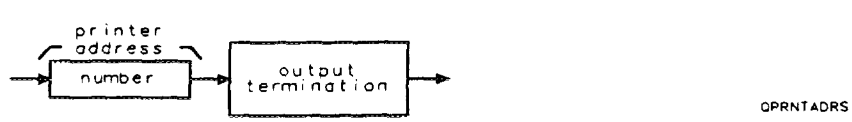
```
300 OUTPUT 718;"OUTPUT PRNTADRS,F3.0,L_OC;"
```
*You could use this statement within a DLP. This statement outputs the number 12 to the printer.*

## Description

You may find it useful to assign PRNTADRS near the beginning of your program, and, from then on, refer to the printer address in your program as PRNTADRS. The advantage of using PRNTADRS in this way is that if you need to change the printer address, you need only change the programming line that assigns the printer address to PRNTADRS (see line 20 of the programming example).

## Query Response

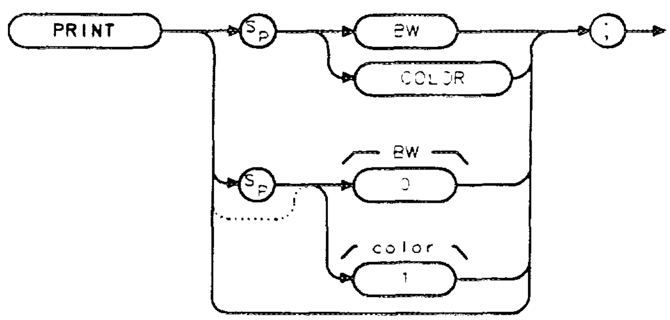
PRNTADRS? returns the current HP-IB address of the printer.



# PRINT
# Print

Initiates a output of the screen data to the remote interface. With appropriate HP-IB commands, the HP-IB can be configured to route the data to an external printer.

## Syntax




IPRINT

Related Commands: GETPRNT, PLOT.

## Example for the HP-IB Interface

The printer usually resides at address 1 and the plotter at address 5. (The program is only valid for HP 9000 Series 200 and 300 computers and HP Vectra personal computer with an HP raster graphics printer, such as the HP Thinkjet.)

This example illustrates how an external controller can initiate the sending of print data to an external printer.

```
OUTPUT 718;"PRINT;"
SEND 7;UNT UNL LISTEN 1 TALK 18 DATA
```
*Sends data to printer.*

**Note**

To print without disconnecting the computer, you must execute the following BASIC commands:

```
ABORT 7
LOCAL 7
```

Then press (COPY).

## Description

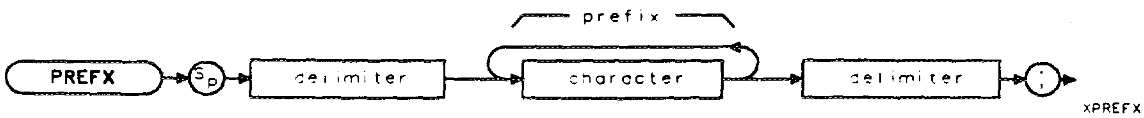
The data is output in HP raster graphics format. PRINT, PRINT 0, or PRINT BW produces a monochrome printout. PRINT 1 and PRINT COLOR produces a "color format" output for an HP PaintJet printer. Execute "MENU 0;" before printing to blank the softkeys.

The PRINT command should not be used within a DLP; you should use the GETPRNT command instead.

# PREFX
# Prefix

Specifies or changes the prefix used in save and recall operations.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | 0 to 6 characters long, A through Z and the underscore (the underscore cannot be the first character of the prefix). |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Equivalent Softkey: **Change Prefix**.
Related Commands: CAT, SAVRCLN, STOR.

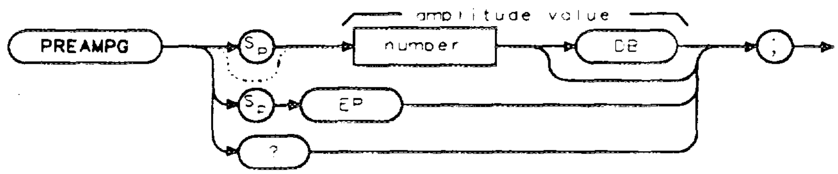
## Example

```
OUTPUT 718;"PREFX %DAVE%;"
```

# PREAMPG
# External Preamplifier Gain

Subtracts a positive or negative preamplifier gain value from the displayed signal.

## Syntax




XPREAMPG

## Example

```
OUTPUT 718;"PREAMPG 10DB;"
```

## Description

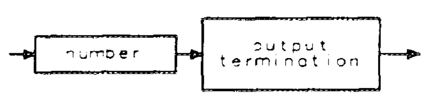
Unlike using ROFFSET, PREAMPG can change the attenuation depending on the preamplifier gain entered.

A preamplifier gain offset is used for measurements that require an external preamplifier or long cables. The offset is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the input of the preamplifier or long cable. The preamplifier gain offset is displayed at the top of the screen and is removed by entering zero.

**Note** PREAMPG is not reset to 0 by an instrument preset (IP). Be sure to execute "PREAMPG 0;" when the preamplifier gain is no longer needed.

Press **CAL STORE** if you want the spectrum analyzer to use the current preamplifier gain offset when power is turned on. Preamplifier gain offset is set to zero by **DEFAULT CONFIG**.

## Query Response

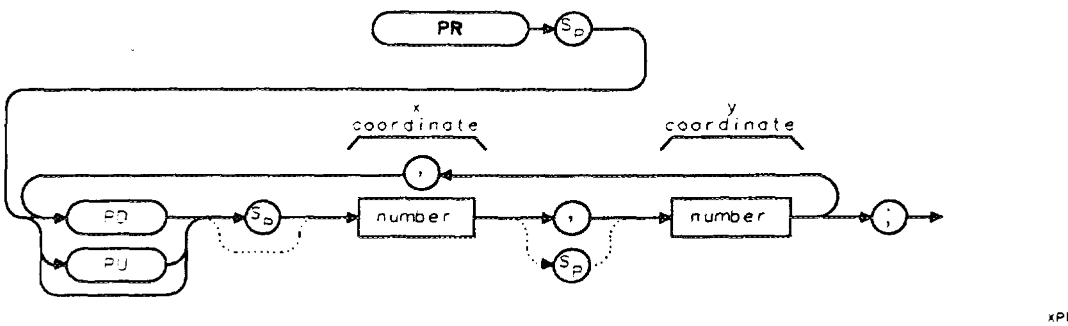



001

# PR
# Plot Relative

Moves the pen to a new plot location on the spectrum analyzer screen relative to the current coordinates in display units.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | Dependent on the current pen position. |

Related Commands: DSPLY, PA, PLOT, PRINT, PU, TEXT.

## Example

```
OUTPUT 718;"IP;"                                    Initializes spectrum analyzer.
OUTPUT 718;"BLANK TRA;ANNOT OFF;"                   Clears the display.
OUTPUT 718;"GRAT OFF;"                              Turns off graticule.
OUTPUT 718;"PU;PA 0,100;"                           Positions pen.
OUTPUT 718;"PD;PR 100,0,0,-100,-100,0,0,100;"       Draws a rectangle.
```

## Description

Vector coordinate sets (x,y pairs) following the PR command can be either positive or negative, depending on the direction of the individual vectors to be drawn. PU (pen up) and PD (pen down) commands tell the spectrum analyzer to draw or not draw the vectors on the screen. (See "PU" and "PD.")

Display units are the scaling units of the spectrum analyzer display for on screen graphics commands such as PA or PR. See "PA" for more information about display units.

The coordinates of the lower left screen corner of the screen are −40,−22 and the upper right screen corner of the screen are 471,233. For the graticule area, the coordinates of the lower left corner of the graticule are 0,0 and the coordinates of the upper right graticule area are 400,200. For example, you could execute "PU;PA 0,0;PD;PA 0,200,400,200,400,0,0,0;" to draw a box around the graticule area.

Because PR is an active function, executing PR causes the active function area on the spectrum analyzer screen to blank. To prevent the text following PR from being written in the active function area, execute hold (HD) after PR.

# PP
# Preselector Peak

Peaks the preselector.

## Syntax


Equivalent Softkey: **PRESEL PEAK**.

Restrictions: Not compatible with Analog+ display mode. See "ANLGPLUS" for more information.

Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.

Related Commands: MKA, MKCF, MKD, MKF, MKN, MKPK.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 3GHZ;SP 500KHZ;"` | *Initializes spectrum analyzer, changes center frequency, span.* |
| `OUTPUT 718;"TS;MKPK HI;MKCF;PP;"` | *Peaks the highest on-screen signal.* |

## Description

To use PP, set the desired trace to clear-write mode, place a marker on a desired signal, then execute PP. Commands following PP are not executed until after the spectrum analyzer has finished peaking the preselector.

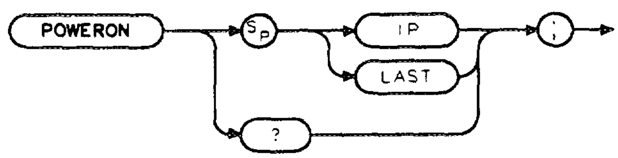
PP automatically adjusts the preselector tracking to peak the signal at the active marker. (When the marker is tuned to a signal and **PRESEL PEAK** is pressed, an internal routine searches for the peak response of the preselector and adjusts the tracking accordingly.) Using preselector peak prior to measuring a signal yields the most accurate amplitude reading.

Preselector peak operates with the **MARKER NORMAL** or **MARKER Δ** markers. If the marker is OFF, pressing **PRESEL PEAK** initiates a peak search routine and then peaks the response at that marker; otherwise, it peaks around the active marker. The `CAL:PEAKING` message appears on the active graticule area to indicate operation of the peaking routine. Preselector peak only operates in the 2.75 to 22 GHz preselector bands.

# POWERON
## Power-On State

Selects the state of the spectrum analyzer when the spectrum analyzer is turned on: the IP state (same state as an instrument preset command) or last state (the state the spectrum analyzer was in when the spectrum analyzer was turned off).

### Syntax




XPOWERON

Equivalent Softkey: **POWER ON IP LAST**.

### Example

```
OUTPUT 718;"POWERON LAST;"
```

### Description

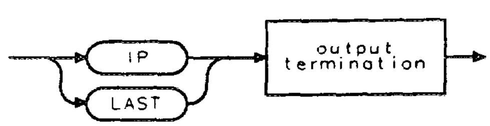
POWERON LAST restores the last state of the spectrum analyzer. Limit line testing is not considered to be a spectrum analyzer state and is not resumed after the spectrum analyzer is turned off. The limit line table will be restored even if the spectrum analyzer is turned off, however.

**Note** The last state of the spectrum analyzer is not retained in the case of battery power failure of the spectrum analyzer's internal battery.

When used as a predefined variable, POWERON returns either a "0" or a "1," depending on the setting of the POWERON parameter. Refer to the following table.

| Parameter Setting | Value Returned |
|---|---|
| IP | 0 |
| LAST | 1 |

### Query Response




QPOWERON

## Description

The PLOT command transfers the trace data, graticule, and annotation of the spectrum analyzer screen to a plotter via the spectrum analyzer interface (softkey labels excluded). The data is transferred in ASCII, HPGL format.

The example routes the data to an external plotter; however, the controller can read the data into a string if desired.

When using the PLOT command, the scaling points (P1x, P1y; P2x, P2y) can be specified. These scaling points specify the (x,y) coordinates, which determine the size of the plot. (P1x,P1y) refers to the lower-left plotter coordinates. (P2x,P2y) refers to the upper-right plotter coordinates.

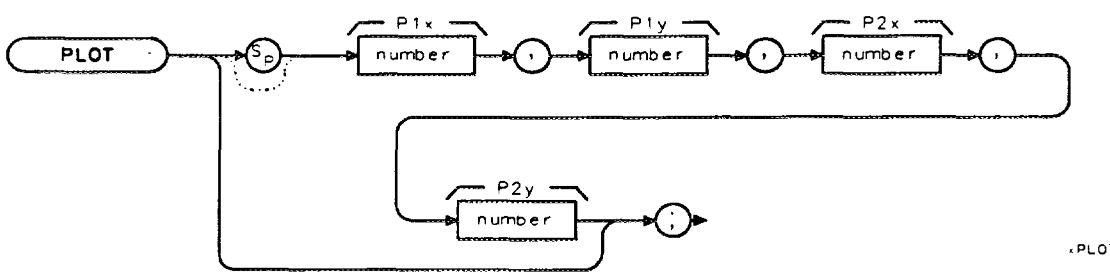
The PLOT command should not be used within a DLP; you should use the GETPLOT command instead.

**Note** The HP 7470A plotter does not support 2 plots per page. If you use an HP 7470A plotter with an HP 8590 Series spectrum analyzer, you can select one plot per page or four plots per page but not 2 plots per page.

# PLOT
# Plot

Initiates a plotter output of the screen data to the remote interface. With the appropriate HP-IB commands, the HP-IB can be configured to route the data to an external plotter.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Number within the plotter coordinates. |

Related Commands: GETPLOT, PRINT, SNGLS, TS.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example for the HP-IB Interface

The plotter is at address 5 and the spectrum analyzer is at address 18 in this example. (The program is only valid for HP 9000 series 200 and 300 computers.)

This example illustrates how an external controller can initiate the sending of print data to an external printer.

| | |
|---|---|
| `10 DIM P$[80]` | *Allocates room in memory.* |
| `20 OUTPUT 705;"OP;"` | *Plotter outputs lower-left and upper-right display dimensions.* |
| `30 ENTER 705;P$` | *Puts the plotter response in the computer string.* |
| `40 OUTPUT 718;"PLOT";P$` | *Plots the spectrum analyzer display according to the dimensions stored in the computer string.* |
| `50 SEND 7;LISTEN 5 TALK 18 DATA` | *Configures the interface to output data from spectrum analyzer to plotter.* |
| `60 END` | |

## Description

PKZOOM finds the highest displayed signal and narrows the frequency span to the specified value. PKZOOM ignores the spectrum analyzer's local oscillator (LO) feedthrough signal. PKZOOM sets the reference level to the signal's amplitude, sets the center frequency step size to the signal's frequency, and if the signal is within a preselected band, performs the preselector peak routine (HP 8592D, HP 8593E, HP 8595E, or HP 8596E only). The minimum value for the final frequency span depends on the model of the spectrum analyzer.

| Spectrum Analyzer Model | Frequency Span |
|---|---|
| HP 8590D or HP 8592D | 500 kHz |
| HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E | 10 kHz |
| HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E with Option 130 | 300 Hz |

To be able to find a valid signal, PKZOOM changes the following commands:

| | |
|---|---|
| TH | Sets the threshold to 8 divisions from the top screen. |
| LG | Changes the amplitude scale to logarithmic. |
| MKPX | Sets the peak excursion to 6 dB. |
| VAVG | Sets video averaging to off. |
| AT, RB, VB | Attenuation, resolution bandwidth, and video bandwidth are autocoupled. |
| MKSS | The center frequency step size is set to the marker's frequency. |

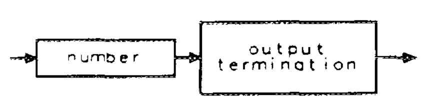
If the local oscillator feedthrough signal is the only signal found, PKZMOK will be set to zero and the PKZOOM routine will end. Otherwise, PKZMOK will be set to one and the routine will continue. For a signal to be found by PKZOOM, the signal must have a peak excursion (rise and fall) by at least 6 dB.

**Note** If the local oscillator feedthrough signal is not found, the PKZOOM routine assumes a valid signal is present.

### Restrictions

Executing PKZOOM turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), and power menu measurements (ACP, ACPE, CHP, and OBW).

## Query Response

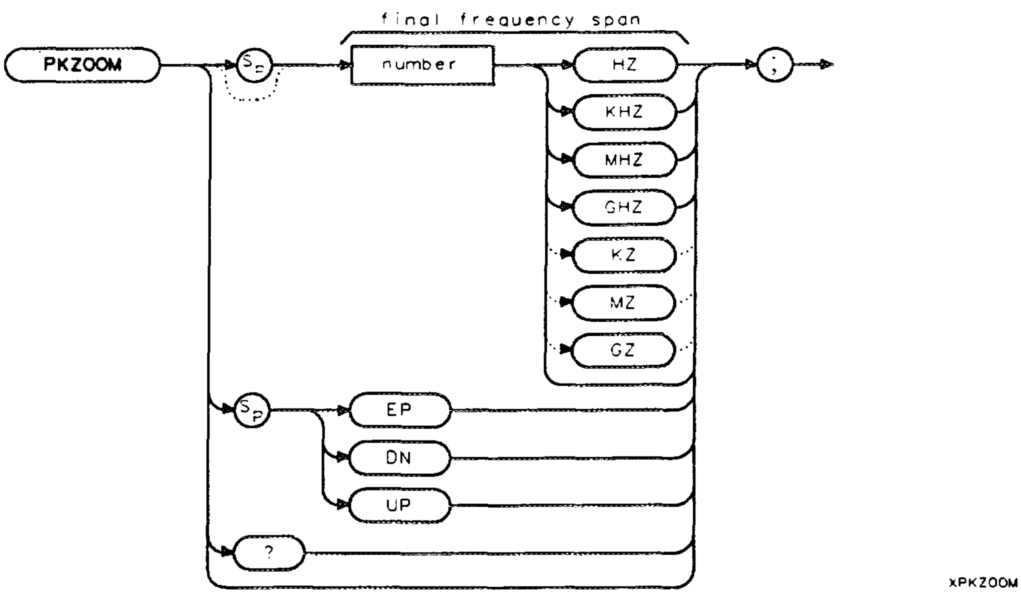



001

# PKZOOM
# Peak Zoom

Automatically tunes the spectrum analyzer to the signal with the highest amplitude level while narrowing the frequency span to the specified frequency span.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Minimum frequency span depends on model, maximum frequency span is 1 GHz. |

Equivalent Softkey: **PEAK ZOOM**.
Preset State: 1 MHz.
Related Commands: PKZMOK.

## Example

```
OUTPUT 718;"PKZOOM 1MHZ;"        Sets the final frequency span to 1 MHz.
OUTPUT 718;"PKZMOK?;"            Queries the value of PKZMOK.
ENTER 718;Peak_zoom_ok
IF Peak_zoom_ok = 0 THEN         If PKZMOK is equal to 0, the PKZOOM routine found
                                 the LO feedthrough.
   PRINT "Found LO feedthrough"
ELSE
:
```

# PKZMOK
# Peak Zoom Okay

Returns a "0" if the peak zoom routine (PKZOOM) found only the spectrum analyzer's local oscillator feedthrough, otherwise a "1" is returned.

## Syntax

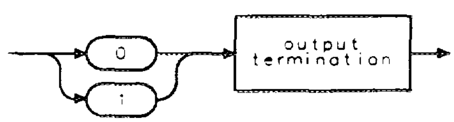

XPKZMOK

Related Commands: PKZOOM.

## Example

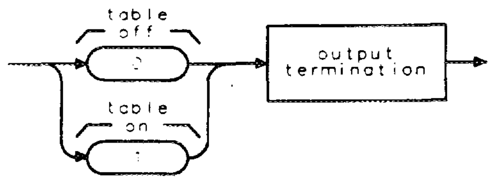
| | |
|---|---|
| `OUTPUT 718;"PKZOOM 1MHZ;"` | *Sets the final frequency span to 1 MHz.* |
| `OUTPUT 718;"PKZMOK?;"` | *Queries the value of PKZMOK.* |
| `ENTER 718;Peak_zoom_ok` | |
| `IF Peak_zoom_ok = 0 THEN` | *If PKZMOK is equal to 0, the PKZOOM routine found the LO feedthrough.* |
| `   PRINT "Found LO feedthrough"` | |
| `ELSE` | |
| `:` | |

## Query Response




QPKZMOK

## Query Response

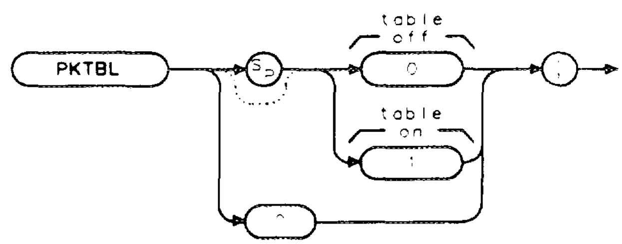



QPKTBL

# PKTBL
# Peak Table

Turns on or off the peak table.

## Syntax




XPKTBL

Equivalent Softkey: PK **TABLE ON OFF**.

Preset State: 0 (Off).

Related Commands: DL, PKRES, PKSORT, PKDLMODE.

## Example

`OUTPUT 718;"MOV PKTBL,1;"` *Turns on the peak table.*

## Description

When the peak table is turned on, the spectrum analyzer screen displays two windows. The upper window displays trace A, with the signal peaks of trace A identified and numbered (the peaks are numbered according to their frequency or amplitude, see "PKSORT" for more information). The lower window displays the peak table. The peak table displays the following information about the on-screen signal peaks: the number of the peak, the frequency of the peak, and the amplitude of the peak. A signal must be equal to or exceed the peak excursion to be considered a peak. (See "MKPX" for more information about the peak excursion.) While the peak table is turned on, the frequency and amplitude of each peak is updated at the end of every sweep (PKTBL command uses the ONEOS command to update the peak table information).

See "PKRES" for information about how to get the information in the peak table remotely.

You can execute the PKTBL command two different ways. You can either execute the PKTBL command directly (for example, "`PKTBL 1;`") or use the MOV command to move the 1 or 0 into the PKTBL command (for example, "`MOV PKTBL,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

**Restrictions**

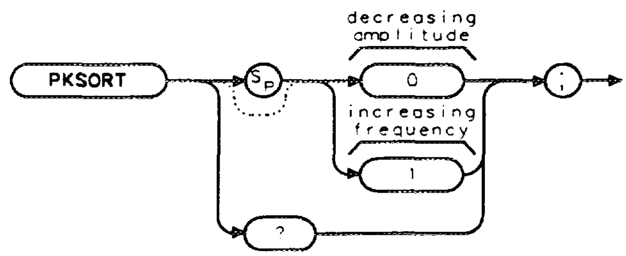
Turning on the peak table turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), percent AM (PCTAM), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW).

You should turn off the peak table (set PKTBL to 0) when you are done with the peak table.

# PKSORT
# Peak Sort

Selects how the signal peaks listed in the peak table are sorted: by decreasing amplitude or by ascending frequency.

## Syntax




XPKSORT

Equivalent Softkey: **PK SORT FRQ AMP** .
Preset State: 0 (sort by decreasing amplitude).
Related Commands: DL, PKSORT, PKTBL.

## Example

```
OUTPUT 718;"MOV PKTBL,1;"     Turns on the peak table.
OUTPUT 718;"MOV PKSORT,0;"    Sorts the peaks by decreasing amplitude.
```

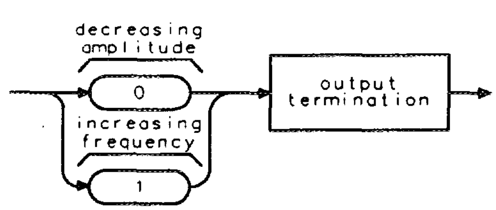
## Description

If PKSORT is set to 0, the spectrum analyzer sorts and displays the list of the peaks according to the amplitude of the peaks (highest amplitude first). If PKSORT is set to 1, the spectrum analyzer sorts and displays the list of the peaks according to frequency (lowest frequency signal peak is listed first).

See "PKRES" for information about how to get the information in the peak table remotely.

You can execute the PKSORT command two different ways. You can either execute the PKSORT command directly (for example, "PKSORT 1;") or use the MOV command to move the 1 or 0 into the PKSORT command (for example, "MOV PKSORT,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response




QPKSORT

## Description

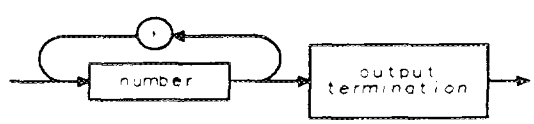
PKRES is an array that contains 10 elements. Each element of the PKRES array contains the $x$-axis coordinate of a signal peak, if a signal peak was found. If a signal peak was not found, the PKRES element contains a 0. The order in which the signal peaks are placed in the PKRES array depends on how the signal peaks were sorted (see "PKSORT" for more information).

You must do the following before using PKRES:

1. Set the trace data format to TDF A, TDF B, TDF I, or TDF M only. You cannot use the TDF P trace data format before PKRES is queried.
2. Use PKSORT to select sorting the signal peaks by amplitude or by frequency.
3. Turn on the peak table with PKTBL.
4. Execute a take sweep (TS) to ensure that valid data is stored in PKRES.

## Query Response

Querying PKRES returns the values of the 10 trace elements, with each value separated by a comma. Querying one element of PKRES (for example, "PKRES [1]?;") returns the value of that element, followed by the output termination.

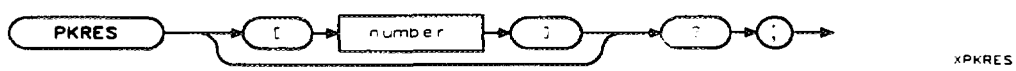



QPKRES

# PKRES
# Peak Result

PKRES returns the $x$-axis coordinates of the peaks in the peak table.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | An integer number. | 1 to 10. |

Related Commands: DL, PKSORT, PKTBL, TDF.

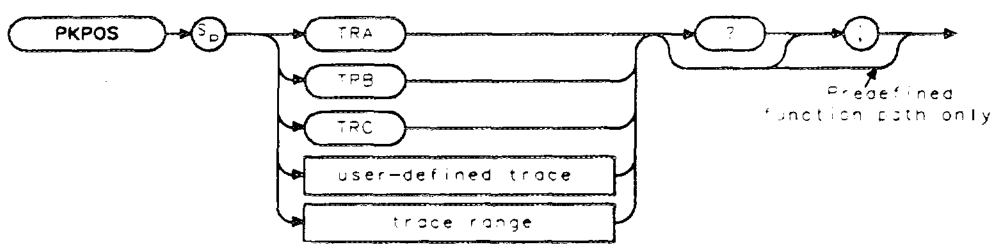
## Example

| | |
|---|---|
| `DIM Results(10)` | *Dimensions an array to hold the results.* |
| `OUTPUT 718;"TDF M;"` | *Changes the trace data format to measurement units.* |
| `OUTPUT 718;"PKSORT 0;"` | *Selects listing the peaks by decreasing amplitude.* |
| `OUTPUT 718;"MOV PKTBL,1;"` | *Turns on the peak table.* |
| `OUTPUT 718;"TS;"` | *Performs a take sweep.* |
| `FOR I=1 TO 10` | *Uses a FOR NEXT loop to get the data from PKRES.* |
| `  OUTPUT 718;"PKRES[";I;"]?"` | *Queries each PKRES element.* |
| `  ENTER 718;Results(I)` | *Enters the PKRES element into the Results element.* |
| `NEXT I` | |
| `OUTPUT 718;"TDF P;"` | *Changes the trace data format to parameter units.* |
| `PRINT "PEAK","FREQUENCY","AMPLITUDE"` | *Prints a heading.* |
| `FOR I=1 TO 10` | *Uses a FOR NEXT loop to print the results.* |
| `  IF Results(I)>0 THEN` | *Results(I) is greater than zero if peak was found.* |
| `    OUTPUT 718;"MKP ";Results(I);";"` | *Places a marker at the x- axis coordinate.* |
| `    OUTPUT 718;"MKF?;"` | *Returns the frequency of the marker.* |
| `    ENTER 718;A` | *Enters the marker's frequency into A.* |
| `    OUTPUT 718;"MKA?;"` | *Returns the amplitude of the marker.* |
| `    ENTER 718;B` | *Enters the marker's amplitude into B.* |
| `    PRINT I,A,B` | *Prints the peak number, frequency, and amplitude.* |
| `  END IF` | *Ends the IF THEN statement.* |
| `NEXT I` | |

# PKPOS
# Peak Position

Returns a value, which is the index of the maximum value in trace A, trace B, trace C, or user-defined trace.

## Syntax




XPKPOS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MINPOS, MXM.

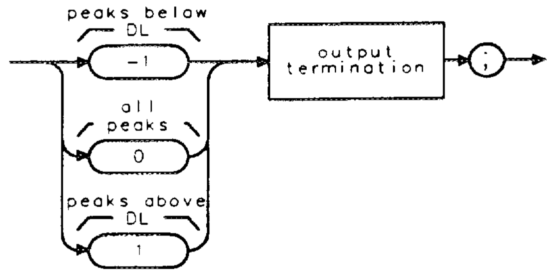
## Example

```
OUTPUT 718;"IP;"              Initializes spectrum analyzer.
OUTPUT 718;"SNGLS;TS;"        Activates single-sweep mode, takes sweep.
OUTPUT 718;"PKPOS TRA;"       Finds the position of the highest peak.
ENTER 718;Pkresult            Outputs result to the computer.
DISP Pkresult                 Displays the result.
```

## Description

If a trace range is used with PKPOS, PKPOS returns a value relative to the first element of the trace range. For example, if a trace has a range of 150 to 300 elements, and the maximum value is element 200, PKPOS will return the value of 51.

## Query Response

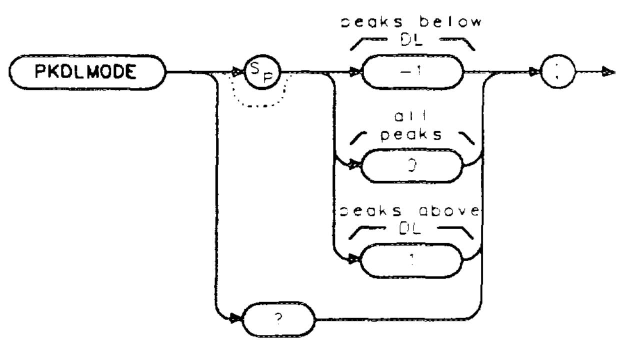



QPKDLMODE

# PKDLMODE
# Peak Table Delta Display Line Mode

Selects the signal peaks that are displayed in the peak table. The signal peaks can be selected as follows: all the signal peaks, only the signal peaks that are above the display line, or only the peaks that are below the display line.

## Syntax




Equivalent Softkey: **PK MODE <>DL NRM**.
Preset State: 0 (display all the signal peaks).
Related Commands: DL, PKSORT, PKTBL.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV PKTBL,1;"` | *Turns on the peak table.* |
| `OUTPUT 718;"DL -20;"` | *Sets the display line.* |
| `OUTPUT 718;"MOV PKDLMODE,1;"` | *Displays the only the signal peaks that are above the display line.* |

## Description

The value of PKDLMODE determines how the signal peaks are displayed. You can set PKDLMODE to the following values:

- If PKDLMODE is set to 0, all signal peaks are displayed and listed.
- If PKDLMODE is set to −1, only the signal peaks below the display line are displayed and listed.
- If PKDLMODE is set to 1, only the signal peaks above the display line are displayed and listed.

You can execute the PKDLMODE command two different ways. You can either execute the PKDLMODE command directly (for example, "PKDLMODE 1;") or use the MOV command to move the 1 or 0 into the PKDLMODE command (for example, "MOV PKDLMODE,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

**PEAKS Peaks**

If the FRQ parameter is used with the PEAKS command, the programming example returns the values that shown in the following table.

| Trace Element | Amplitude | Frequency |
|---|---|---|
| TRB[1] | −28.98 | −3E+8 |
| TRB[2] | −14.02 | 4.E+6 |
| TRB[3] | −28.21 | 3.04E+8 |
| TRB[4] | −42.29 | 6.04E+8 |
| TRB[5] | −32.69 | 9.07+8 |

If the AMP parameter is used with the PEAKS command, the programming example returns the values that are shown in the following table.

| Trace Element | Amplitude | Frequency |
|---|---|---|
| TRB[1] | −13.95 | 4.E+6 |
| TRB[2] | −28.14 | 3.04E+8 |
| TRB[3] | −28.89 | −2.96E+8 |
| TRB[4] | −32.6 | 9.07E+8 |
| TRB[5] | −42.23 | 6.08+8 |

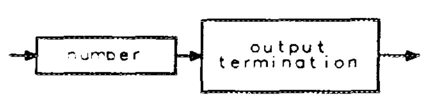
Notice that MKA? and MKF? are used to determine the amplitude and frequency of the peak position.

PEAKS sorts only signals that are above the threshold value. To be classified as a signal peak, a signal must be MKPX above the threshold value and it must rise and fall at least the peak excursion (MKPX value). To change the threshold, use the TH command before PEAKS is executed.

If necessary, the last sorted value is repeated to fill remaining elements of the destination trace.

PEAKS must be used as either a query or as a source in another spectrum analyzer-command function. Form a query by ending the PEAKS statement with a "?." When used as a query, PEAKS returns the number of peaks found. When querying the trace elements of destination trace, the $x$-axis coordinate (relative to the first trace element) of the peak is returned.

## Query Response




QQ1

```
OUTPUT 718;"PEAKS TRB,TRA,FRQ?;"          Returns the number of peaks in
                                          trace A above the threshold.
ENTER 718;Number                          Gets the number of peaks from
                                          the spectrum analyzer.
DISP Number                               Displays the result on the com-
                                          puter screen.
FOR I=1 TO Number                         For one to the number of peaks,
                                          do the following steps.
    OUTPUT 718;"MKP TRB[";I;"]";          Place marker at the position of
                                          the first trace B element.
    OUTPUT 718;"MKA?;"                    Find the amplitude of the marker.
    ENTER 718;A
    OUTPUT 718;"MKF?;"                    Find the frequency of the marker.
    ENTER 718;B
    PRINT A,B                             Print the amplitude and the
                                          frequency of the marker.
NEXT I                                    Repeat the FOR NEXT loop for
                                          all of the peaks that were found.
```

## Description

When sorting by frequency (FRQ), PEAKS first computes the horizontal position of all peaks. These positions are loaded into the destination trace consecutively, with the lowest frequency value occupying the first element. Thus, signal frequencies, from low to high, determine the amplitude of the destination trace from left to right.

When sorting by amplitude (AMP), PEAKS first computes the amplitudes of all peaks in the source trace in measurement units, and sorts these values from high to low. The positions of the peaks are then loaded into the destination trace, with the position of the highest amplitude value occupying the first element.

For example, executing the programming example results in the following spectrum analyzer display:

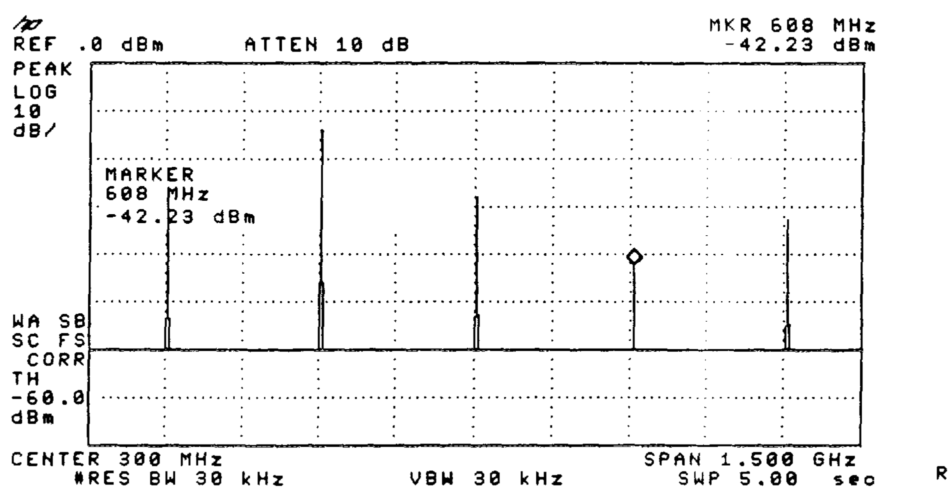
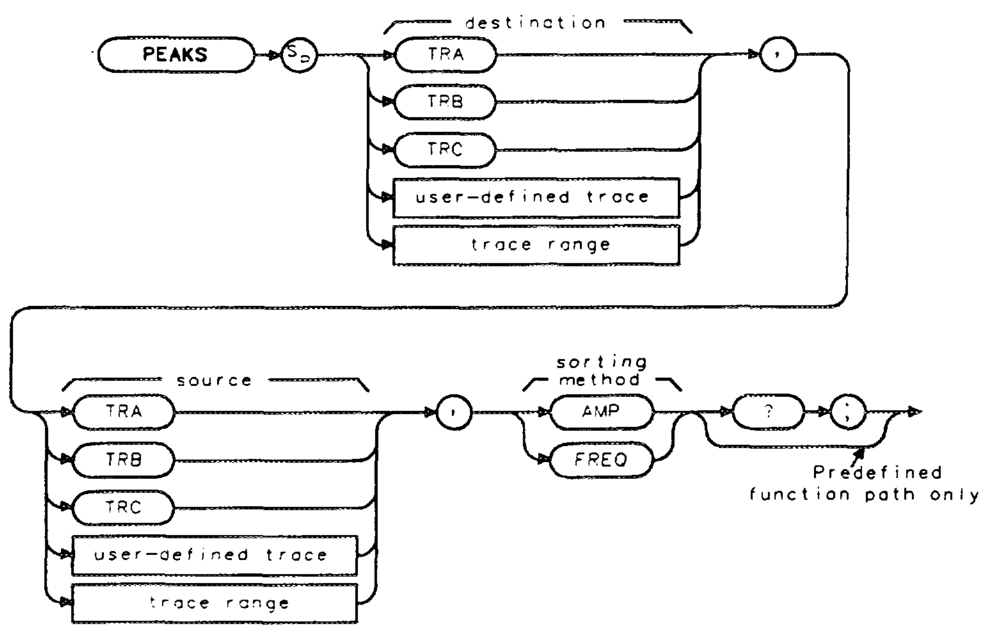



**Figure 5-2. Frequency and Amplitude of the Peaks**

# PEAKS
# Peaks

Sorts signal peaks by frequency or amplitude, stores the results in the destination trace, and returns the number of peaks found.

## Syntax




XPEAKS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MKPX, TH.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"CF 300MHZ;SP 1500MHZ;RB 30KHZ;SNGLS;"` | *Changes the center frequency, span, bandwidth. Activates single-sweep mode.* |
| `OUTPUT 718;"TH -60DM;MKPX 10DB;TS;"` | *Sets up threshold, sets minimum peak excursion.* |

| | |
|---|---|
| `90 FOR I = 1 TO Num_sweeps` | *This finds the maximum number of sweeps that can be taken before numerical overflow (greater than 32,767.)* |
| `100 OUTPUT 718;"TS;PDF TRB,TRA;"` | *When I = Num_sweeps, trace B contains the number of sweep that had amplitudes at or above the threshold level of −50 dBm.* |
| `110 NEXT I` | |
| `120 END` | |

## Description

The TH command permits the user to set an amplitude threshold value. When PDF is performed, measurement buckets of the source trace that exceed the threshold increment the corresponding frequency bucket in the destination trace.

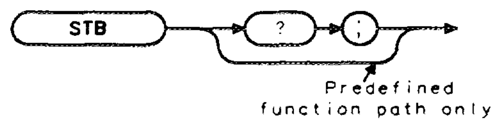
The destination trace should be set to zeros before PDF is executed for the first time. Subsequent calls to PDF increment the destination trace.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination. The PDF function is similar to the probability density function in statistics. The probability density function has the $y$-axis as the probability of an occurrence, where the PDF function of the HP 8590 Series spectrum analyzer has the number of occurrences as its $y$-axis. The PDF could be converted to a probability density function by dividing, in an external controller, the value on each bucket by the total number of buckets. Note that performing the division inside the spectrum analyzer would not be appropriate because the result is less than 1, which would be truncated to 0.

# STB
# Status Byte Query

Returns to the controller the decimal equivalent of the status byte.

## Syntax




xSTB

Related Commands: RQS, SRQ.

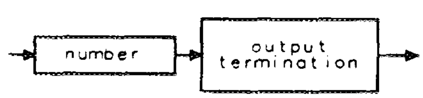
## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"SNGLS;" | *Activates single-sweep mode.* |
| 30 OUTPUT 718;"CLS;" | *Clears the status bits.* |
| 40 OUTPUT 718;"TS;" | *Takes sweep.* |
| 50 OUTPUT 718;"STB?;" | *Returns the status bits.* |
| 60 ENTER 718;Status_Byte | *Puts the spectrum analyzer response in the computer variable, Status_Byte.* |
| 70 PRINT Status_byte | *Displays the result.* |
| 80 END | |

## Description

The STB command is equivalent to a serial poll command. The RQS and associated bits are cleared in the same way that a serial poll command would clear them. The bits in the status byte are explained under the RQS command.

## Query Response

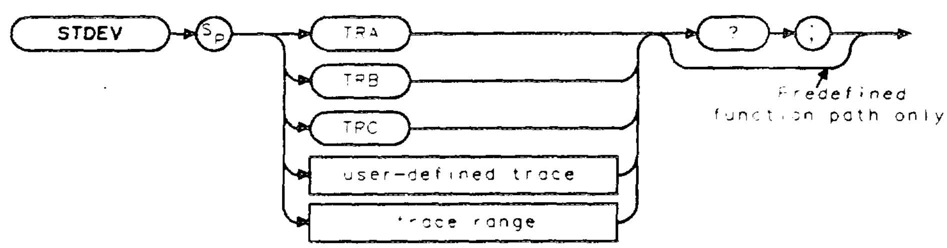



QQ1

# STDEV
# Standard Deviation of Trace Amplitudes

Returns the standard deviation of the trace amplitude in measurement units.

## Syntax




XSTDEV

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, PDA, PDF, VARIANCE.

## Example

The following program segment finds the standard deviation of the amplitude of trace A.

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `OUTPUT 718;"CF 300MHZ;SP 2MHZ;RB 100KHZ;"` | *Changes the center frequency, span, and resolution bandwidth.* |
| `OUTPUT 718;"TS;"` | *Takes sweep.* |
| `OUTPUT 718;"STDEV TRA?;"` | *Finds the standard deviation of trace A.* |
| `ENTER 718;Number` | *Get the response from the spectrum analyzer.* |
| `PRINT "THE STANDARD DEVIATION OF TRACE A ";Number/100;"DB"` | |

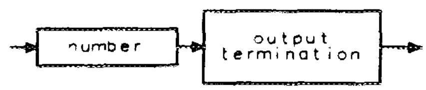
## Description

The formula to calculate the standard deviation is as follows:

$$\sqrt{\frac{\sum_{i=1}^{n}(\overline{x} - x_i)^2}{n - 1}}$$

$n$ represents the number of data points.
$x_i$ represents a data point.
$\overline{x}$ represents the mean of data.

## Query Response

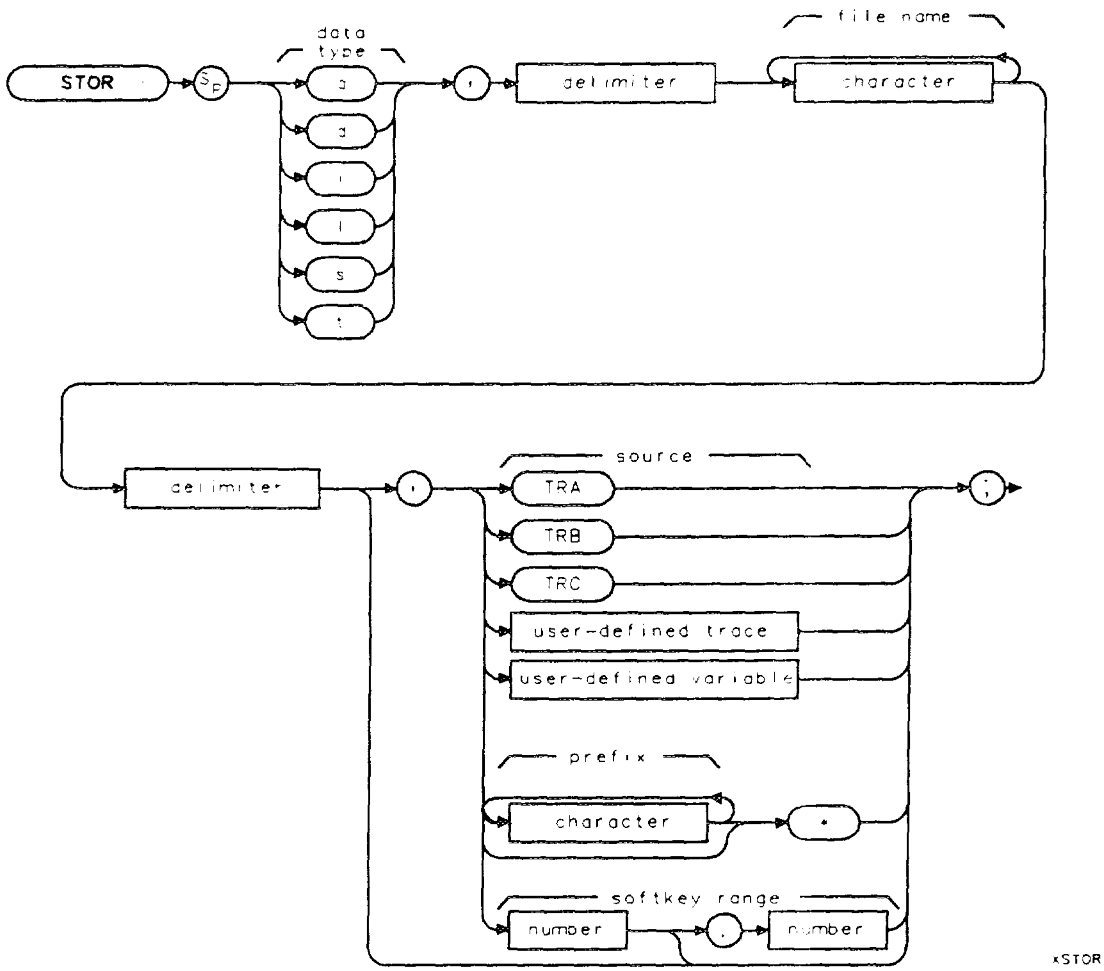



001

# STOR
# Store

Stores data on a RAM card.

## Syntax



| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Character (file name) | Any valid character. Characters form the file type and file name. | File type (lowercase a, c, d, i, l, s, or t) should precede the file name. File name is 0 to 6 characters long, A through Z and the underscore (the underscore should be used as the second character of the label). |
| Character (prefix) | Any valid character. | |
| Number | A valid softkey number range. Use a decimal point to separate the softkey numbers when specifying a softkey range. | 1 to 6, 601 to 1200. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Option Required: An HP 8590D or HP 8592D spectrum analyzer needs Option 003 installed in it to use STOR.
Related Commands: CAT, LOAD, PREFX.

## Example

| | |
|---|---|
| `OUTPUT 718;"TRDEF N_EW,400;"` | *Defines a trace.* |
| `OUTPUT 718;"MOV N_EW,TRA;"` | *Moves the contents of trace A into N_EW.* |
| `OUTPUT 718;"STOR t,%tF_UNCX%,N_EW;"` | *Stores N_EW under the file name of tFUNCX as trace data.* |
| `OUTPUT 718;"STOR d,%dP_ROG_1%,*;"` | *Stores all downloadable programs in the spectrum analyzer memory on the RAM card.* |
| `OUTPUT 718;"STOR a,%aA_MPDATA_7%;"` | *Stores the current amplitude correction factors.* |
| `OUTPUT 718;"STOR l,%lL_IMITS_1%;"` | *Stores the current limit-line tables.* |
| `OUTPUT 718;"STOR s,%sS_TATE_1%;"` | *Stores the spectrum analyzer state.* |
| `OUTPUT 718;"STOR d,%dK_EYS_15%,601.606;"` | *Stores softkey functions 601 through 606 in the file dKEYS_1.* |
| `OUTPUT 718;"STOR d,%dK_EY_1%,601;"` | *Stores softkey function 601 in the file dKEY_1.* |
| `OUTPUT 718;"STOR d,%dF_ILES_1%,KEN*;"` | *Stores all downloadable programs with the prefix "KEN" on the RAM card.* |

## Description

The STOR command stores the source data on the RAM card under the specified file name and data type.

**Data type:** Use the data type as the first character of the file name in order to catalog the file by the file type. For example, use tFUNCX instead of FUNCX to catalog it by traces. If the file type is not specified as the first character of the file name, the file is stored as an ASCII file. It is necessary to use the correct data type (a, d, i, l, s, or t) to load the file into spectrum analyzer memory correctly. The letters correspond to the data type as shown in the following table.

| Data Type | Description |
|---|---|
| a | Amplitude correction factor table. |
| d | Downloadable program. |
| i | Displays image. |
| l | Limit-line table. |
| s | Instrument state. |
| t | Trace and instrument state. |

**Note**

The STOR saves data on a RAM card. See "SAVET," "SAVES," or "SAVRCLN" to save data in spectrum analyzer memory.

With the memory card reader, the spectrum analyzer can read from either a RAM (random-access memory) card or a ROM (read-only memory card). To write to a memory card, the card must be a RAM card. The spectrum analyzer cannot write to a ROM card.

## Specifying the source

When storing trace data, enter the location of the trace data (trace A, trace B, trace C, or user-defined trace) as the source.

Downloadable programs can be stored as follows:

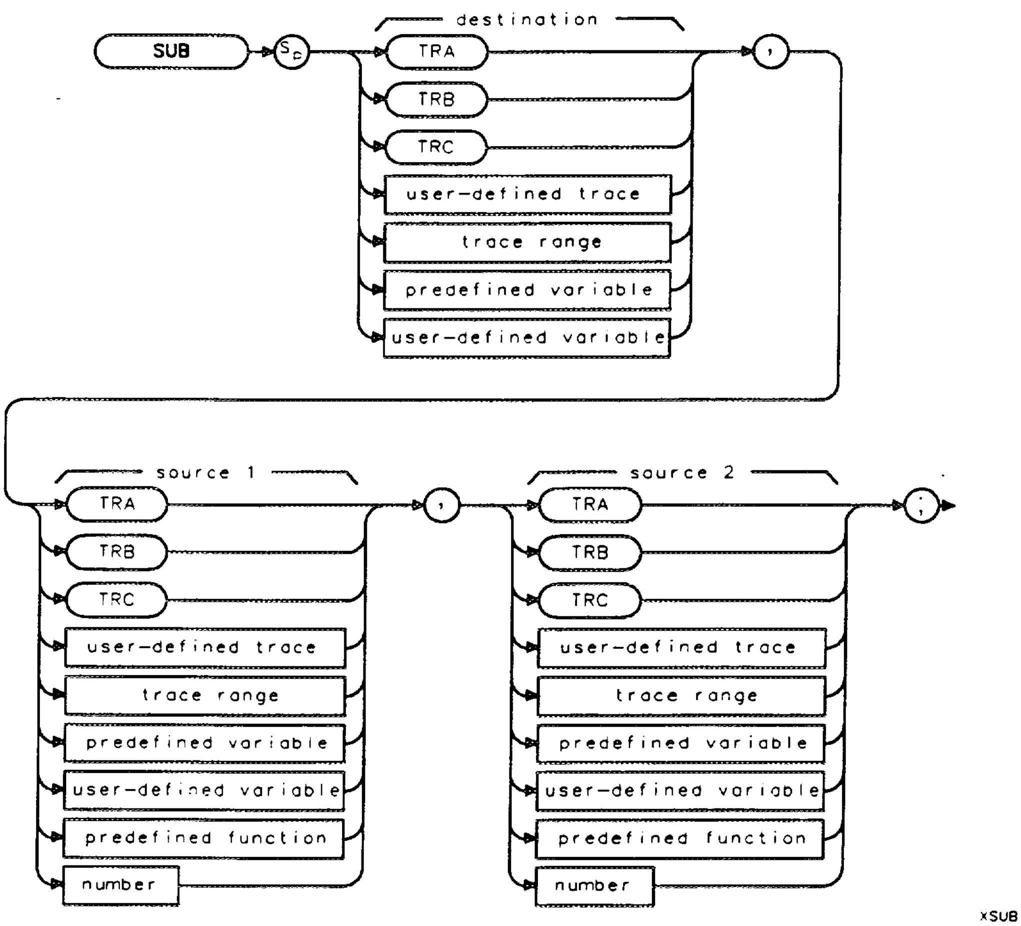
- For storing all downloadable programs in spectrum analyzer memory on a RAM card, use an asterisk as the source.
- For storing all downloadable programs with a certain prefix, use a prefix followed by an asterisk as the source.
- For storing a range of softkey functions, specify the softkey numbers separated with a decimal. Use the downloadable program file type when storing user-defined variables.

**Space required:** To store a file on a memory card, there must be enough space on the memory card for the file. See "Determining the Amount of Space on a RAM Card" in Chapter 4 for more information about space requirements.

# SUB
# Subtract

Subtracts source 2 from source 1, point by point, and sends the difference to the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: AMB, AMBPL, BML, LIMITEST, SUM.

## Example

```
OUTPUT 718;"SUB TRA,TRB,TRC;"
```
*Subtracts trace C from trace B and places the result in trace A.*

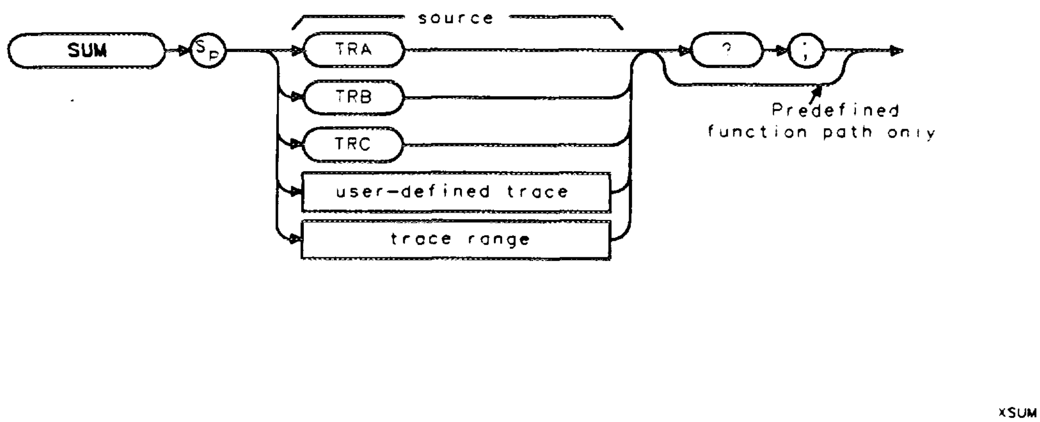
## Description

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# SUM
# Sum of Trace Amplitudes

Returns the sum of the amplitudes of the trace elements in measurement units.

## Syntax



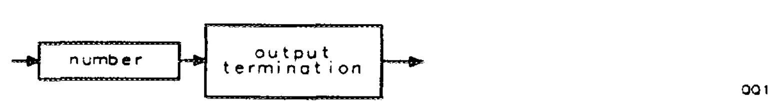

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: ADD, DIV, MEAN, MPY, SUB, TS, VARIANCE.

## Example

```
10 OUTPUT 718;"IP;"                        Initializes spectrum analyzer.
20 OUTPUT 718;"SNGLS;TS;"                  Activates single-sweep mode, takes sweep.
30 OUTPUT 718;"SUM TRA?;"                  Gets the result.
40 ENTER 718;Trace_sum                     Puts the spectrum analyzer response in the
                                           computer variable, Trace_sum.
50 DISP Trace_sum;"MEASUREMENT UNITS"      Displays the result.
60 END
```

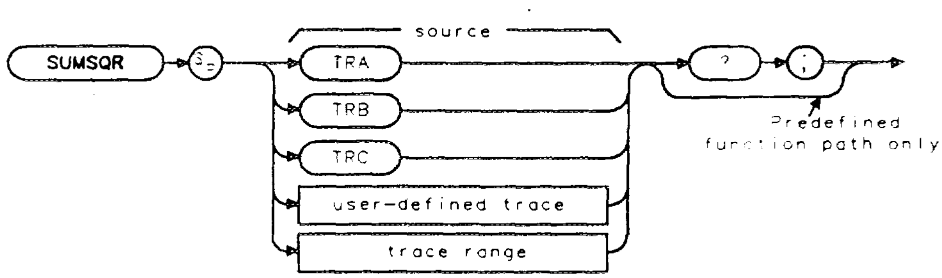
## Query Response



# SUMSQR
## Sum of Squared Trace Amplitudes

Returns the sum of the squares of the amplitude of each trace element in measurement units.

### Syntax




XSUMSQR

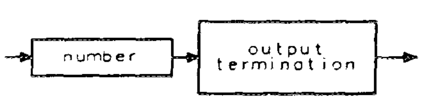
| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.

### Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep mode, takes sweep.* |
| `OUTPUT 718;"SUMSQR TRA?;"` | *Gets the result.* |
| `ENTER 718;Trace_sqrsum` | *Puts the spectrum analyzer response in the computer variable, Trace_sqrsum.* |
| `DISP Trace_sqrsum;"MEASUREMENT UNITS"` | *Displays the result.* |

### Query Response

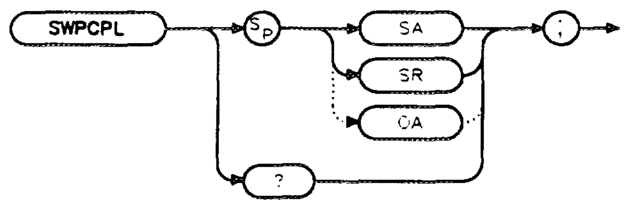



001

# SWPCPL
# Sweep Couple

Selects either a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time.

## Syntax




Equivalent Softkey: **SWP CPLG SR SA**.
Option Required: Option 010 or 011.
Preset State: SWPCPL SA.
Related Commands: SRCPWR.

## Example

```
10 OUTPUT 718;"IP;SNGLS;"
20 OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30 OUTPUT 718;"SRCPWR -10DB;"
40 OUTPUT 718;"SWPCPL SR;"
50 OUTPUT 718;"SRCTKPK;DONE?;"
60 ENTER 718;Done
70 LOCAL 718
80 END
```

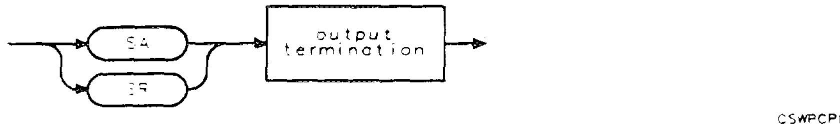
## Description

In stimulus-response mode, auto-coupled sweep times are usually much faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test.

When used as a predefined variable, SWPCPL returns either a "0" or a "1," depending on the setting of the SWPCPL parameters. Refer to the following table.

| Parameter setting | Value returned |
|---|---|
| SA | 0 |
| SR | 1 |

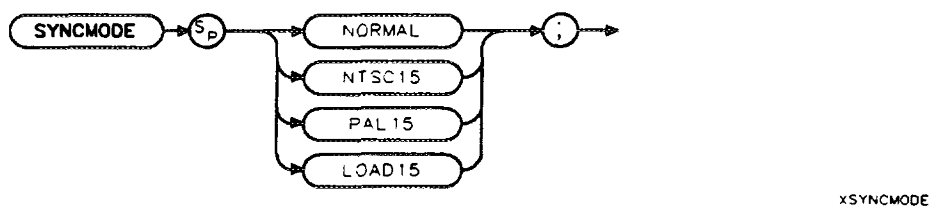
## Query Response



# SYNCMODE
## Synchronize Mode

Selects either the horizontal and vertical synchronizing constants, or the synchronization rate for both the internal monitor of the spectrum analyzer and the video signal that is output to the MONITOR OUTPUT connector.

### Syntax




Equivalent Softkey: **SYNC NRM NTSC**, **DEFAULT SYNC**, **SYNC NRM PAL**.
Related Commands: CRTHPOS, CRTVPOS, IP.

### Example

| | |
|---|---|
| `OUTPUT 718;"SYNCMODE NTSC15;"` | *Selects the NTSC format for the spectrum analyzer monitor and monitor output.* |
| `OUTPUT 718;"IP;"` | *An instrument preset activates the new synchronizing constants.* |

### Description

Whenever you use SYNCMODE to change the synchronizing constants, you must press (PRESET) or execute IP to activate the new synchronizing constants. Changing the vertical scanning rate may change the location of the time and date display on the spectrum analyzer display.

The SYNCMODE parameters NORMAL and LOAD15 allow you to change the horizontal and vertical synchronizing constants for both the spectrum analyzer's internal monitor and the video signal to the MONITOR OUTPUT connector.

The SYNCMODE parameters NTSC15 and PAL15 allow you to change the vertical scanning rate for both the spectrum analyzer's internal monitor and the video signal that is output to the MONITOR OUTPUT connector. The regular vertical scanning rate for the spectrum analyzer's monitor is 57 Hz; the NTSC15 changes the vertical scanning rate to 60 Hz, and the PAL15 changes the vertical scanning rate to 50 Hz. If you want to record the spectrum analyzer display on a video cassette recorder (VCR) that uses the NTSC format, you must use the NTSC15 parameter to change the vertical scanning rate of the spectrum analyzer monitor to 60 Hz. If you want to record the spectrum analyzer display on a VCR that uses the PAL format, you must use the PAL15 parameter to change the vertical scanning rate of the spectrum analyzer monitor to 50 Hz. The parameters for SYNCMODE are described below.

NORMAL — Restores the previous values for the horizontal and vertical synchronizing constants of the spectrum analyzer display if SYNCMODE NTSC15 or SYNCMODE PAL15 was previously executed. The previous values for the horizontal and vertical position are the positions that were set by CRTHPOS and CRTVPOS. SYNCMODE NORMAL is equivalent to **SYNC NRM NTSC** (with NRM underlined).

NTSC15 — Selects the NTSC format for a spectrum analyzer that has an internal monitor with a horizontal scanning rate of 15.75 kHz (the monitors for the HP 8590D, HP 8591E, HP 8592D, HP 8593E, HP 8594E, HP 8595E, and HP 8596E all have horizontal scanning rates of 15.75 kHz). SYNCMODE NTSC15 is equivalent to **SYNC NRM NTSC** (with NTSC underlined).

PAL15 — Selects the PAL format for a spectrum analyzer that has an internal monitor with a horizontal scanning rate of 15.75 kHz (the monitors for the HP 8590D, HP 8591E, HP 8592D, HP 8593E, HP 8594E, HP 8595E, and HP 8596E all have horizontal scanning rates of 15.75 kHz). SYNCMODE PAL15 is equivalent to **SYNC NRM PAL** (with PAL underlined).

LOAD15 — Loads the default constants horizontal and vertical position for the display of a spectrum analyzer with an internal monitor with 15.75 kHz horizontal scanning (the HP 8590D, HP 8591E, HP 8592D, HP 8593E, HP 8594E, HP 8595E, and HP 8596E all have horizontal scanning rates of 15.75 kHz). The default constants are the constants that are stored into the spectrum analyzer's read-only memory (ROM). SYNCMODE LOAD15 is equivalent to **DEFAULT SYNC**.

When used as a predefined variable, SYNCMODE returns a number from 0 to 5. The value that is returned by SYNCMODE depends on the SYNCMODE parameter, as shown in the following table.

| Parameter setting | Value returned |
|---|---|
| NORMAL | 0 |
| NTSC15 | 1 |
| PAL15 | 3 |
| LOAD15 | 5 |

# TA
# Transfer A

Returns trace A amplitude values from the spectrum analyzer to the controller.

## Syntax


XTA

Related Commands: MDS, TB, TDF.

## Example

This example stores the TA results in array A.

| | |
|---|---|
| `DIM A(401)` | *Reserves memory area for array.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"SNGLS;CF 300MHZ;SP 2MHZ;TS;"` | *Activates single-sweep mode, changes center frequency and span, takes sweep.* |
| `OUTPUT 718;"TDF P;TA;"` | *Changes trace data format, outputs trace A.* |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves each element of trace A to the computer.* |
| `  ENTER 718;A(N)` | |
| `NEXT N` | |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves the trace values from the computer to the printer.* |
| `  PRINT A(N)` | *Prints out the results.* |
| `NEXT N` | |

## Description

The display unit values are transferred in sequential order (from left to right) as seen on the screen.

Transfer of trace amplitude data should be done only as follows:

1. Select single sweep mode (SNGLS).
2. Select desired spectrum analyzer settings.
3. Take one complete sweep (TS).
4. Transfer data (TA).

This procedure ensures that the current settings of the spectrum analyzer are reflected in the transferred data.

See Chapter 3, "Different Formats for Trace Data Transfers," for more information about transferring trace data. Items are separated by a comma when in TDF P format.

# TB
# Transfer B

Transfers trace B amplitude values from the spectrum analyzer to the controller.

## Syntax


XTB

Related Commands: MDS, TA, TDF.

## Example

| | |
|---|---|
| `DIM A(401)` | *Reserves memory area for array.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"SNGLS;CF 300MHZ;SP 2MHZ;TS;"` | *Activates single-sweep mode, changes center frequency and span, takes sweep.* |
| `OUTPUT 718;"TDF P;TB;"` | *Changes trace data format, outputs trace B.* |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves each element of trace A to the computer.* |
| `  ENTER 718;A(N)` | |
| `NEXT N` | |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves the trace values from the computer to the printer.* |
| `  PRINT A(N)` | *Prints out the results.* |
| `NEXT N` | |

## Description

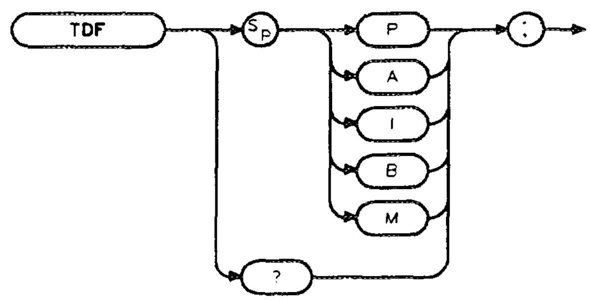
The operation of TB is similar to the operation of TA.

See Chapter 3, "Different Formats for Trace Data Transfers," for more information about transferring trace data.

# TDF
# Trace Data Format

Formats trace information for return to the controller.

## Syntax




Related Commands: MDS, MKA, TA, TB, TRA.

## Example

| | |
|---|---|
| `DIM A(401)` | *Holds trace data.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"BLANK TRA;CLRW TRB;"` | *Views trace B.* |
| `OUTPUT 718;"SNGLS;CF 300MHZ;SP 2MHZ;TS;"` | *Activates single-sweep mode, changes center frequency and span.* |
| `OUTPUT 718;"TDF P;TB;"` | *Formats trace data.* |
| `FOR N = 1 TO 401` | *Transfers trace data to array A, one element at a time.* |
| `  ENTER 718;A(N)` | |
| `  NEXT N` | |
| `FOR N = 1 TO 401` | *Loop prints out trace B data.* |
| `  PRINT A(N)` | *Prints out the results.* |
| `NEXT N` | |

## Description

The different trace data formats are as follows:

## TDF P

**Description:** TDF P is the real number format. An example of a trace element returned with the real number format is 10.00 dB. When querying the trace or marker value, the value is returned using the amplitude unit set by AUNITS (for example, watts or dBm).

**Restrictions:** The spectrum analyzer must be in log scale to use TDF P. To send the trace data back to the spectrum analyzer, the data must be converted to measurement units.

**How data is returned:** The following table describes what is transferred when the trace data format is set to P, but the AUNITS are changed. In every case, the trace data transfer is ended by a carriage return, and a line feed with an EOI.

**TDF Trace Data Format**

**Trace Data Transfers with TDF P**

| AUNITS Setting | Example | Description |
|---|---|---|
| Watts | TDF P;AUNITS W;TA; | Transfers 401 real values, in watts, with each value separated by a carriage return and a line feed. |
| dBm | TDF P;AUNITS DBM;TA; | Transfers 401 real values, in dBm, with each value separated by a carriage return and a line feed. |
| dBmV | TDF P;AUNITS DBMV;TA; | Transfers 401 real values, in dBmV, with each value separated by a carriage return and a line feed. |
| dBμV | TDF P;AUNITS DBUV;TA; | Transfers 401 real values, in dBμV, with each value separated by a carriage return and a line feed. |
| Volts | TDF P;AUNITS V;TA; | Transfers 401 real values, in volts, with each value separated by a carriage return and a line feed. |

**Example of how data is returned:** For example, if the reference level of the spectrum analyzer is set to −10 dBm, the amplitude scale is set to 10 dB per division, and trace A contains the following data:

TRA[1] contains 8000 (in measurement units). The value 8000 indicates trace element 1 is at the reference level.
TRA[2] = 7000 measurement units (trace element 2 is −10 dB below the reference level).
TRA[3] through TRA[401] each contain 6000 (in measurement units). The value 6000 indicates that the trace elements 3 through 401 are all at −20 dB below the reference level.

Querying trace A with the TDF P format and AUNITS set to DBM returns ASCII character codes for the following:

−10.00,−20.00,−30.00,(−30.00 is repeated 398 times),<CR><LF><EOI>

## TDF A

**Description:** TDF A is the A-block data format. With the A-block data format, trace data is preceded by "#," "A," and a two-byte number (the two byte number indicates the number of trace data bytes). The setting of the MDS command determines whether the trace data is transferred as one or two 8-bit bytes.

**Restrictions:** To use the A-block format for sending data, you must provide the number of data bytes.

**How data is returned:** The following table describes what is transferred when the trace data format is set to A, but the MDS setting is changed.

**Trace Data Transfers with TDF A**

| MDS Setting | Example | Description |
|---|---|---|
| Binary | TDF A;MDS B;TA; | Transfers "#A," the number of bytes of trace data, then the 401 bytes of trace data. Using MDS B "reduces" each trace value into one byte by dividing (DIV) the trace value by 32. The trace data transfer is ended with an EOI. |
| Word | TDF A;MDS W;TA; | Transfers "#A," the number of bytes of trace data, then 802 bytes of trace data. MDS W uses two bytes per trace element to transfer trace data. The first byte contains the trace value divided by (DIV) 256, the second byte contains the remainder (MOD) of that division. The trace data transfer is ended with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF A format and MDS set to binary (MDS B) would return the ASCII character codes for the following:

#A(401 div 256)(401 mod 256)(8000 div 32)(7000 div 32)(6000 div 32)(the number for 6000 div 32 is repeated 398 times)<EOI>

Notice that #A is followed by the two bytes that contain the number of trace elements. Because MDS is set to binary, the number of trace elements is 401.

If MDS is set to W, querying trace A with the TDF A format would return the ASCII character codes for the following:

#A(802 div 256)(802 mod 256)(8000 div 256)(8000 mod 256)(7000 div 32)(7000 mod 256)(6000 div 256)(6000 mod 256)(the number for 6000 div 256, then the number for 6000 mod 256 is repeated 398 times)

Notice that #A is followed by the two bytes that contain the number of trace elements. Because MDS is set to W (word), the number of trace elements is 802.

## TDF I

**Description:** TDF I is the I-block data format. With the I-block data format, trace data must be preceded by "#," and "I." The setting of the MDS command determines whether the trace data is transferred as one or two 8-bit bytes. Unlike using the A-block format, you do not provide the number of data bytes when sending trace data back to the spectrum analyzer.

**Restrictions:** This format is not recommended for use with an RS-232 interface.

**How data is returned:** The following table describes what is transferred when the trace data format is set to I, but the MDS setting is changed.

**Trace Data Transfers with TDF I**

| MDS Setting | Example | Description |
|---|---|---|
| Binary | TDF I;MDS B;TA; | Transfers "#I," then the 401 bytes of trace data. Using MDS B "reduces" the trace value into 1 byte by dividing (DIV) the trace value by 32. The trace data transfer is ended with an EOI. |
| Word | TDF I;MDS W;TA; | Transfers "#A," then 802 bytes of trace data. MDS W uses two bytes per trace element to transfer trace data. The first byte contains the trace value divided by (DIV) 256, the second byte contains the remainder (MOD) of that division. The trace data transfer is ended with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF I format and MDS set to binary (MDS B) would return the ASCII character codes for the following:

#I(8000 div 32)(7000 div 32)(6000 div 32)(the number for 6000 div 32 is repeated 398 times)

If MDS is set to W, querying trace A with the TDF I format would return the ASCII character codes for the following:

#I(8000 div 256)(8000 mod 256)(7000 div 32)(7000 mod 256)(6000 div 256)(6000 mod 256)(the number for 6000 div 256, then the number for 6000 mod 256 is repeated 398 times)

## TDF B

**Description:** TDF B enables the binary format. With the binary format, the marker or trace data is transferred as bytes. Of all the trace data formats, TDF B transfers trace data the fastest. The setting of the MDS command determines whether the trace data is transferred as one or two 8-bit bytes.

**Restrictions:** The TDF B format cannot be used to send data back to the spectrum analyzer (you must use the A-block format to send data back to the spectrum analyzer).

**How data is returned:** The following table describes what is transferred when the trace data format is set to B, but the MDS setting is changed.

**Trace Data Transfers with TDF B**

| MDS Setting | Example | Description |
|---|---|---|
| Binary | TDF B;MDS B;TA; | Transfers the 401 bytes of trace data. Using MDS B "reduces" the trace value into 1 byte by dividing (DIV) the trace value by 32. The trace data transfer is ended with an EOI. |
| Word | TDF B;MDS W;TA; | Transfers the 802 bytes of trace data. MDS W uses two bytes per trace element to transfer trace data. The first byte contains the trace value divided by (DIV) 256, the second byte contains the remainder (MOD) of that division. The trace data transfer is ended with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF B format and MDS set to binary (MDS B) would return the ASCII character codes for the following:

(8000 div 32)(7000 div 32)(6000 div 32)(the number for 6000 div 32 is repeated 398 times)

If MDS is set to W, querying trace A with the TDF B format would return the ASCII character codes for following:

(8000 div 256)(8000 mod 256)(7000 div 32)(7000 mod 256)(6000 div 256)(6000 mod 256)(the number for 6000 div 256, then the number for 6000 mod 256 is repeated 398 times)

## TDF M

**Description:** TDF M is the measurement data format. The measurement data format transfers trace data in measurement units, and the measurement data can range from −32768 to +32767.

**Restrictions:** TDF M cannot be used to send trace data back to the spectrum analyzer.

**How trace data is returned:** The following table describes what is transferred when the trace data format is set to M.

**Trace Data Transfers with TDF M**

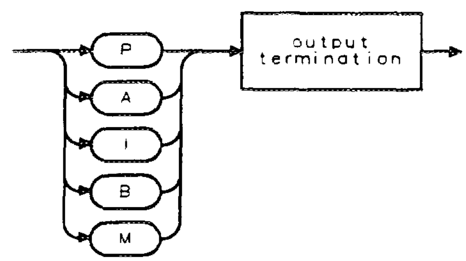
| Example | Description |
|---|---|
| TDF M;TA; | Transfers 401 bytes, with each trace value in measurement units. The trace data transfer is ended with a carriage return, a line feed with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF M would return the ASCII character codes for the following:

8000,7000,6000,(6000 repeated 398 times),<CR><LF>

Refer to Chapter 3, "Different Formats for Trace Data Transfers," for more information about transferring trace data.

## Query Response

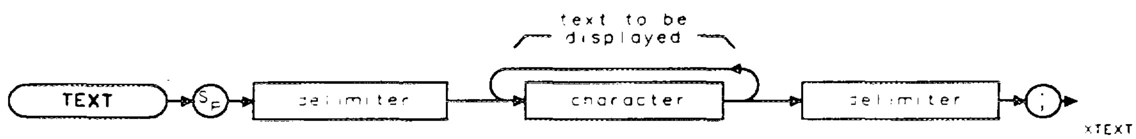



QTDF

# TEXT
# Text

Writes text on the spectrum analyzer screen at the current pen position.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of analyzer commands. | ` \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. See "LB" for additional characters available. | |

Related Commands: DSPLY, LB, PA, PD, PU, PR.

## Example

```
OUTPUT 718;"PU;PA 80,80;TEXT%CONNECT ANTENNA%;"
```
*Displays CONNECT ANTENNA on the analyzer screen.*

```
OUTPUT 718;"PU;PA 100,100;TEXT%50";CHR$(250);"%;"
```
*Displays 50Ω on the analyzer screen.*

## Description

The TEXT origin is at the lower-left corner of the first character. The pen is placed to the right of and behind the last character position after the text characters. Line feeds are not automatically generated for lines that extend past the edge of the screen.

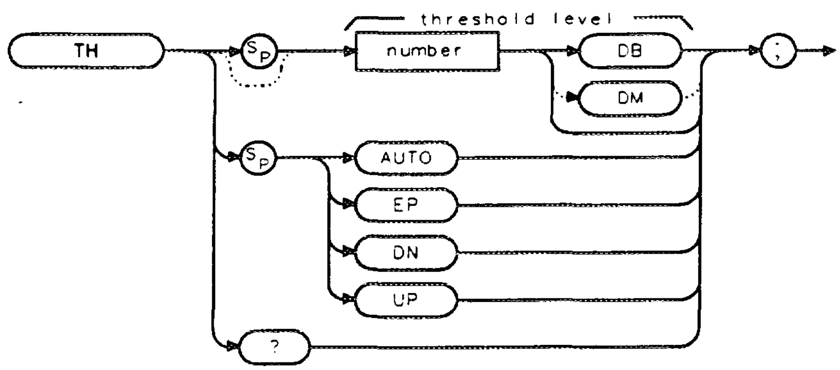
See "LB" for the additional characters available by specifying the ASCII character code. (See second line of the example for an example of using the ASCII character code.)

The TEXT command also enters the text into the display list. See "DA" for more information about the display list.

# TH
# Threshold

Clips signal responses below the threshold level.

## Syntax




XTH

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | Range dependent on RL setting. |

Equivalent Softkey: **THRESHLD ON OFF**.
Preset State: Clip off, positioned one division above bottom graticule line.
Step Increment: One division.
Related Commands: AUTO, DL, MEANTH, MKPK, PEAKS, RL.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

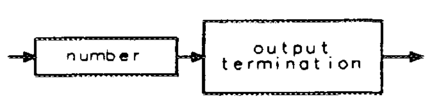
## Example

`OUTPUT 718;"TH UP;"` *Increases the threshold level.*

## Description

The threshold level is eight graticule divisions below the top of the screen unless otherwise specified. The threshold level is annotated in reference level units at the lower-left corner of the spectrum analyzer screen. AUTO deactivates clipping. The TH level is used for next peak marker movements (see "MKPK") and the PEAKS command even if the display clipping is off.

## Query Response

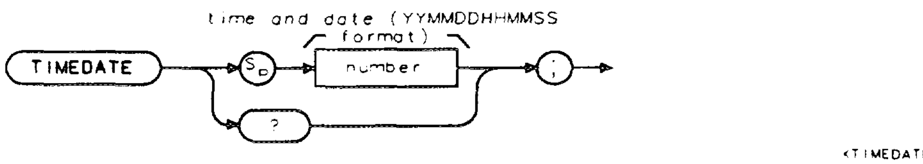



QQ1

# TIMEDATE
# Time Date

Allows you to set the time and date for the spectrum analyzer real-time clock in the YYMMDDHHMMSS format.

## Syntax



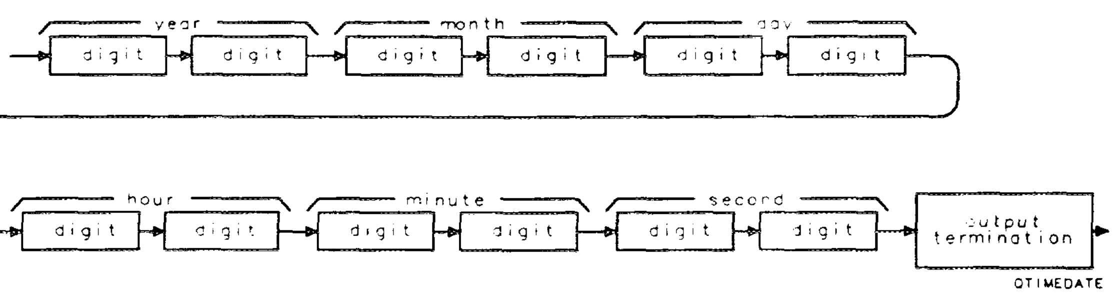

| Item | Description/Default | Range |
|---|---|---|
| Number | A number representing the date and time in the YYMMDDHHMMSS (24 hour) format. | A valid date and time. |

Related Commands: SETDATE, SETTIME, TIMEDSP.

## Example

`OUTPUT 718;"TIMEDATE 881231135501;"` *Sets the analyzer time and date to 1:55:01* PM *on 31 December 1988.*

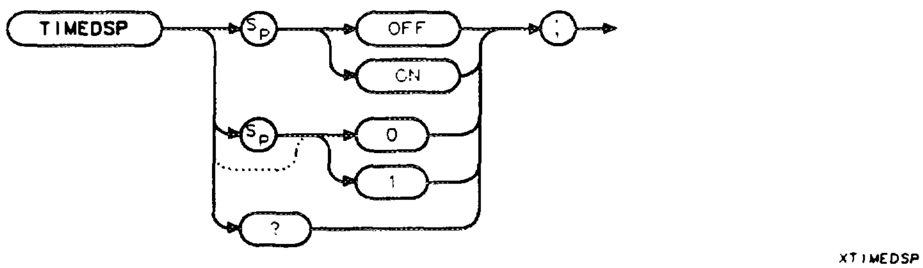
## Query Response



# TIMEDSP
# Time Display

Enables the display of the time and date on the spectrum analyzer screen.

## Syntax



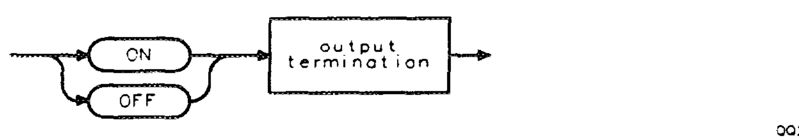

Equivalent Softkey: **TIMEDATE ON OFF**.

Related Commands: ANNOT, SETDATE, SETTIME, TIMEDATE.

## Example

```
OUTPUT 718;"TIMEDSP OFF;"
```

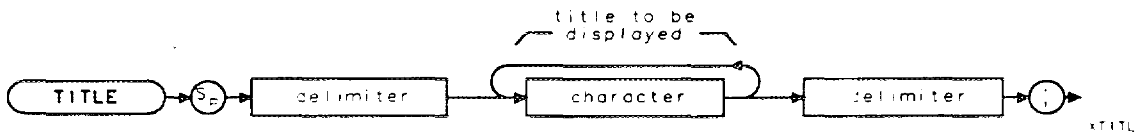
## Query Response



# TITLE
# Title

Activates the screen title mode. The title is displayed above the top graticule and is left justified.

## Syntax




<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Character</td><td>Any valid character. See "LB" for additional characters available.</td><td>Up to 53 characters.</td></tr>
</table>

Equivalent Softkey: **Change Title** .
Related Commands: IP, LB, SAVES, TEXT.

## Example

`OUTPUT 718;"TITLE %ADJUST ANTENNA%;"` *Displays "ADJUST ANTENNA" on the analyzer screen.*

## Description

This function writes a message at the top of the spectrum analyzer

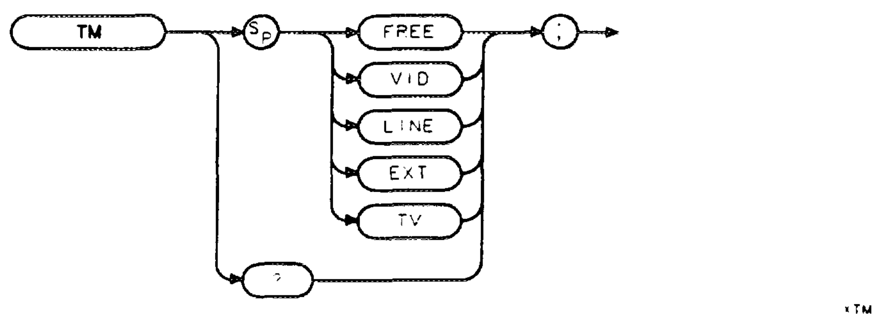
screen. The full width of the display is available for writing a maximum of 53 characters. However, the marker readout may interfere with the last 26 characters. IP removes the message.

The SAVET command saves the screen title is along with the trace in the trace register.

# TM
# Trigger Mode

Selects a trigger mode: free, line, video, TV, or external.

## Syntax




Equivalent Softkeys: The keys accessed by (TRIG).
Related Commands: DL.

## Example

`OUTPUT 718;"TM EXT;"` *Activates the external trigger mode.*

## Description

The conditions of the four trigger modes are as follows:

**FREE** allows the next sweep to start as soon as possible after the last sweep. The functions of TM FREE and **FREE RUN** are identical.

**VID** allows the next sweep to start if the trace data rises across a level set by the display line. The functions of TM VID and **VIDEO** are identical.

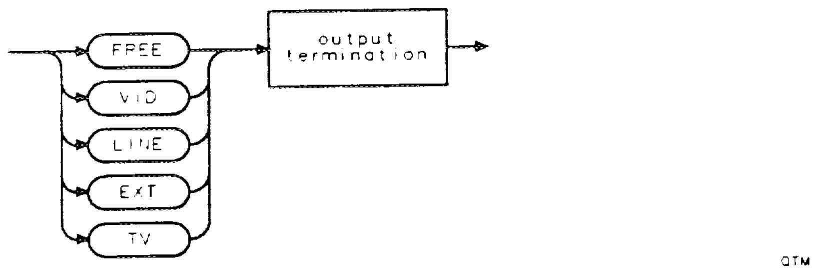
**LINE** allows the next sweep to start when the line voltage passes through zero, going positive. The functions of TM LINE and **LINE** are identical.

**EXT** allows the next sweep to start when an external voltage level passes through approximately 1.5 V, going positive. The external trigger signal level must be between 0 V and +5 V. Connect the external trigger to the EXT TRIG INPUT. The functions of TM EXT and **EXTERNAL** are identical.

**TV** allows TV triggering if Options 101 and 102, or Option 301 is installed. The functions of TM TV and **TV TRIG** are similar. TM TV does not select the TV line number, set up the amplitude level, change the span, change the bandwidth, or change the sweep time.

**Note** Some spectrum analyzer functions are not performed until the spectrum analyzer is triggered.

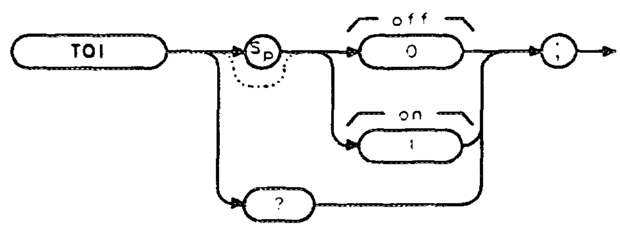
## Query Response



# TOI
# Third-Order Intermodulation Measurement

Turns on or off the third-order intermodulation (TOI) measurement.

## Syntax




XTOI

Equivalent Softkey: **TOI ON OFF**.
Related Commands: AUNITS, MKPX, TH, TOIR.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV TOI,1;"` | *Turns on the third-order intermodulation measurement.* |
| `OUTPUT 718;"TOIR?;"` | *Queries TOIR. TOIR contains the results of the third-order intermodulation measurement.* |
| `ENTER 718;Toi` | *Stores the value of TOIR in the variable Toi.* |
| `PRINT "Third-order intermodulation is ",Toi` | *Prints the results.* |
| `OUTPUT 718;"MOV TOI,0;"` | *Turns off the third-order intermodulation measurement.* |

## Description

Setting TOI to 1 turns on the third-order intermodulation measurement. Setting TOI to 0 turns off the third-order intermodulation measurement. When the third-order intermodulation measurement is turned on, the spectrum analyzer first determines that there are four signals on the spectrum analyzer display; the four signals must be the two fundamental signals and two distortion products. All of the signals must be greater than the peak excursion above the threshold. If four valid signals could not be found for the third-order intermodulation measurement, the value of TOIR is −100. If four valid signals could be found, the spectrum analyzer does the following:

1. Finds the four highest on-screen signals. (If the four highest on-screen signals are not the two signals and two distortion products, the TOI measurement cannot be performed.)
2. Determines the spacing between the highest two signals. The highest two signals are tone A and tone B.
3. Verifies that the third and fourth highest signals (distortion A and distortion B) fall above and below tone A and tone B by the frequency difference between tone A and tone B.

4. Measures the levels of the four signals (tone A, tone B, distortion A, and distortion B) and calculates the third-order intermodulation intercept.

The third-order intermodulation intercept is calculated as follows:

$$TOI = \frac{(2 \times Level_{Tone\ A} - Level_{Distortion\ A} + Level_{Tone\ B})}{2}$$

The frequency of the distortion product (Distortion A) is equal to the following:

$$Frequency_{Distortion\ A} = 2 \times Frequency_{Tone\ A} - Frequency_{Tone\ B}$$

You must query TOIR to determine the value of the higher third-order intermodulation product.

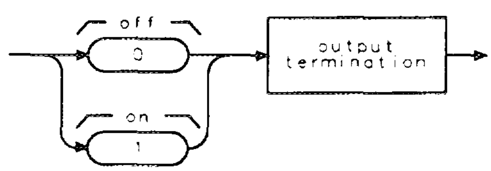
The third-order intermodulation measurement is repeated at the end of every sweep (TOI uses the ONEOS command to update the measurement data) until you turn off the third-order intermodulation measurement.

**Restrictions**
Turning the TOI measurement on turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW).

You can execute the TOI command two different ways. You can either execute the TOI command directly (for example, "`TOI 1;`") or use the MOV command to move the 1 or 0 into the TOI command (for example, "`MOV TOI,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

Because TOI is performed at the end of every measurement sweep, you should turn off the third-order intermodulation measurement (set TOI to 0) when you are done with the third-order intermodulation measurement.

## Query Response

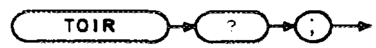



CTOI

# TOIR
# Third-Order Intermodulation Response

Returns the intercept point for the highest third-order intermodulation product measured by the third-order intermodulation measurement (TOI).

## Syntax




XTOIR

Related Commands: AUNITS, MKPX, TH, TOI.

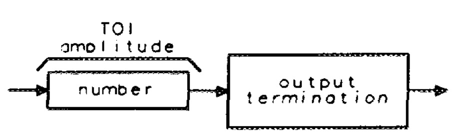
## Example

| | |
|---|---|
| `OUTPUT 718;"MOV TOI,1;"` | *Turns on the third-order intermodulation measurement.* |
| `OUTPUT 718;"TOIR?;"` | *Queries TOIR. TOIR contains the results of the third-order intermodulation measurement.* |
| `ENTER 718;Toi` | *Stores the value of TOIR in the variable Toi.* |
| `PRINT "Third-order intermodulation is ",Toi` | *Prints the results.* |
| `OUTPUT 718;"MOV TOI,0;"` | *Turns off the third-order intermodulation measurement.* |

## Description

TOIR returns a −100 if the TOI function has not been turned on, or if four on-screen signals are not valid or are not present. For TOI to perform a third-order intermodulation measurement, there needs to be four signals on the spectrum analyzer display, and all four signals must be greater than the peak excursion above the threshold.

## Query Response

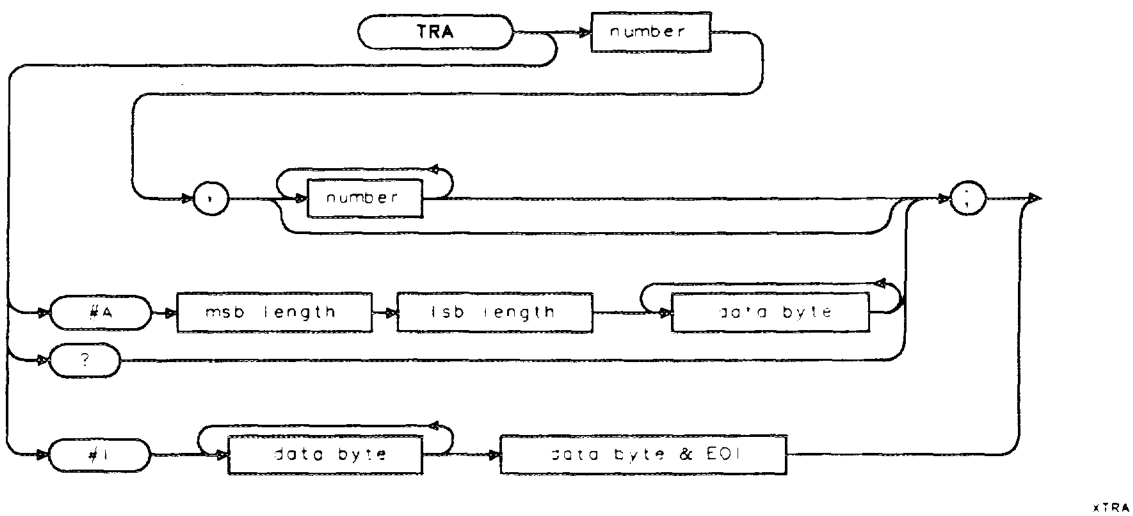



QTOIR

# TRA/TRB/TRC
# Trace Data Input and Output

The TRA/TRB/TRC commands provide a method for returning or storing 16-bit trace values.

## Syntax




Use the same syntax for TRB and TRC as shown for TRA, just substitute TRB or TRC for TRA.

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Integer number range |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Data byte | 8-bit byte containing numeric or character data. | |
| Data byte & EOI | 8-bit byte containing numeric or character data followed by END. | |

Related Commands: LOAD, ONEOS, RCLT, SAVET, STOR, TDF.

## Example

```
10 REAL Trace_a(1:401)             Creates a 401-point trace array.
20 OUTPUT 718;"IP;"                Initializes analyzer.
30 OUTPUT 718;"TDF P;"             Changes the format for real numbers.
40 OUTPUT 718;"SNGLS;"
50 OUTPUT 718;"CF 300MHZ;"         Changes the center frequency.
60 OUTPUT 718;"SP 200MHZ;"         Changes the span.
70 OUTPUT 718;"TS;"
80 OUTPUT 718;"MKPK HI;"
90 OUTPUT 718;"MKCF;"              Moves peak to center of analyzer screen.
100 OUTPUT 718;"TS;"               Updates measurement trace.
110 OUTPUT 718;"TRA?;"             Gets the trace data.
```

```
120 ENTER 718;Trace_a(*)       Sends the trace data to the computer.
130 OUTPUT 718;"CONTS;"        Activates continuous sweep mode.
140 END
```

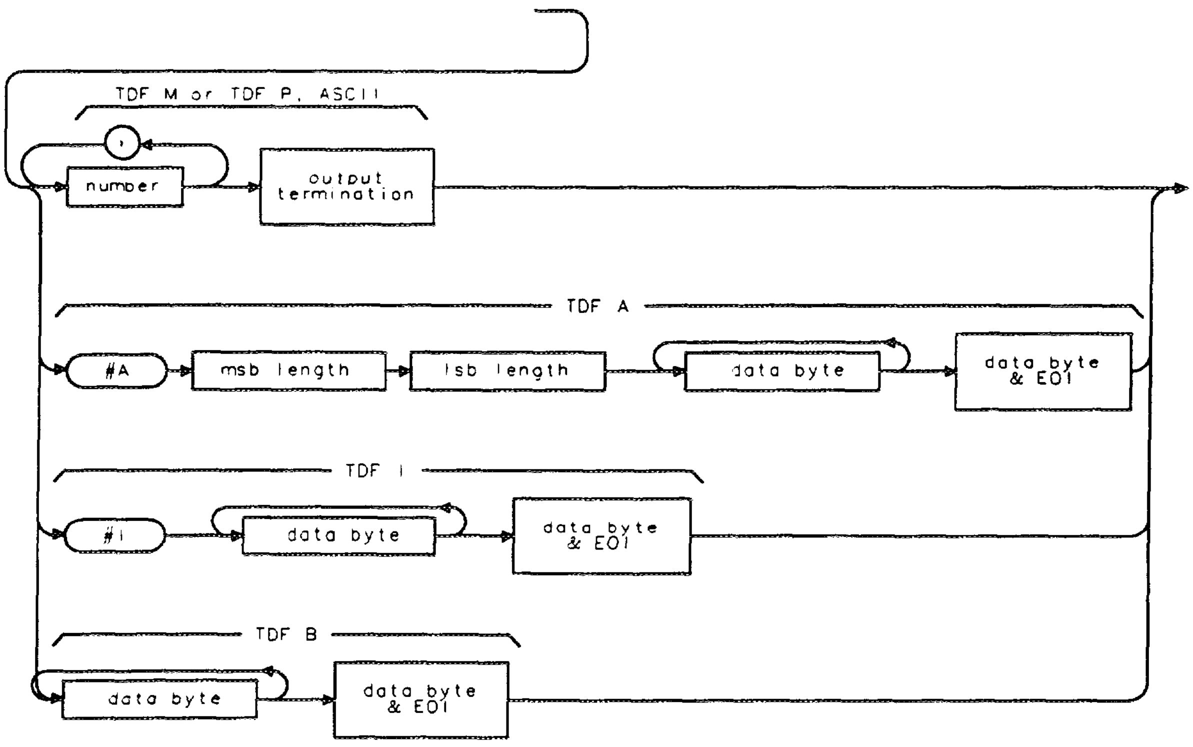
## Description

Trace data that is input in the A-block or the I-block format is treated as measurement units independent of trace data format (TDF). Enter words in measurement units only. The output format is specified according to TDF and MDS.

The command may be used to input integer data to traces. See "Saving Trace Data" in Chapter 3. Because the lengths of trace A, trace B, and trace C are fixed, there are always 401 or 802 bytes transferred during binary input or binary output mode, respectively.

## Query Response

The form of the query response is dependent upon the previously used TDF and MDS commands as follows:

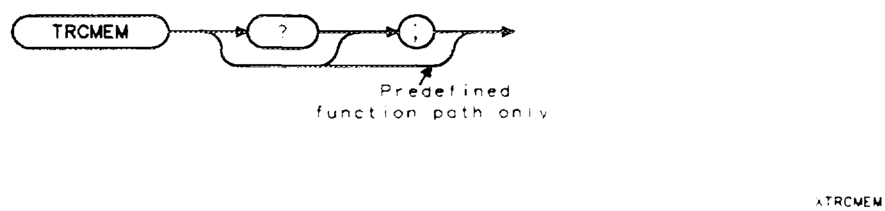



If Analog+ display mode is turned on, only the 401 or 802 bytes of trace data are returned; the dot display is not returned.

# TRCMEM
# Trace Memory

Returns a nonnegative integer that indicates the total number of trace registers available for SAVET and RCLT.

## Syntax




Related Commands: ACTDEF, DISPOSE, FUNCDEF, RCLT, SAVET, TRDEF.

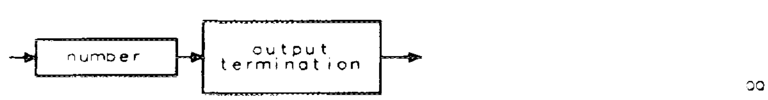
## Example

```
OUTPUT 718;"TRCMEM?;"     Gets the total number of trace registers.
ENTER 718;Number
DISP Number
```

## Description

The value of TRCMEM is displayed on the spectrum analyzer display when you save a trace, limit-line table, or table of amplitude correction factors in spectrum analyzer memory with `Trace -> Internl`.

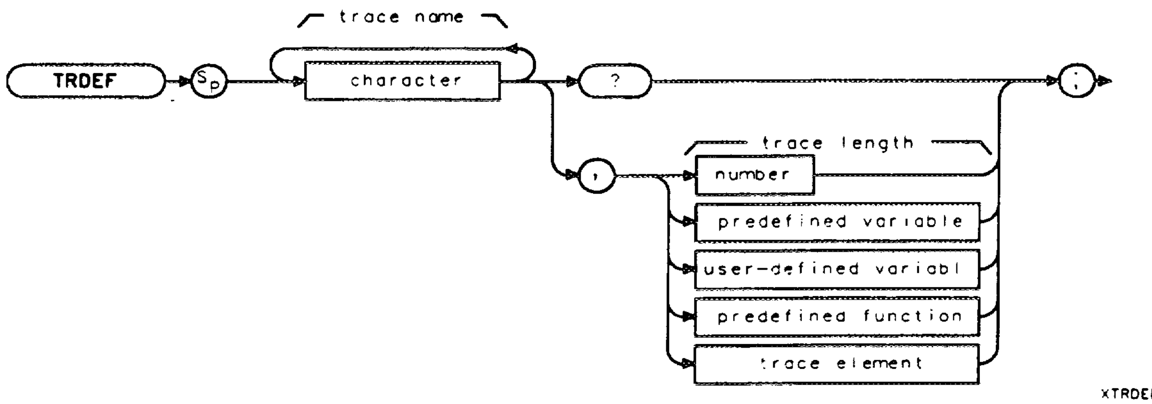
## Query Response



# TRDEF
# Trace Define

Creates a user-defined trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | 2 to 11 characters long, A through Z and the underscore (the underscore should be used as the second character of the label). |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | 2 to 2047. |

Parameter Value: 2 to 2047.
Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: DISPOSE.

## Example

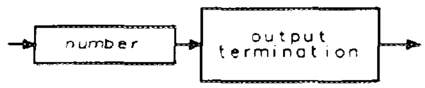
`OUTPUT 718;"TRDEF NEW,100;"` *Defines a trace called NEW.*

## Description

The TRDEF command defines a trace and the number of points the trace will contain. Each trace element consists of 16 bits and stores the trace amplitude in measurement units. See the description for the TDF M format that is described in "Different Formats for Trace Data Transfers" in Chapter 3 for more information about measurement units.

## Query Response

The query response returns the number of trace elements in the trace.

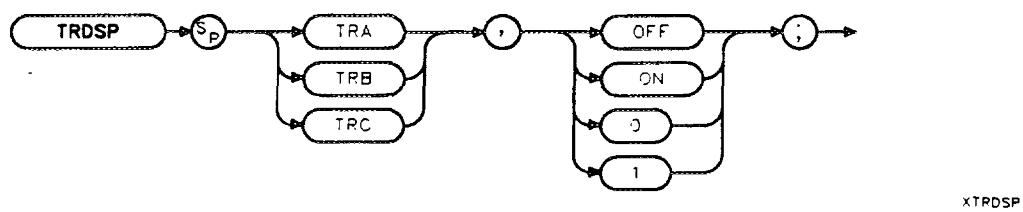



001

# TRDSP
# Trace Display

Turns on or off the display of trace A, B, or C without clearing the trace (measurements can still be taken).

## Syntax




Related Commands: TRPRST, TRSTAT.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"TRDSP TRA,OFF;"
```

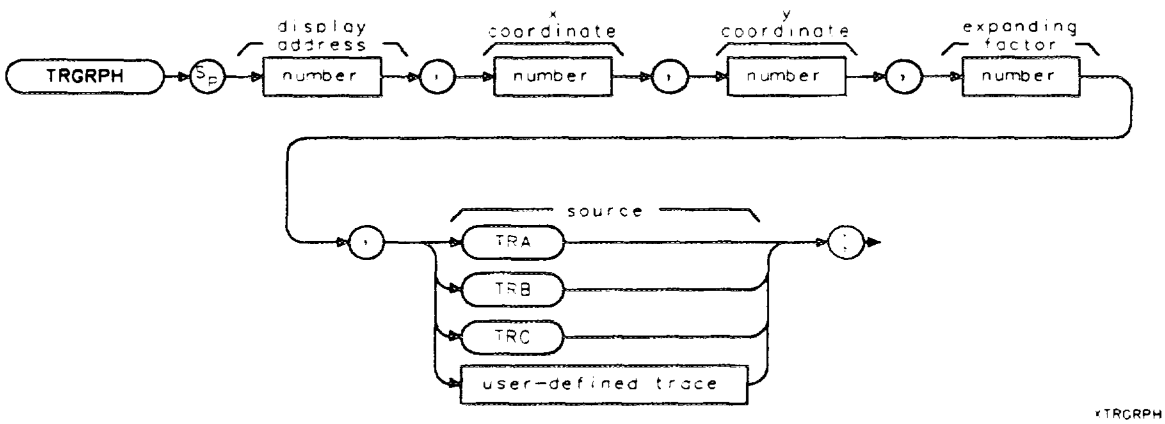
## Description

TRDSP OFF reduces the time duration between sweeps.

# TRGRPH
# Trace Graph

Displays a compressed trace on the spectrum analyzer display.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 0 to 4000 for the $x$ coordinate, 0 to 8000 for the $y$ coordinate. |
| Number (expanding factor) | Any valid integer. | 0 to 100. |
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |

Prerequisite Commands: TRDEF when using a user-defined trace.
Related Commands: COMPRESS, DSPLY.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"TRDEF NEW,100;"` | *Defines a trace called NEW with 100 trace elements.* |
| `OUTPUT 718;"CF 300MHZ;SNGLS;"` | *Changes the center frequency, activates single-sweep mode.* |
| `OUTPUT 718;"TS;"` | *Takes sweep.* |
| `OUTPUT 718;"COMPRESS NEW,TRA,POS;"` | *Compresses the contents of trace A into trace NEW.* |
| `OUTPUT 718;"BLANK TRA;"` | |
| `OUTPUT 718;"TRGRPH 0,0,400,4,NEW;"` | *Redraws trace NEW 400 measurement units above the baseline, expanded by a factor of 4.* |

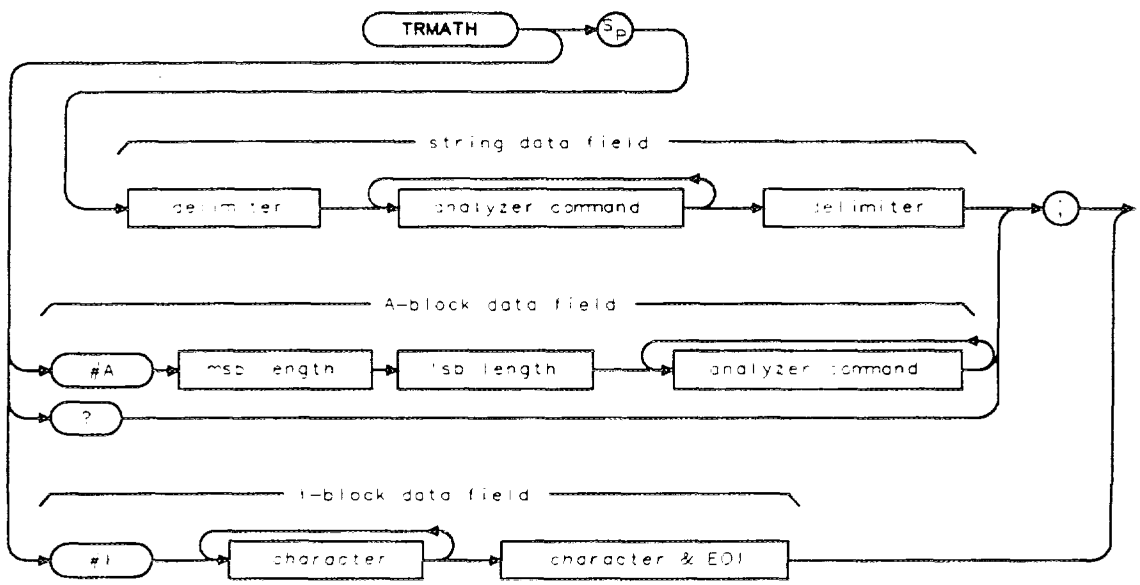
## Description

The $x$ and $y$ coordinates specify the position of the first trace element. Each horizontal division represents 40 $x$ coordinates. Each vertical division represents 1000 $y$ coordinates. The display address is inoperative; it is specified for backward compatibility only. The trace can be expanded according to the scale determined by the expanding factor.

# TRMATH
# Trace Math

Executes a list of spectrum analyzer commands at the end of each sweep.

## Syntax




XTRMATH

| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer Command | Any spectrum analyzer command except TS. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Character | Any valid character. | |
| Character & EOI | Any valid character and END. | |

Related Commands: LIMITEST, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME.

## Example

The program below halves the amplitude of trace A and moves it to trace B.

| | |
|---|---|
| `OUTPUT 718;"CLRW TRA;VIEW TRB;"` | *Displays trace B.* |
| `OUTPUT 718;"DISPOSE TRMATH;"` | *Disposes of existing TRMATH commands.* |
| `OUTPUT 718;"TRMATH! DIV TRB,TRA,2! ;"` | *Divides trace A by 2 and moves it into trace B.* |

## Description

The TRMATH command executes the list of spectrum analyzer commands at the end of each sweep. Any spectrum analyzer command except TS is allowed within the list of commands.

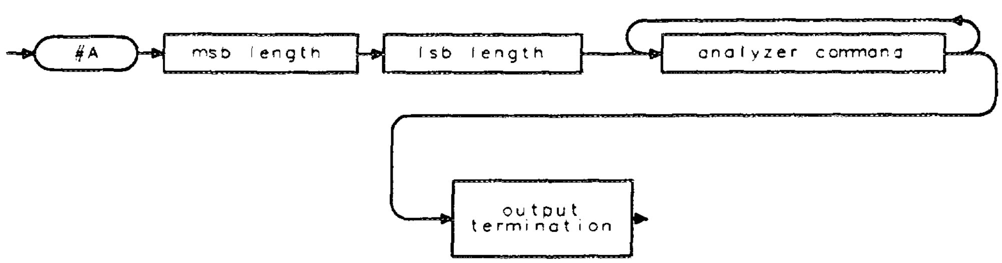
The operands and results of trace math are truncated if they are not within certain limits. If operating on traces A, B, or C, trace lengths must be less than or equal to 401. If operating on user-defined traces, results must be less than or equal to 2047.

After the TRMATH command is executed, any current ONEOS definitions are executed, and then any current limit-line testing (LIMITEST).

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the TRMATH definition:** IP clears the TRMATH definition. You can use the DISPOSE command to clear the TRMATH definition also.

## Query Response




3ONEOS

# TRPRST
# Trace Preset

Sets the trace operations to their preset values.

## Syntax


XTRPRST

Related Commands: AMB, BLANK, CLRDSP, CLRW, DISPOSE, DL, IP, TH.

## Example

```
OUTPUT 718;"TRPRST;"
```

## Description

TRPRST executes these commands:

AMB OFF
AMBPL OFF
ANLGPLUS OFF
BLANK TRB
BLANK TRC
CLRW TRA
DISPOSE ONEOS
DISPOSE ONSWP
DISPOSE TRMATH
DL OFF
EM
TH OFF

# TRSTAT
# Trace Status

Returns the status of traces A, B, and C: clear write, blank, view, minimum hold, or maximum hold.

## Syntax


XTRSTAT

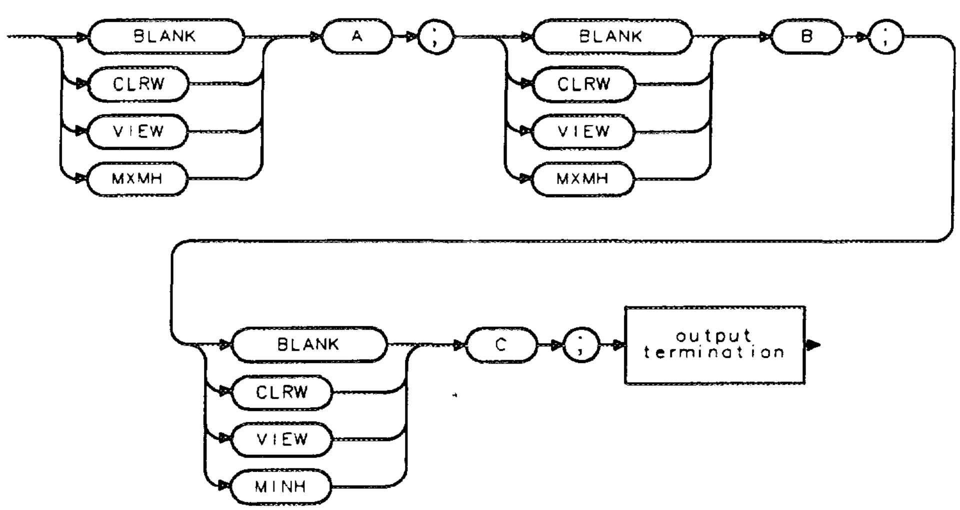
Related Commands: BLANK, CLRW, DET, MINH, TRDSP, VIEW.

## Example

This example returns the measurement state of traces A, B, and C.

```
DIM States$[40]                    Declares array for results.
OUTPUT 718;"TRSTAT?;"              Returns the status results to the computer.
ENTER 718 USING "-K";States$
PRINT States$                      Prints out status of traces.
```

## Query Response

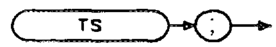



QTRSTAT

# TS
# Take Sweep

Starts and completes one full sweep before the next command is executed.

## Syntax




Related Commands: SNGLS, TM.

## Example

`OUTPUT 718;"SNGLS;TS;"` *Activates the single-sweep mode, and performs a take sweep.*

## Description

A take sweep is required for each sweep in the single-sweep mode. TS prevents further input from the interface bus until the sweep is completed to allow synchronization with other instruments.

In the example below, the command sequence does not allow sufficient time for a full sweep of the specified span before VIEW is executed. Therefore, only the span set by the instrument is displayed in trace A.

```
OUTPUT 718;"IP;SNGLS;CF 400MHZ;SP 20KHZ;VIEW TRA;"
```

A TS command inserted before VIEW makes the spectrum analyzer take one complete sweep before displaying trace A. This allows the spectrum analyzer sufficient time to respond to each command in the

sequence.

```
OUTPUT 718;"IP;CF 400MHZ;SP 20MHZ;TS;VIEW TRA;"
```

TS is recommended before transmission of marker data and before executing marker operations such as peak search. This is because the active marker is repositioned at the end of each sweep. When the spectrum analyzer receives a TS command, it is not ready to receive any more data until one full sweep has been completed. However, when slow sweep speeds are being used, the controller can be programmed to perform computations or address other instruments while the spectrum analyzer completes its sweep.

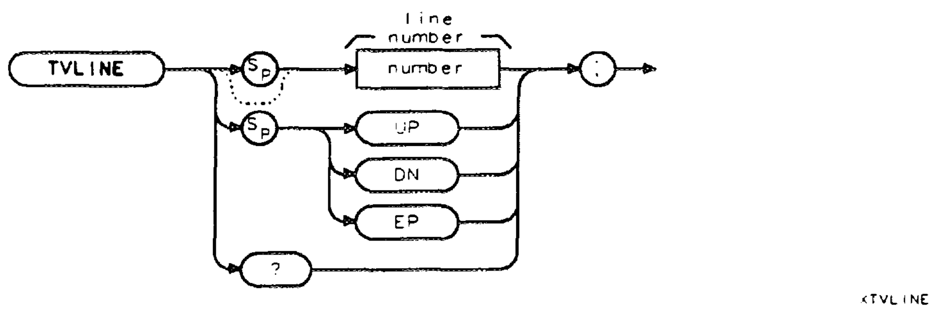
On-event commands (ONCYCLE, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME, and TRMATH) do not interrupt a take sweep.

**Note** When MKPAUSE or MKSTOP are activated, TS considers the sweep complete when it reaches the active marker.

# TVLINE
# TV Line

Selects which horizontal line of video to trigger on.

## Syntax



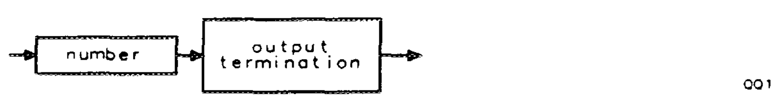

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. Default value is 17. | 1 to 1012. |

Equivalent Softkey: **TV LINE #**.
Options Required: Options 101 and 102, or Option 301.
Preset Value: 17.
Related Commands: HAVE, TVSFRM, TVSTND.

## Example

```
OUTPUT 718;"TVLINE 20;"
```

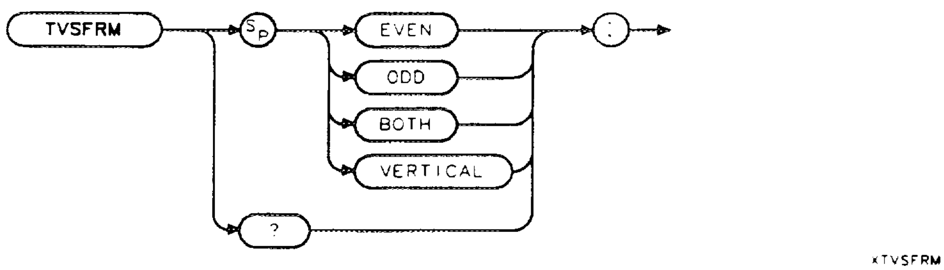
## Query Response



# TVSFRM
# TV Frame

Selects the type of video frame to trigger on.

## Syntax




Options Required: Options 101 and 102, or Option 301.
Related Commands: HAVE, TVLINE, TVSYNC.

## Example

```
OUTPUT 718;"TVSFRM BOTH;"
```

## Description

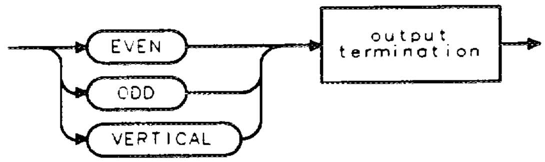
The ODD and EVEN trigger are for interlaced formats, and VERTICAL is for noninterlaced display formats.

The functions of TVSFRM ODD, TVSFRM EVEN, and TVSFRM BOTH are identical to **TV TRIG ODD FLD**, **TV TRIG EVEN FLD**, and **TV TRIG VERT INT**, respectively. TVSFRM BOTH is the same as TVSFRM VERTICAL.

When used as a predefined variable, TVSFRM returns a number. The number that is returned depends upon the setting of the TVSFRM parameter, as shown in the following table.

| TVSFRM Parameter Setting | Value Returned |
|---|---|
| VERTICAL or BOTH | 0 |
| EVEN | 1 |
| ODD | 2 |

## Query Response

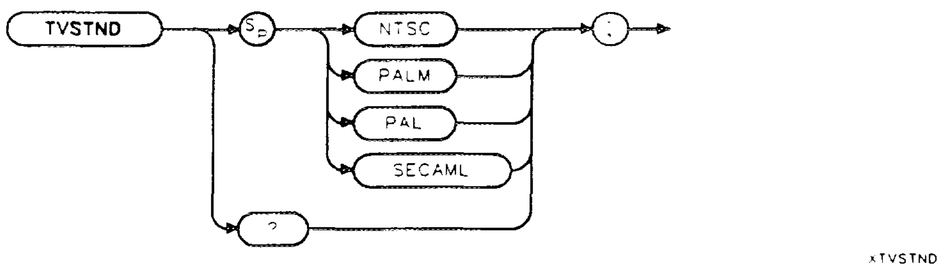



QTVSFRM

# TVSTND
# TV Standard

Selects the triggering for NTSC, PAL, PAL-M, and SECAM-L formats.

## Syntax




Equivalent Softkey: **TV Standard**.
Options Required: Options 101 and 102, or Option 301.
Related Commands: TM, TVLINE, TVSYNC.

## Example

```
OUTPUT 718;"TVSTND PAL;"
```

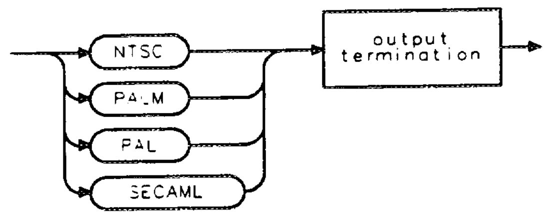
## Description

TVSTND sets corrections for TVLINE for each standard format. TVSTND sets the polarity to trigger on (positive or negative) automatically; it is necessary to use TVSYNC after using TVSTND only if you require a non-standard format.

When used as a predefined variable, TVSTND returns a number. The number that is returned depends upon the setting of the TVSTND parameter, as shown in the following table.

| TVSTND Parameter Setting | Value Returned |
|---|---|
| NTSC | 0 |
| PALM | 1 |
| PAL | 2 |
| SECAML | 3 |

## Query Response

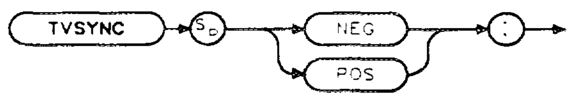



QTVSTND

# TVSYNC
# TV Sync

Selects the polarity of video modulation to trigger on.

## Syntax




XTVSYNC

Equivalent Softkey: **TV SYNC NEG POS**.

Options Required: Options 101 and 102, or Option 301.
Preset Value: TVSYNC NEG.
Related Commands: HAVE, TVLINE, TVSFRM, TVSTND.

## Example

```
OUTPUT 718;"TVSYNC POS;"
```

## Description

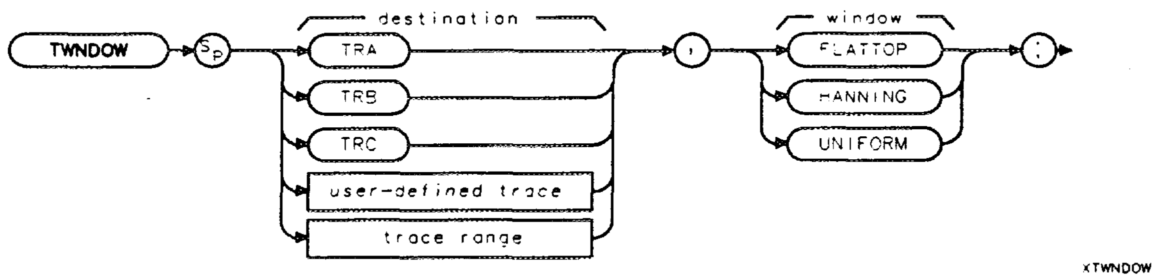
TVSYNC allows you to trigger on the negative or positive modulation video format. TVSTND changes the triggering polarity for the selected video format.

When used as a predefined variable, TVSYNC returns a "0" when TVSYNC is set to POS, a "1" if TVSYNC is set to NEG.

# TWNDOW
# Trace Window

Creates a window trace array for the fast Fourier transform (FFT) function.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: FFT.

## Example

Connect calibrator signal to the spectrum analyzer input.

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"CF 300MHZ;"` | *Changes the center frequency.* |
| `OUTPUT 718;"SP 0HZ;ST 800MS;"` | *Changes span, sweep time.* |
| `OUTPUT 718;"TRDEF NEW,401;"` | *Defines a trace called NEW.* |
| `OUTPUT 718;"TWNDOW NEW,UNIFORM;"` | *Trace NEW stores the window algorithm, UNIFORM.* |
| `OUTPUT 718;"CLRW TRB;"` | |
| `OUTPUT 718;"SNGLS;TS;TS;"` | *Activates single-sweep mode and updates trace.* |
| `OUTPUT 718;"FFT TRA,TRB,NEW;"` | *Performs fast Fourier transform on trace B and stores the results in trace A.* |
| `OUTPUT 718;"BLANK TRB;"` | |
| `OUTPUT 718;"VIEW TRA;"` | *Displays the result.* |

## Description

The trace window function creates a trace array according to three built-in algorithms: UNIFORM, HANNING, or FLATTOP. When used with the FFT command, the three algorithms give resultant passband shapes that represent a give-and-take between amplitude uncertainty, sensitivity, and frequency resolution. See "FFT" for more information about these algorithms and the FFT function.

# UP
# Up

Increases the value of the active function by the applicable step size.

## Syntax


XUP

Related Commands: See the list of active functions listed in the description for UP.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;MKN;RB 10KHZ;MKPK NH;UP;"` | *Increases the resolution bandwidth to 30 kHz because MKPK NH does not change the active function.* |

## Description

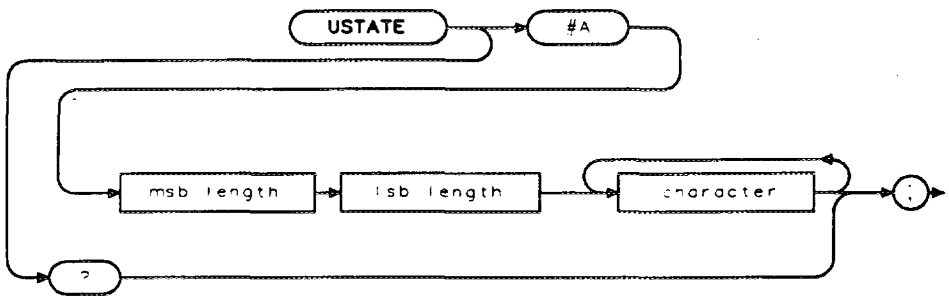
Before executing UP, be sure that the function to be decreased is the active function. For example, the programming example increases the resolution bandwidth, because marker peak (MKPK) is not an active function.

The active functions are ACPBW, ACPSP, AT, CF, CRTHPOS, CRTVPOS, DL, DOTDENS, FA, FB, FMGAIN, GD, GL, LG, MKA, MKD, MKFCR, MKN, MKPAUSE, MKPX, ML, NDB, NRL, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCALC, SRCAT, SRCPOFS, SRCPSWP, SRCPWR, SRCTK, SS, ST, TH, TVLINE, VB, VBR, and user-defined active function specified by the ACTDEF command.

# USTATE
# User State

Transmits information that has been stored in the spectrum analyzer by the user.

## Syntax




XUSTATE

| Item | Description/Default | Range |
|---|---|---|
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Character | Any valid character. | |

Related Commands: FUNCDEF, KEYDEF, ONEOS, SAVES, TRDEF, VARDEF.

## Example

| | |
|---|---|
| `DIM User$[20000]` | *Dimensions a string to store the user state data.* |
| `OUTPUT 718;"USTATE?;"` | *Sends contents of user state memory to the computer.* |
| `ENTER 718 USING "#,-K";User$` | *Stores contents in string. "-K" allows control codes to be treated as characters.* |

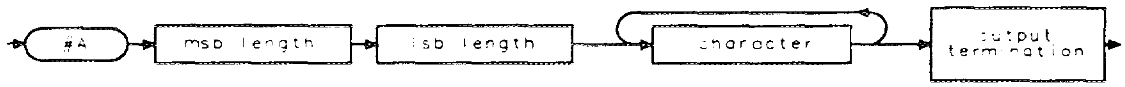
## Description

The user state information contains the contents of user memory, which contains:

- User-defined functions (FUNCDEF).
- User-defined variables (VARDEF).
- On-cycle algorithm (ONCYCLE).
- On-delay algorithm (ONDELAY).
- On-end-of-sweep algorithm (ONEOS).
- On-marker algorithm (ONMKR).
- On-SRQ algorithm (ONSRQ).
- On-time algorithm (ONTIME).
- User-defined keys (KEYDEF).
- User-defined trace arrays (TRDEF).
- Values stored in user-defined variables and user-defined traces.

## Query Response

USTATE? returns the user state to the computer. Also returned are instructions required by the spectrum analyzer when the user state information is transmitted to the spectrum analyzer. The contents of user memory can be restored by executing USTATE followed by the A-block data retrieved by a previous "USTATE?;" command.

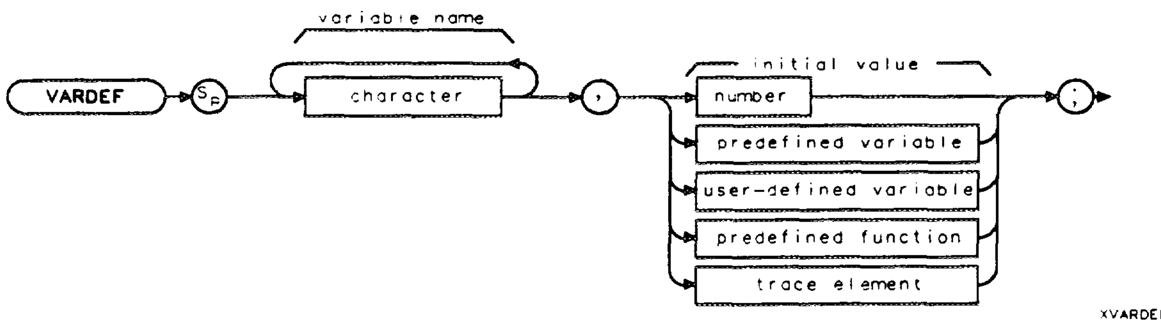



QUSTATE

# VARDEF
# Variable Definition

Creates a user-defined variable and assigns it a value.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | 2 to 11 characters long, A through Z and the underscore (the underscore should be used as the second character of the label). |
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Related Commands: DISPOSE, TRDEF.

## Example

| | |
|---|---|
| `OUTPUT 718;"VARDEF V_AR,0;"` | *Defines variable called V_AR and assigns it a value of 0.* |
| `DISP "ENTER THE VALUE OF THE VARIABLE USING THE ANALYZER KEYS"` | |
| `OUTPUT 718;"V_AR EP;"` | *The value of V_AR is changed by using the front-panel controls.* |
| `OUTPUT 718;"V_AR?;"` | |
| `ENTER 718;N` | *Returns entered value of V_AR to the computer.* |
| `PRINT N` | *Displays value on the computer screen.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"V_AR?;"` | *The value of V_AR changes to its initial value after an IP.* |

```
ENTER 718;N
PRINT N                                         Displays "0."
```

## Description

The VARDEF command creates a user-defined variable and assigns it a value. User-defined variables can be used in many of the spectrum-analyzer remote-control processes. Use user-defined variables wherever "user-defined variable" appears in the syntax diagrams. An instrument preset (IP) sets user-defined variables to their initial value (see example).

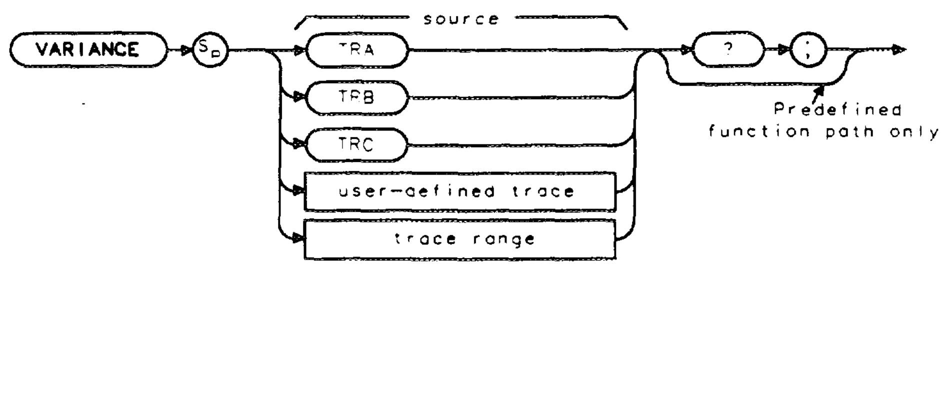
An error results if a variable name is the same as any reserved word. Table 5-2 lists reserved words.

User-defined variables occupy spectrum analyzer memory. Use the DISPOSE command to clear user-defined variables from memory.

# VARIANCE
# Variance of Trace Amplitudes

Returns the amplitude variance of the specified trace, in measurement units.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, RMS, STDEV.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep mode.* |
| `OUTPUT 718;"VARIANCE TRA?;"` | *Returns variance of trace A to computer.* |
| `ENTER 718;Number` | *Stores value in computer variable.* |
| `DISP Number;"MEASUREMENT UNITS"` | *Displays the results on computer screen.* |

## Description

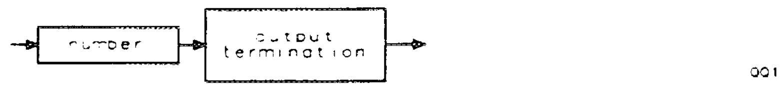
Taking the square root of a variance yields the standard deviation value.

The formula to calculate the variance is as follows:

$$\frac{\sum_{i=1}^{n}(\bar{x} - x_i)^2}{n-1}$$

$n$ represents the number of data points.
$x_i$ represents a data point.
$\bar{x}$ represents the mean of data.

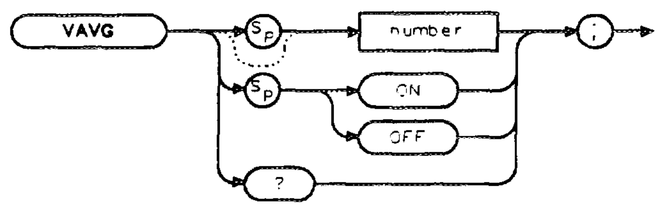
## Query Response



# VAVG
# Video Average

Enables the video-averaging function, which averages trace points to smooth the displayed trace.

## Syntax




XVAVG

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. Default is 100. | 1 to 16384. |

Equivalent Softkey: **VID AVG ON OFF**.

Related Commands: AUTO, CLRAVG, IP, SMOOTH.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

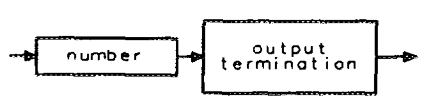
## Example

`OUTPUT 718;"VAVG 150;"` *Video averages the trace.*

## Description

Use VAVG to view low-level signals without slowing the sweep time. Video averaging can lower the noise floor by more than a 30 Hz video bandwidth if a large number of sweeps has been specified for averaging. VAVG may also be used to monitor instrument state changes (for example, changing bandwidths, center frequencies) while maintaining a low noise floor. The active function readout indicates the number of sweeps to be averaged; the default for the number of sweeps is 100 unless otherwise specified. Executing "VAVG OFF;" turns off video averaging. Executing "VAVG ON;" turns on video averaging.

## Query Response

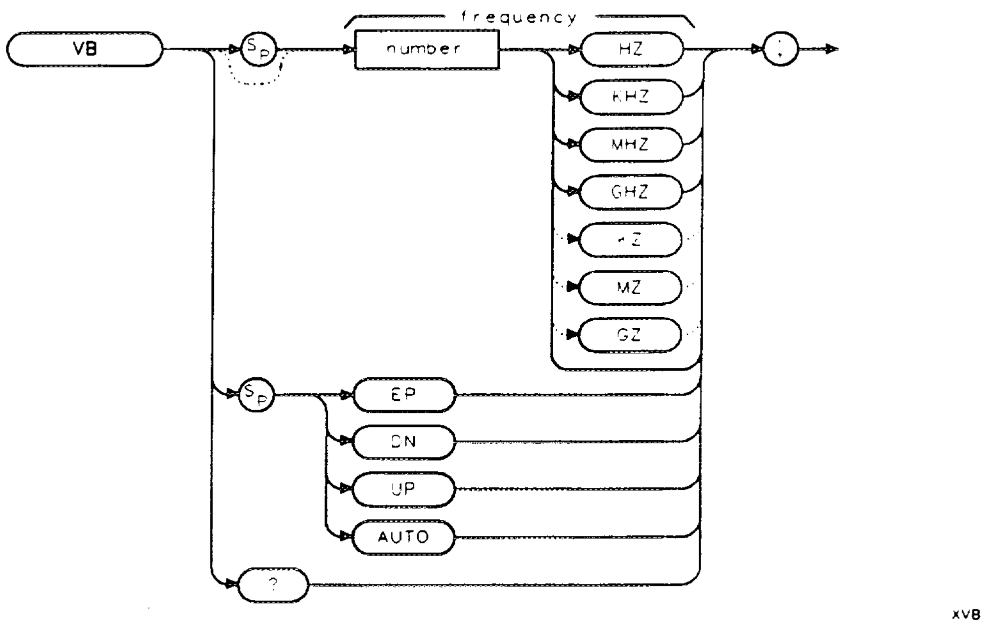



QQ1

# VB
# Video Bandwidth

Specifies the video bandwidth, which is a post-detection, low-pass filter.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 30 Hz to 3 MHz. |

Equivalent Softkey: **VID BW AUTO MAN**.
Preset State: 1 MHz.
Step Increment: In a 1, 3, 10 sequence.
Related Commands: AUTO, RB, SP, ST, VBR.

## Example

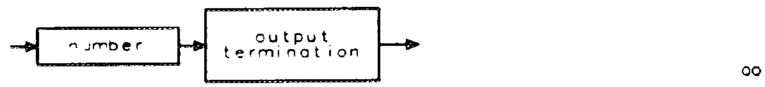
`OUTPUT 718;"VB 10KHZ;"` *Changes the video bandwidth to 10 kHz.*

## Description

The resolution bandwidth, video bandwidth, and sweep time are normally coupled to the span. Executing VB uncouples video bandwidth from resolution bandwidth (it does nothing to the sweep-time, resolution-bandwidth, and span coupling). Executing AUTO recouples video bandwidth to the resolution bandwidth.

Frequency values other than the values in the 1, 3, 10 sequence are rounded to the nearest permissible value.

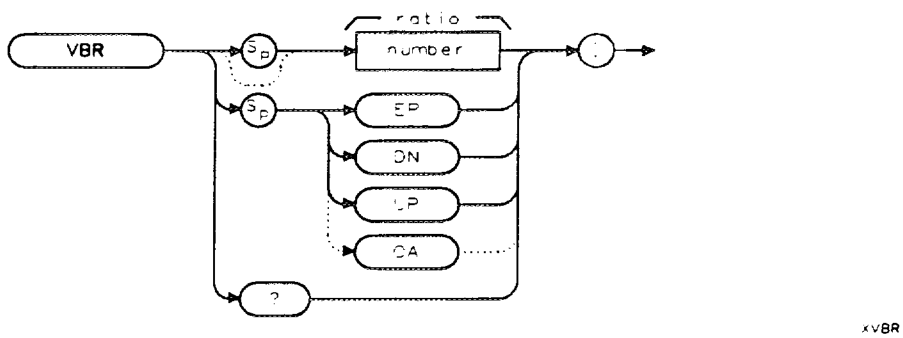
## Query Response



# VBR
# Video Bandwidth Ratio

The VBR parameter is multiplied by the resolution bandwidth to determine the automatic setting of video bandwidth.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid real number. | 0 to 3000000 |

Equivalent Softkey: **VBW/RBW RATIO** .
Preset State: 0.300.
Step Increment: 1, 3, 10 sequence.
Related Commands: AUTO, RB, SP, VB.

## Example

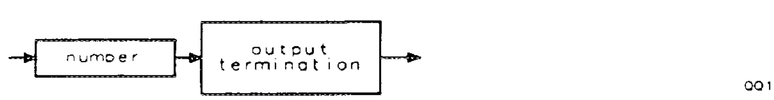
```
OUTPUT 718;"VBR 1;"
```

## Description

Ratio values other than the values in the 1, 3, 10 sequence are rounded to the nearest permissible value.

VBR returns a real number when used as a predefined variable.

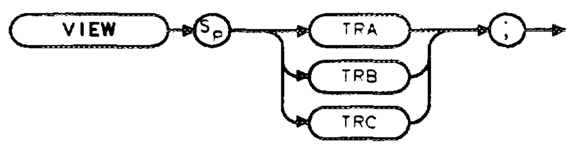
## Query Response



# VIEW
# View Trace

Displays trace A, trace B, or trace C, and stops taking new data into the viewed trace.

## Syntax




XVIEW

Equivalent Softkey: **VIEW A**, **VIEW B**, and **VIEW C**.
Related Commands: BLANK, CLRW, MINH, MXMH.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

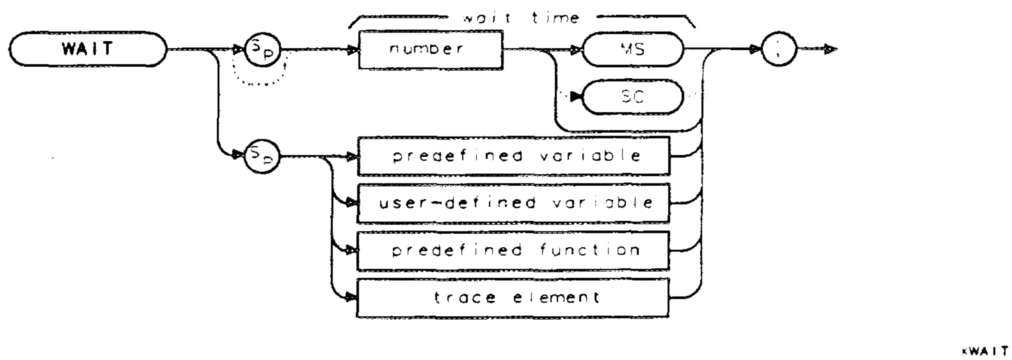
```
OUTPUT 718;"VIEW TRA;"
```

## Description

In the VIEW mode the trace is not updated. When VIEW is executed, the contents of the trace are stored in display memory.

# WAIT
# Wait

Suspends all spectrum analyzer operation for the specified time duration.




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 ms to 1000 s. |

## Example

Use WAIT to suspend spectrum analyzer operation.

```
130  OUTPUT 718;"TRDSP TRA,OFF;TS;"    Blanks trace A.
140  OUTPUT 718;"WAIT 2SC;"            Suspends analyzer operation for 2 seconds.
150  OUTPUT 718;"TRDSP TRA,ON;"        Displays trace A.
```

## Description

The WAIT command suspends *all* spectrum analyzer operation for the specified time. Use the ONDELAY command if you want the spectrum analyzer to keep taking data during the elapsed time period.

# WINNEXT
# Window Next

When using the windows display mode, you can use WINNEXT to select the upper or lower window as the active window.

## Syntax


XWINNEXT

Equivalent Front-Panel Key (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): (NEXT).
Related Commands: WINON, WINOFF.

## Example

| | |
|---|---|
| `OUTPUT 718;"WINON;"` | *Turns on the windows display mode.* |
| `OUTPUT 718;"WINNEXT;"` | *Selects the window that is currently not active to be the active window.* |

## Description

When the windows display mode is activated, there will be two windows displayed on the spectrum analyzer display. Only one of the windows is active (the currently active window will have a solid line around the graticule rather than a broken line.) You can use the WINNEXT command to select the active window.

# WINOFF
# Window Off

Turns off the windows display mode.

## Syntax


XWINOFF

Equivalent Softkey (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): **WINDOWS OFF**.

Related Commands: WINON.

## Example

| | |
|---|---|
| `OUTPUT 718;"WINON;"` | *Turns on the windows display mode.* |
| `OUTPUT 718;"WINNEXT;"` | *Selects the window that is currently not active to be the active window.* |
| `OUTPUT 718;"WINOFF;"` | *Turns off the windows display mode.* |

## Description

When you execute WINON, there will be two windows displayed on the spectrum analyzer screen. You must execute WINOFF to turn the windows off and return to a single display, and the display will have the settings of the last active window. In contrast, WINZOOM also changes from two windows to one full screen display but does not exit the windows display mode; you can still access the second window by executing WINZOOM again.

# WINON
# Window ON

Displays the two windows on the spectrum analyzer display.

## Syntax


XWINON

Equivalent Front-Panel Key (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): ON.
Related Commands: WINOFF, WINNEXT, WINZOOM.

## Example

```
OUTPUT 718;"WINON;"
```

## Description

WINON activates the windows display mode and the zone marker.

**Windows display mode:** When the windows display mode is first activated, there will be two windows displayed on the spectrum analyzer display. Only one of the windows is active (the active window will have a solid line around the graticule rather than a broken line.) You can use the WINNEXT command to select the active window. The instrument state of the active window can be changed without affecting the state of the inactive window.

**Zone marker:** The zone marker is shown in the upper window by two vertical lines. The frequency span between the two edges of the zone marker is the frequency range of the lower window. The zone marker can be moved and changed by using the ZMKCNTR, ZMKSPAN, ZMKPKNR, or ZMKPKNL programming commands. Changing the span or center frequency of the lower window will change the span or location of the zone marker on the upper window correspondingly.

Most programming commands can be executed when the windows display mode is used. Some functions cannot be used with the windows display mode, however. Table 5-10 lists the programming commands that, when executed, exit the windows display mode.

**Table 5-10.**
**Programming Commands That Exit The Windows Display Mode**

| Command | Description |
|---|---|
| ACP | Measures adjacent channel power. |
| CAL | Performs the calibration routines. |
| CHP | Measures channel power. |
| CNF | Performs the confidence test. |
| DISPOSE ALL or ERASE | Disposes of the contents of user memory. |
| FFTAUTO, FFTCONTS, FFTSNGLS | Initiates a FFT measurement. |
| GDVRUTIL | Accesses the time-gate functions. |
| IP | Performs an instrument preset. |
| LF | Performs an instrument preset into base band. |
| NDBPNT | Measures NdB bandwidth. |
| OBW | Measures occupied bandwidth. |
| PCTAM | Measures the percent AM. |
| PKZOOM | Performs the peak zoom routine. |
| TOI | Makes a third order intercept measurement. |

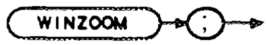
When in the windows display mode, saving the trace or state saves the state of the currently active window only. The recall state function recalls the stored state into the currently active window.

You must execute WINOFF to turn the windows off.

# WINZOOM
# Window Zoom

When using the windows display mode, you can use WINZOOM to either expand the size of the active window so that it fills the entire spectrum analyzer display, or display both the upper and lower windows on the spectrum analyzer display.

## Syntax




XWINZOOM

Equivalent Front-Panel Key (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): ZOOM.
Related Commands: WINNEXT, WINON.

## Example

```
OUTPUT 718;"WINON;"      Turns on the windows display mode.
OUTPUT 718;"WINZOOM;"    Expands the size of the active window.
```

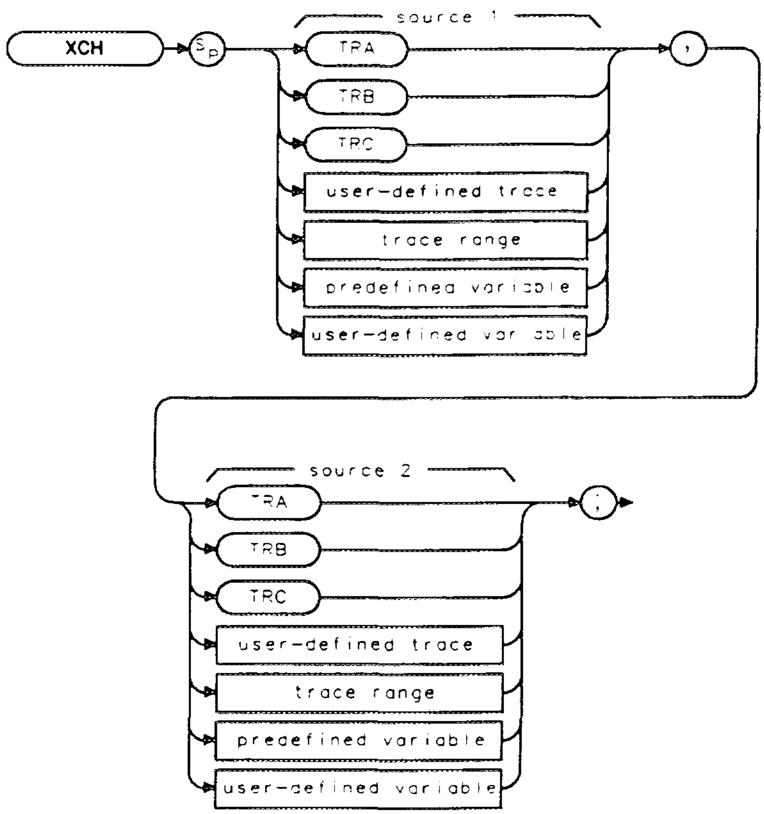
## Description

The first time WINZOOM is executed, it expands the active window. Executing WINZOOM again restores the windows display mode so that both of the windows are displayed on the spectrum analyzer display.

# XCH
# Exchange

Exchanges the contents of sources 1 and 2.

## Syntax




XXCH

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: AXB, BXC.

## Example

`OUTPUT 718;"XCH TRA,TRB;"` *Exchanges the contents of trace A with trace B.*

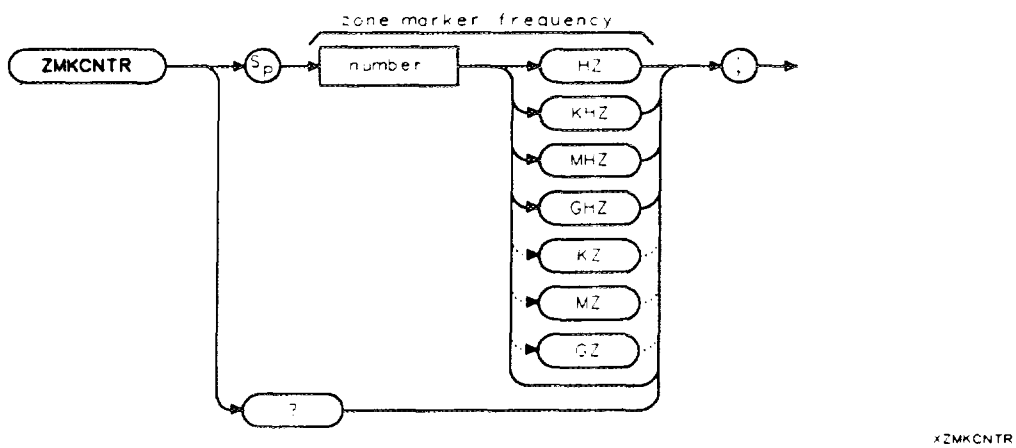
## Description

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# ZMKCNTR
# Zone Marker at Center Frequency

Positions the zone marker at the specified frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency range of the spectrum analyzer. |

Equivalent Softkey (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): **ZONE CENTER**.

Default value: If a marker is on-screen, the frequency value of the marker. If a marker is not on-screen, the spectrum analyzer center frequency.

Related Commands: CF, SP, WINON, ZMKSPAN.

## Example

```
OUTPUT 718;"WINON;"            Turns on the windows display mode.
OUTPUT 718;"ZMKCNTR 300MHZ;"   Places the zone marker at 300 MHz.
```

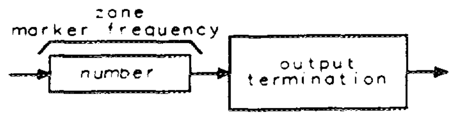
## Description

ZMKCNTR allows you to move the zone marker within the frequency range displayed in the upper window. When the lower window is the active window, changing the center frequency (CF) or frequency span (SP) of the lower window changes the position of zone marker in the upper window.

**Restrictions:** Use ZMKCNTR only if the window is in non-zero span; ZMKCNTR does not apply if the window is in the time domain. The zone marker can be moved beyond the frequency range displayed by the upper window (the zone marker cannot exceed the frequency range of the spectrum analyzer, however.) ZMKCNTR should only be used when the windows display mode is turned on.

You can use ZMKSPAN to change the span of the zone marker.

## Query Response




QZMKCNTR

# ZMKPKNL
# Zone Marker for Next Left Peak

Places the zone marker at the next signal peak that is left of the zone marker's current position.

## Syntax


*ZMKPKNL

Equivalent Softkey (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): **ZONE PK LEFT** .

Related Commands: MKPX, WINON, ZMKCNTR, ZMKSPAN, ZMKPKNR.

## Example

| | |
|---|---|
| `OUTPUT 718;"WINON;"` | *Turns on the windows display mode.* |
| `OUTPUT 718;"ZMKPKNL;"` | *Places the zone marker at the next peak to the left of the current position of the zone marker.* |

## Description

ZMKPKNL does the following:

1. Searches for the next signal peak outside and to the left of the zone marker. ZMKPKNL only applies if the window is in a non-zero span; ZMKPKNL does not apply if the window is in the time domain.
2. If a peak is found, ZMKPKNL moves the zone marker so that it is centered around the peak. If a signal peak cannot be found, or the window is in zero span, the zone marker is not moved.
3. Changes the center frequency of the lower window to the frequency of the signal peak.

To be considered a signal peak, the signal must be greater than the peak excursion (see "MKPX" for more information about the peak excursion).

ZMKPKNL should only be used when the windows display mode is turned on.

# ZMKPKNR
# Zone Marker for Next Right Peak

Places the zone marker at the next peak to the right of the zone marker's current position.

## Syntax


XZMKPKNR

Equivalent Softkey (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only):
**ZONE PK RIGHT**.
Related Commands: MKPX, WINON, ZMKCNTR, ZMKSPAN, ZMKPKNL.

## Example

| | |
|---|---|
| `OUTPUT 718;"WINON;"` | *Turns on the windows display mode.* |
| `OUTPUT 718;"ZMKPKNR;"` | *Places the zone marker at the next peak to the right of the current position of the zone marker.* |

## Description

ZMKPKNR does the following:

1. Searches for the next signal peak outside and to the right of the zone marker. ZMKPKNR only applies if the window is in a non-zero span; ZMKPKNR does not apply if the window is in the time domain.
2. If a peak is found, moves the zone marker so that it is centered around the peak. If a signal peak cannot be found, or the window is in zero span, the zone marker is not moved.
3. Changes the center frequency of the lower window to the frequency of the signal peak.

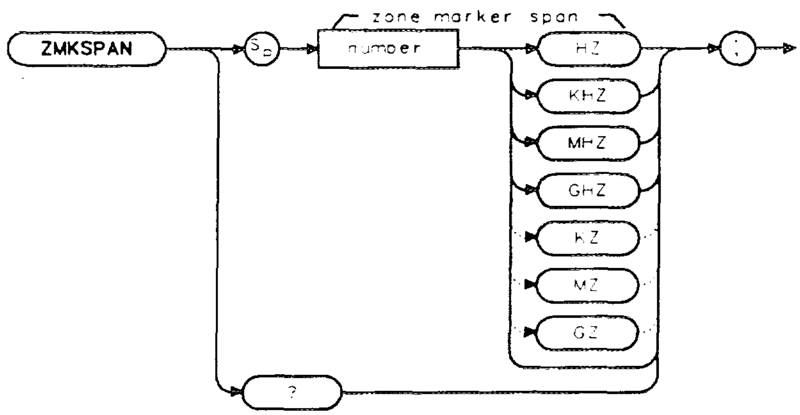
To be considered a signal peak, the signal must be greater than the peak excursion (see "MKPX" for more information about the peak excursion).

ZMKPKNR should only be used when the windows display mode is turned on.

# ZMKSPAN
# Zone Marker Span

Changes the width of the zone marker.

## Syntax




XZMKSPAN

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 0 to maximum frequency span of the spectrum analyzer. |

Equivalent Softkey (HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only): **ZONE SPAN**.

Default value: 1/10 of the spectrum analyzer's frequency span.

Related Commands: SP, WINON, ZMKCNTR.

## Example

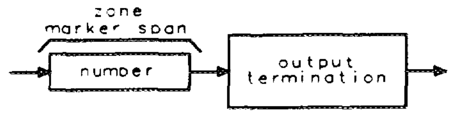
```
OUTPUT 718;"WINON;"             Turns on the windows display mode.
OUTPUT 718;"ZMKSPAN 100MHZ;"    Sets the span of the zone marker to 100 MHz.
```

## Description

ZMKSPAN allows you to change the frequency span of the zone marker that is displayed in the upper window. When the lower window is the active window, frequency span (SP) of the lower window changes the frequency span of zone marker in the upper window.

**Restrictions:** Use ZMKSPAN only if the window is in non-zero span; ZMKSPAN does not apply if the window is in the time domain. ZMKSPAN should only be used when the windows display mode is turned on.

## Query Response




QZMKSPAN

# A

# Spectrum Analyzer Error Messages

## Error Messages

The spectrum analyzer can generate various messages that appear on its screen during operation to indicate a problem.

There are three types of messages: hardware error messages (H), user-created error messages (U), and informational messages (M).

- Hardware error messages indicate the spectrum analyzer hardware is probably broken. Refer to Chapter 8 in the *HP 8590 Series Spectrum Analyzer User's Guide* for more information.
- User-created error messages appear when the spectrum analyzer is used incorrectly. They are usually generated during remote operation (entering programming commands using either a controller or the external keyboard).
- Informational messages provide information indicating the spectrum analyzer's progress within a specific procedure.

The messages are listed in alphabetical order on the following pages; each message is defined, and its type is indicated by an (H), (U), or (M).

**ϕ LOCK OFF**
Indicates slow YTO tuning. This message may appear if the spectrum analyzer is using default correction factors. If this message appears constantly, perform the CAL FREQ routine to try to eliminate this message. ϕ LOCK OFF appears briefly during the CAL FREQ routine, during instrument preset, or when the frequency value is changed; this is normal and does not indicate a problem. (U) and (H)

**ADC-2V FAIL**
Indicates a hardware failure. (H)

**ADC-GND FAIL**
Indicates a hardware failure. (H)

**ADC-TIME FAIL**
Indicates a hardware failure. (H) and (U)

**CAL:_ _ _**
During the self-calibration routine, messages may appear on the display to indicate how the calibration routines are progressing. For example, `sweep`, `freq`, `span`, `MC delay`, `FM coil`, and `atten` can appear on the spectrum analyzer display. `ϕ LOCK OFF` appears briefly during the CAL FREQ self-calibration routine; this is normal and does not indicate a problem. (M)

**CAL:_ _ _ : done Press CAL STORE to save**
Indicates that the self-calibration routine is finished and that you should press **CAL STORE**. (M)

**CAL: cannot execute CALAMP enter: 0 dB PREAMP GAIN**
The preamplifier gain should be set to 0 dB before the CAL AMPTD routine is performed. The preamplifier gain is set by using **EXTERNAL PREAMPG**. This message also sets SRQ 110. (U)

**CAL: DATA NOT STORED CAL AMP NEEDED**
The correction factors are corrupt and cannot be stored. You need to perform the CAL FREQ & AMPTD routine before trying to store the correction factors. This message also sets SRQ 110. (U)

**CAL: FM SPAN SENS FAIL**
The spectrum analyzer could not set up span sensitivity of the FM coil. (H)

**CAL: GAIN FAIL**
Indicates the signal amplitude is too low during the CAL AMPTD routine. This message also sets SRQ 110. (H)

**Cal harmonic >= 5.7 GHz NOT found**
Indicates that the CAL YTF routine for an HP 8595E cannot find a harmonic of the 300 MHz calibration signal. If this happens, ensure that the CAL OUT connector is connected to the spectrum analyzer input, perform the CAL FREQ & AMPTD routine, and then perform the CAL YTF routine again. (U) and (H)

**CAL: MAIN COIL SENSE FAIL**
The spectrum analyzer could not set up span sensitivity of the main coil. If this message appears, press (FREQUENCY), −37, (Hz), (CAL), **More 1 of 4**, **More 2 of 4**, **DEFAULT CAL DATA**, and perform the CAL FREQ routine again. (H)

**CAL: NBW 200 Hz notch amp failed**
Indicates that the 200 Hz resolution bandwidth is not the correct shape for the calibration routine. (H)

**CAL: NBW 200 Hz notch failed**
Indicates that the 200 Hz resolution bandwidth is not the correct shape for the calibration routine. (H)

**CAL: NBW 200 Hz width failed**
Indicates that the 200 Hz resolution bandwidth is not the correct bandwidth for the calibration routine. (H)

**CAL: NBW gain failed**
Indicates that one of the resolution bandwidths is not the correct amplitude for the calibration routine. (H)

**CAL: NBW width failed**
Indicates that one of the resolution bandwidths is not the correct width for the calibration routine. (H)

**CAL: PASSCODE NEEDED**
Indicates that the function cannot be accessed without the pass code. For the DEFAULT CAL DATA function, the pass code is setting the center frequency of the spectrum analyzer to −37 Hz. (M)

**CAL: RES BW AMPL FAIL**
The relative insertion loss of the resolution bandwidth is incorrect. This message also sets SRQ 110. (H)

**CAL SIGNAL NOT FOUND**
Indicates the calibration signal (CAL OUT) cannot be found. Check that the CAL OUT and the spectrum analyzer input connectors are connected with an appropriate cable. If the calibration signal is connected to the spectrum analyzer input but cannot be found, press (FREQUENCY), −37, (Hz), (CAL), **More 1 of 4**, **More 2 of 4**, **DEFAULT CAL DATA**. If the calibration signal still cannot be found, press (FREQUENCY), −37, (Hz) and perform the CAL FREQ or CAL FREQ & AMPTD self-calibration routines. This message also sets SRQ 110. (U) and (H)

**CAL: SPAN SENS FAIL**
The self-calibration span sensitivity routine failed. This message also sets SRQ 110. (H)

**CAL: USING DEFAULT DATA**
Indicates that the calibration data is corrupt and the default correction factors are being used. Interruption of the self-calibration routines or an error can cause this problem. (M)

**CAL YTF FAILED**
Indicates that the CAL YTF routine could not be successfully completed. If this message appears, ensure that the CAL OUT connector (for the HP 8595E) or 100 MHz COMB OUT connector (for the HP 8592D, HP 8593E, or HP 8596E) is connected to the spectrum analyzer input, perform the CAL FREQ & AMPTD routine, and then perform the CAL YTF routine again. (U) and (H)

**CAL: ZERO FAIL**
The spectrum analyzer could not set up the tuning sensitivity of the main coil. If this message appears, press (FREQUENCY), −37, (Hz), (CAL), **More 1 of 4**, **More 2 of 4**, **DEFAULT CAL DATA**, and perform the CAL FREQ routine again. (H)

**Cannot engage phase lock with current CAL FREQ data**
Indicates that the CAL FREQ routine needs to be performed before phase locking can be turned on. (U)

**Cannot reach N dB points**
Indicates that the number of dB specified for the N dB PTS function is greater than the distance of the signal peak from the spectrum analyzer noise floor or peak threshold. (U)

**Check trigger input**
Indicates that the spectrum analyzer needs an external trigger signal to use the time-gating functions. Before using the time-gating functions, you should ensure there is a trigger pulse connected to the GATE TRIGGER INPUT connector on the rear panel of spectrum analyzer and that the GATE OUTPUT is connected the EXT TRIG INPUT connector. (U)

**Comb harmonic at _ _ _ GHz NOT found**
Indicates that the CAL YTF routine for the spectrum analyzer cannot find a harmonic of the comb generator at frequency displayed. If this happens, ensure that the 100 MHz COMB OUT connector (for an HP 8592D, HP 8593E, or HP 8596E) or the CAL OUT connector (for an HP 8595E) is connected to the spectrum analyzer input with a low-loss, short cable before the CAL YTF routine is performed. (U) and (H)

**COMB SIGNAL NOT FOUND**
The comb signal cannot be found. Check that 100 MHz COMB OUT is connected to the spectrum analyzer input. The comb generator is available with the HP 8592D, HP 8593E, or HP 8596E only. (U) and (H)

**COMMAND ERROR:_ _ _**
The specified programming command is not recognized by the spectrum analyzer. (U)

**CONF TEST FAIL**
Indicates that the confidence test failed. If this happens, ensure that the CAL OUT connector is connected to the spectrum analyzer input, perform the CAL FREQ & AMPTD routine, and then perform the confidence test again. This message also sets SRQ 110. (H) and (U)

**Factory dlp, not editable**
Indicates that the downloadable program or variable that you have selected is used by a "personality" and cannot be edited. A personality is a program that is manufactured by Hewlett Packard and is available for use with the HP 8590 Series spectrum analyzer. An example of a personality is the HP 85716A CATV system monitor personality. (U)

**FAIL:_ _ _**
An error was discovered during the power-up check. The 4-digit by 10-digit code indicates the type of error. Error codes are described in the spectrum analyzer's service guide. (H)

**File type incompatible**
Indicates that the selected file is not a display image file. The file name for a display image file is always preceded by an "i." (U)

**FREQ UNCAL**
If the FREQ UNCAL message appears constantly, it indicates a YTO-tuning error. If this message appears constantly, perform the CAL FREQ routine. FREQ UNCAL appears briefly during the CAL FREQ routine; this is normal and does not indicate a problem. (U) and (H) (U) and (H)

**Function not available in current Mode**
Indicates that the function that you have selected can only be used with the spectrum analyzer mode. You can use the (MODE) key to select the spectrum analyzer mode. (U)

**Function not available with analog display**
Indicates that the function that you have selected is not compatible with the Analog+ display mode. To use the function, you must first turn off the Analog+ display mode with ANALOG+ ON OFF. (U)

**Gate card not calibrated**
This message can indicate that either the CAL AMPTD routine need to be performed before the time-gating functions can be used, or that something was connected to the GATE TRIGGER INPUT connector during the CAL AMPTD or CAL FREQ & AMPTD routines. If your spectrum analyzer has an Option 105 installed in it, you should ensure that nothing is connected to the GATE TRIGGER INPUT connector when the CAL AMPTD or CAL FREQ & AMPTD routines are performed. (U) and (H)

**INTERNAL LOCKED**
The spectrum analyzer's internal trace and state registers have been locked. To unlock the trace or state registers, press SAV LOCK ON OFF so that OFF is underlined. For remote operation, use PSTATE OFF. (U)

**INVALID ACTDEF: _ _ _**
The specified ACTDEF name is not valid. See the ACTDEF programming command. (U)

**INVALID AMPCOR: FREQ**
For the AMPCOR command, the frequency data must be entered in increasing order. See the description for the AMPCOR programming command for more information. (U)

**INVALID BLOCK FORMAT: IF STATEMENT**
An invalid block format appeared within the IF statement. See the description for the IF THEN ELSE ENDIF programming command for more information. (U)

**INVALID CARD**
Indicates one of the following conditions: a card reader is not installed, the memory card is write-protected (check the position of the switch on the memory card), the memory card is a read-only memory (ROM) card, or a memory card has not been inserted. This message can also occur if remote programming commands for the memory card capability are executed with an HP 8590D or HP 8592D that does not have an Option 003. (U)

**INVALID CARD: BAD MEDIA**
Indicates the formatting routine (FORMAT CARD) for the memory card could not be completed. See the description for INVALID CARD above for more information about the possible causes of this message. (U) and (H)

**INVALID CARD: DATA ERROR**
Indicates the data could not be retrieved from the memory card. (U) and (H)

**INVALID CARD: DIRECTORY**
Indicates the memory card has not been formatted. (U)

**INVALID CARD: NO CARD**
Indicates a memory card has not been inserted. (U)

**INVALID CARD: TYPE**
Indicates one of the following conditions: a card reader is not installed, the memory card is write-protected (check the position of the switch on the memory card), the memory card is a read-only memory (ROM) card, or a memory card has not been inserted. This message can also occur if remote programming commands for the memory card capability are executed with an HP 8590D or HP 8592D that does not have an Option 003. (U)

**INVALID CHECKSUM: USTATE**
The user-defined state does not follow the expected format. (U)

**INVALID COMPARE OPERATOR**
An IF/THEN or REPEAT/UNTIL routine is improperly constructed. Specifically, the IF or UNTIL operands are incorrect. (U)

**INVALID DET: FM or TV option only**
Indicates that the selected detector cannot be used until the appropriate option is installed in the spectrum analyzer. (U)

**INVALID ENTER FORMAT**
The enter format is not valid. See the appropriate programming command description to determine the correct format. (U)

**INVALID <file name> NOT FOUND**
Indicates that the specified file could not be loaded into spectrum analyzer memory or purged from memory because the file name cannot be found. (U)

**INVALID FILENAME _ _ _**
Indicates the specified file name is invalid. A file name is invalid if there is no file name specified, if the first letter of the file name is not alphabetic, or if the specified file type does not match the type of file. See the description SAVRCLW or STOR programming command for more information. (U)

**INVALID FILE: NO ROOM**
Indicates that there is insufficient space available on the memory card to store the data. (U)

**INVALID HP-IB ADRS/OPERATION**
An HP-IB operation was aborted due to an incorrect address or invalid operation. Check that there is only one controller (the spectrum analyzer) connected to the printer or plotter. (U)

**INVALID HP-IB OPERATION REN TRUE**
The HP-IB operation is not allowed. (This is usually caused by trying to print or plot when a controller is on the interface bus with the spectrum analyzer.) To use the spectrum analyzer print or plot functions, you must disconnect any other controllers on the HP-IB. If you are using programming commands to print or plot, you can use an HP BASIC command instead of disconnecting the controller. See the description for the PRINT command for more information. (U)

**INVALID ITEM:_ _ _**
Indicates an invalid parameter has been used in a programming command. (U)

**INVALID KEYLBL: _ _ _**
Indicates that the specified key label contains too many characters. A key label is limited to 8 printable characters per label line. (U)

**INVALID KEYNAME:_ _ _**
The specified key name is not allowed. (The key name may have conflicted with a spectrum analyzer programming command.) To avoid this problem, use an underscore as the second character in the key name, or avoid beginning the key name with the following pairs of letters: LB, OA, OL, TA, TB, TR, MA, MF, TS, OT, and DR. (U)

**INVALID OUTPUT FORMAT**
The output format is not valid. See the appropriate programming command description to determine the correct format. (U)

**INVALID RANGE: Stop < Start**
Indicates that the first trace element specified for a range of trace elements is larger that ending trace element. When specifying a trace range the starting element must be less than the ending element. For example, TRA[2,300] is legal but TRA[300,2] is not. (U)

**INVALID REGISTER NUMBER**
The specified trace register number is invalid. (U)

**INVALID REPEAT MEM OVFL**
Memory overflow occurred due to a REPEAT routine. This can occur if there is not enough spectrum analyzer memory for the REPEAT UNTIL declaration, or if the REPEAT UNTIL declaration exceeds 2047 characters. (U)

**INVALID REPEAT NEST LEVEL**
The nesting level in the REPEAT routine is improperly constructed. This can occur if too many REPEAT routines are nested. When used within a downloadable program (DLP), the maximum number of REPEAT UNTIL statements that can be nested is 20. (U)

**INVALID RS-232 ADRS/OPERATION**
An RS-232 operation was aborted due to an invalid operation. (U)

**INVALID SAVE REG**
Data has not been saved in the specified state or trace register, or the data is corrupt. (U)

**INVALID SCRMOVE**
Indicates the spectrum analyzer may have a hardware failure. See the spectrum analyzer's Service Guide for more information. (H)

**INVALID START INDEX**
Indicates that the first trace element specified for a range of trace elements is not within the trace range of the specified trace. (U)

**INVALID STOP INDEX**
Indicates that the ending trace element specified for a range of trace elements is not within the trace range of the specified trace. (U)

**INVALID STORE DEST: _ _ _**
The specified destination field is invalid. (U)

**INVALID SYMTAB ENTRY: SYMTAB OVERFLOW**
This message indicates that too many user-defined items (functions, variables, key definitions), or downloadable programs have been loaded into spectrum analyzer memory. If this message appears, use `DISPOSE USER MEM` and then load the user-defined item or downloadable program into spectrum analyzer memory. (U)

**INVALID TRACE: _ _ _**
The specified trace is invalid. (U)

**INVALID TRACE NAME: _ _ _**
The specified trace name is not allowed. Use an underscore as the second character in the

trace name, or avoid beginning the trace name with the following pairs of letters: LB, OA, OL, TA, TB, TR, MA, MF, TS, OT, and DR. (U)

**INVALID TRACENAME: _ _ _**
Indicates the specified trace could not be saved because the trace name is not allowed. To avoid this problem, use an underscore as the second character in the trace name, or avoid beginning the trace name with the following pairs of letters: LB, OA, OL, TA, TB, TR, MA, MF, TS, OT, and DR. (U)

**INVALID VALUE PARAMETER: _ _ _**
The specified value parameter is invalid. (U)

**INVALID VARDEF: _ _ _**
The specified variable name is not allowed. To avoid this problem, use an underscore as the second character in the variable label, or avoid beginning the variable label with the following pairs of letters: LB, OA, OL, TA, TB, TR, MA, MF, TS, OT, and DR. (U)

**INVALID WINDOW TYPE: _ _ _**
The specified window is invalid. See the description for the TWNDOW programming command. (U)

**LOST SIGNAL**
For the HP 8592D, HP 8593E, or HP 8596E, this message indicates that the cable from the 100 MHz COMB OUT connector to the spectrum analyzer input is defective or has become disconnected during the CAL YTF routine. For the HP 8595E, this message indicates that the cable from the CAL OUT connector is defective or has been disconnected during the CAL YTF routine. Be sure to use a short, low-loss cable to connect the signal to the spectrum analyzer input when performing the CAL YTF routine. (U)

**LO UNLVL**
Indicates that the spectrum analyzer's local oscillator distribution amplifier is not functioning properly. (H)

**Marker Count Reduce SPAN**
Indicates the resolution bandwidth to span ratio is too small to use the marker count function. Check the span and resolution bandwidth settings. (U)

**Marker Count Widen RES BW**
Indicates that the current resolution bandwidth setting is too narrow to use with the marker counter function. The marker counter function can be in narrow resolution bandwidths (bandwidths that are less than 1 kHz) with the following procedure:

1. Place the marker on the desired signal.
2. Increase the resolution bandwidth to 1 kHz and verify the marker is on the signal peak.
3. If the marker in on the signal peak, the marker count function can be used in either the 1 kHz resolution bandwidth or the original narrow resolution bandwidth setting. If the marker is not on the signal peak, it should be moved to the signal peak and the marker counter function should not be used with a resolution bandwidth setting of less than 1 kHz.

(U)

**MEAS UNCAL**
The measurement is uncalibrated. Check the sweep time, span, and bandwidth settings, or press [AUTO COUPLE], **AUTO ALL**. (U)

**No card found**
Indicates that the memory card is not inserted. (U)

**No points defined**
Indicates the specified limit line or amplitude correction function cannot be performed because no limit line segments or amplitude correction factors have been defined. (U)

**OVEN COLD**
Indicates that the spectrum analyzer has been powered up for less than 5 minutes. (The actual temperature of the precision frequency oven is not measured.) (Option 004 only.) (M)

**PARAMETER ERROR: _ _ _**
The specified parameter is not recognized by the spectrum analyzer. See the appropriate programming command description to determine the correct parameters. (U)

**PASSCODE NEEDED**
Indicates that the function cannot be accessed without the pass code. (U)

**POS-PK FAIL**
Indicates the positive-peak detector has failed. (H)

**REF UNLOCK**
Indicates that the frequency reference is not locked to the external reference input. Check that the 10 MHz REF OUT connector is connected to the EXT REF IN connector, or, when using an external reference, that an external 10 MHz reference source of sufficient amplitude is connect to the EXT REF IN connector. (U) and (H)

**Require 1 signal > PEAK EXCURSION above THRESHOLD**
Indicates that the N dB PTS routine cannot locate a signal that is high enough to measure. The signal must be greater than the peak excursion above the threshold level to measure. (U)

**Require 3 signals > PEAK EXCURSION above THRESHOLD**
Indicates that the % AM routine cannot locate three signals that are high enough to measure. The signals must be greater than the peak excursion above the threshold level to measure. (U)

**Require 4 signals > PEAK EXCURSION above THRESHOLD**
Indicates that the TOI routine cannot locate four signals that are high enough to measure. The signals must be greater than the peak excursion above the threshold level to measure. (U)

**Required option not installed** Some spectrum analyzer functions require that an option be installed in the spectrum analyzer. See the description for the function in the *HP 8590 Series Spectrum Analyzer User's Guide* for more information about which option is required. (U)

**RES-BW NOISE FAIL**
Indicates the noise floor level is incorrect at the indicated bandwidth. (H)

**RES-BW SHAPE FAIL**
Indicates the 3 dB bandwidth is not within specifications. (H)

**RF PRESEL ERROR**
Indicates that the preselector peak routine cannot be performed. (H)

**RF PRESEL TIMEOUT**
Indicates that the preselector peak routine cannot be performed. (H)

**SAMPLE FAIL**
Indicates the sample detector has failed. (H)

**SETUP ERROR**
Indicates that the span, channel bandwidth, or channel spacing are not set correctly for the adjacent channel power or channel power measurement. (U)

**SIGNAL CLIPPED**
Indicates that the current FFT measurement sweep resulted in a trace that is above the top

graticule line on the spectrum analyzer display. If this happens, the input trace (trace A) has been "clipped," and the FFT data is not valid. (U)

**Signals do not fit expected % AM pattern**
Indicates that the % AM routine cannot perform the percent AM measurement because the on-screen signals do not have the characteristics of a carrier with two sidebands. (U)

**Signals do not fit expected TOI pattern**
Indicates that the TOI routine cannot perform the third-order intermodulation measurement because the on-screen signals do not have the characteristics of two signals and two distortion products. (U)

**SMPLR UNLCK**
Indicates that the sampling oscillator circuitry is not functioning properly. If this message appears, check that the external frequency reference is correctly connected to the EXT REF INPUT. (U) and (H)

**SOFTKEY OVFL**
Softkey nesting exceeds the maximum number of levels. (U)

**SRQ _ _ _**
The specified service request is active. Service requests are a form of informational message and are explained in Appendix A of the *HP 8590 Series Spectrum Analyzer User's Guide.* (M)

**STEP GAIN/ATTN FAIL**
Indicates the step gain has failed. (H)

**Stop at marker not available with negative detection**
Indicates that the marker counter cannot be used when negative peak detection is selected. To use the marker counter, turn off negative peak detection with `DETECTOR PK SP NG`. (U)

**SYMTAB EMPTY**
Indicates that the user-defined items (user-defined functions, user-defined variables, user-defined traces, user-defined softkeys) and any personalities (for example, the HP 85716A CATV System Monitor Personality) in the spectrum analyzer's memory have been deleted. If this message appears, use `DISPOSE USER MEM` to clear spectrum analyzer memory. If the message is still displayed, it may indicate a hardware failure. See the spectrum analyzer's Service Guide for more information. (U)

**TABLE FULL**
Indicates the upper or lower table of limit lines contains the maximum number of entries allowed. Additional entries to the table are ignored. (U)

**TG SIGNAL NOT FOUND**
Indicates the tracking generator output signal cannot be found. Check that the tracking generator output (RF OUT 50Ω or RF OUT 75Ω) is connected to the spectrum analyzer input connector with an appropriate cable. (U)

**TG UNLVL**
This message can indicate the following: that the source power is set higher or lower than the spectrum analyzer can provide, that the frequency span extends beyond the specified frequency range of the tracking generator, or that the calibration data for the tracking generator is incorrect. See "Stimulus-Response Measurements" in Chapter 4 of the *HP 8590 Series Spectrum Analyzer User's Guide* for more information. (U)

**Too many signal with valid N dB points**
Indicates the N dB PTS function has located two or more signals that have amplitudes within the specified dB from the signal peak. If this happens, you should decrease the span of the spectrum analyzer so that only the signal that you want to measure is displayed. (U)

**Trace A is not available**
Indicates that trace A is in the store-blank mode and cannot be used for limit-line testing. Use `CLEAR WRITE A` or `VIEW A` to change trace A from the store-blank mode to the clear write mode, and then turn on limit-line testing. (U)

**UNDF KEY**
The softkey number is not recognized by the spectrum analyzer. (U)

**USING DEFAULTS self cal needed**
Indicates that the current correction factors are the default correction factors and that the CAL FREQ & AMPTD routine needs to be performed. For the HP 8592D, HP 8593E, HP 8595E, or HP 8596E, CAL YTF routine needs to be performed also. (U)

**Verify gate trigger input is disconnected before CAL AMPTD**
This message is meant to remind you that nothing should be connected to the GATE TRIGGER INPUT connector on the spectrum analyzer's rear panel during the CAL AMPTD routine. (U)

**VID-BW FAIL**
Indicates the video bandwidths have failed. (H)

**Waiting for gate input . . .**
Indicates that the spectrum analyzer needs an external trigger signal to use the time-gating functions. Before using the time-gating functions, you should ensure there is a trigger pulse connected to the GATE TRIGGER INPUT connector on the rear panel of spectrum analyzer and that the GATE OUTPUT is connected the EXT TRIG INPUT connector. If you do not want to use the time-gating functions, press (PRESET). (U)

**YTF is not available**
The YTF is only available for the HP 8592D, HP 8593E, HP 8595E, and HP 8596E. (U)

B

# HP-IB Option 021

This appendix tells you how to connect a computer to your HP 8590 Series Option 021 spectrum analyzer with the Hewlett-Packard Interface Bus (HP-IB).

Your spectrum analyzer has an HP-IB connector on the rear panel, as shown in Figure B-1.

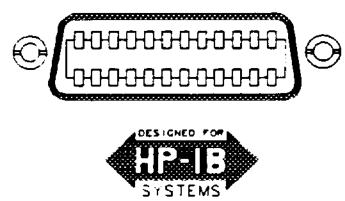



**Figure B-1. HP-IB Connector**

The HP-IB system utilizes a party-line bus structure. Devices such as the spectrum analyzer are connected on the party line with HP-IB cables. A computer gives instructions and is the "controller." The spectrum analyzer takes orders and is the "listener." The spectrum analyzer is also capable of transmitting data over the party line. Devices that transmit data back to the computer are "talkers."

Each device on the party line has an address. Device addresses are used by the controller to specify who talks and who listens. A device's address is usually set at the factory.

The number 7 preceding the device's address (for example, `Analyzer=718`), signifies that the HP-IB interface is selected.

When you turn on the spectrum analyzer, the HP-IB address appears on the screen (for example, `HP-IB ADRS: 18`). If necessary, you can reset the address of the spectrum analyzer by pressing (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, entering in the address number using the front-panel number keys, then pressing (ENTER). You may use any address between 0 and 30. (Usually, 1 is reserved for printers and 5 for plotters.)

C

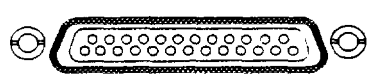
# RS-232 Option 023

## What You'll Learn in This Appendix

This appendix explains how to connect a computer to your HP 8590 Series Option 023 spectrum analyzer using the RS-232 interface. It contains information pertaining to RS-232 signals, cable connections, and baud rate.

### Introducing the RS-232 Interface

Your spectrum analyzer has an RS-232 connector on the rear panel, as shown in Figure C-1.



cu18e

**Figure C-1. RS-232 Connector**

The RS-232 interface utilizes serial data transmission. Data is sent, one bit at a time, in groups of 10 to 12 data-bits.

Two devices, such as the spectrum analyzer and a computer, can exchange commands and data over the RS-232 connection. This interface uses two serial data lines and five handshaking lines. Handshaking signals are required for full hardware control of the information exchange. It is possible to use a three-wire connection, in some situations.

Another parameter for the RS-232 interface is the "baud," or data rate. This is the speed at which the computer and spectrum analyzer exchange data. The baud rate of each of the two RS-232 devices must be the same.

#### The RS-232 Data Lines

RS-232 uses serial data transmission, meaning that data is transmitted one bit at a time. There are two data lines carrying signals:

- Transmit data (TxD)—the serial data output. This line is connected to the RxD input line.
- Receive data (RxD)—the serial data input. This line is connected to the TxD output line.

#### The RS-232 Handshaking Lines

In addition to the data signals, there are five other signals lines (called handshaking lines), used to control the flow of data. Listed below are the handshake signal descriptions:

- Request to send (RTS)—Output signal indicates that the spectrum analyzer is ready to communicate. This line is true at power-up and stays true while power is on.
- Clear to send (CTS)—Input signal indicates that the external controller is ready to receive data.

- Data terminal ready (DTR)—Output signal from the spectrum analyzer. When the input buffer is full, this line goes false.
- Data set ready (DSR)—Is not available.
- Data carrier detect (DCD)—Input to the spectrum analyzer. If DCD is true, the spectrum analyzer will receive data from the controller. If false, no data will be input. The data will be ignored.

The spectrum analyzer checks its CTS input before transmitting data to the computer. If the CTS line is false, the spectrum analyzer will not transmit data. The spectrum analyzer transmits data when the CTS line is true.

The spectrum analyzer sets the DTR line (PC CTS) false when its input buffer is full.

## Baud Rate

The speed at which data is exchanged is called the baud rate or data rate. This is usually expressed in baud or bits per second. Common baud rates are 1200 and 9600.

**Note** Some of the programs in this manual use 1200 baud for proper operation. If your system uses the RS-232 handshake lines, you can use 9600 baud for all of the programs.

If you need to change the baud rate, refer to the "Setting the Spectrum Analyzer Baud Rate" in this appendix.

## Protocol

The RS-232 protocol is as follows:

Baud rate 300 to 57,000 baud.
8 bits per character.
1 stop bit.
No parity.
Software handshake—none.
Xon/Xoff and ENQ/ACK not supported by the spectrum analyzer.

When BREAK is issued to the spectrum analyzer, the following occurs:

1. The present command is aborted.
2. The input buffer is cleared.
3. The output buffer is cleared.
4. All trace output is stopped.
5. The command parser is reinitialized.

BREAK does not perform any of the following:

- Invoke instrument preset.
- Clear SRQ off screen.
- Clear illegal command off screen.

The RTS signal goes true on power-up and does not go false during any communication. It stays true while power is on.

Figure C-2 lists the signal connections between a personal computer and the spectrum analyzer.

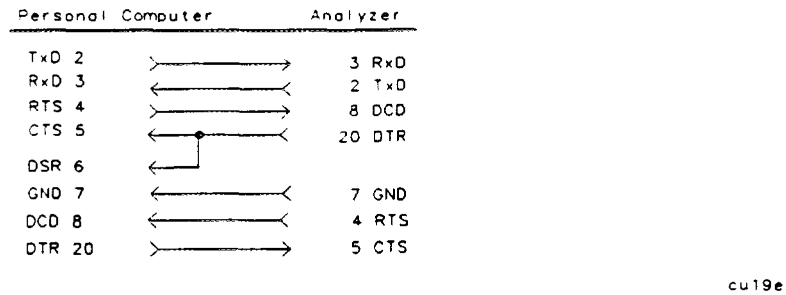



**Figure C-2. Full Handshaking Connection**

If your computer operates with only three wires, you can use the cable connections in Figure C-3.

Some computers require that the CTS, DSR, and DCD inputs be true before serial transmission can occur. To solve this problem, you can wire these three signals to the personal computer RTS line.

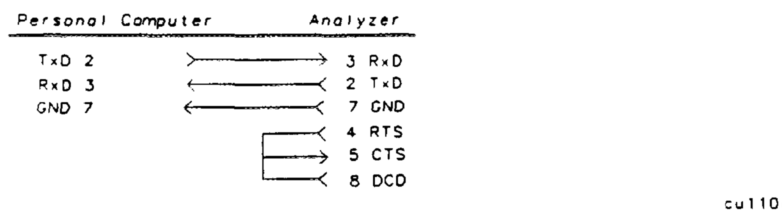



**Figure C-3. 3-Wire Connection**

## Connecting a ThinkJet Printer

To connect an HP ThinkJet printer to the spectrum analyzer, use the information in Figure C-4, Table C-1, Table C-2, and Table C-3. Be sure to turn the printer off and then back on *after* changing the printer settings. See the ThinkJet Printer Manual for more information.

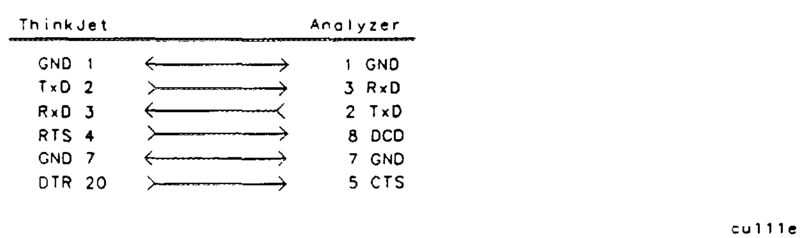



**Figure C-4. ThinkJet Printer Connection**

**ThinkJet Printer** Mode Switches:

**Table C-1. Setting of Thinkjet Printer Mode Switches**

| Switch Number | Setting | Comments |
|---|---|---|
| 1 | down | Printer performs a carriage return only. |
| 2 | down | Printer performs a line feed only. |
| 3 | up | Sets the printer to skip paper perforations. |
| 4 | down | Sets the printer for a paper length of 11 inches. |
| 5 | down | Sets the printer to HP MODE. |
| 6 | up | |
| 7 | down | Sets the printer to USASCII. |
| 8 | down | |

**Table C-2. Setting of RS-232 Switches**

| Switch Number | Setting | Comments |
|---|---|---|
| 1 | up | DTR. |
| 2 | down | no parity, 8 bits. |
| 3 | down | |
| 4 | down | 9600 baud. |
| 5 | down | |

**Table C-3. Setting the Baud Rate**

| Baud Rate | Setting for Switch 4 | Setting for Switch 5 |
|---|---|---|
| 1200 | up | up |
| 2400 | up | down |
| 9600 | down | down |

## Connecting a Modem

To connect a modem to the spectrum analyzer, use the information in Figure C-5. The connection is for a Hayes 1200 Modem and the spectrum analyzer.

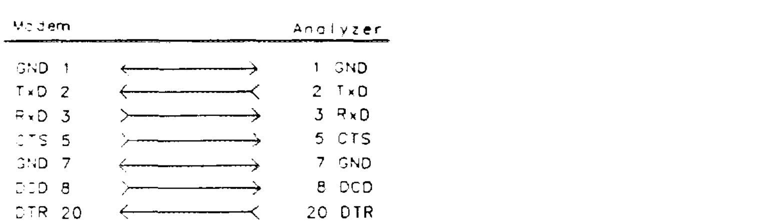



**Figure C-5. Modem Connection**

### System Settings

Select 1200 baud for both the modem and the spectrum analyzer.

## Connecting an HP-GL Plotter

To connect an HP-GL plotter to the spectrum analyzer, use the information in Figure C-6.

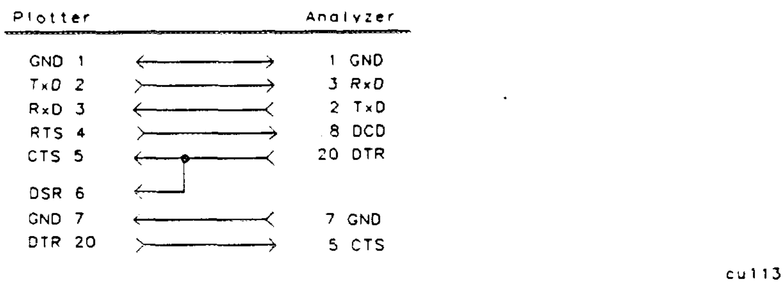



**Figure C-6. HP-GL Plotter Connection**

### Switch Settings

Set the switches on the HP-GL plotter to the following settings. Set the baud rate of the plotter and spectrum analyzer to the same value. After setting the switch positions, turn plotter off, then on again.

| Switch Position | Switch Position |
| --- | --- |
| Expand: ◀ | Parity: ▶ (Off) |
| Emulate: ◀ | Even/Odd: ▶ (Odd) |
| Stand-alone: ◀ | Duplex: ▶ (Full) |
| Monitor Mode: ▶ (normal) | Hardwire: ◀ |
| Local ▶ (normal) | DTR-Bypass: ▶ (normal) |

## Setting the Spectrum Analyzer Baud Rate

The baud rates of the spectrum analyzer and the personal computer must be the same. For example, to set the spectrum analyzer to 9600 baud, use the following procedure:

1. Press the (CONFIG), **More 1 of 3**.
2. Press the **BAUD RATE** softkey.
3. Press these keys: 9600, (Hz). To set the baud rate to 1200 baud, press these keys: 1200, (Hz).

**Note** Some of the programs in this manual use 1200 baud for proper operation. If your system uses the RS-232 handshake lines, you can use 9600 baud for all of the programs.

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**D**

## E

**F**

## M

## N

## R

## S

Finally, in line 60, we end the program with the END command. (If you forget to include the END command, the computer will give an error message.)

Enter the program lines, press (RUN) on the computer, and watch the spectrum analyzer display as it completes each instruction.

## Program Example for the RS-232 Interface

```
10 'File = 232PROG1
20 OPEN "COM1: 9600,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;TS;"
50 END
```

Line 20 of the program opens the RS-232 COM1: line, identifies it as #1, and sets the RS-232 parameters as follows:

```
9600 baud
no parity
8 bits/character
1 stop bit
```

Line 30 of the program introduces the instrument preset (IP) command, which corresponds to the (PRESET) key on the spectrum analyzer. The IP command sets all of the analog parameters of the spectrum analyzer to known values and provides a good starting point for every measurement.

**Note**

All softkey functions on the spectrum analyzer have corresponding programming commands. As you continue programming, you will learn the command names that correspond to the front-panel keys and softkeys.

Line 40 activates the single-sweep mode. Most remotely controlled measurements require control of the sweep. Once SNGLS has activated the single-sweep mode, take sweep (TS) starts and completes one full sweep. The TS command maintains absolute control over the sweep, which is necessary for accurate computer data transfer and reduced program execution time. Finally, in line 50, end the program with the END command.

Make sure that the spectrum analyzer baud rate is 9600 via the **BAUD RATE** softkey. Enter the program lines, then press (RUN) on the computer. Watch the spectrum analyzer display as it completes each instruction.

**Note**

When using an HP 9000 Series 200 or 300 computer, END commands are necessary. Refer to your BASIC manual to determine END statement requirements for your specific computer.

## Modifying the Program

Remote operation of the spectrum analyzer is similar to manual operation. Remote measurements are executed by commands that correspond to front-panel keys and softkeys.

The first chapter in the spectrum analyzer operating manual shows you how to make a simple measurement using the calibration signal. We can add instructions to our program so that it will make the same measurement. (Because the manual process closely resembles that of the program, you may want to review "Making a Measurement" in the *HP 8590 Series Spectrum Analyzer User's Guide*.)

By inserting a few lines into the initial program, we can set functions such as the center frequency and span, and we can activate a marker to find a signal's frequency and amplitude.

### Program Example for the HP-IB Interface

First, we set the center frequency to 300 MHz. The CF command corresponds to the center frequency function, **CENTER FREQ** . (All spectrum analyzer commands, such as CF, are described in Chapter 5.)

Insert the following program line between lines 40 and 50:

```
41 OUTPUT Analyzer;"CF 300MZ;"
```

Next, we set the span to 200 MHz with the SP command. Add the following program line:

```
42 OUTPUT Analyzer;"SP 200MZ;"
```

Because we are controlling the sweep, we must update the spectrum analyzer display screen with the following program line:

```
43 OUTPUT Analyzer;"TS;"
```

When the program is executed, the spectrum analyzer takes one full sweep before executing line 41. Line 41 changes the center frequency to 300 MHz, and line 42 changes the span to 200 MHz.

Enter the following program line to place a marker at the highest peak on the trace with a MKPK HI command:

```
44 OUTPUT Analyzer:"MKPK HI;"
```

The completed program is shown below:

```
05  !File: "IBPROG2"
10 Analyzer=718
20 CLEAR Analyzer
30 OUTPUT Analyzer;"IP;"
40 OUTPUT Analyzer;"SNGLS;TS;"
41 OUTPUT Analyzer;"CF 300MZ;"
42 OUTPUT Analyzer;"SP 200MZ;"
43 OUTPUT Analyzer;"TS;"
44 OUTPUT Analyzer;"MKPK HI;"
50 LOCAL 7
60 END
```

Run the program to make the measurement. Watch the spectrum analyzer display as it completes each instruction. Notice that the program executes the instructions faster than is possible from the front panel.

When a certain measurement is repeated often, a computer program can save time. In addition, the computer is less likely to make an error than an operator manually entering the same instructions from the front panel.

## Program Example for the RS-232 Interface

First, we set the center frequency to 300 MHz. The CF command corresponds to the center frequency function, CENTER FREQ. (All spectrum analyzer commands, such as CF, are described in Chapter 5.)

Insert the following program lines between lines 40 and 50 of the previous program.

```
41 PRINT #1,"CF 300MZ;"
```

Next, set the span to 200 MHz with the SP command. Add the following program line:

```
42 PRINT #1,"SP 200MZ;"
```

Because we are controlling the sweep, we must update the spectrum analyzer display with the following program line:

```
43 PRINT #1,"TS;"
```

When the program is executed, the spectrum analyzer takes one full sweep before executing line 41. Line 41 changes the center frequency to 300 MHz. Line 42 changes the span to 200 MHz.

Enter the following program line to place a marker at the highest peak on the trace:

```
44 PRINT #1,"MKPK HI;"
```

The completed program is shown below:

```
10 'File = 232PROG2
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;TS;"
41 PRINT #1,"CF 300MZ;"
42 PRINT #1,"SP 200MZ;"
43 PRINT #1,"TS;"
44 PRINT #1,"MKPK HI;"
50 END
```

Run the program to make the measurement. Watch the spectrum analyzer display as it completes each instruction. When a certain measurement is repeated often, a computer program can save time. Also, the computer is much less likely to make an error than an operator manually entering the same instructions from the front panel.

## Enhancing the Program with Variables

In the last program, specific center frequency and span values were set. By modifying the program, we can cause different values to be set each time the program is run.

### Program Example for the HP-IB Interface

In the following program, the exclamation point (!) allows the words that follow to be ignored by the computer. Thus, they serve as comments in the program.

```
10   !FILE: "VAR10"
20  REAL C_freq,S_pan  !define the variables
30  Analyzer=718
40  CLEAR Analyzer
50  OUTPUT Analyzer;"IP;SNGLS;TS;"
60   !ask for the desired center frequency:
70  INPUT "CENTER FREQUENCY(MHz)?",C_freq
80   !ask for the desired span:
90  INPUT "SPAN(MHz)?",S_pan
100  !send the center frequency and span to the
110  !analyzer and take a sweep to update the
120  !analyzer screen:
130 OUTPUT Analyzer;"CF ";C_freq;"MZ;"
140 OUTPUT Analyzer;"SP ";S_pan;"MZ;"
150 OUTPUT Analyzer;"TS;"
160  !find the signal peak with peak search:
170 OUTPUT Analyzer;"MKPK HI;"
180 LOCAL 7
190 END
```

Three modifications are made to the previous program so it includes center frequency and span variables. First, using the HP BASIC REAL command, we define two variables, C_freq and S_pan. The frequency and span parameters are stored in these variables. (Refer to line 20.)

Second, using the HP BASIC INPUT command, we prompt the user to enter the desired center frequency and span. The center frequency and span values are entered on the computer; because the measurement units will be entered by the program, the user does not enter them. (See lines 70 to 140.)

Third, we modify the output parameter statements so that the values stored in C_freq and S_pan are sent to the spectrum analyzer. (See lines 130 to 140.)

A sweep is taken after the parameters are sent to the spectrum analyzer, to ensure that the spectrum analyzer screen is updated before the marker is placed on the highest signal peak.

### Program Example for the RS-232 Interface

In the following program, the apostrophe (') allows the words that follow to be ignored by the computer. Thus, they serve as comments in the program.

```
10 'File = 232PROG3
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;TS;"
50 'Ask for the center frequency and span
60 PRINT "INPUT THE CENTER FREQUENCY (MZ)  ";
70 INPUT CENTER
```

```
80 PRINT "INPUT THE SPAN (MZ)  ";
90 INPUT SPAN
100 'Send center freq and span to spectrum analyzer
110 'take a sweep to update screen
120 PRINT #1,"CF ";CENTER;"MZ;"
130 PRINT #1,"SP ";SPAN;"MZ;"
140 PRINT #1,"TS;"
150 'find the signal peak with peak search
160 PRINT #1,"MKPK HI;"
170 END
```

Three modifications are made to the previous program in order to include center frequency and span variables. First, we use two variables, CENTER and SPAN, to store the frequency and span parameters.

Second, using the BASIC INPUT command, we ask the computer operator to enter the desired center frequency and span. (See lines 70 and 90 in previous program example). Next, we modify the output parameter statements so that the values stored in the CENTER and SPAN variables are sent to the spectrum analyzer. (See lines 120 and 130.) A sweep is taken after the parameters are sent to the spectrum analyzer, to ensure that the spectrum analyzer screen is updated before the marker is placed on the highest signal peak.

## Getting Information from the Spectrum Analyzer

The first part of this chapter demonstrated techniques for setting spectrum analyzer parameters. This section demonstrates a technique for getting information out of the spectrum analyzer.

For example, in the second program of this chapter, we placed a marker at the highest peak of a trace and the value of the marker could be read in the upper right-hand corner of the spectrum analyzer display. In the following program, we will add some commands that will read the marker's frequency and amplitude value and return those values to the computer.

### Program Example for the HP-IB Interface

```
10  !FILE: "MKR"
20 REAL A_mpmarker,F_reqmarker !define variables
30 Analyzer=718
40 OUTPUT Analyzer;"IP;"
50  !set the output format of the spectrum analyzer for
60  !real numbers:
70 OUTPUT Analyzer;"TDF P;"
80  !set the spectrum analyzer parameters:
90 OUTPUT Analyzer;"SNGLS;"
100 OUTPUT Analyzer;"CF 300MZ;"
110 OUTPUT Analyzer;"SP 200MZ;"
120 OUTPUT Analyzer;"TS;"
130 OUTPUT Analyzer;"MKPK HI;"
140  !ask the spectrum analyzer for the marker's
150  !amplitude value:
160 OUTPUT Analyzer;"MKA?;"
170  !send the amplitude value to the computer:
180 ENTER Analyzer;A_mpmarker
190  !ask the spectrum analyzer for the marker's
200  !frequency value:
210 OUTPUT Analyzer;"MKF?;"
220  !send the frequency value to the computer:
230 ENTER Analyzer;F_reqmarker
240  !print the amplitude and frequency:
250 PRINT "THE SIGNAL PEAK IS ";A_mpmarker;
260 PRINT " dBm AT ";F_reqmarker/1.E+6;" MHz"
270  !set the spectrum analyzer to continuous sweep mode:
280 OUTPUT Analyzer;"CONTS;"
290 LOCAL 7
300 END
```

First, using the HP BASIC REAL command, we define two variables, A_mpmarker and F_reqmarker. The amplitude and frequency values of the marker are stored in these variables. (See line 20.)

Second, we set the output format of the spectrum analyzer for real numbers with the spectrum analyzer's trace data format (TDF) command. (See line 70.) As in our original program, we set the center frequency and span values. A sweep is taken and the marker is placed on the trace.

Next, we ask the spectrum analyzer for the amplitude value of the marker. We have the spectrum analyzer send the marker amplitude value to the computer. Note that there can be only one spectrum analyzer query per programming line. We also ask the spectrum analyzer for the frequency value of the marker, and we have the spectrum analyzer send the marker frequency value to the computer. (See lines 100 through 230.)

Finally, we print the values on the computer screen:

```
"THE SIGNAL PEAK IS ... dBm AT ... MHz"
```

Before we end the program, we return the spectrum analyzer to continuous-sweep mode and local control.

## Program Example for the RS-232 Interface

```
10 'File = 232PROG4
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"IP;"
40 'Set the output format of the spectrum analyzer for
50 'real numbers
60 PRINT #1,"TDF P;"
70 'set the spectrum analyzer's parameters
80 PRINT #1,"SNGLS;"
90 PRINT #1,"CF 300MZ;"
100 PRINT #1,"SP 200MZ;"
110 PRINT #1,"TS;"
120 PRINT #1,"MKPK HI;"
130 'ask the spectrum analyzer for the marker's
140 'amplitude value
150 PRINT #1,"MKA?;"
160 'get the amplitude from the spectrum analyzer
170 INPUT #1,AMPMARKER
180 'ask the spectrum analyzer for the marker's frequency value
190 PRINT #1,"MKF?;"
200 'get the frequency value from the spectrum analyzer
210 INPUT #1,FREQMARKER
220 'print the amplitude and frequency
230 PRINT "THE SIGNAL PEAK IS ";AMPMARKER;
240 PRINT " dbm AT ";FREQMARKER/1000000!;" MZ"
250 'set the spectrum analyzer to continuous sweep mode
260 PRINT #1,"CONTS;"
270 END
```

First, set the output format of the spectrum analyzer to real numbers with the spectrum analyzer's trace data format (TDF) command (line 60).

As in the original program, the center frequency and span values are set and a sweep is taken. Next, the marker is placed on the trace.

Two additional variables are used for AMPMARKER and FREQMARKER. The amplitude and frequency values of the marker are stored in these variables (lines 170 and 210). The program requests the amplitude and frequency values of the marker (lines 150 and 190). Note that there can be only one spectrum analyzer query per programming line.

Finally, the amplitude and frequency values are displayed on the computer screen:

```
"THE SIGNAL PEAK IS ... dBM AT ... MZ"
```

## Programming Guidelines

1. Perform the measurement manually, keeping track of the sequence of functions used.
2. In the written program, execute an instrument preset (IP) and set single-sweep mode (SNGLS) before setting other spectrum analyzer functions.
3. Use variables for function values. List variables at the beginning of the program.
4. Activate spectrum analyzer functions in logical order. Place quotation marks around spectrum analyzer commands. Separate commands with semicolons.
5. After setting spectrum analyzer functions, execute a take sweep (TS) command before reading data or activating markers.
6. The spectrum analyzer can return only one value per programming line. Do not have more than one query per programming line.
7. Use the exclamation point (!) to include comment lines when using HP BASIC. Use the apostrophe (') or REM to create comment lines when using GW BASIC. (The use of the exclamation point and the apostrophe to create comment lines are dependent on the controller and the programming language [not interface-dependent] and may be different for your system.)

# 3

# Programming Topics

## What You'll Learn in This Chapter

This chapter contains the following advanced programming techniques and topics.

- An example of moving and saving trace data from the spectrum analyzer into the computer.
- An example of how spectrum analyzer states are saved with the computer, then returned to the spectrum analyzer.
- An example of reading trace data from a computer disk.
- An example of saving and recalling instrument states.
- An example of returning the spectrum analyzer to its former state.
- An example of remotely measuring harmonic distortion.
- A summary of using different formats for trace data transfers.

Many of the programming suggestions discussed in Chapter 2, "Writing a Program," have been incorporated into the programs in this chapter.

**Note** All programming examples for the HP-IB interface in this chapter are written in HP BASIC 4.0. For the RS-232 interface, examples are written in GW BASIC.

A general knowledge of the BASIC programming language is recommended before reading this chapter. (Refer to your software documentation manuals.) Chapter 5 of this manual, "Programming Commands," defines spectrum analyzer commands alphabetically.

## Controlling Trace Data with a Computer

Using sample programs, this section shows you how to read trace data and store the data with your computer.

### Reading Trace Data

The following program, which has been annotated with comments, reads a trace from the spectrum analyzer and stores the trace data in a variable.

### Program Example for the HP-IB Interface

```
10 !FILE: "IBPROG5"
20  !create a 401 point trace array:
30 REAL Trace_a(1:401)
40 Analyzer=718
50 OUTPUT Analyzer;"IP;"
60  !set the output format of the spectrum analyzer for
70  !real numbers:
80 OUTPUT Analyzer;"TDF P;"
90  !set the spectrum analyzer parameters:
100 OUTPUT Analyzer;"SNGLS;"
110 OUTPUT Analyzer;"CF 300MZ;"
120 OUTPUT Analyzer;"SP 200MZ;"
130 OUTPUT Analyzer;"TS;"
140 OUTPUT Analyzer;"MKPK HI;"
150  !move peak to center of spectrum analyzer screen:
160 OUTPUT Analyzer;"MKCF;"
170 OUTPUT Analyzer;"TS;"
180  !ask the spectrum analyzer for trace data:
190 OUTPUT Analyzer;"TRA?;"
200  !send the trace data to the computer:
210 ENTER Analyzer;Trace_a(*)
220 OUTPUT Analyzer;"CONTS;"
230 LOCAL 7
240 END
```

Trace data can be read with the computer by making three changes to the program created in Chapter 2. First, we modify the program to create a 401-point trace array, called Trace_a, in which the trace data will be stored. Second, the program uses the TRA command to request trace A data. (The MKA and MKF commands from the previous program have been deleted.) Third, the spectrum analyzer sends trace A data to the variable, Trace_a.

### Program Example for the RS-232 Interface

```
10 'File = 232PROG5
20 OPEN "COM1:9600,N,8,1" AS #1
30 'create a 401-point trace array
40 DIM TRCA(401)
50 PRINT #1,"IP;"
60 'set output format of spectrum analyzer for real numbers
70 PRINT #1,"TDF P;"
80 'set spectrum analyzer parameters
90 PRINT #1,"SNGLS;"
100 PRINT #1,"CF 300MZ;"
```

```
110 PRINT #1,"SP 200MZ;"
120 PRINT #1,"TS;"
130 PRINT #1,"MKPK;"
140 'move peak to center of spectrum analyzer screen
150 PRINT #1,"MKCF;"
160 PRINT #1,"TS;"
170 'ask spectrum analyzer for trace data
180 PRINT #1,"TRA?;"
190 'retrieve trace data from spectrum analyzer
200 FOR I=1 TO 401
210 INPUT #1,TRCA(I)
220 NEXT I
230 'set continuous-sweep mode
240 PRINT #1,"CONTS;"
250 END
```

Trace data can be read with the computer by making three changes to the program created in Chapter 2. First, we modify the program to create a 401-point trace array, called TRCA in which trace data will be stored (line 40). Second, the program uses the TRA command to request trace A data (line 180). (The MKA and MKF commands in the original program have been deleted.) Third, we will have the spectrum analyzer send the trace A data into the TRCA variable (line 210).

## Saving Trace Data

The trace data in the previous program can be stored on a computer disk by making three program modifications.

```
10  !FILE: "IBPROG6"
20  !create a 401 point trace array:
30 REAL Trace_a(1:401)
40 Analyzer=718
50 OUTPUT Analyzer;"IP;"
60  !set the output format of the spectrum analyzer for
70  !real numbers:
80 OUTPUT Analyzer;"TDF P;"
90  !set the spectrum analyzer parameters:
100 OUTPUT Analyzer;"SNGLS;"
110 OUTPUT Analyzer;"CF 300MZ;"
120 OUTPUT Analyzer;"SP 200MZ;"
130 OUTPUT Analyzer;"TS;"
140 OUTPUT Analyzer;"MKPK HI;"
150  !move peak to center of spectrum analyzer screen:
160 OUTPUT Analyzer;"MKCF;"
170 OUTPUT Analyzer;"TS;"
180  !ask the spectrum analyzer for trace data:
190 OUTPUT Analyzer;"TRA?;"
200  !send the trace data to the computer:
210 ENTER Analyzer;Trace_a(*)
220  !create file to store trace
230  !file is 13 records long:
240 CREATE BDAT "DATA_A",13
250  !assign path for the file:
260 ASSIGN @File TO "DATA_A"
270  !send trace data to the file:
280 OUTPUT @File;Trace_a(*)
290 OUTPUT Analyzer;"CONTS;"
300 LOCAL 7
310  !close file:
320 ASSIGN @File TO *
330 END
```

First, using the CREATE command, we create an empty file on the disk for storing the trace. The file is 13 records long. (To determine the number of records, the 401-point trace is multiplied by 8 bytes per point, the storage required for real numbers, then divided by 256 bytes per record. The result is rounded to the next largest integer.)

Next, we assign an input and an output path to the file DATA_A. Then, we send the trace data to the file. (See lines 260 through 280.) Finally, in line 320, we close the file.

**Note**

If a program containing the CREATE command is run twice, the computer will report an error the second time because the file already exists. To prevent this error, place an exclamation mark before the CREATE command to "comment out" the line after the first run. (See line 240.)

## Program Example for the RS-232 Interface

```
10 'File = 232PROG6
20 OPEN "COM1:9600,N,8,1" AS #1
30 'create a 401-point trace array
40 DIM TRCA(401)
50 PRINT #1,"IP;"
60 'set output format of spectrum analyzer for real numbers
70 PRINT #1,"TDF P;"
80 'set spectrum analyzer parameters
90 PRINT #1,"SNGLS;"
100 PRINT #1,"CF 300MZ;"
110 PRINT #1,"SP 200MZ;"
120 PRINT #1,"TS;"
130 PRINT #1,"MKPK;"
140 'move peak to center of spectrum analyzer screen
150 PRINT #1,"MKCF;"
160 PRINT #1,"TS;"
170 'ask spectrum analyzer for trace data
180 PRINT #1,"TRA?;"
190 'input the trace data to the BASIC program
200 FOR I=1 TO 401
210 INPUT #1,TRCA(I) 'data input in dBm
220 NEXT I
230 'create file to store trace on disk
240 OPEN "TRACEA" FOR OUTPUT AS #2
250 'print the trace data to the disk
260 FOR I=1 TO 401
270 PRINT #2,TRCA(I)
280 NEXT I
290 'put spectrum analyzer into continuous-sweep mode
300 PRINT #1,"CONTS;"
310 END
```

Using the OPEN command, we create an empty file on the disk for storing the trace and assign an input and an output path to the file TRACEA. Then we send the trace data to the file. (See lines 260 through 280.)

Lines 20 through 220 of 232PROG6 are identical to the previous program, 232PROG5.

## Reading Trace Data from a Computer Disk

If we want to return trace data to the spectrum analyzer for later viewing, we must work the "saving" process in reverse. The following program reads a trace previously stored on a computer disk and stores the trace in an array variable.

### Program Example for the HP-IB Interface

```
10 !FILE: "IBPROG7"
20 !create a 401-point trace array:
30 REAL Trace_a(1:401)
40 !assign path to the file with the
50 !trace in it:
60 ASSIGN @File TO "DATA_A"
70 !enter trace into variable Trace_a:
80 ENTER @File;Trace_a(*)
90 !close file:
100 ASSIGN @File TO *
110 END
```

First, in line 30, the program creates a 401-point trace array. Then, in line 60, the program assigns a path to the trace file. Finally, in line 80, the program sends the trace data to the variable Trace_a(*).

### Program Example for the RS-232 Interface

```
10 'File = 232PROG7
20 OPEN "COM1:9600,N,8,1" AS #1
30 'create a 401-point trace array
40 DIM TRCA(401)
50 'assign number to file with trace data in it
60 OPEN "TRACEA" FOR INPUT AS #2
70 'enter the trace into the array
80 FOR I=1 TO 401
90 INPUT #2,TRCA(I)
100 NEXT I
110 CLOSE
120 END
```

First, in line 40, the program creates a 401-point trace array. Then, in lines 60 through 100, the program reads the disk file TRACEA and stores data in the array variable TRCA.

## Saving and Recalling Instrument States

The spectrum analyzer's control settings (or its "state") can be saved with a computer and retrieved later to streamline test sequences or repeat manual measurements. Control settings can be stored in one of eight state registers in the spectrum analyzer, in computer memory, or on a computer disk.

The first program in this section demonstrates techniques for saving an instrument state, along with its current trace A data. The second program demonstrates how the state information and the trace data is read from the computer and returned to the spectrum analyzer.

If you wish to save states in the spectrum analyzer, see the descriptions of the save state (SAVES) and recall state (RCLS) commands in Chapter 5.

### Saving the Spectrum Analyzer's State

The following two programs read and store a trace from the spectrum analyzer.

### Program Example for the HP-IB Interface

```
10  !FILE: "IBPROG8"
20  !define 202 character string:
30 DIM Learn_string$[202]
40  !create 401-point array to store trace:
50 INTEGER Trace_a(1:401)
60 Analyzer=718
70  !set output format for two byte integers:
80 OUTPUT Analyzer;"TDF B;"
90  !ask spectrum analyzer for trace data:
100 OUTPUT Analyzer;"TRA?;"
110  !send trace to the computer:
120 ENTER Analyzer USING "#,W";Trace_a(*)
130  !get learnstring from spectrum analyzer:
140 OUTPUT Analyzer;"OL;"
150 ENTER Analyzer USING "#,202A";Learn_string$
160  !create file to store trace:
170 CREATE BDAT "STATE",4
180  !assign path to the file:
190 ASSIGN @File TO "STATE"
200  !send trace to the file:
210 OUTPUT @File;Learn_string$,Trace_a(*)
220  !return output format to default mode:
230 OUTPUT Analyzer;"TDF P;"
240  !close file:
250 ASSIGN @File TO *
260 END
```

The HP-IB version stores the trace in the variable called Trace_a(*). The state of the spectrum analyzer is stored in the variable Learn_string$. These two variables are then saved in a file called STATE. Finally, the file is stored on a disk.

Using the data stored in STATE, the spectrum analyzer settings can be reset according to the saved state. Then, using the stored trace data, trace data can be viewed on the spectrum analyzer display.

Line 30 gives the dimensions of the learn string using the HP BASIC DIM command. Learn strings for the spectrum analyzer require 202 bytes of storage space. Also see the output learn string (OL) command.

Line 70 uses TDF B to format the output in binary. Binary provides the fastest data transfer and requires the least amount of memory to store data. Each data point is transferred in binary as two 8-bit bytes. The data points are in the internal representation of measurement data. (See "Different Formats for Trace Data Transfers" at the end of this chapter for more information about trace data formats.)

When the trace and state data are sent from the spectrum analyzer to the computer, they must be formatted. Lines 120 and 150 format trace data with the HP BASIC USING command. In the formatting statement, "#" indicates that the statement is terminated when the last ENTER item is terminated. EOI (end-or-identify) and LF (line feed) are item terminators, and early termination will result in an inaccurate learn string. "W" specifies word format. "202A" indicates the size of the learn string.

Line 170 creates a file called STATE that is 4 records long. (To determine the number of records for the computer in our example, the 401-point trace is multiplied by 2 bytes per point and the 202-byte learn string is added to give 1004 bytes total. This total is divided by 256 bytes per record, resulting in 4 records.)

**Note**

*If the program containing the CREATE command is run twice, the computer will report an error the second time because the file already exists. To prevent this, place an exclamation mark before the CREATE command to "comment out" line 170 after the program has been executed.*

## Program Example for the RS-232 Interface

```
10 'File = 232PROG8
20 OPEN "COM1:9600,N,8,1" AS #1
30 'Define 202-character string
40 DIM LEARN$(202)
50 'Create 802-character string to store trace data
60 DIM TR1$(200),TR2$(200),TR3$(200)
70 DIM TR4$(200),TR5$(2),TR6$(200)
80 'ask spectrum analyzer for trace data in binary format
90 PRINT #1,"TDF B; TRA?;"
100 'enter trace data from spectrum analyzer
110 TR1$=INPUT(200,#1) 'first 200 characters
120 TR2$=INPUT(200,#1) 'second 200 characters
130 TR3$=INPUT(200,#1) 'third 200 characters
140 TR4$=INPUT(200,#1) 'fourth 200 characters
150 TR5$=INPUT(2,#1)   'last two characters
160 'ask for learn string from spectrum analyzer
170 PRINT #1,"OL;"
180 'get learn string from spectrum analyzer
190 LEARN$=INPUT$(202,#1)
200 'create file to store trace on disk
210 OPEN "TRACEA" FOR OUTPUT AS #2
220 'change ASCII data to integers for disk storage
230 'because ASCII 26 will put EOF on disk
240 DEFINT X,Y,I 'integer variables
250 DIM X1(202),Y1(802) 'arrays for the data
260 'first format the learn string
270 FOR I= 1 TO 202
```

```
280 'get ASCII character from string
290 L2$=MID$(LEARN$,I,1)
300 'make integer of ASCII value 0-255
310 X1(I)=ASC(L2$)
320 NEXT I
330 'format the data strings
340 T5=1 'set counter
350 TR6$=TR1$ 'set string to be converted
360 GOSUB 620 'do the conversion
370 T5=201 'set counter
380 TR6$=TR2$ 'set string to be converted
390 GOSUB 620 'do conversion
400 T5=401
410 TR6$=TR3$
420 GOSUB 620
430 T5=601
440 TR6$=TR4$
450 GOSUB 620
460 'convert last two characters
470 L2$=MID$(TR5$,1,1)
480 Y1(801)=ASC(L2$)
490 L2$=MID$(TR5$,2,1)
500 Y(802)=ASC(L2$)
510 'data is now formatted, write to disk
520 FOR I=1 TO 202
530 PRINT #2,X1(I)
540 NEXT I
550 FOR I=1 TO 802
560 PRINT #2,Y1(I)
570 NEXT I
580 'close the data file
590 CLOSE
600 GOTO 680
610 'subroutine for converting data:
620 FOR I=1 TO 200
630 L2$=MID$(TR6$,I,1) 'get ASCII character
640 Y1(T5)=ASC(L2$)    'set value in array
650 T5=T5+1
660 NEXT I
670 RETURN   'done with conversion
680 END
```

The previous program reads a trace from the spectrum analyzer, then stores it in the variable called TRCA. The state of the spectrum analyzer is stored in the variable LEARN$. These two variables are then saved in a file called TRACEA. Finally, the file is stored on a disk.

Using the data stored in TRCA, the spectrum analyzer settings can be reset according to the saved state. Then, using the stored trace data, trace data can be viewed on the spectrum analyzer display.

Line 40 gives the dimensions of the learn string using the GW BASIC DIM command. Learn strings for the spectrum analyzer require 202 bytes of storage space. Refer to the output learn string (OL) command description in Chapter 5 for more information.

Line 90 uses TDF B to format the output in binary. Binary provides the fastest data transfer and requires the least amount of memory to store data. Each data point is transferred in binary as two 8-bit bytes. The data points are in the internal representation of measurement data. (See "Different Formats for Trace Data Transfers" at the end of this chapter for more information about trace data formats.)

When the trace and state data is sent from the spectrum analyzer to the computer, it must be formatted. Lines 270 through 320 format the trace data.

## Returning the Spectrum Analyzer to its Former State

The following programs read a trace stored in a file and load it into a variable.

### Program Example for the HP-IB Interface

```
10  !FILE: "IBPROG9"
20  !define 202 character string:
30 DIM Learn_string$[202]
40  !create 401 point array to store trace:
50 INTEGER Trace_a(1:401)
60 Analyzer=718
70  !assign path to the file:
80 ASSIGN @File TO "STATE"
90  !get values for Learn_string$
100  !and Trace_a(*) from disk:
110 ENTER @File;Learn_string$,Trace_a(*)
120  !send learnstring to spectrum analyzer:
130 OUTPUT Analyzer;"IP DONE;"
140 ENTER Analyzer
150 OUTPUT Analyzer;Learn_string$
160  !set single sweep mode:
170 OUTPUT Analyzer;"SNGLS;"
180  !prepare spectrum analyzer for a trace from
190  !the computer:
200 OUTPUT Analyzer;"TRA #A";
210  !send trace to the spectrum analyzer
220 OUTPUT Analyzer USING "#,W";802,Trace_a(*)
230  !view trace to see it was sent:
240 OUTPUT Analyzer;"VIEW TRA;"
250  !close file:
260 ASSIGN @File TO *
270 END
```

The HP-IB program reads a trace stored in the file STATE, then loads it into the variable Trace_a(*).

First, the settings of the spectrum analyzer that were stored in the variable LEARN$ are recalled. The spectrum analyzer state is changed to the same state as when the trace was stored. Then previously stored trace data is returned to the spectrum analyzer and the trace is viewed on the spectrum analyzer screen. Finally, line 220 uses the HP BASIC USING command to format the trace data.

### Program Example for the RS-232 Interface

```
10 'File = 232PROG9
20 OPEN "COM1:9600,N,8,1" AS #1
30 DEFINT X,Y,I 'integer variable
40 'define 202-character string
50 DIM LEARN$(202),X1(202)
60 'create an 802-character string to store disk data
70 DIM TR1$(200),TR2$(200),TR3$(200),TR4$(200)
80 DIM TR5$(2),TR6$(200),Y1(802)
90 'open disk file "TRACEA"
100 OPEN "TRACEA" FOR INPUT AS #2
110 'enter learn array from disk
```

```
120 FOR I=1 TO 202
130 INPUT #2,X1(I)  'get integer variable from disk
140 NEXT I
150 'enter trace data from disk
160 FOR I=1 TO 802
170 INPUT #2,Y1(I)
180 NEXT I
190 'close the disk file
200 CLOSE #2
210 'format the integer data into strings
220 'for the spectrum analyzer. See 232PROG8 for explanation
230 LEARN$=""  'null out the learn string
240 FOR I=1 TO 202  'format learn string first
250 LEARN$=LEARN$+CHR$(X1(I))
260 NEXT I
270 'format the trace data
280 I2=1  'set the counter
290 GOSUB 500 'do the conversion
300 TR1$=TR6$  'set the string
310 I2=201
320 GOSUB 500  'do the conversion
330 TR2$=TR6$
340 I2=401
350 GOSUB 500
360 TR3$=TR6$
370 I2=601
380 GOSUB 500
390 TR4$=TR6$
400 'format last two characters
410 TR5$=""
420 TR5$=TR5$+CHR$(Y1(801))+CHR$(Y1(802))
430 'write to spectrum analyzer
440 PRINT #1,LEARN$
450 'output trace data
460 PRINT #1,"IB";TR1$;TR2$;TR3$;TR4$;TR5$;
470 PRINT #1,"VIEW TRB;"
480 GOTO 560 'end program
490 'subroutine for converting integer data to ASCII
500 TR6$=""  'set the string to a null value
510 FOR I=1 TO 200
520 TR6$=TR6$+CHR$(Y1(I2))
530 I2=I2+1
540 NEXT I
550 RETURN 'done with conversion
560 END
```

The RS-232 program, 232PROG9, reads a trace stored in the file TRACEA and loads it into the variable TRCA. This program assumes that trace data is stored on the disk from the previous program example, 232PROG8.

First, the settings of the spectrum analyzer that were stored in the variable LEARN$ are recalled. The spectrum analyzer state is changed to the same state as when the trace was stored. Then previously stored trace data is returned to the spectrum analyzer and the trace is viewed on the spectrum analyzer screen.

```
;Fundamental;" MHz"
910 OUTPUT CRT USING "11X,K,DDDD.D,K";"AMP = ";Fund_amptd_dbm;"
dBm"
920 OUTPUT CRT USING "11X,K,DDD.D,K";"2nd HARMONIC =
-";Harmonic_dbc(2);" dBc"
930 OUTPUT CRT USING "11X,K,DDD.D,K";"3rd HARMONIC =
-";Harmonic_dbc(3);" dBc"
940 FOR I=4 TO Max_harmonic
950  OUTPUT CRT USING "10X,DD,K,DDD.D,K";I;"th HARMONIC =
-";Harmonic_dbc(I)
dBc"
960 NEXT I
970 OUTPUT CRT USING "11X,K,DDD.D,K";"TOTAL DISTORTION =
";Prcnt_distort;" %"
980  !
990 LOCAL 7
1000 STOP
1010 !
1020 Clearscreen:  !alpha clear subroutine
1030 !the statement below presses the "CLR SCR" key on
1040 !the keyboard:
1050 OUTPUT KBD USING "#,B";255,75
1060 RETURN
1070 END
```

The program prompts the user to connect a source to the spectrum analyzer INPUT and enter the source frequency. It sets the spectrum analyzer center frequency to the value of the source, or fundamental, frequency. It measures and records the frequency and amplitude of the fundamental, then measures and records the amplitude of the second, third, and fourth harmonics. These values are used to compute percent of harmonic distortion. The result of the harmonic distortion percentage computation, plus harmonic amplitudes in dBc (decibels relative to the carrier), are displayed on the computer display. Extensive annotation has been added (after the exclamation points) to help clarify the program.

If necessary, change the number of harmonics in line 80.

## Program Example for the RS-232 Interface

```
10 'File = THDTEST
20 OPEN "COM1:9600,N,8,1" AS #1
30 'allow user to change the number of harmonics
40 MAXHARMONIC=4
50 DIM HARMONICV(10),HARMONICDBC(10)
60 'clear the screen
70 CLS
80 'ask for the frequency of the fundamental
90 PRINT "******* HARMONIC DISTORTION *******"
100 PRINT
110 PRINT "CONNECT SOURCE TO ANALYZER INPUT, THEN"
120 PRINT "ENTER FREQUENCY OF THE FUNDAMENTAL IN MHZ"
130 PRINT
140 INPUT FUNDAMENTAL
150 CLS
160 'print measuring fundamental on screen
170 PRINT "MEASURING FUNDAMENTAL"
180 'preset the spectrum analyzer, set single-sweep and
```

```
185 'take sweep
190 PRINT #1,"IP;SNGLS;TS;"
200 PRINT #1,"DONE;"
210 INPUT #1,DONE
220 'tune the spectrum analyzer to the fundamental freq and set
225 '20  MHz span
230 PRINT #1,"CF ";FUNDAMENTAL;"MHZ"
240 PRINT #1,"SP 20MZ;TS;"
250 PRINT #1,"DONE;"
260 INPUT #1,DONE
270 'put a marker on signal peak, move marker to
275 'reference level
280 PRINT #1,"MKPK HI;MKRL;TS;"
290 'find signal peak, activate signal track, and
295 'narrow span
300 PRINT #1,"MKPK HI;TS;"
310 PRINT #1,"MKTRACK ON;SP 100KZ;TS;"
320 PRINT #1,"DONE;"
330 INPUT #1,DONE
340 'turn off signal track
350 PRINT #1,"MKTRACK OFF;"
360 'find peak of signal, move peak to center of screen
370 'make units in volts
380 PRINT #1,"AUNITS V;"
390 'find peak of signal, send amplitude value to
395 'computer
400 PRINT #1,"MKPK HI;MKA?;"
410 INPUT #1,FUNDAMPTDV
420 'send marker frequency to computer, enter frequency
425 'value
430 PRINT #1,"MKF?;"
440 INPUT #1,FUNDAMENTAL
450 'make the fundamental frequency the center freq
455 'step size
460 PRINT #1,"MKSS;"
470 'set the fundamental frequency units to MHZ
480 FUNDAMENTAL=FUNDAMENTAL/1000000!
490 FOR NUMBER = 2 TO MAXHARMONIC
500 PRINT "MEASURING HARMONIC # ";NUMBER
510 'set span and tune to next harmonic
520 PRINT #1,"SP 20MZ;"
530 PRINT #1,"CF UP;TS;"
540 PRINT #1,"DONE;"
550 INPUT #1,DONE
560 'take a second sweep to allow spectrum analyzer to move to
570 'the center frequency, find the signal peak,
575 'activate the signal track
580 PRINT #1,"TS;"
590 PRINT #1,"MKPK HI;MKTRACK ON;SP 100KZ;TS;"
600 PRINT #1,"MKTRACK OFF;"
610 'find signal peak, send amplitude value to computer
620 'enter amplitude of harmonic
630 PRINT #1,"MKPK HI;MKA?;"
640 INPUT #1,HARMONICV(NUMBER)
650 NEXT NUMBER
```

```
660 'set amplitude units to dBm
670 PRINT #1,"AUNITS DBM;"
680 'calculate the fundamental amplitude in dBm because
690 'it was measured in volts
700 FUNDAMPTDDBM=10*(LOG(FUNDAMPTDV^2/.05)/2.3026)
710 'calculate the sum of the squares of the amplitudes
720 'of the harmonics, calculate amplitudes of
725 'harmonics (dBm)
730 SUMSQR=0
740 FOR I=2 TO MAXHARMONIC
750 SUMSQR=SUMSQR+HARMONICV(I)^2
760 HARMONICDBC(I)=20*(LOG(FUNDAMPTDV/HARMONICV(I))/2.3026)
770 NEXT I
780 'calculate the percent distortion
790 PRCNTDISTORT=SQR(SUMSQR)/FUNDAMPTDV*100
800 CLS
810 'output the data
820 PRINT "******* HARMONIC DISTORTION RESULTS *******"
830 PRINT "FREQUENCY = ";FUNDAMENTAL;"MHZ"
840 PRINT "AMPLITUDE = ";FUNDAMPTDDBM;" dbc"
850 FOR I=2 TO MAXHARMONIC
860 PRINT "HARMONIC # ";I;" = -";HARMONICDBC(I);" dbm"
870 NEXT I
880 PRINT "TOTAL DISTORTION = ";PRCNTDISTORT;" %"
890 END
```

The RS-232 program prompts the operator to connect a source to the spectrum analyzer INPUT and enter the source frequency. It sets the spectrum analyzer center frequency to the value of the source, or fundamental, frequency. It measures and records the frequency and amplitude of the fundamental, then measures and records the amplitude of the second, third, and fourth harmonics. These values are used to compute percent of harmonic distortion. The results of the harmonic distortion percentage computation, plus harmonic amplitude in dBc (decibels relative to the carrier), are displayed on the computer display.

If necessary, change the number of harmonics in line 40.

## Different Formats for Trace Data Transfers

Two different ways to format trace data using the TDF command were introduced earlier in this chapter (TDF P and TDF B). This section describes all the available trace data formats.

The HP 8590 Series spectrum analyzer provides five formats for trace data transfers: real number (P) format, binary (B) format, A-block format, I-block format, and measurement units (M) format.

### P Format

The P format allows you to receive or send trace data in a real-number format. This is the default format when the instrument is powered up. Numbers are in dBm, dBmV, dB$\mu$V, volts, or watts. The AUNITS command can be used to specify the amplitude units. Real-number data may be an advantage if you wish to use the data later in a program. However, data transfers using P format tend to be slow and take up a lot of memory (compared to binary format, the P format can take up to four times the amount of memory). Data is transferred as ASCII type.

Although the spectrum analyzer can send the trace data to the computer as real numbers, the trace data cannot be sent back to the spectrum analyzer without changing the trace data to measurement units (integers). See the following example.

#### Example of Using the P Format

This example sends trace data to the computer and back to the spectrum analyzer using P format.

**Note** The spectrum analyzer must be in the log amplitude scale to use the TDF P format.

| | |
|---|---|
| `1 REAL Trace_data(1:401)` | *Declare an array for trace data.* |
| `10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;SNGLS;TS;"` | *Take a measurement sweep.* |
| `20 OUTPUT 718;"TDF P;TRA?;"` | *Activate the P format, output trace A data.* |
| `30 ENTER 718;Trace_data(*)` | *The computer receives trace A data from the spectrum analyzer.* |
| `40 OUTPUT 718;"VIEW TRA;MOV TRA,0;"` | *To verify that the trace data is transferred back to the spectrum analyzer, set trace A to zeros.* |
| `50 OUTPUT 718;"RL?;"` | *Determine the amplitude of the reference level. The amplitude of the reference level is used to change the integers sent to the spectrum analyzer into real numbers.* |
| `60 DISP "PRESS CONTINUE WHEN READY"` | |
| `70 PAUSE` | |
| `80 ENTER 718;Ref_level` | *Get the reference level.* |
| `90 MAT Trace_data=Trace_data-(Ref_level)` | *These lines change the real trace* |
| `100 MAT Trace_data=Trace_data*(100)` | *data (stored in Trace_data) into* |
| `110 MAT Trace_data=Trace_data+(8000)` | *integers (in measurement units).* |
| `120 OUTPUT 718;"TRA ";` | *Sends the trace data back to the* |
| `130 OUTPUT 718;Trace_data(*)` | *spectrum analyzer in measurement units.* |

```
140 LOCAL 718
150 END
```

The trace data is sent to the computer in parameter units. A parameter unit is a standard scientific unit. For the TDF P format, the parameter unit depends on the current amplitude units (dBm, dBmV, dBμV, V, W). Use the AUNITS command to change the units.

For more detailed information about the P format, see the description for TDF in Chapter 5.

## B Format

The B format allows you to receive or send trace data in a binary format. The B format provides the fastest data transfer and requires the least amount of memory to store data. Each data point is transferred in binary as two 8-bit bytes. The data points are in the internal representation of measurement units (0 to 8000). Unlike the A-block format, the B format does not send a header. An end-or-identify (EOI) is sent with the last byte of data.

### Example of Using the B Format

This example sends trace data from the spectrum analyzer in B format. The trace data format must be changed to A-block format to return the trace data to the spectrum analyzer. See following example.

**Note** It is not possible to return data to the spectrum analyzer using binary format. You must use either A-block or I-block format to return the trace data to the spectrum analyzer.

| | |
|---|---|
| `10 INTEGER Tra_binary(1:401)` | *Tra_binary stores the trace data.* |
| `20 ASSIGN @Sa TO 718;FORMAT OFF` | |
| `30 OUTPUT @Sa;"IP;CF 300MZ;SP 20MZ;SNGLS;TS;"` | *Takes a measurement sweep.* |
| `40 OUTPUT @Sa;"MDS W;TDF B;TRA?;"` | *Outputs trace A data.* |
| `50 ENTER @Sa;Tra_binary(*)` | |
| `60 OUTPUT @Sa;"TDF A;"` | *Changes the trace data format to A-block format.* |
| `70 OUTPUT @Sa;"MOV TRA,0;"` | *To verify that the trace data is sent back to the spectrum analyzer, move all zeros into trace A.* |
| `80 DISP "PRESS CONTINUE WHEN READY"` | |
| `90 PAUSE` | |
| `100 OUTPUT @Sa USING "#,K,W";"TRA#A",802` | *Prepares the spectrum analyzer for the trace data.* |
| `110 OUTPUT @Sa;Tra_binary(*)` | *Transfers the trace data back to the spectrum analyzer.* |
| `120 OUTPUT @Sa;"VIEW TRA;"` | |
| `130 LOCAL 718` | |
| `140 END` | |

The result is transmitted as binary information. The MDS command can be used to change the data format from two 8-bit bytes to one 8-bit byte. For more detailed information about the B format and the MDS command, see the descriptions for TDF and MDS in Chapter 5.

Binary data can be converted to dBm or volts. For example, use the following equation to change the trace data (in measurement units) to a real logarithmic number (dBm):

$$\text{dBm} = \big((\text{trace data} - 8000) \times 0.01\big) + \text{reference level(in dBm)}$$

To change the trace data (in measurement units) to linear data (volts):

$$\text{volts} = \left(\frac{\text{reference level}}{8000}\right) \times \text{trace data}$$

The following programming converts binary data to dBm.

```
10    ! 859X binary data to real numbers
20    Sa=718
30    ASSIGN @Sa_bin TO Sa;FORMAT OFF
40    INTEGER Trace_a(1:401)
50    OUTPUT Sa;"AUNITS DBM;"
60    OUTPUT Sa;"RL?;"
70    ENTER Sa;Ref_lev
80    PRINT Ref_lev
90    OUTPUT Sa;"TDF B;TRA?;"
100   ENTER @Sa_bin;Trace_a(*)
110   ! now the spectrum analyzer has all the data
120   ! to determine the measured trace data
130   REAL Trace_a_real(1:401)
140     MAT Trace_a= Trace_a-(8000) ! Results in below ref
150     ! level
160     MAT Trace_a_real= Trace_a*(.01)! now in hundredths of db
170     ! below ref lev
180     MAT Trace_a_real= Trace_a_real+(Ref_lev)
190   FOR I=1 TO 401
200       PRINT Trace_a_real(I)
210       NEXT I
220   END
```

The following programming converts binary data to volts.

```
10    ! 859X binary data to real numbers (linear)
20    Sa=718
30    ASSIGN @Sa_bin TO Sa;FORMAT OFF
40    INTEGER Trace_a(1:401)
50    OUTPUT Sa;"AUNITS V;"
60    OUTPUT Sa;"RL?;"
70    ENTER Sa;Ref_lev
80    Ref_lev_factor=Ref_lev/8000
90    OUTPUT Sa;"TDF B;TRA?;"
100   ENTER @Sa_bin;Trace_a(*)
110   ! now the spectrum analyzer has all the data
120   ! to determine the measured trace data
130   REAL Trace_a_real(1:401)
140     MAT Trace_a_real= Trace_a*(Ref_lev_factor)
150   FOR I=1 TO 401
160       PRINT Trace_a_real(I)
170       NEXT I
180   END
```

## A-Block Format

The A-block format is similar to binary format in that each data point is sent as two 8-bit bytes (this, too, is in the internal representation of measurement data). A-block format also transfers a four-byte header before the 401 points of trace data. These bytes are the ASCII character "#", "A", and two-byte number representing the length of the trace data, followed by the data bytes.

### Example of Using the A-Block Format

This example sends trace data from the spectrum analyzer to the computer and back to the spectrum analyzer in A-block format.

| | |
|---|---|
| `10 INTEGER Tra_binary(1:401)` | *Declare an array for trace data.* |
| `20 DIM Header$[4]` | *Declare a string for the #, A, MSB length, and LSB length header.* |
| `30 OUTPUT 718;"IP;CF 300MZ;SP 20MZ;SNGLS;TS;"` | *Take a measurement sweep.* |
| `40 OUTPUT 718;"MDS W;TDF A;TRA?;"` | *Send trace A to the computer in A-block format.* |
| `50 ENTER 718 USING "#,4A,401(W)";Header$,Tra_binary(*)` | *The computer receives the header and the trace data.* |
| `60 PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"` | |
| `70 PAUSE` | |
| `80 OUTPUT 718;"IP;TS;VIEW TRA;"` | *View trace A.* |
| `90 OUTPUT 718;"TDF A;"` | |
| `100 OUTPUT 718 USING "#,K,W,401(W)";"TRA#A",802,Tra_binary(*),";"` | *The spectrum analyzer receives the trace data from the computer.* |
| `110 END` | |

The transferred trace data consists of #A, a two-byte number representing the most significant byte (MSB) length and the least significant byte (LSB) length, and the data bytes. Depending on the terminal you are using, the data bytes may appear as symbols instead of numbers. Consult your computer documentation to determine the numeric value of the data bytes.

For more detailed information about the A-block format and the MDS command, see the descriptions for TDF and MDS in Chapter 5.

## I-Block Format

**Note** The I-block format is not recommended for use with the RS-232 interface (Option 023).

The I-block format transfers data points as two 8-bit bytes in the internal representation of measurement data. In addition to transferring trace data, I-block format also transfers the characters "#" and "I". These characters indicate that the trace data is in I-block format. The I-block format allows the spectrum analyzer to accept up to 401 points of trace data when using I-block format. Fewer than 401 points of trace data can be specified, and the spectrum analyzer will accept data until an EOI signal is sent to it. Therefore, returning the trace data to the spectrum analyzer requires an important instruction, END. (See following example.)

### Example of Using the I-Block Format

This example sends trace data from the spectrum analyzer to the computer and back to the spectrum analyzer in I-block format.

| | |
|---|---|
| `10 INTEGER Tra_binary(1:401)` | *Declare an array for trace data.* |
| `20 DIM Header$[2]` | *Declare an array for #, I header.* |
| `30 OUTPUT 718;"IP;CF 300MZ;SP 20MZ;SNGLS;TS;"` | *Take a measurement sweep.* |
| `40 OUTPUT 718;"TDF I;TRA?;"` | *Send trace A data in I-block format.* |
| `50 ENTER 718 USING "#,2A,401(W)";Header$,Tra_binary(*)` | *The computer receives the header and trace A data.* |
| `60 PRINT "PRESS CONTINUE TO RETURN DATA TO THE ANALYZER"` | |
| `70 PAUSE` | |
| `80 OUTPUT 718;"IP;TS;VIEW TRA;"` | *View trace A.* |
| `90 OUTPUT 718;"TDF I;"` | |
| `100 OUTPUT 718 USING "#,K,W,401(W)";"TRA#I", Tra_binary(*)END` | *The trace data is returned to the spectrum analyzer.* |
| `110 END` | |

The END statement in line 100 sends the spectrum analyzer the last data byte stored in the array and sets the HP-IB EOI line "true," as required by the I-block format.

The transferred trace data consists of #I, followed by data bytes until the EOI line is set true.

For more detailed information about the I-block format and the MDS command, see the descriptions for TDF and MDS in Chapter 5.

## M Format

The M format is for sending trace data only. It formats the trace data in the internal format used by the spectrum analyzer, also known as measurement units.

Refer to Figure 3-1. The displayed amplitude of each element falls on one of 8000 vertical points with 8000 equal to the reference level. For log scale data, each point is equal to 0.01 dB. The peak of the signal in Figure 3-1 is equal to −20 dBm, or two divisions below the reference level. In measurement units, it is equal to 6000 (8000 − 2000 = 6000). In linear mode, each point has a resolution of [reference level in volts divided by 8000]. The range of internal data is −32,768 to +32,767. In practice however, the range limits can be reached during trace math operations only.

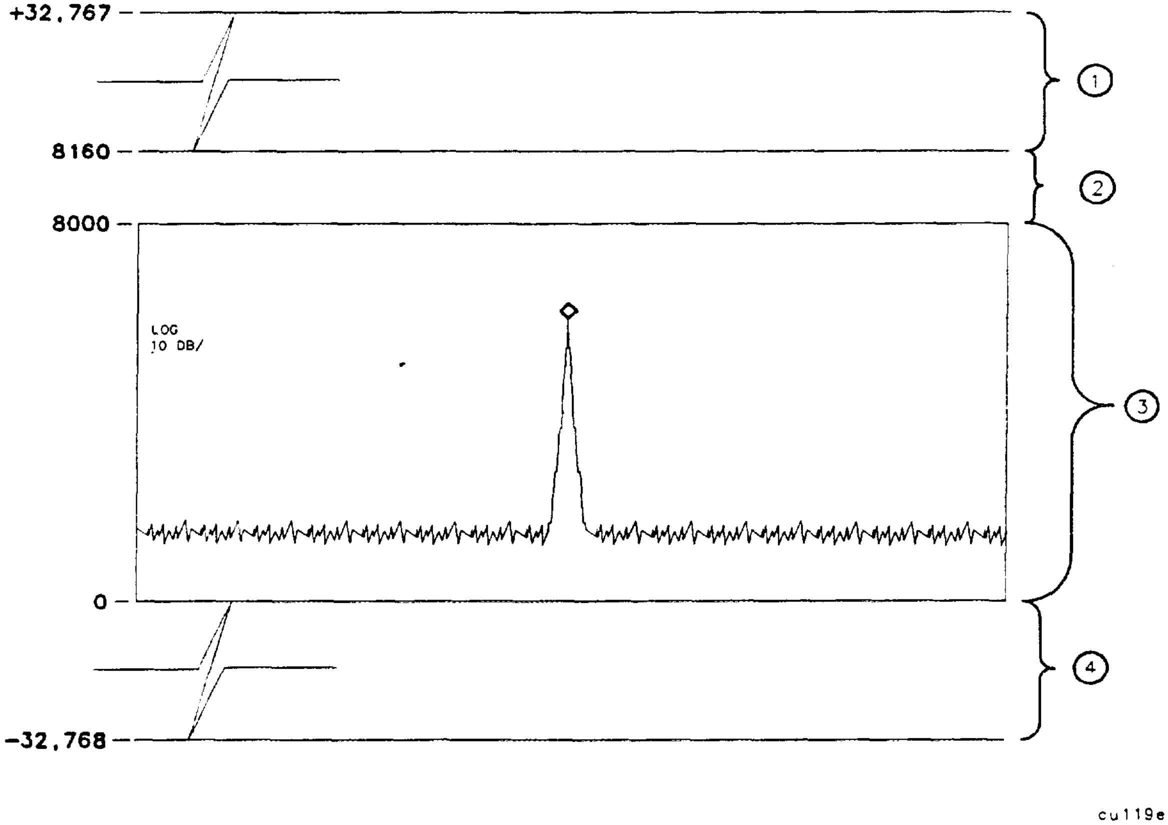



**Figure 3-1. Measurement Unit Range and Trace Amplitudes**

**Table 3-1. Measurement Units**

| Index Number | Description |
|---|---|
| 1 | A number within the range of 8161 to 32,767 measurement units is obtainable with trace math operations only. |
| 2 | The area from 8000 (reference level) to 8160 (1.6 dB above reference level) represents the amount a trace element's amplitude can exceed the top graticule and still be valid. |
| 3 | The area from 0 to 8000 represents the displayed range for trace amplitude data. The range of 0 to 8000 varies according to the amplitude scale of the spectrum analyzer as follows:<br>■ In 10 dB/division, the range is from 0 to 8000.<br>■ In 5 dB/div, the range is from 4000 to 8000.<br>■ In 2 dB/div, the range is from 8000 to 6000.<br>■ In 1 dB/div, the range is from 8000 to 7000. |
| 4 | A number within the range of 0 to −32,768 measurement units is obtainable with trace math operations only. |

### Example of Using the M Format

This example sends trace data from the spectrum analyzer to the computer in M format.

```
10 INTEGER A(1:401)                          Dimension array A.
30 OUTPUT 718;"IP;CF 300MZ;SP 20MZ;SNGLS;TS;"  Take a measurement sweep.
40 OUTPUT 718;"TDF M;TRA?;"                  Send trace A data in M format.
50 ENTER 718;A(*)                            The computer receives the trace data.
60 PRINT A(*)                                Print trace data.
70 END
```

**Note**

All trace math functions are done using measurement units. See Table 5-4 for a list of all trace math functions. See the description for the AMB command in Chapter 5 for an example of trace math subtraction in measurement units.

The result is in measurement units (−32768 to +32767). For more detailed information about the M format, see the description for TDF in Chapter 5.

Table 3-2 summarizes the different trace data formats.

**Table 3-2. Summary of the Trace Data Formats**

| Trace Data Format | Description | Remarks |
|---|---|---|
| TDF P | Real Number Format | Spectrum analyzer must be in log scale to use TDF P. To send the trace data back to the spectrum analyzer, the data must be converted to measurement units. |
| TDF B | Binary Format | Fastest format for trace data transfers. Use the A-block format to send data back to the spectrum analyzer. |
| TDF A | A-Block Data Format | Trace data preceded by "#," "A," and a two-byte number. To use the A-block format for sending data, you must provide the number of data bytes. |
| TDF I | I-Block Data Format | Trace data preceded by "#," and "I." This format is not recommended for use with an RS-232 interface. Unlike using the A-block format, you do not provide the number of data bytes when sending data. |
| TDF M | Measurement Data Format | TDF M cannot be used to send trace data back to the spectrum analyzer. |

4

# Creating and Using Downloadable Programs

## What You'll Learn in This Chapter

This chapter provides fundamental information about downloadable programs (DLPs).

This chapter contains the following sections:

- Creating and executing a DLP.
- Storing DLPs on a RAM card.
- Determining the amount of memory needed for a DLP.
- Using the DLP editor.
- DLP programming guidelines.

### What is a DLP?

A DLP is a sequence of programming commands used to perform a specific operation. You can define a DLP that is made up of several user-defined functions, user-defined variables, and user-defined traces, then store the DLP in analyzer memory or on a RAM card. DLPs are created with the FUNCDEF command.

### Why Use a DLP?

A DLP provides an easy way to execute programming commands without the use of an external controller. Almost any instruction that the analyzer can execute over the interface bus or with front-panel operation can be executed in a DLP. In addition, DLPs have the ability to control other instruments over the instrument bus. DLPs remain in analyzer memory even when the spectrum analyzer power is turned off; the DLPs are stored in the battery-backed RAM of the analyzer memory and can be used repeatedly, whenever needed.

## Creating and Executing a DLP

This section contains information about how to create and execute a DLP. This section contains the following procedures:

- Create a DLP.
- Execute the DLP with a softkey.
- Execute the DLP within a program.
- Use user-defined variables and user-defined traces within a DLP.
- Enter values into a DLP.
- Create a modular DLP.

### To Create a DLP

A DLP is created by using the FUNCDEF command.

1. Begin the FUNCDEF declaration by specifying the FUNCDEF command, the label for the function you are creating, a comma, and then a delimiter. See line 10 of the example.

   Use unique names (unique from the analyzer programming commands) for the label. To avoid confusion with the internal variables used by the spectrum analyzer, Hewlett-Packard recommends that you use an underscore as the second character of the label.
2. Enter in the programming commands that you want the DLP to perform. See lines 20 and 30 of the example. Be sure to use semicolons to separate and terminate each programming command.
3. End the FUNCDEF declaration by specifying the same delimiter that was used in step 1. See line 40 of the example. The delimiters are used to enclose the programming commands for the function.

To avoid problems with the FUNCDEF declaration, you should remember the following:

- Loading a DLP into analyzer memory requires space in the analyzer's memory. If you are creating a large DLP, you should see "Determining the Amount of Memory Needed for a DLP" in this chapter for information on how to determine the amount of available analyzer memory and the size of the DLP.
- Limit the number of characters between the delimiters in the FUNCDEF declaration to a maximum of 2047 characters. If the DLP is too large, you may need to segment the program into several functions with a main program to call the functions. See "To Create a Modular DLP" in this chapter for more information.
- Ensure that the commands within the DLP are spelled correctly, that the syntax for the command is correct, and that each command is properly terminated with a semicolon.
- Keep the program lines short. If necessary, divide the spectrum analyzer programming commands into several lines, and place a semicolon at the end of every line. (The semicolon suppresses a carriage return and a line feed.) See the example.
- See the description for the FUNCDEF command in Chapter 5 for a list of programming commands that cannot be used within a FUNCDEF declaration.

#### Example

Executing the following programming lines creates a downloadable program called Z_OOM. Z_OOM presets the analyzer, sets the center frequency to 300 MHz, sets the span to 10 MHz, and places a marker on the highest signal. After executing the following lines, Z_OOM will be in spectrum analyzer memory.

10 OUTPUT 718;"FUNCDEF Z_OOM,@"; — *Begins the FUNCDEF declaration. The "@" sign delimits the programming commands that are within the FUNCDEF called Z_OOM. The semicolon at the end of the line suppresses a carriage return and line feed.*

20 OUTPUT 718;"IP;CF 300MHZ;"; — *Enters IP and CF 300 MHz commands into Z_OOM.*

30 OUTPUT 718;"SP 10MHZ;TS;MKPK HI;"; — *Enters the SP 10 MHz, TS, MKPK HI commands into Z_OOM.*

40 OUTPUT 718;"@;" — *Ends the FUNCDEF declaration.*

50 LOCAL 718 — *Places the analyzer in local mode.*

60 END

## To Execute a DLP by Using a Softkey

There are two ways to execute a DLP. You can execute the DLP by pressing a softkey that has been assigned a function as shown in this procedure, or execute the DLP within a program (shown in the following procedure).

1. Use the KEYDEF command to assign the function that you created with the FUNCDEF command to a softkey.
2. Press (MEAS/USER), **User Menus** to access the softkey.

### Example

The following example uses the KEYDEF command to assigns the Z_OOM function to softkey 1.

10 OUTPUT 718;"KEYDEF 1, Z_OOM,%CAL SIG|ZOOM%;"; — *Assigns the function Z_OOM to softkey 1 and assigns softkey 1 the label "CAL SIG ZOOM."*

20 LOCAL 718

30 END

You can access **CAL SIG ZOOM** by pressing (MEAS/USER), **User Menus** .

## To Execute the DLP within a Program

You can also execute the DLP within a program.

- Use the name of the DLP within a program.

### Example

The following programming line executes the Z_OOM function remotely.

```
OUTPUT 718;"Z_OOM;"
```

## To Use a User-Defined Variable within a DLP

User-defined variables are variables that you create with the VARDEF or ACTDEF commands. User-defined variables remain in spectrum analyzer memory and retain their values until redefined, disposed of, or altered by MOV or math commands. Because user-defined variables remain in memory, you should define the variables outside of the DLP. Problems can be avoided by defining variables at the beginning of a program.

To use a user-defined variable within a DLP:

1. Use the VARDEF command to declare the variable. You should declare the variable outside of the function.
2. Begin the FUNCDEF declaration.
3. Use the variable within the function declaration. If you want to display the value of the variable, use the DSPLY command.
4. End the FUNCDEF declaration.

If variables are defined at the beginning of a program, then the MEM? query returns the correct value for available spectrum analyzer memory after the DLP is downloaded by an external controller.

### Example

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF A_MP,0;";` | *Declares the variable called A_MP and initializes its value to zero.* |
| `20 OUTPUT 718;"FUNCDEF A_MPFUNC,!;"` | *Begins the declaration of a function called A_MPFUNC.* |
| `30 OUTPUT 718;"IP;SNGLS;";` | *Does an instrument preset, sets it to single-sweep mode.* |
| `40 OUTPUT 718;"FA 275MHZ;FB 325MHZ;";` | *Sets the start and stop frequencies to 275 and 325 MHz, respectively.* |
| `50 OUTPUT 718;"TS;MKPK HI;";` | *Puts a marker on the highest signal.* |
| `60 OUTPUT 718;"MOV A_MP,MKA;";` | *Moves the marker amplitude value into A_MP.* |
| `70 OUTPUT 718;"PU;PA 60,180;TEXT %MARKER AMPLITUDE IS %;";`<br>`80 OUTPUT 718;"DSPLY A_MP,3.1;TEXT %dBm%;";` | *Displays the message "MARKER AMPLITUDE IS, " then displays the marker amplitude and dBm.* |
| `90 OUTPUT 718;"!;"` | *Ends the function declaration.* |
| `100 OUTPUT 718;"A_MPFUNC;"` | *Executes the A_MPFUNC DLP.* |
| `110 END` | |

The programming example above alters the variable A_MP that was defined with the VARDEF command. The math commands can be used to alter variable values. Examples of math commands are the ADD, DIV, SUB, and MPY. Refer to Table 5-4 in Chapter 5 for a complete list of the math commands.

## To Use a User-Defined Trace within a DLP

Like variables, you should define user-defined traces outside of the DLP. User-defined traces retain their values until redefined, disposed of, or altered by the MOV command or a math command.

1. Use the TRDEF command to define a trace. Declare the trace outside of the function.
2. Initialize the elements of the trace to 0.
3. Use the trace (you can use the trace within a DLP).
4. To display the contents of the user-defined trace, move the contents of the user-defined trace into trace A, trace B, or trace C with the MOV command and then use the VIEW command to display the destination trace (trace A, trace B, or trace C).

### Example

The following example demonstrates how to define a trace, move a value into the trace, move the trace to trace A, and view trace A.

| | |
|---|---|
| `10 OUTPUT 718;"TRDEF T_RACEA,401;";` | *Defines a 401-point trace called "T_RACEA."* |
| `20 OUTPUT 718;"MOV T_RACEA,0;";` | *Initializes the trace values to zero.* |
| ⋮ | *Use the T_RACEA for a measurement.* |
| `130 OUTPUT 718;"FUNCDEF D_ISPTRACE,!;"` | *Defines a function called D_ISPTRACE.* |
| `140 OUTPUT 718;"MOV TRA,T_RACEA; ";` | *Moves the contents of T_RACEA into trace A.* |
| `150 OUTPUT 718;"VIEW TRA;";` | *Displays trace A.* |
| `160 OUTPUT 718;"!; "` | *Ends the FUNCDEF declaration.* |
| `170 OUTPUT 718;"D_ISPTRACE;"` | *Executes the D_ISPTRACE DLP.* |
| `180 END` | |

## To Enter Values into a DLP

To allow the spectrum analyzer user to enter a value with the analyzer front-panel keys, you need to use the active function definition command (ACTDEF) instead of the enter parameter command (EP) for entering values in a DLP.

- Use the ACTDEF command within the DLP. Do not use the EP command.

### Example

For example, if you want the user to enter the resolution bandwidth during the execution of a program (but not within a DLP), you would use the following:

| | |
|---|---|
| `OUTPUT 718;"ACTDEF M_BW,%ENTER THE RESOLUTION BANDWIDTH%,5MHZ,STEP,!MOV RB,M_BW!;"` | *Lets the user enter the value of the resolution bandwidth with the front-panel keys.* |

Notice that like moving a value into a variable or a trace, the MOV command or another MATH command must be used to move the function name into the RB command. See the command description for ACTDEF in Chapter 5 for more information.

## To Create a Modular DLP

A modular DLP is a DLP that is made up of several user-defined functions. Within a modular DLP, there are subroutines and a main programs. A subroutine is a user-defined function that usually performs only one task, and is called by another DLP. The main program calls the subroutines.

To create a modular DLP:

1. Enter the file name that the DLP will be stored under, if desired.
2. Enter the date of the last revision to the DLP, if desired.
3. Enter the DLP author's name, if desired.
4. Begin the FUNCDEF declaration for the subroutine
5. Enter in the programming commands that you want the subroutine to perform.
6. End the FUNCDEF declaration.
7. Repeat steps 4 through 6 for all the subroutines.
8. Create a main program that calls the subroutines.

Creating a modular DLP instead of a DLP that is made up of only one FUNCDEF has the following advantages:

- Because the number of character for a FUNCDEF declaration is limited to a maximum of 2047 characters, you must change a large DLP into a modular DLP if its size exceeds 2047 characters.
- Modular DLPs are easier to write, read, and find problems within the DLP.

It is also easier to read and find problems in a program that has a comments added to it. For example, adding the file name, the date of the last revision, and the author's name help keep a consistent program structure and make it easier to modify the DLP. The following program is an example of a modular DLP with the recommended program structure.

### Example

Notice that the program has a main program that calls the five subroutines (S_PANONE, S_PANTWO, S_PANTHREE, S_PANFOUR, and C_HECK). The lines from 140 through 400 now become a subprogram. Each of the five subroutines is called from the main program, E_XAMPLE. Line 560 assigns the DLP to softkey 2, so the function can be executed by pressing (MEAS/USER), **User Menus**, **EXAMPLE**.

File name

```
10 !File name: EXAMPLE
```

Date and author's name

```
20 !Date: 9/1/88 Author:  Jane Doe
```

Program Description

```
30 !Description of the program:  This program checks for
40 !signals above -50 dBm in the following frequency
50 !spans: 10 to 12 MHz, 12 to 14 MHz,
60 !14 to 16 MHz, and 16 to 110 MHz. If a
70 !signal is found, it autozooms to
80 !1 MHz span, records the signal
90 !level, and displays the highest frequency
100 !signal found in trace B.
```

Define variable

```
110 OUTPUT 718;"VARDEF P_OWER,0;"; ! Defines a variable named
120 ! "P_OWER" and initialize it to zero.
```

Define trace

```
130 OUTPUT 718;"TRDEF S_AVE,401;"; ! Defines a trace.
140 ! Subroutines:
```

Define subroutine

```
150 OUTPUT 718;"FUNCDEF S_PANONE,@;"; !Defines a function.
160 OUTPUT 718;"FA 10MHZ;FB 12MHZ;"; !Set the start and stop
170 ! frequencies.
180 OUTPUT 718;"@;"; Ends the function.
```

Define subroutine

```
190 OUTPUT 718;"FUNCDEF S_PANTWO,@;";
200 OUTPUT 718;"FA 12MHZ;FB 14MHZ;";
210 OUTPUT 718;"@;";
```

Define subroutine

```
220 OUTPUT 718;"FUNCDEF S_PANTHREE,@;";
230 OUTPUT 718;"FA 14MHZ;FB 16MHZ;";
240 OUTPUT 718;"@;";
```

Define subroutine

```
250 OUTPUT 718;"FUNCDEF S_PANFOUR,@;";
260 OUTPUT 718;"FA 16MHZ;FB 110MHZ;";
270 OUTPUT 718;"@;";
```

Define subroutine

```
280 OUTPUT 718;"FUNCDEF C_HECK,@;";
290 OUTPUT 718;"TS;MKPK HI;"; ! Places a marker on
295 ! highest signal.
300 OUTPUT 718;"IF MKA,GT,-50 THEN "; ! If the signal is higher
310 OUTPUT 718;"MKTRACK ON;"; ! than -50dBm, zoom to 1 MHz
320 OUTPUT 718;"SP 1MHZ;"; ! span, center it and bring it
330 OUTPUT 718;"MKTRACK OFF;TS;"; ! to the reference level.
340 OUTPUT 718;"MKPK HI;MKCF;TS;"; ! Store it in a 401-point
350 OUTPUT 718;"MKRL;TS;"; ! trace previously defined as
360 OUTPUT 718;"MOV P_OWER,MKA;"; ! having the label, "S_AVE".
370 OUTPUT 718;"MOV S_AVE,TRA;"; ! Save the control settings
380 OUTPUT 718;"SAVES 1;"; ! in register 1.
390 OUTPUT 718;"ENDIF;"; ! End the IF statement.
400 OUTPUT 718;"@;"; ! End the definition of C_HECK."
```

Main program

```
410 ! Main Program
420 OUTPUT 718;"FUNCDEF E_XAMPLE,@;"; ! Begins the main program.
430 OUTPUT 718;"IP;SNGLS;MOV S_AVE,0;"; ! Places the analyzer in
440 ! single-sweep mode and set all values in "S_AVE" to zero.
450 OUTPUT 718;" REPEAT ";
460 OUTPUT 718;" S_PANONE;C_HECK;";
470 OUTPUT 718;" S_PANTWO;C_HECK;"; ! Checks each span or a
480 OUTPUT 718;" S_PANTHREE;C_HECK;"; ! signal greater than -50 dBm.
490 OUTPUT 718;" S_PANFOUR;C_HECK;"; ! Repeat sequence until a
500 OUTPUT 718;"UNTIL S_AVE[0],NE,0;"; ! non-zero value is found in
510 OUTPUT 718;"MOV TRB,S_AVE;"; ! S_AVE. It then displays the located
520 OUTPUT 718;"RCLS 1;BLANK TRA;VIEW TRB;"; ! signal in trace B,
530 OUTPUT 718;"@;"; ! and recalls the analyzer settings
540 ! that existed when the signal
550 ! was found. E_XAMPLE is assigned
560 OUTPUT 718;"KEYDEF 2,E_XAMPLE,%EXAMPLE%;"; ! to softkey 2 so the
570 END ! program may be executed from the front panel.
```

Notice that the previous example uses descriptive labels and flows in a logical fashion, making the DLP easier to understand. In addition, the use of subroutines makes the DLP easier to modify because a subroutine can be changed without having to modify the main program or other subroutines. For example, if the application requires the stop frequency of the last span to extend to 4 GHz, simply change the stop frequency (FB 110MHZ) in S_PANFOUR to a stop frequency of 4 GHz (FB 4GHZ).

## Storing DLPs on a RAM Card

If the spectrum analyzer has a memory card reader installed in it, you can store the DLP on a RAM card, and, at a later time, load the DLP into analyzer memory from the RAM card. This section contains the procedures for storing a DLP on a RAM card remotely, and loading the DLP from the RAM card into analyzer memory remotely.

These procedures are all for remote operation; see the *HP 8590 Series Spectrum Analyzer User's Guide* for information about how to do these procedures by using the front-panel keys of the spectrum analyzer.

### To Store DLPs on a RAM Card

Storing the DLP on the RAM card is a convenient way of backing-up the functions in analyzer memory, and transferring the DLPs from one analyzer to another.

1. Install a RAM card into the memory card reader of the analyzer. Be sure the RAM card's write-protect switch not set to SAFE (write-protected).
2. Use the MSI command to select the memory card reader as the mass storage device.
3. Use the STOR command to copy the contents of spectrum analyzer memory onto the RAM card.

#### Example

The following example sets the mass storage device to the memory card reader, and then stores the contents of analyzer memory on the RAM card.

| | |
|---|---|
| `OUTPUT 718;"MSI CARD;STOR d,%dZ_OOM%,*;"` | *Stores a copy of the contents of analyzer memory on the RAM card under the file name of Z_OOM.* |

Saving a DLP on a RAM card also saves other contents of the analyzer memory. This means a program cannot be saved selectively if several programs are present in the analyzer memory at the time. You may want to delete the items in user memory that you do not wish to be saved on the RAM card.

### To Load DLPs from a Memory Card into Analyzer Memory

Once a DLP has been stored on a RAM card, it can be loaded back into spectrum analyzer memory when desired. DLPs remain in spectrum analyzer memory until disposed of with the DISPOSE command, ERASE command, or **DISPOSE USER MEM**.

1. To load a DLP from a RAM or ROM card into analyzer memory, insert the memory card into the memory card reader.
2. Use the MSI command to select the memory card reader as the mass storage device.
3. Use the LOAD command to copy the contents of the RAM card file into spectrum analyzer memory.

#### Example

The following example sets the mass storage device to the memory card reader, and then copies the contents of RAM card file called Z_OOM into spectrum analyzer memory.

| | |
|---|---|
| `OUTPUT 718;"MSI CARD;LOAD %dZ_OOM%;"` | *Loads a copy of Z_OOM from the RAM card into spectrum analyzer memory.* |

## Determining the Amount of Memory Needed for a DLP

DLPs, user-defined variables, user-defined traces, command trigger commands (for example, ONSRQ, ONEOS, and TRMATH), and user-defined softkeys all consume some amount of spectrum analyzer memory. If you write a large DLP, or if you have a several DLPs stored in spectrum analyzer memory, you may run out of spectrum analyzer memory that is available for storing the DLPs. Also, the storage space on a RAM card is finite. If you are creating large DLPs, you may need to determine the amount of spectrum analyze memory the DLP requires and delete unused items from spectrum analyzer memory. This section contains the procedures for the following:

- Determining the available amount of spectrum analyzer memory or RAM card space.
- Delete a DLP from spectrum analyzer memory or a RAM card.

### To Determine Available Analyzer Memory

Because the amount of analyzer memory available for user-defined functions is limited, it may sometimes be necessary to determine the amount of analyzer memory available.

- Use the MEM command to determine the available analyzer memory remotely.

**Example**

| | |
|---|---|
| `10 OUTPUT 718;"MEM?;";` | *Determines the available analyzer memory.* |
| `20 ENTER 718;Memory` | *Stores the available analyzer memory value in the variable Memory.* |
| `30 PRINT "MEMORY = ";Memory` | *Prints the amount of analyzer memory.* |
| `40 END` | |

If you are sure that the amount of memory that a DLP requires will not exceed the amount of spectrum analyzer memory available, you can download the DLP into analyzer memory and then execute the previous program again. The amount of analyzer memory that the DLP requires is the difference between the value that MEM? returned before the DLP was loaded into analyzer memory and the value MEM? returned after the DLP was loaded into analyzer memory.

If the amount of memory that a DLP requires could exceed the amount of spectrum analyzer memory available, you should delete any unnecessary variables, traces, DLPs, or command trigger commands from spectrum analyzer memory. See "To Delete a DLP from Spectrum Analyzer Memory" for more information.

### To Determine the Amount of Space on a RAM Card

To save a DLP on a RAM card, it may be necessary to determine the amount of space available on the RAM card. To determine the amount of space on a RAM card, you must do the following:

1. Catalog the memory card.
2. Determine the total number of records for the RAM card. The total number of records on the RAM card is displayed when cataloging the card (see Figure 4-1). The number of records on the RAM card is determined by dividing the memory capacity of the RAM card by 256 (because the records are 256 bytes long). For example, if the RAM card has a capacity of 32K bytes (which is equal to 32 x 1024), the total number of records on the RAM card is 128 (32,768 divided by 256).
3. Determine the number of records on the RAM card that are in use. The number of records stored on the RAM card can be determined by cataloging the card, finding the starting

record address for the last catalog entry, adding the number of records used for the last catalog entry to the starting record address, and then subtracting one.

4. Subtract the number of records stored (determined in step 3) from the total number of records available (determined in step 2) to determine the number of unused records on the RAM card.

## Example

Figure 4-1 shows that the number of records on the RAM card that are in use is 53 (35 + 19 − 1 = 53), and the total number of records available are 128. The number of unused records on the RAM card is 75 (128 − 53 = 75).

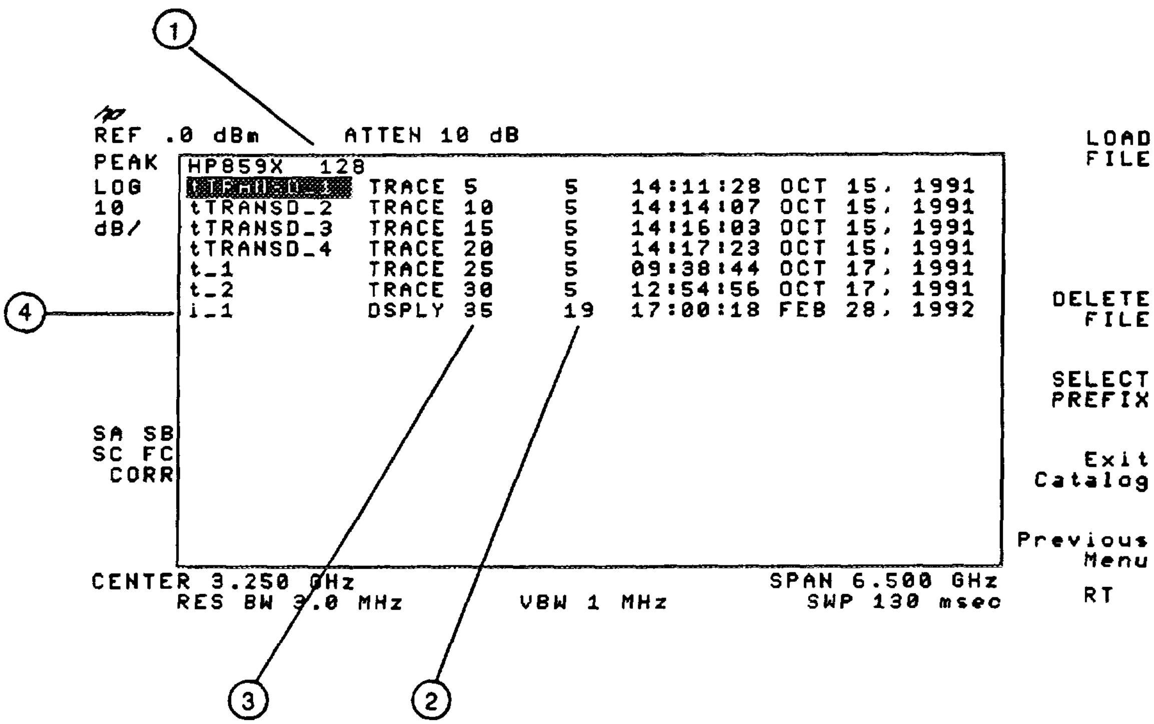



**Figure 4-1. Determining the Number of Records**

**Table 4-1. Cataloging a RAM Card**

| Index | Description |
|---|---|
| 1 | Total number of records. |
| 2 | Number of records for the last catalog item. |
| 3 | Starting record address for the last catalog entry. |
| 4 | The last catalog entry. |

## To Delete a DLP from Spectrum Analyzer Memory

- Use the PURGE or DISPOSE command to delete the DLP from analyzer memory.

A DLP can be deleted from analyzer memory remotely by using either the PURGE or the DISPOSE command. The DISPOSE command can also be used to remove softkey functions, user-defined variables, and user-defined traces. (See the description for the DISPOSE command in Chapter 5 for more information.)

### Example

To remove the DLP called Z_OOM from analyzer memory, you would execute the following command:

```
OUTPUT 718;"DISPOSE Z_OOM;";
```

Use DISPOSE ALL to remove all DLPs, user-defined traces, limit-lines, and user-defined variables from analyzer memory. For example, `OUTPUT 718;"DISPOSE ALL;";`
(`DISPOSE USER MEM` is equivalent to DISPOSE ALL.)

## To Erase the DLP from a RAM Card

- Select the memory card as the mass storage device by using the MSI command, and then use the PURGE command to delete a specific file from the RAM card.

### Example

To delete the file called Z_OOM from the RAM card, you would execute the following command:

```
OUTPUT 718;"MSI CARD;PURGE %dZ_OOM%;"
```

## Using the DLP Editor

The DLP editor functions allow you to create or modify a DLP with only an external keyboard connected to the spectrum analyzer (an external controller is not required). This section contains the following procedures:

- Connect the external keyboard to the spectrum analyzer.
- Access the DLP editor functions.
- Use the DLP editor functions to create a DLP.
- Use the DLP editor functions to modify a DLP.
- Use the DLP editor functions to modify a catalog item.

For more information about DLPs, see "Creating and Executing a Downloadable Program" in this chapter.

The external keyboard can also be used to enter screen titles and remote programming commands; see the *HP 8590 Series Spectrum Analyzer User's Guide* for more information.

### To Connect the External Keyboard to the Spectrum Analyzer

**Caution** The analyzer *must* be turned off before connecting an external keyboard to the spectrum analyzer. Failure to do so may result in loss of factory-installed correction constants.

1. Turn off the spectrum analyzer.
2. Connect an HP C1405 Option 002 (or Option 003) cable from the spectrum-analyzer rear-panel connector EXT KEYBOARD to the HP C1405A Option ABA keyboard.
3. Press (LINE) to turn the spectrum analyzer on.
4. Place the template for the external keyboard on the external keyboard.

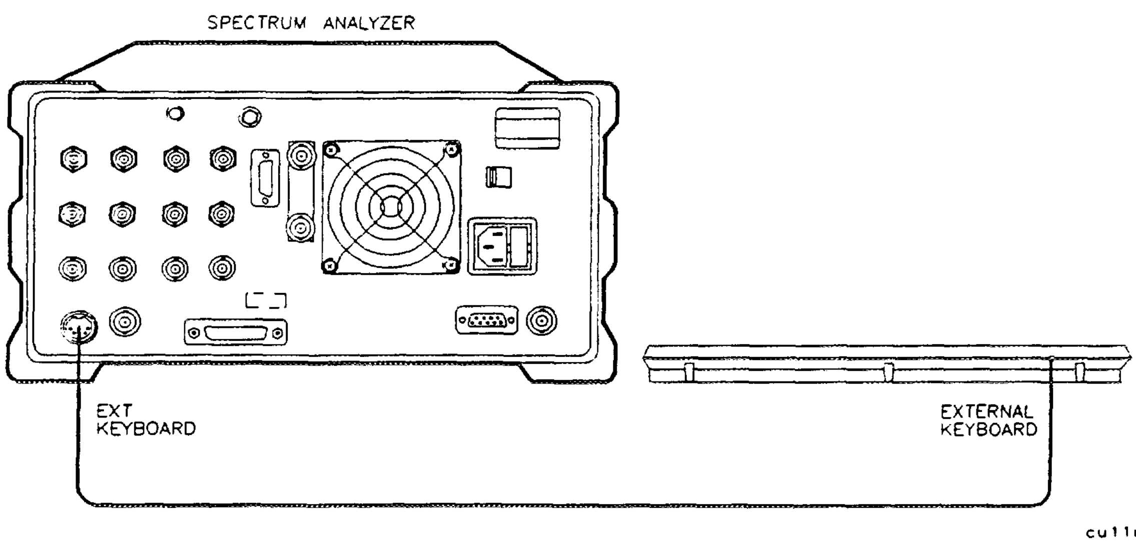



**Figure 4-2. Connecting the External Keyboard to the Spectrum Analyzer**

You can now use the external keyboard to enter or modify a DLP with the DLP editor, enter a screen title, enter programming commands, or enter a prefix.

## To Access the DLP Editor

- Press (SAVE) or (RECALL), then **INTERNAL CARD** (so that INTERNAL is underlined), **Catalog Internal**, **CATALOG ALL**, and then **Editor**.

  Or,

  Press (Pause) on the external keyboard.

**Editor** or (Pause) accesses the DLP editor. There are some differences between using **Editor** and (Pause) however. **Editor** allows you to access all the DLP editor softkeys (**EDIT LAST**, **EDIT CAT ITEM**, **APND CAT ITEM**, **SAVE EDIT**, and **NEW EDIT**). With (Pause), you can only access **EDIT LAST**, **SAVE EDIT**, and **NEW EDIT**. (Pause) allows you to change between the DLP editor functions and the "keyboard entry" functions such as entering programming commands, screen title, and prefix.

With the external keyboard connected to the spectrum analyzer, you can use the function keys (F1 through F6) of the external keyboard to accesses the softkeys of the spectrum analyzer. For example, you could press F1 to access the first softkey, F2 to access the second softkey, and so forth.

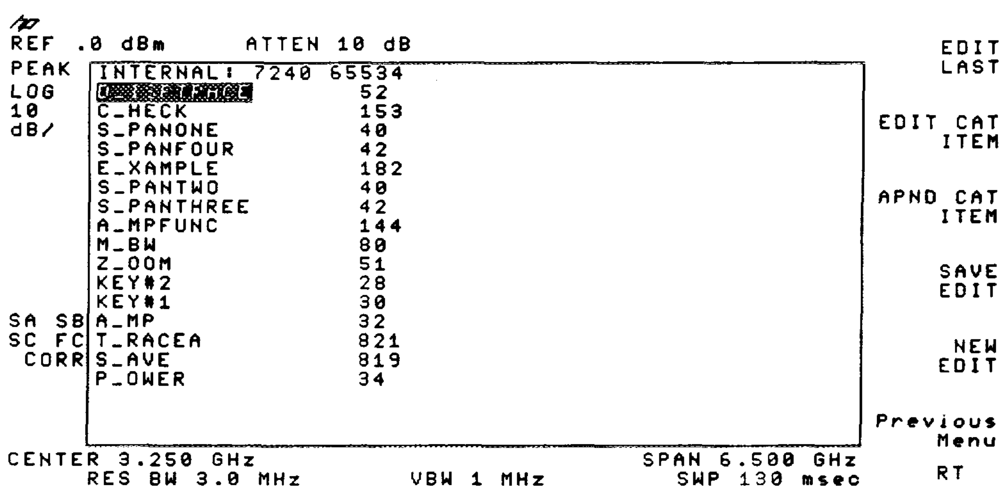



**Figure 4-3. Accessing the DLP Editor**

## To Create a DLP

1. Press **NEW EDIT**, **NEW EDIT** to enter a DLP into the buffer of the DLP editor.

2. Use the external keyboard keys to enter the DLP. Because you are not using an external computer, the spectrum analyzer commands are entered without an OUTPUT or PRINT statement preceding them.

   While using the DLP editor, you may want to use the "typing keys." The typing keys are the function keys F7 through F12. The typing keys automatically place the command mnemonic at the position of the cursor on the spectrum analyzer display. The commands accessed by the typing keys are shown at the bottom of the spectrum analyzer display; you can use the (Page Up) and (Page Down) keys of the external keyboard to access different command mnemonics.

3. When the DLP has been entered and you want it executed, press **SAVE EDIT**. **SAVE EDIT** executes the contents of the DLP editor buffer as remote commands, and when executing a FUNCDEF, will result in the FUNCDEF present in spectrum analyzer memory under the name given for the user-defined function. If you do not want to save the DLP, press **NEW EDIT**, **NEW EDIT** to clear the screen.

The buffer for the DLP editor is limited to 2500 characters, so we recommend that, if the FUNCDEF is large, you should only edit one user-defined function at a time.

For example, if you use the DLP editor to enter the Z_OOM function, the spectrum analyzer display would look as follows:

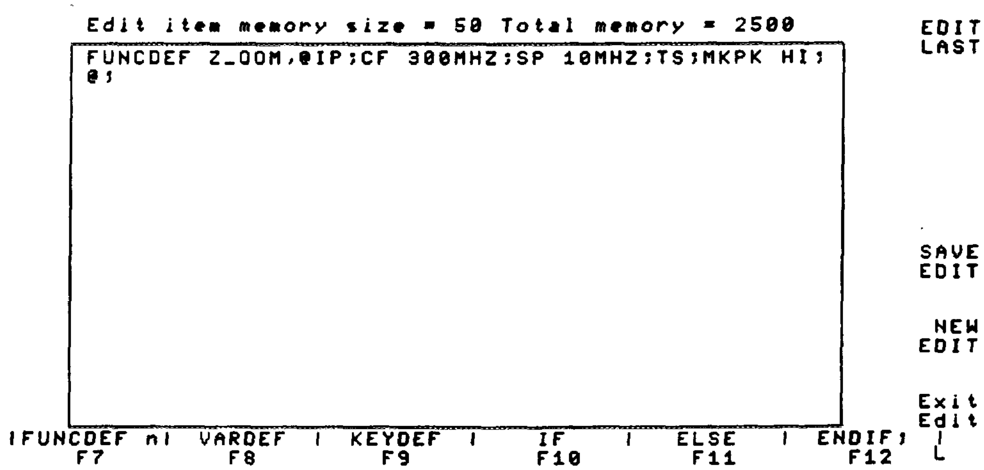



**Figure 4-4. Entering a DLP**

## To Modify the DLP

1. If necessary, press (Pause) to reenter the DLP editor.
2. If the DLP is not displayed, press **EDIT LAST** to display the previous contents of the DLP editor.
3. Use the external keyboard keys to edit the DLP. Because you are not using an external computer, the spectrum analyzer commands are entered without an OUTPUT or PRINT statement preceding them.
4. When the DLP has been entered, press **SAVE EDIT**. **SAVE EDIT** executes the DLP in spectrum analyzer memory. If you do not want to execute the DLP, press **NEW EDIT**, **NEW EDIT** to clear the screen.

## To Modify a Catalog Item

1. Press (RECALL) or (SAVE), then **INTERNAL CARD** (so that INTERNAL is underlined).
2. Press **Catalog Internal**, **CATALOG ALL**, and then **Editor**. (You can use one of the other catalog softkeys instead of **CATALOG ALL**. For example, you could press **CATALOG DLP** if you wanted only the DLPs cataloged.)
3. Use the large knob on the spectrum analyzer's front panel to highlight the item that you want to edit. The user-defined functions, user-defined traces, and user-defined variable are

listed by their label, and user-defined softkeys are listed by "KEY" followed by the key number.

4. Press **EDIT CAT ITEM**. If there is already some text in the DLP editor, you need to press **EDIT CAT ITEM** again to clear the text from the DLP editor's buffer.
5. Use the external keyboard keys to edit the cataloged item. Because you are not using an external computer, the spectrum analyzer commands are entered without an OUTPUT or PRINT statement preceding them.
6. When the catalog item has been edited, press **SAVE EDIT**. **SAVE EDIT** executes the DLP in spectrum analyzer memory, and will replace the catalog item. If you do not want to the changes to the catalog item, press **NEW EDIT**, **NEW EDIT** to clear the screen.

You may find if useful to use **APND CAT ITEM**. **APND CAT ITEM** appends the catalog item to the text that is already in the DLP editor.

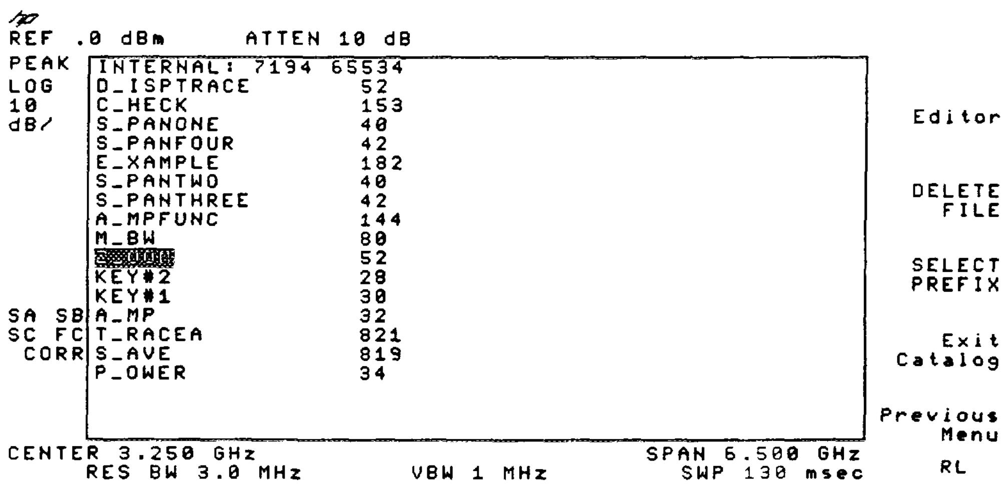



**Figure 4-5. Selecting a Catalog Item**

## DLP Programming Guidelines

This section contains some suggestions that can make it easier to write a DLP, read and understand the DLP code, and find problems in a DLP.

### To Make the DLP more Readable

Here are a few suggestions which help make any program, including a DLP, more readable:

- Write short program lines.
- Use standard indent format for looping, branching, and subroutines.
- Use descriptive variable names and labels.
- Add comments to the programming lines, if necessary.
- Make the program modular. A modular program is one that uses subroutines and a main program. A subroutine is a function that groups programming commands that perform a specific functions within the same FUNCDEF declaration. The main program calls the subroutines.

### To Find Problems a DLP

More often than not, new programs do not work as they were intended to work. In DLPs, problems (also referred to as bugs) may appear in any of the following ways:

- As an error message displayed on the analyzer screen.
- The DLP does the unexpected. For example, it halts execution, or enters an infinite loop, or starts executing before its start-execution command occurs.
- As an unexpected or out-of-range result or value is obtained.

Some suggestions for find a problem in a DLP are as follows:

- Test each subroutine individually. Comment out the calls to the other subroutines in the main program, if necessary.
- Follow the suggestions in "To make the DLP more readable."
- Check that each function has matching delimiters.
- Check that the commands within the DLP are spelled correctly, contain spaces where indicated by the syntax diagram for the command, and are terminated by a semicolon.
- If the FUNCDEF definition requires more than one line, make sure each program line ends with a semicolon. The semicolon suppresses a carriage return and a line feed.
- You may want to create the DLP, and then use the DLP editor to inspect the contents of the DLP before you execute it. The DLP editor shows what characters the spectrum analyzer will use when executing the DLP. This can be helpful for finding omitted spaces.

If a DLP causes the spectrum analyzer not to respond normally (for example, the spectrum analyzer seems to be in an infinite loop or an error message is displayed), try one or all of the following suggestions:

- Press (PRESET).
- Press (CONFIG), `More 1 of 3`, `DISPOSE USER MEM`, `DISPOSE USER MEM`.
  (`DISPOSE USER MEM` deletes any DLPs from spectrum analyzer memory.)
- Turn the spectrum analyzer off and then back on.

If the spectrum analyzer is still not responding, you should do the following:

- For a spectrum analyzer with Option 021 installed in it, execute the following program line:

| | |
|---|---|
| `SEND 7;UNL MTA LISTEN 18 CMD 12` | *This sends a command to the spectrum analyzer instructing it to delete any DLPs and user-defined variables from spectrum analyzer memory.* |

**Note**

If the spectrum analyzer is not at address 18, change the number 18 in the previous program line to the spectrum analyzer's current address.

- For a spectrum analyzer with Option 023 installed in it, execute a break, and then press (CONFIG), **More 1 of 3**, **DISPOSE USER MEM**, **DISPOSE USER MEM**.

5

# Programming Commands

## What You'll Learn in This Chapter

This chapter is a reference for the HP 8590 Series spectrum analyzer command language. It is a command dictionary; commands are listed alphabetically.

To find a programming command that performs a particular function, first refer to the functional index (Table 5-4) where commands are categorized by function. Once the desired command is found in the functional index, refer to the description for the command in this chapter.

This chapter includes the reference tables listed below:

- Table 5-1, Syntax Elements.
- Table 5-2, Characters and Secondary Keywords (Reserved Words).
- Table 5-3, Summary of Compatible Commands.
- Table 5-4, Functional Index.

## Syntax Conventions

Command syntax is represented pictorially.

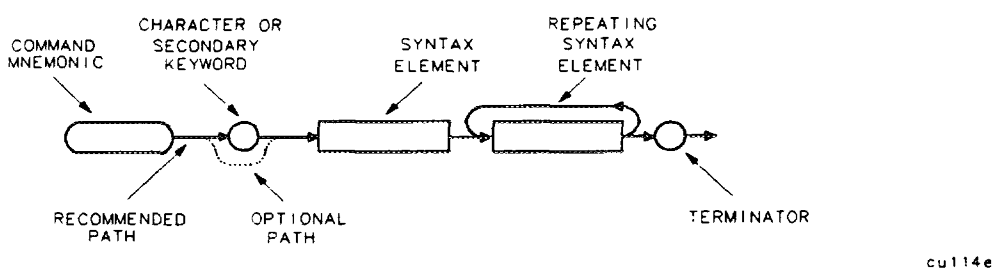



**Figure 5-1. Command Syntax Figure**

- Ovals enclose command mnemonics. The command mnemonic must be entered exactly as shown.
- Circles and ovals surround secondary keywords or special numbers and characters. The characters in circles and ovals are considered reserved words and must be entered exactly as shown. See Table 5-2.
- Rectangles contain the description of a syntax element defined in Table 5-1.
- A loop above a syntax element indicates that the syntax element can be repeated.
- Solid lines represent the recommended path.

- Dotted lines indicate an optional path for bypassing secondary keywords or using alternate units.
- Arrows and curved intersections indicate command path direction.
- Semicolons are the recommended command terminators. Using semicolons makes programs easier to read, prevents command misinterpretation, and is recommended by IEEE Standard 728.

**Note** Uppercase is recommended for entering all commands unless otherwise noted.

Syntax Elements are shown in the syntax diagrams as elements within rectangles.

## Table 5-1. Syntax Elements

<table>
<tr><th>Syntax Component</th><th>Definition/Range</th></tr>
<tr><td>analyzer command</td><td>Any spectrum-analyzer command in this chapter, with required parameters and terminators.</td></tr>
<tr><td>character</td><td>Sp ! " # $ % & ' ( ) + , / 0 1 2 3 4 5 6 7 8 9 : ; A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ? _ ' a b c d e f g h i j k l m n o p q r s t u v w x y z (Characters are a subset of data byte.)</td></tr>
<tr><td>character & EOI</td><td>8-bit byte containing only character data and followed by end-or-identify (EOI) condition, where the EOI control line on HP-IB is asserted to indicate the end of the transmission. END signifies the EOI condition.</td></tr>
<tr><td>data byte</td><td>8-bit byte containing numeric or character data.</td></tr>
<tr><td>data byte & EOI</td><td>8-bit byte containing numeric or character data followed by end-or-identify (EOI) condition, where the EOI control line on HP-IB is asserted to indicate the end of the transmission. END signifies the EOI condition.</td></tr>
<tr><td>delimiter</td><td>~ | \ @ = / ^ $ % ; ! ' : " &<br>Matching characters that mark the beginning and end of a character string, or a list of user-defined functions or spectrum analyzer commands. Choose delimiting characters that are not used within the string they delimit.</td></tr>
<tr><td>digit</td><td>0 1 2 3 4 5 6 7 8 9</td></tr>
<tr><td>lsb length</td><td>Represents the least significant byte of a two-byte word that describes the number of bytes returned or transmitted. See msb length.</td></tr>
<tr><td>msb length</td><td>Represents the most significant byte of a two-byte word that describes the number of bytes returned or transmitted. See lsb length.</td></tr>
<tr><td>number</td><td>Expressed as integer, decimal, or in exponential (E) form. Real Number Range: $\pm$ 1.797693134862315 x $10^{308}$, including 0.<br><br>Up to 15 significant figures allowed.<br>Numbers may be as small as $\pm$ 2.225073858507202 x $10^{-308}$<br><br>Integer Number Range: −32,768 through +32,767</td></tr>
<tr><td>output termination</td><td>Carriage return ($C_R$) and line feed ($L_F$), with end-or-identify (EOI) condition. ASCII codes 13 (carriage return) and 10 (line feed) is sent via HP-IB, then the end-or-identify control line on HP-IB sets to indicate the end of the transmission.</td></tr>
<tr><td>predefined function</td><td>ACTVF, AMPLEN, BITF, CNTLI, CORREK, DONE, HAVE, HN, LIMIFAIL, MEAN, MEANTH, MEM, MINPOS, MKBW, PEAKS, PKPOS, PWRBW, REV, RMS, SER, STB, STDEV, SUM, SUMSQR, TRCMEM, VARIANCE.<br><br>A predefined function is an analyzer command that returns a number that can be operated on by other spectrum analyzer commands. Insert a predefined function into a command statement where predefined function appears in the command syntax chart.<br><br>If a predefined function takes a parameter (for example, PKPOS TRA), it can be used only as the last parameter of an spectrum analyzer command that has two or more predefined functions as parameters. For example, MPY V_AR,PKPOS TRB,HAVE CARD; is illegal, but MPY V_AR,DONE,HAVE CARD; is not.</td></tr>
</table>

## Table 5-1. Syntax Elements (continued)

| Syntax Component | Definition/Range |
| --- | --- |
| predefined variable | The values of the following variables change depending on the current instrument settings. Each variable represents the value of the command function that has the same name as the variable.<br>AMB, AMBPL, ANLGPLUS, ANNOT, AT, BAUDRATE, CF, CNTLA, CNTLB, CNTLC, CNTLD, COUPLE, CRTHPOS, CRTVPOS, DATEMODE, DET, DL, DOTDENS, FA, FB, FMGAIN, FOFFSET, GATE, GATECTL, GD, GL, GP, GR, GRAT, INZ, LG, LIMIDISP, LIMIMODE, LIMIREL, LIMITEST, MEASURE, MENU, MF, MKA, MKACT, MKF, MKFCR, MKN, MKNOISE, MKP, MKPAUSE, MKPX, ML, MKTRACK, MODE, MSI, NRL, POWERON, PREAMPG, PRNTADRS, PSTATE, RB, RL, RLPOS, ROFFSET, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCALC, SRCAT, SRCNORM, SRCPOFS, SRCPSTP, SRCPSWP, SRCPWR, SRCTK, SS, ST, SWPCPL, SYNCMODE, TH, TIMEDATE, TIMEDSP, TVLINE, TVSFRM, TVSYNC, TVSTND, VB, VBR, WINZOOM, ZMKCNTR, ZMKSPAN. |
| trace element | Value contained in one trace point. Notated as TRA[N] where N specifies the point position in the trace array. Values for N are 1 to 401 (for traces A, B, C) or 1 to 2047 (for traces specified by TRDEF). The same values apply to trace B (TRB[N]), trace C (TRC[N]), and user-defined traces (LABEL[N]). |
| trace range | Values contained in trace segment. Multi-point segments are notated as TRA[N,M], where N and M are end points of a segment and specify point positions in trace array. Values for N or M are 1 to 401 (for traces A, B, C), or 1 to the length of a trace as specified by TRDEF. The same values apply to trace B (TRB[N,M]), trace C (TRC[N,M]), and user-defined traces (LABEL[N,M]). Single-point segments are notated the same as the trace element above. |
| units | Represent standard scientific units.<br>Frequency Units: GHZ or GZ, MHZ or MZ, KHZ or KZ, HZ<br>Amplitude Units: DB, DM, DBMV, DBUV, V, MV, UV, W, MW, UW<br>Time Units: SC, MS, US<br>Current Units: A, MA, UA<br>Impedance Units: OHM |
| user-defined function | A label 2 to 11 characters long that is defined by the FUNCDEF command. Choice of characters is A through Z and the underscore (_). The underscore should be used as the second character of the label. Omitting the underscore, or using the underscore as other than the second character in a label, is not recommended. |
| user-defined trace | A label 2 to 11 characters long that is defined by the TRDEF command. Choice of characters is A through Z and the underscore(_). The underscore should be used as the second character of the label. Omitting the underscore, or using the underscore as other than the second character in a label, is not recommended. |
| user-defined variable | A label 2 to 11 characters long that is defined by the VARDEF or ACTDEF command. Choice of characters is A through Z and the underscore(_). The underscore should used as be the second character of the label. Omitting the underscore, or using the underscore as other than the second character in a label, is not recommended. |

In the syntax diagrams, characters and secondary keywords are shown within circles or ovals. Characters and secondary keywords must be entered exactly as shown.

**Table 5-2. Characters and Secondary Keywords (Reserved Words)**

| Element | Description |
|---|---|
| a | Amplitude correction factors. |
| A | Amp (unit) or A-block data field. |
| ABSHZ | Absolute Hz (unit). |
| AC | Alternating current. |
| ALL | All. |
| AM | Amplitude modulation. |
| AMP | Amplitude. |
| AMPCOR | Amplitude correction. |
| AUTO | Auto couple or set to automatic. |
| AVG | Average. |
| B | 8-bit byte or binary format. |
| BOTH | Both odd and even frames trigger. |
| BW | Black and white. |
| CARD | Memory card. |
| CNT | Counter-lock. |
| COLOR | Color. |
| d | Downloadable programs. |
| DB | Decibel (unit). |
| DBM | Absolute decibel milliwatt (unit). |
| DBMV | Decibel millivolt (unit). |
| DBUV | Decibel microvolt (unit). |
| DC | Direct current. |
| DELTA | Delta. |
| DISP | Display. |
| DLP | Downloadable program. |
| DM | Absolute decibel milliwatt (unit). |
| DMY | Day, month, year format. |
| DN | Decreases parameter one step size. |
| DUMP | Dump. |
| EDGE | Triggers on the edge of the trigger input. |
| EP | Pauses program for data entry from spectrum analyzer front panel. |
| EQ | Equal to. |
| EVEN | Even video frame. |
| EXT | External trigger. |
| FADC | Fast analog-to-digital converter (ADC). |
| FETCH | Fetch. |
| FFT | Fast Fourier transform. |
| FIXED | Fixed. |
| FLAT | Flat. |
| FLATTOP | Flat top filter window. |
| FMD | Frequency modulation demodulator. |

**Table 5-2.**
**Characters and Secondary Keywords (Reserved Words) (continued)**

| Element | Description |
|---|---|
| FM | Frequency modulation. |
| FMV | Frequency modulation detection. |
| FREE | Free run. |
| FREQ or FRQ | Frequency. |
| GATE | Gate. |
| GE | Greater than or equal to. |
| GHZ | Gigahertz (unit). |
| GT | Greater than. |
| GZ | Gigahertz (unit). |
| HANNING | Hanning filter window. |
| HI | Highest. |
| HPIB | HP-IB. |
| HZ | Hertz (unit). |
| I | I-block data field. |
| i | Display image file. |
| INIT | Initialize. |
| INT | Internal or integer. |
| IP | Instrument preset. |
| IST | Inverse sweep time. |
| K | Free field ASCII format with no terminator. |
| KC | Free field ASCII format with "CR" an "LF" terminator. |
| KHZ | Kilohertz (unit). |
| KL | Free field ASCII format with "CR" an "END" terminator. |
| KZ | Kilohertz (unit). |
| l | Limit line. |
| LAST | Last state. |
| LE | Less than or equal to. |
| LEVEL | Level gating. |
| LIMILINE | Limit line. |
| LINE | Line trigger. |
| LOAD15 | Loads the values for the horizontal and vertical position of the spectrum analyzer. |
| LOWER | Lower limit line. |
| LT | Less than. |
| M | Measurement units. |
| MA | Milliamp (unit). |
| MDY | Month, day, year format. |
| MHZ | Megahertz (unit). |
| MS | Millisecond (unit). |
| MTR | Meter. |
| MV | Millivolts (unit). |
| MW | Milliwatt (unit). |
| MZ | Megahertz (unit). |
| NE | Not equal to. |
| NEG | Negative. |
| NH | Next highest peak. |
| NL | Next peak left. |

**Table 5-2.**
**Characters and Secondary Keywords (Reserved Words) (continued)**

| Element | Description |
|---|---|
| NONE | No units. |
| NR | Next peak right. |
| NRM or NORMAL | Normal. |
| NTSC or NTSC15 | NTSC video format. |
| OA | Output amplitude. |
| ODD | Odd video frame trigger. |
| OFF | Turns off function. |
| ON | Turns on function. |
| P | Parameter units. |
| PAL or PAL15 | PAL video format. |
| PALM | PAL-M video format. |
| PER | Period. |
| PKAVG | Peak average. |
| PKPIT | Peak pit. |
| POINT | Point. |
| POS | Positive. |
| PSN | Position. |
| RECALL | Recall operation. |
| RS232 | RS-232 interface. |
| s | State. |
| SA | Signal analysis. |
| SAVE | Save operation. |
| SC | Seconds (unit). |
| SECAML | SECAM-L video format. |
| SLOPE | Slope. |
| SMP | Sample detection mode. |
| SP | Space. |
| SR | Stimulus response. |
| STATE | State register. |
| STEP | Step key ability. |
| STORE | Store. |
| SWT | Sweep time. |
| t | Trace. |
| TG | Tracking generator. |
| TRA | Trace A. |
| TRB | Trace B. |
| TRC | Trace C. |
| TV | TV trigger. |
| UA | Microamp (unit). |
| UNIFORM | Uniform filter window. |
| UP | Increases the parameter one step size. |
| UPLOW | Upper and lower limit lines. |
| UPPER | Upper limit line. |
| US | Microseconds (unit). |
| UV | Microvolts (unit). |
| UW | Microwatt (unit). |

**Table 5-2.**
**Characters and Secondary Keywords (Reserved Words) (continued)**

| Element | Description |
|---|---|
| V | Volts (unit). |
| VERTICAL | Vertical triggering. |
| VID | Video trigger. |
| W | Watts or word (for MDS command). |
| YTF | YIG-tuned filter. |
| XTAL | Crystal. |
| * | Asterisk (used as a wildcard). |
| ; | Semicolon (ASCII code 59). |
| , | Comma (ASCII code 44). |
| 0 | Off (command argument). |
| 1 | On (command argument). |
| 50 | 50Ω. |
| 75 | 75Ω. |
| ? | Returns a query response containing the value or state of the associated parameter. The query response is followed by a carriage-return/line-feed. |

The alternate commands (listed in the left column of Table 5-3) provide compatibility with commands used by the HP 8566A/B, HP 8568A/B, and HP 70000 Series instruments. The equivalent commands for the HP 8590 Series spectrum analyzer are listed in the right column.

**Table 5-3. Summary of Compatible Commands**

| Alternate Commands | Description | HP 8590 Series Command |
|---|---|---|
| A1 | Clear write trace A | CLRW TRA |
| A2 | Max hold trace A | MXMH TRA |
| A3 | Store and view trace A | VIEW TRA |
| A4 | Store and blank trace A | BLANK TRA |
| B1 | Clear write trace B | CLRW TRB |
| B2 | Max hold trace B | MXMH TRB |
| B3 | Store and view trace B | VIEW TRB |
| B4 | Store and blank trace B | BLANK TRB |
| BL | B − DL -> B | BML |
| C1 | Trace A minus trace B off | AMB OFF |
| C2 | Trace A minus trace B on | AMB ON |
| CA | Coupled input attenuation | AT AUTO |
| CR | Coupled resolution bandwidth | RB AUTO |
| CS | Coupled step size | SS AUTO |
| CT | Coupled sweep time | ST AUTO |
| CV | Coupled video bandwidth | VB AUTO |
| E1 | Peak search | MKPK HI |
| E2 | Enter marker into center frequency | MKCF |
| E3 | Enter marker delta into center frequency step size | MKSS |
| E4 | Enter marker amplitude into reference level | MKRL |
| EM | Erase graphics memory | CLRDSP |
| EX | Exchange trace A and B | AXB |
| KSA | dBm amplitude units | AUNITS DBM |
| KSB | dBmV amplitude units | AUNITS DBMV |
| KSC | dB$\mu$V amplitude units | AUNITS DBUV |
| KSD | Volt amplitude units | AUNITS V |
| KSE | Screen title | TITLE |
| KSG | Video average on | VAVG ON |
| KSH | Video average off | VAVG OFF |
| KSM | Marker noise | MKNOISE |
| KSO | Marker value to span | MKSP |
| KSZ | Reference level offset | ROFFSET |
| KSc | Trace A plus trace B into trace A | APB |
| KSi | Exchange trace B and C | BXC |
| KSl | Trace B into trace C | BTC |
| KSm | Graticule off | GRAT OFF |
| KSn | Graticule on | GRAT ON |
| KSo | Annotation off | ANNOT OFF |
| KSp | Annotation on | ANNOT ON |
| L0 | Display line off | DL OFF |

## Table 5-3. Summary of Compatible Commands (continued)

| Alternate Commands | Description | HP 8590 Series Command |
|---|---|---|
| M1 | Marker off | MKOFF |
| M2 | Marker normal | MKN |
| M3 | Marker delta | MKD |
| MA | Marker amplitude | MKA? |
| MC | Marker count | MKFC |
| MT0 | Marker track off | MKTRACK OFF |
| MT1 | Marker track on | MKTRACK ON |
| O1 | Output format, in real number format | TDF P |
| O2 | Output format, in binary format, two bytes (word) per element | TDF B;MDS W |
| O3 | Output format, in measurement data format | TDF M |
| O4 | Output format, in binary format, 1 byte per element | TDF B;MDS B |
| R1 | Activates illegal command service request only | RQS 32 |
| R2 | Activates end-of-sweep, illegal command | RQS 36 |
| R3 | Activates broken hardware, illegal command | RQS 40 |
| R4 | Activates units-key pressed, illegal command | RQS 34 |
| RC | Recall state | RCLS |
| S1 | Sweep continuous | CONTS |
| S2 | Sweep single | SNGLS |
| SV | Save state | SAVES |
| T0 | Threshold off | TH OFF |
| T1 | Trigger mode free run | TM FREE |
| T2 | Trigger mode line | TM LINE |
| T3 | Trigger mode external | TM EXT |
| T4 | Trigger mode video | TM VID |
| T7 | Trigger mode level | GATECTL LEVEL |
| T8 | Trigger mode edge | GATECTL EDGE |

This functional index categorizes the programming commands by the type of function that the command performs. The functional index contains the following information: the programming command mnemonic, the softkey or front-panel key that corresponds to the command's function, and a brief definition of the command. Once the desired command is found, refer to the alphabetical listing of commands later in this chapter for more information about the command.

**Table 5-4. Functional Index**

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| AMPLITUDE | AT | ATTEN AUTO MAN | Specifies RF input attenuation. |
| | AUNITS | Amptd Units | Specifies amplitude units for input, output, and display. |
| | COUPLE* | COUPLE AC DC* | Selects direct-current (dc) coupling or alternating-current (ac) coupling. |
| | INZ | INPUT Z 50Ω 75Ω | Specifies the value of input impedance expected at the active input port. |
| | LG | SCALE LOG LIN (when LOG is underlined) | Specifies the vertical graticule divisions as logarithmic units, without changing the reference level. |
| | LN | SCALE LOG LIN (when LIN is underlined) | Specifies the vertical graticule divisions as linear units, without changing the reference level. |
| | ML | MAX MXR LVL | Specifies the maximum signal level that is applied to the input mixer for a signal that is equal to or below the reference level. |
| | NRL | | Sets the normalized reference level. |
| | PREAMPG | EXTERNAL PREAMPG | Subtracts a positive or negative preamplifier gain value from the displayed signal. |
| | PP† | PRESEL PEAK† | Performs a preselector peak. |
| | RESETRL | | Resets the reference level to its instrument preset level. |
| | RL | REF LVL | Specifies the amplitude value of the reference level. |
| | ROFFSET | REF LVL OFFSET | Offsets all amplitude readouts without affecting the trace. |
| AUTO COUPLING | AUTO | AUTO ALL | Couples the active functions automatically. |
| AUXILIARY CONTROL | CNTLA | CNTL A 0 1 | Sets the control line A of the auxiliary interface high or low. |
| | CNTLB | CNTL B 0 1 | Sets the control line B of the auxiliary interface high or low. |
| | CNTLC | CNTL C 0 1 | Sets the interface control line C of the auxiliary interface high or low. |
| | CNTLD | CNTL D 0 1 | Sets the interface control line D of the auxiliary interface high or low. |
| | CNTLI | DISPLAY CNTL I | Returns a "1" when the interface control line I of the auxiliary interface is high, and "0" if the line is low. |

* For HP 8594E, HP 8595E, or HP 8596E only.
† For HP 8592D, HP 8593E, HP 8595E, or HP 8596E only.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| AUXILIARY CONTROL (continued) | COMB* | COMB GEN ON OFF * | Turns on or off the comb generator. |
| | DEMOD† | DEMOD ON OFF †, DEMOD AM FM † | Turns the demodulator on or off, and selects between AM, FM, or quasi-peak demodulation. |
| | FMGAIN† | FM GAIN † | Sets the total FM frequency deviation for full screen demodulation. |
| | MEASURE‡ | | Determines the type of measurement: signal analysis, stimulus response, or signal normalization. |
| | NRL | | Sets the normalized reference level. |
| | RLPOS | | Selects the position of reference level. |
| | SPEAKER† | SPEAKER ON OFF † | Turns on or off the internal speaker. |
| | SQLCH† | SQUELCH † | Sets the squelch level. |
| | SRCALC‡ | ALC MTR INT XTAL ‡ or ALC INT EXT ‡ | Selects internal or external leveling for the tracking generator. |
| | SRCAT‡ | SRC ATN MAN AUTO ‡ | Attenuates the source output level. |
| | SRCNORM | | Subtracts trace B from trace A, adds the display line, and sends the result to trace A. |
| | SRCPOFS‡ | SRC PWR OFFSET ‡ | Offsets the source power level readout. |
| | SRCPSTP‡ | SRC PWR STP SIZE ‡ | Selects the source-power step size. |
| | SRCPSWP‡ | PWR SWP ON OFF ‡ | Selects sweep range of the source output. |
| | SRCPWR‡ | SRC PWR ON OFF ‡ | Selects the source power level. |
| | SRCTK‡ | MAN TRK ADJUST ‡ | Adjusts tracking of source output with spectrum-analyzer sweep. |
| | SRCTKPK‡ | TRACKING PEAK ‡ | Adjusts tracking of source output with spectrum-analyzer sweep. |
| | SWPCPL‡ | SWP CPLG SR SA ‡ | Selects a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time. |
| BANDWIDTH | RB | RES BW AUTO MAN, 200 Hz EMI BW §, 9 kHz EMI BW, 120 kHz EMI BW | Specifies the resolution bandwidth. |
| | VAVG | VID AVG ON OFF | Turns on or off video averaging. |
| | VB | VID BW AUTO MAN | Specifies the video bandwidth. |
| | VBR | VBW/RBW RATIO | Specifies coupling ratio of video bandwidth to resolution bandwidth. |

* For HP 8592D, HP 8593E, or HP 8596E only.
† For Options 102, 103, or 301 only.
‡ For Options 010 or 011 only.
§ For Option 130 only.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| CALIBRATION | AMPCOR | **Amp Cor** functions | Applies amplitude corrections at specified frequencies. |
| | AMPLEN | | Returns the number of frequency-amplitude correction factors that have been entered. |
| | CAL | (CAL) calibration functions | Initiates self-calibration routines. |
| | CNF | **CONF TEST** | Performs the confidence test. |
| | CORREK | | Returns a "1" if the correction factors are on, a "0" if they are off. |
| | CRTHPOS | **CRT HORZ POSITION** | Specifies the horizontal position of the text and graticule on the spectrum analyzer's display. |
| | CRTVPOS | **CRT VERT POSITION** | Specifies the vertical position of the text and graticule on the spectrum analyzer's display. |
| COMMAND TRIGGER | ONCYCLE | | Executes the list of analyzer commands periodically. |
| | ONDELAY | | Executes the list of analyzer commands after the time value has elapsed. |
| | ONEOS | | Executes the list of analyzer commands after the end of the sweep. |
| | ONMKR | | Performs the list of analyzer commands when the sweep reaches the marker position. |
| | ONMKRU | | Executes the list of analyzer commands whenever the value or the units of the active marker are changed. |
| | ONSRQ | | Executes the list of analyzer commands whenever a service request occurs. |
| | ONSWP | | Executes the list of analyzer commands at the beginning of the sweep. |
| | ONTIME | | Executes the list of analyzer commands at the specified time. |
| | WAIT | | Suspends all spectrum analyzer operation for the specified time duration. |
| CONFIGURATION | BAUDRATE | **BAUD RATE** | Specifies the baud rate of a spectrum analyzer with Option 023 installed in it. |
| | CAT | **Catalog Card***, **Catalog Internal** | Returns the catalog information of either spectrum analyzer memory or the memory card. |
| | DATEMODE | **DATEMODE MDY DMY** | Allows you to set the format for displaying the real-time clock. |
| | DISPOSE | **DISPOSE USER MEM** | Frees spectrum analyzer memory that was previously allocated for user-defined operands. |
| | FORMAT* | **FORMAT CARD*** | Formats the memory card. |
| | POWERON | **POWER ON IP LAST** | Selects the spectrum analyzer's power on state. |

* An HP 8590D or HP 8592D needs an Option 003 installed in it to use this command.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| **CONFIGURATION (continued)** | PREFX | **Change Prefix** | Specifies or changes the prefix used in save and recall operations. |
| | SETDATE | **SET DATE** | Sets the date of the real-time clock. |
| | SETTIME | **SET TIME** | Sets the time of the real-time clock. |
| | SYNCMODE | **SYNC NRM NTSC**, **DEFAULT SYNC**, **SYNC NRM PAL** | Selects either the horizontal and vertical synchronizing constants, or the synchronization rate for the internal monitor. |
| | TIMEDATE | | Sets the time and date of the real-time clock. |
| | TIMEDSP | **TIMEDATE ON OFF** | Turns on or off the display of the real-time clock. |
| **DISPLAY** | ANLGPLUS* | **ANALOG+ ON OFF** * | Turns the Analog+ display mode on or off. |
| | ANNOT | **ANNOTATN ON OFF** | Turns on or off the screen annotation. |
| | DA | | Accesses the current address of the display list. |
| | DL | **DSP LINE ON OFF** | Defines the level of the display line in the active amplitude units and displays the display line on the spectrum analyzer screen. |
| | DOTDENS* | **ANALOG+ ON OFF** * | Sets the dot density value in the Analog+ display mode. |
| | DSPLY | | Displays the value of a variable on the spectrum analyzer screen. |
| | GRAT | **GRAT ON OFF** | Turns on or off the graticule. |
| | HD | **HOLD** or (HOLD) | Disables data entry via the spectrum analyzer numeric keypad, knob, or step keys. The active function readout is blanked, and any active function is deactivated. |
| | MENU | | Displays specified menu on the spectrum analyzer screen. |
| | PREFX | **Change Prefix** | Specifies the prefix. |
| | TH | **THRESHLD ON OFF** | Clips signal responses below the threshold level. |
| | TITLE | **Change Title** | Activates the screen title mode. |
| **FREQUENCY** | CF | **CENTER FREQ** | Specifies center frequency. |
| | FA | **START FREQ** | Specifies the start frequency. |
| | FB | **STOP FREQ** | Specifies the stop frequency. |
| | FOFFSET | **FREQ OFFSET** | Specifies the frequency offset for all absolute frequency readouts such as center frequency. |
| | SS | **CF STEP AUTO MAN** | Specifies center-frequency step size. |

* For Option 101 or 301 only.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| GRAPHICS | CLRBOX | | Clears a rectangular area on the spectrum analyzer display. |
| | CLRDSP | | Erases user-generated graphics and text. |
| | DA | | Accesses the current address of the display list. |
| | DRAWBOX | | Draws a rectangular box on the spectrum analyzer display. |
| | DT | | Defines any character as a label terminator. |
| | GETPLOT | (COPY) | Initiates output of the spectrum analyzer display to a plotter. |
| | GETPRNT | (COPY) | Initiates output of the spectrum analyzer display to a printer. |
| | GR | | Graphs the given *y* coordinate while incrementing the *x* coordinate by 1. |
| | LB | | Writes text at the current pen position. |
| | PA | | Moves the pen to a vector location on the spectrum analyzer screen relative to the reference coordinates (0,0). |
| | PD | | Instructs the spectrum analyzer to plot vectors on the spectrum analyzer screen until a PU command is received. |
| | PR | | Moves the pen to a new plot location on the spectrum analyzer screen relative to the current coordinates in display units. |
| | PRINT | (COPY) to a printer | Prints screen data. |
| | PRNTADRS | PRINTER ADDRESS | Allows you to set the HP-IB address of the printer. |
| | PU | | Instructs the spectrum analyzer not to plot vectors on the spectrum analyzer screen until a PD command is received. |
| | TEXT | | Writes text on the analyzer screen at the current pen position. |
| | TRGRPH | | Graphs compressed trace. |
| INFORMATION | ACTVF | | Returns a "0" if the given function is not active, a "1" if it is active. |
| | BIT | | Places the state of a bit in the destination. |
| | BITF | | Returns the state of a bit. |
| | CLS | | Clears all status bits. |
| | HAVE | SHOW OPTIONS | Returns a "0" if a device or option is not installed. |
| | ID | SHOW OPTIONS | Returns the spectrum analyzer model number. |
| | MDU | | Returns values for the spectrum analyzer's baseline and reference level. |
| | OP | | Returns the coordinates of the lower-left and upper-right corners of the spectrum analyzer display. |
| | PWRUPTIME | | Returns the number of milliseconds that have elapsed since the spectrum analyzer was turned on. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| INFORMATION (continued) | REV | SHOW OPTIONS | Returns the date code of the firmware revision number in YYMMDD format. |
| | RQS | | Sets a bit mask for service requests. |
| | SER | SHOW OPTIONS | Returns the serial number suffix of the spectrum analyzer. |
| | SRQ | | The SRQ command is used by an external controller to simulate interrupts from the spectrum analyzer. |
| | STB | | Returns to the controller the decimal equivalent of the status byte. |
| INPUT and OUTPUT | EE | | Sends the controller the values entered on the spectrum analyzer numeric keypad by the operator. |
| | EK | | Allows data entry with the front-panel knob when the spectrum analyzer is under remote control. |
| | ENTER | | Allows the spectrum analyzer to receive data from other devices on the HP-IB. |
| | EP | | Sends values entered on the spectrum analyzer number keyboard to the present active function value. |
| | OA | | Returns the value of the active function. |
| | OL | | Transmits information to the controller that describes the state of the spectrum analyzer when the OL command is executed. |
| | OUTPUT | | Allows the spectrum analyzer to send data to other devices on the HP-IB. |
| | RELHPIB | | Releases spectrum analyzer control of the HP-IB. |
| | TA | | Returns trace A amplitude values from the analyzer to the controller. |
| | TB | | Transfers trace B amplitude values from the analyzer to the controller. |
| | TDF | | Formats trace information for return to the controller. |
| | TRA TRB TRC | | Controls trace data input or output. |
| LIMIT LINES | LIMIDEL | PURGE LIMITS | Deletes all segments in the current limit-line table. |
| | LIMIDISP | LMT DISP Y N AUTO | Controls when the limit line (or limit lines) are displayed. |
| | LIMIFAIL | LMT TEST ON OFF | Returns a "0" if the last measurement sweep of trace A is equal to or within the limit-line bounds. |
| | LIMIFT | LIMITS FRQ TIME | Selects how the limit-line segments are placed on the spectrum analyzer display: according to frequency, or according to the sweep time setting of the spectrum analyzer. |
| | LIMIHI | | Allows you to specify a fixed trace as the upper limit line. |
| | LIMILINE | | Outputs the current limit-line table definitions. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| **LIMIT LINES (continued)** | LIMILO | | Allows you to specify a fixed trace as the lower limit line. |
| | LIMIMIRROR | | Reflects the current definition about the amplitude axis at the largest frequency or the largest sweep time in the definition. |
| | LIMIMODE | **Edit Upper**, **Edit Lower**, **Edit Up/Low**, **Edit Mid/Delt** | Determines whether the limit-line entries are treated as upper amplitude values, lower amplitude values, upper and lower amplitude values, or mid-amplitude and delta values. |
| | LIMIREL | **LIMITS FIX REL** | Specifies the current limit lines as fixed or relative. |
| | LIMISEG | **Edit Upper**, **Edit Lower** | Adds new segments to the current frequency limit line in either the upper limit line or the lower limit line. |
| | LIMISEGT | **Edit Upper**, **Edit Lower** | Adds new segments to the current sweep time limit line in either the upper limit line or the lower limit line. |
| | LIMITEST | **LMT TEST ON OFF** | Compares trace A with the current limit-line data. |
| | SEGDEL | **DELETE SEGMENT** | Deletes the specified segment from the limit-line tables. |
| | SENTER | **Edit Up/Low**, **Edit Mid/Delt** | Enters the limit-line data in either the upper and lower limit-line tables or the mid and delta table for limit lines based on frequency. |
| | SENTERT | **Edit Up/Low**, **Edit Mid/Delt** | Enters the limit-line data in either the upper and lower limit-line table or the mid and delta table for limit lines based on sweep time. |
| **MARKER** | MDS | | Specifies measurement data size as byte or word. |
| | MF | | Returns the frequency (or time) of the on-screen active marker. |
| | MKA | | Specifies amplitude of the active marker. |
| | MKACT | **SELECT 1 2 3 4** | Specifies the active marker. |
| | MKACTV | **MARKER <number> ON OFF** | Makes the current active marker the active function. |
| | MKBW | **N dB PTS ON OFF** | Returns the bandwidth at the specified power level relative to an on-screen marker (if present) or the signal peak (if no on-screen marker is present). |
| | MKCF | **MARKER -> CF** | Sets the center frequency equal to the marker frequency and moves the marker to the center of the screen. |
| | MKCONT | | Resumes the sweep after execution of a MKSTOP command. |
| | MKD | **MARKER Δ** | Activates the delta marker. |
| | MKDLMODE | **TABLE ADL NRM** | Selects if the marker amplitude values are shown as relative to the reference level or relative to the display line. |
| | MKF | | Specifies the frequency value of the active marker. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| MARKER (continued) | MKFC* | MK COUNT ON OFF * | Turns on or off marker frequency counter. |
| | MKFCR* | CNT RES AUTO MAN * | Sets the resolution of the marker frequency counter. |
| | MKMIN | MARKER -> MINIMUM | Moves active marker to minimum signal detected. |
| | MKN | MARKER NORMAL | Activates and moves the marker to the specified frequency. |
| | MKNOISE | MK NOISE ON OFF | Displays the average noise level at the marker. |
| | MKOFF | MARKER ALL OFF | Turns off either the active marker or all the markers. |
| | MKP | | Places the active marker at the given $x$-coordinate. |
| | MKPAUSE | MK PAUSE ON OFF | Pauses the sweep at the active marker for the duration of the delay period. |
| | MKPK | (PEAK SEARCH), NEXT PEAK, NEXT PK RIGHT, NEXT PK LEFT, MARKER ->PK-PK | Positions the active marker on a signal peak. |
| | MKPX | PEAK EXCURSN | Specifies the minimum signal excursion for the spectrum analyzer's internal peak-identification routine. |
| | MKREAD | MK READ F T I P | Selects the type of active trace information displayed by the spectrum analyzer marker readout. |
| | MKRL | MARKER -> REF LVL | Sets the reference level to the amplitude value of the active marker. |
| | MKSP | MARKER Δ -> SPAN | Sets the start and stop frequencies to the values of the delta markers. |
| | MKSS | MARKER -> CF STEP | Sets the center-frequency step-size to the marker frequency. |
| | MKSTOP | | Stops the sweep at the active marker. |
| | MKTBL | MK TABLE ON OFF | Turns on or off the marker table. |
| | MKTRACE | MK TRACE AUTO ABC | Moves the active marker to a corresponding position in trace A, trace B, or trace C. |
| | MKTRACK | MK TRACK ON OFF | Moves the signal with an active marker to the center of the spectrum analyzer display and keeps the signal peak at center screen. |
| | MKTYPE | MARKER AMPTD | Changes the type of the current active marker. |
| | M4 | | Activates a single marker on the trace and enables the knob to change the position of the marker. The active function is then set to span. |
| | PKDLMODE | PK MODE <>DL NRM | Selects the signal peaks that are displayed in the peak table. |
| | PKRES | | Returns the x-axis coordinates of the peaks in the peak table. |

* Not available for an HP 8592D. An HP 8590D needs Option 013 installed in it.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| MARKER (continued) | PKSORT | PK SORT FRQ AMP | Selects how the signal peaks listed in the peak table are sorted: by decreasing amplitude or by ascending frequency. |
| | PKTBL | PK TABLE ON OFF | Turns on or off the peak table. |
| MATH (see also Trace Math) | ABS | | Places the absolute value of the source values in the destination. |
| | ADD | | Adds the sources and sends the sum to the destination. |
| | AVG | | Averages the source and the destination. |
| | BIT | | Returns the state of a bit. |
| | CTA | | Converts the source values from measurement units to the current absolute amplitude units and stores the result in the destination. |
| | CTM | | Converts the source values to measurement units and places the result in the destination. |
| | DIV | | Divides source 1 by source 2 and places the result in the destination. |
| | EXP | | Places the exponential of the source in the destination. |
| | INT | | Places the greatest integer that is less than or equal to the source value into the destination. |
| | LOG | | Takes the logarithm (base 10) of the source, multiplies the result by the scaling factor, then stores it in the destination. |
| | MEAN | | Returns the mean value of the given trace in measurement units. |
| | MEANTH | | Returns the mean value of the given trace above the threshold, in measurement units. |
| | MIN | | Compares source 1 and 2, point by point, and stores the lesser of the two in the destination. |
| | MINPOS | | Returns a value, which is the $x$-axis position (in display units) of the minimum amplitude value in trace A, trace B, trace C, or user-defined trace. |
| | MOD | | Stores the remainder from the division of source 1 by source 2 in the destination. |
| | MPY | | Multiplies the sources, point by point, and places the results in the destination. |
| | MXM | | Compares source 1 and source 2, point by point, sending the greater value of each comparison to the destination. |
| | PDA | | Sums the probability distribution of amplitude in the destination trace with the amplitude distribution function of the source trace. |
| | PDF | | Increments an element of the destination trace whenever the corresponding element of the source trace exceeds a threshold. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| MATH (continued) | RMS | | Returns the root mean square value of the trace in measurement units. |
| | SQR | | Places the square root of the source into the destination. |
| | STDEV | | Returns the standard deviation of the trace amplitude in measurement units. |
| | SUB | | Subtracts source 2 from source 1, point by point, and sends the difference to the destination. |
| | VARIANCE | | Returns the amplitude variance of the specified trace, in measurement units. |
| MEASURE/USER | ACP | **ADJ CHAN POWER** | Performs the adjacent channel power measurement. |
| | ACPBW | **CHANNEL BANDWDTH** | Allows you to specify the channel bandwidth used for the adjacent channel power (ACP), adjacent channel power extended (ACPE), and channel power (CHP) measurements. |
| | ACPCONTM | **CONT MEAS** | Changes the spectrum analyzer's sweep mode to continuous sweep, and then performs the previous power measurement (occupied bandwidth, adjacent channel, or channel power) at the end of every sweep. |
| | ACPE | **ADJ CHAN PWR extd** | Performs the adjacent channel power extended measurement. |
| | ACPGRAPH | **COMPUTE ACPGRAPH** | Computes and displays an adjacent channel power (ACP) graph. |
| | ACPPAR | **PARAM AUTO MAN** | Determines if the spectrum analyzer settings used for the adjacent channel power (ACP), adjacent channel power extended (ACPE), channel power (CHP), or occupied bandwidth (OBW) measurement are set manually or automatically. |
| | ACPSNGLM | **SINGLE MEAS** | Changes the spectrum analyzer's sweep mode to single sweep, performs a take sweep (TS), and then performs the previous power measurement. |
| | ACPSP | **CHANNEL SPACING** | Allows you to specify the frequency spacing between channels. |
| | CHP | **CHANNEL POWER** | Performs the channel power measurement. |
| | FFT | | Performs a discrete fast Fourier transform on the source trace array and stores the result in the destination array. |
| | FFTAUTO | **MARKER -> AUTO FFT** | Performs a fast Fourier transform (FFT) on the signal on which the marker is placed. |
| | FFTCLIP | | Indicates if the FFT results are valid. |
| | FFTCONTS | **CONTINUS FFT** | Performs a fast Fourier transform (FFT) continuously on the current signal. |
| | FFTMKR | **FFT MARKERS** | Activates the FFT markers and displays the FFT annotation on the spectrum analyzer display. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| MEASURE/USER (continued) | FFTMM | MARKER -> MID SCRN | Changes the FFT midscreen frequency of the spectrum analyzer to the frequency of the FFT marker. |
| | FFTMS | MARKER -> FFT STOP | Changes the FFT stop frequency of the spectrum analyzer to the frequency of the FFT marker. |
| | FFTOFF | FFT OFF | Exits the fast Fourier transform (FFT) measurement and FFT settings. |
| | FFTPCTAM | % AM ON OFF (during an FFT measurement) | Turns the percent AM function on or off. |
| | FFTPCTAMR | | Returns the percent of amplitude modulation (AM). |
| | FFTSNGLS | SINGLE FFT | Changes the spectrum analyzer's sweep mode to single sweep mode (if necessary), and then performs a fast Fourier transform (FFT) on trace A. |
| | FFTSTAT | | Returns the status of the spectrum analyzer's FFT measurement functions. |
| | FFTSTOP | | Sets the FFT stop frequency of the FFT measurement. |
| | MEASOFF | MEAS OFF | Turns off the current measurement, erases the display, and then displays the menu accessed by MEAS/USER. |
| | NDB | N dB PTS ON OFF | Specifies the distance (in dB) from the signal peak for the N dB points measurement (NDBPNT). |
| | NDBPNT | N dB PTS ON OFF | Turns on or off the N dB points measurement. |
| | NDBPNTR | | Returns the bandwidth measured by the N dB points measurement (NDBPT). |
| | OBW | OCCUPIED BANDWDTH | Performs the occupied bandwidth measurement using the value for occupied bandwidth percent (OBWPCT). |
| | OBWPCT | OCC BW % POWER | Specifies the percent of total power that is to be used in calculating the occupied bandwidth (OBW). |
| | PCTAM | % AM ON OFF | Turns on or off the percent AM measurement. |
| | PCTAMR | | Returns the percent AM measured by the percent AM measurement (PCTAM). |
| | PWRBW | | Computes the bandwidth around the trace center, which includes signals whose total power is a specified percentage of the total trace signal power. |
| | TOI | TOI ON OFF | Turns on or off the third-order intermodulation (TOI) measurement. |
| | TOIR | | Returns the highest third-order intermodulation product measured by the third-order intermodulation measurement (TOI). |
| MODE | MODE | SPECTRUM ANALYZER | Returns a "0" if the mode of operation is spectrum analysis. A number other than "0" is returned if the operating mode (also called "personality") is other than spectrum analysis. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| **OPERATOR ENTRY** | DN | (▼) | Reduces the active function by the applicable step size. |
| | EE | | Enables front-panel number entry. |
| | EK | | Enables front-panel knob control. |
| | EP | | Enter parameter from front panel. |
| | HD | **HOLD** or (HOLD) | Holds or disables entry and blanks active function readout. |
| | UP | (▲) | Increases the active function by the applicable step size. |
| **PLOTTER** | GETPLOT | (COPY) | Initiates output of the spectrum analyzer display to a plotter. (For use within a downloadable program.) |
| | PLOT | (COPY) (to a plotter) | Initiates output of the spectrum analyzer display to a plotter. |
| **PRESET** | IP | (PRESET) | Performs an instrument preset. |
| | LF* | | Performs an instrument preset to the base band (band 0). |
| | POWERON | **POWER ON IP LAST** | Selects the state the spectrum analyzer will be in when it is turned on: IP (instrument preset) or LAST state. |
| | RESETRL | | Resets the reference level to instrument preset value. |
| **PRINTER** | GETPRNT | (COPY) | Initiates output of the spectrum analyzer display to a printer. (For use within a downloadable program.) |
| | PRINT | (COPY) (to a printer) | Initiates output of the spectrum analyzer display to a printer. |
| **PROGRAM FLOW** | ABORT | | Stops the execution all user-defined functions and readies the instrument for the next command received. |
| | IF | | IF/THEN/ELSE/ENDIF forms a decision and branching construct. |
| | REPEAT | | REPEAT/UNTIL forms a looping construct. |
| | RETURN | | Stops the operation of a user-defined command and returns program operation to the point where the user-defined function was called. |
| | WAIT | | Suspends all spectrum analyzer operation for the specified time duration. |
| **RECALL or SAVE** | CAT | **Catalog Internal**, **Catalog Card** † | Displays directory information from either the specified or the current mass storage device. |
| | LOAD† | **LOAD FILE** † | Loads a file from the memory card. |
| | MSI | **INTERNAL CARD** | Allows you to specify the current mass storage device as the spectrum analyzer memory or a memory card. |
| | PREFX | **Change Prefix** | Specifies the prefix. |

* For HP 8592D, HP 8593E, HP 8595E, or HP 8596E only.
† Option 003 required for HP 8590D or HP 8592D.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| RECALL or SAVE | PSTATE | SAV LOCK ON OFF | Protects all of the spectrum analyzer's user state and trace registers from being changed. |
| | PURGE | DELETE FILE | Deletes the specified file from the current mass storage device. |
| | RCLS | INTERNAL -> STATE | Recalls spectrum analyzer state data from one of the nine state registers in spectrum analyzer memory. |
| | RCLT | The softkeys accessed by Internal -> Trace | Recalls previously saved trace data, amplitude factors, or limit-line data from the trace registers in spectrum analyzer memory. |
| | SAVES | STATE -> INTRNL | Saves the currently displayed instrument state in spectrum analyzer memory. |
| | SAVET | The softkeys accessed by Trace -> Intrnl | Saves the selected trace data and state information, amplitude correction factors, or limit-line tables in spectrum analyzer memory. |
| | SAVRCLF | (SAVE) or (RECALL) | Specifies either a save or recall operation. |
| | SAVRCLN | | Specifies the number to append to the prefix for a save or recall operation, and initiates the transfer of data. |
| | SAVRCLW | | Specifies the data to be transferred. |
| | STOR* | STATE -> CARD *, Trace -> Card *, ALL DLP -> CARD * | Stores data on a RAM card. |
| SPAN | FS | FULL SPAN | Sets the frequency span of the spectrum analyzer to full span. |
| | HN† | | Returns the harmonic number of the current harmonic band in which the spectrum analyzer is tuning. |
| | HNLOCK† | Band selection accessed by Band Lock † or BND LOCK ON OFF † | Forces the spectrum analyzer to use only the selected harmonic band. |
| | HNUNLK† | BND LOCK ON OFF (OFF is underlined)† | Unlocks the harmonic band. |
| | LSPAN | LAST SPAN | Changes the spectrum analyzer's span to the previous span setting. |
| | PKZMOK | | Returns a "0" if the peak zoom routine (PKZOOM) found only the spectrum analyzer's local oscillator feedthrough, otherwise a "1" is returned. |
| | PKZOOM | PEAK ZOOM | Automatically tunes the spectrum analyzer to the signal with the highest amplitude level while narrowing the frequency span to the specified frequency span. |

* Option 003 required for HP 8590D or HP 8592D.
† For HP 8592D, HP 8593E, HP 8595E, or HP 8596E only.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| SPAN (continued) | SP | **SPAN** | Changes the total displayed frequency range symmetrically about the center frequency. |
| | SPZOOM | **SPAN ZOOM** | Places a marker on the highest on-screen signal (if an on-screen marker is not present), turns on the signal track function, and activates the span function. |
| SWEEP | CONTS | **SWEEP CONT SGL** (CONT is underlined) | Sets the spectrum analyzer to the continuous sweep mode. |
| | GATE* | **GATE ON OFF** * | Turns on or off the time-gating. |
| | GATECTL* | **GATE CTL EDGE LVL** * | Selects between the edge and the level mode for Option 105, the time-gated spectrum analysis capability. |
| | GC* | (PRESET) | Presets Option 105, the time-gated spectrum analysis capability. |
| | GD* | **GATE DELAY** * | Sets the delay time before the gate opens. |
| | GDRVCLPAR* | **CLEAR PARAM** * | Clears the pulse parameters (pulse width, pulse repetition interval, and reference edge) for a time-gate measurement by setting the pulse parameters to 0. |
| | GDRVGDEL* | **GATE DELAY** * (when using the gate utility) | For the frequency window only, GDRVGDEL sets the time delay from when the gate trigger occurs to when the gate is opened. |
| | GDRVGLEN* | **GATE LENGTH** * | Adjusts the gate length in both the time and frequency windows. |
| | GDRVGT* | **GATE ON OFF** * | Turns on or off the gate in the frequency window. |
| | GDRVGTIM* | **TRIG MKR ON OFF** * | Activates the gate trigger marker, and places it at the given value. |
| | GDRVPRI* | **ENTER PRI** * | Enters the specified value as the pulse repetition interval. |
| | GDRVPWID* | **ENTER WIDTH** * | Enters the specified value as the pulse width. |
| | GDRVRBW* | **CPL RBW ON OFF** * | Couples or uncouples the resolution bandwidth to the specified pulse width. |
| | GDRVREFE* | **ENTER REF EDGE** * | Allows you to enter the position (in time) for a reference edge. |
| | GDRVST* | **CPL SWP ON OFF** * | Couples or uncouples the sweep time to the pulse repetition interval. |
| | GDRVSWAP* | **UPDATE TIMEFREQ** * | Makes the window (either the time or frequency window) that is currently not the active window, the active window. |
| | GDRVSWDE* | **SWEEP DELAY** * | Allows you to specify the delay from the edge of the gate trigger until the sweep is started in the time window. |

* Option 105 required.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| SWEEP (continued) | GDRVSWP* | T WINDOW SWP TIME* | Specifies the sweep time for the time domain window of the gate utility. |
| | GDRVUTIL* | GATE UTILITY* | Turns on or off the gate utility. |
| | GDRVVBW* | CPL VBW ON OFF* | Couples or uncouples the video bandwidth to the gate length. |
| | GL* | GATE LENGTH* | Sets the length of time the gate is open. |
| | GP* | EDGE POL POS NEG* | Sets the polarity (positive or negative) for the gate trigger. |
| | ST | SWP TIME AUTO MAN | Specifies the time in which the spectrum analyzer sweeps the displayed frequency range. |
| SYNCHRONIZATION | DONE | | Allows you to determine when the spectrum analyzer has started to execute all commands prior to and including DONE. |
| | TS | | Starts and completes one full sweep before the next command is executed. |
| TRACE | AMB | A - B -> A ON OFF | Subtracts trace B from trace A and sends the result to trace A during every sweep of the spectrum analyzer. |
| | AMBPL | NORMLIZE ON OFF | Subtracts trace B from trace A, adds the display line value to the difference, and sends the result to trace A during every sweep of the spectrum analyzer. |
| | AXB | A <--> B | Exchanges trace A and trace B. |
| | BLANK | BLANK A, BLANK B, BLANK C | Blanks trace A, trace B, or trace C and stops taking new data into the specified trace. |
| | BML | B - DL -> B | Subtracts display line from trace B and places the result in trace B. |
| | BTC | B -> C | Transfers trace B into trace C. |
| | BXC | B <--> C | Exchanges trace B and trace C. |
| | CLRW | CLEAR WRITE A, CLEAR WRITE B, CLEAR WRITE C | Clears the specified trace and enables trace data acquisition. |
| | DET | DETECTOR PK SP NEG or DETECTOR SMP PK | Selects the spectrum analyzer detection mode. |
| | IB | | Provides a method for putting values into trace B. |
| | MERGE | | Merges the source trace into the specified area of the destination trace. |
| | MINH | MIN HOLD C | Updates trace C elements with minimum level detected. |
| | MOV | | Copies the source values into the destination. |
| | MXMH | MAX HOLD A, MAX HOLD B | Updates trace elements with maximum level detected. |
| | PKPOS | | Returns a value, which is the index of the maximum value in trace A, trace B, trace C, or user-defined trace. |

* Option 105 required.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| **TRACE (continued)** | TA | | Returns trace A data. |
| | TB | | Returns trace B data. |
| | TRA TRB TRC | | Controls trace data input and output. |
| | TRCMEM | | Returns a nonnegative integer that indicates the total number of trace registers available for SAVET and RCLT. |
| | TRDEF | | Creates a user-defined trace. |
| | TRDSP | | Turns on or off the display of trace A, B, or C without clearing the trace (measurements can still be taken). |
| | TRGRPH | | Displays a compressed trace on the analyzer display. |
| | TRPRST | | Sets the trace operations to their preset values. |
| | TRSTAT | | Returns the status of traces A, B, and C: clear write, blank, view, minimum hold, or maximum hold. |
| | TWNDOW | | Creates a window trace array for the fast Fourier transform (FFT) function. |
| | VAVG | **VID AVG ON OFF** | Enables the video-averaging function, which averages trace points to smooth the displayed trace. |
| | VIEW | **VIEW A, VIEW B, VIEW C** | Displays trace A, trace B, or trace C, and stops taking new data into the viewed trace. |
| **TRACE MATH (see also Math)** | APB | | Adds trace A to trace B and sends the result to trace A. |
| | CLRAVG | **VID AVG ON OFF** | Restarts video averaging. |
| | COMPRESS | | Reduces the number of trace elements while retaining the relative frequency and amplitude characteristics of the trace data. |
| | CONCAT | | Combines two traces. |
| | FFT | | Calculates fast Fourier transform. |
| | LINFILL | | Fills linear interpolated data into the specified trace data points of a destination trace. |
| | MIRROR | | Displays the mirror image of a trace. |
| | PEAKS | | Sorts signal peaks by frequency or amplitude, stores the results in the destination trace, and returns the number of peaks found. |
| | SMOOTH | | Smooths the trace according to the number of points specified for the running average. |
| | SUM | | Returns the sum of the amplitudes of the trace elements in measurement units. |
| | SUMSQR | | Returns the sum of the squares of the amplitude of each trace element. |
| | TRMATH | | Executes a list of analyzer commands at the end of each sweep. |
| | XCH | | Exchanges traces. |

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| TRIGGER | ONEOS | | Performs the command list at the end of sweep. |
| | ONSWP | | Performs the command list at beginning of sweep. |
| | SNGLS | (SGL SWP), SWEEP CONT SGL (SGL is underlined) | Selects single-sweep mode. |
| | TM | FREE RUN, LINE, VIDEO, EXTERNAL, TV TRIG * | Specifies trigger mode. |
| | TS | | Begins a new sweep. |
| | TVLINE* | TV LINE # * | Sets the line number of the horizontal line of video on which to trigger. |
| | TVSFRM* | TV TRIG ODD FLD *, TV TRIG EVEN FLD *, TV TRIG VERT INT * | Specifies type of video frame to trigger on. |
| | TVSTND* | TV Standard * | Selects the triggering for NTSC, PAL, PAL-M, and SECAM-L formats. |
| | TVSYNC* | TV SYNC NEG POS * | Selects between negative and positive triggering for video frame formats. |
| USER-DEFINED | ABORT | | Aborts all user-defined functions. |
| | ACTDEF | | Creates a user-defined active function. |
| | DISPOSE | DISPOSE USER MEM | Deletes user-defined functions. |
| | ERASE | | Clears trace A and trace B, disposes of the contents of the user memory, and resets the state registers and the spectrum analyzer to the instrument preset state. |
| | FUNCDEF | | Defines a routine consisting of spectrum analyzer commands, assigns the routine a label, and stores the routine and its label in the user memory. |
| | KEYCLR | | Clears softkeys 1 through 6. |
| | KEYCMD | | Allows you define the function and label of a softkey. The softkey label is updated whenever a softkey is pressed. |
| | KEYDEF | | Assigns a label and user-defined function to a softkey. |
| | KEYENH | | Allows you to activate inverse video mode or underline part or all of the softkey label. |
| | KEYEXC | | Executes the specified, previously defined softkey. |
| | KEYLBL | | Relabels a softkey without changing its function. |
| | MEM | | Returns the amount of spectrum analyzer memory available. |
| | MENU | | Selects and displays the softkey menus on the spectrum analyzer screen. |
| | RETURN | | Returns from user-defined function. |
| | SAVEMENU | | Saves menu 1 under the specified menu number. |

* Options 101 and 102, or Option 301 required.

## Table 5-4. Functional Index (continued)

| Function Category | Command | Corresponding Key Function | Description |
|---|---|---|---|
| USER-DEFINED | TRDEF | | Declares a user-defined trace. |
| | USTATE | | Transmits information that has been stored in the analyzer by the user. |
| | VARDEF | | Creates a user-defined variable and assigns it a value. |
| WINDOWS | WINNEXT | (NEXT)* | Makes the window that is currently not the active window, active. |
| | WINOFF | **WINDOWS OFF** * | Turns off the windows display. |
| | WINON | (ON)* | Activates the windows display mode. |
| | WINZOOM | (ZOOM)* | Expands the size of the active window so that it fills the entire spectrum analyzer display. |
| | ZMKCNTR | **ZONE CENTER** * | Positions the zone marker at the specified frequency. |
| | ZMKPNL | **ZONE PK LEFT** * | Places the zone marker at the next signal peak that is left of the zone marker's current position. |
| | ZMKPNR | **ZONE PK RIGHT** * | Places the zone marker at the next peak to the right of the zone marker's current position. |
| | ZMKSPAN | **ZONE SPAN** * | Allows you to change the width of the zone marker. |

* Not available for the HP 8590D or HP 8592D.

# ABORT
# Abort

Stops the execution all user-defined functions and readies the instrument for the next command received.

## Syntax


XABORT

Related Commands: ACTDEF, FUNCDEF, REPEAT/UNTIL, RETURN.

## Example

In the example below, ABORT is in the function called D_LP.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"CLRDSP;"` | *Clears graphics from the spectrum analyzer display.* |
| `30 OUTPUT 718;"TRDSP TRA,OFF;"` | *Turns off trace A.* |
| `40 OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Blanks annotation and graticule.* |
| `50 OUTPUT 718;"VARDEF C_OUNT,0;"` | *Declares a user-defined variable called C_OUNT.* |
| `60 !` | |
| `70 OUTPUT 718;"FUNCDEF D_LP,@";` | *Declares a user-defined function called D_LP.* |
| `80 OUTPUT 718;"REPEAT;";` | *Begins a repeat loop.* |
| `90 OUTPUT 718;"ADD C_OUNT,C_OUNT,100;";` | *Adds 100 to C_OUNT.* |
| `100 OUTPUT 718;"PU,PA 100,100;PD;";` | |
| `110 OUTPUT 718;"DSPLY C_OUNT,4.0;";` | *Displays the value of C_OUNT.* |
| `120 OUTPUT 718;"IF C_OUNT,EQ,300 THEN;ABORT;ENDIF;";` | *Aborts the function when C_OUNT is equal to 300.* |
| `130 OUTPUT 718;"UNTIL C_OUNT,EQ,400;";` | *This is not executed because of the ABORT command in line 120.* |
| `140 OUTPUT 718;"@;";` | *Marks end of D_LP.* |
| `150 OUTPUT 718;"FUNCDEF S_HELL,@";` | *Defines second user-defined function called S_HELL.* |
| `160 OUTPUT 718;"D_LP;TEXT!INSIDE S_HELL!;@"` | *Executes D_LP and displays message on display.* |
| `170 !` | |
| `180 OUTPUT 718;"S_HELL;"` | *This calls the S_HELL function which in turn calls the D_LP function.* |
| `190 END` | |

**ABORT Abort**

## Description

If ABORT is encountered in a function that has been executed by pressing a softkey, the function is interrupted and front-panel control is returned.

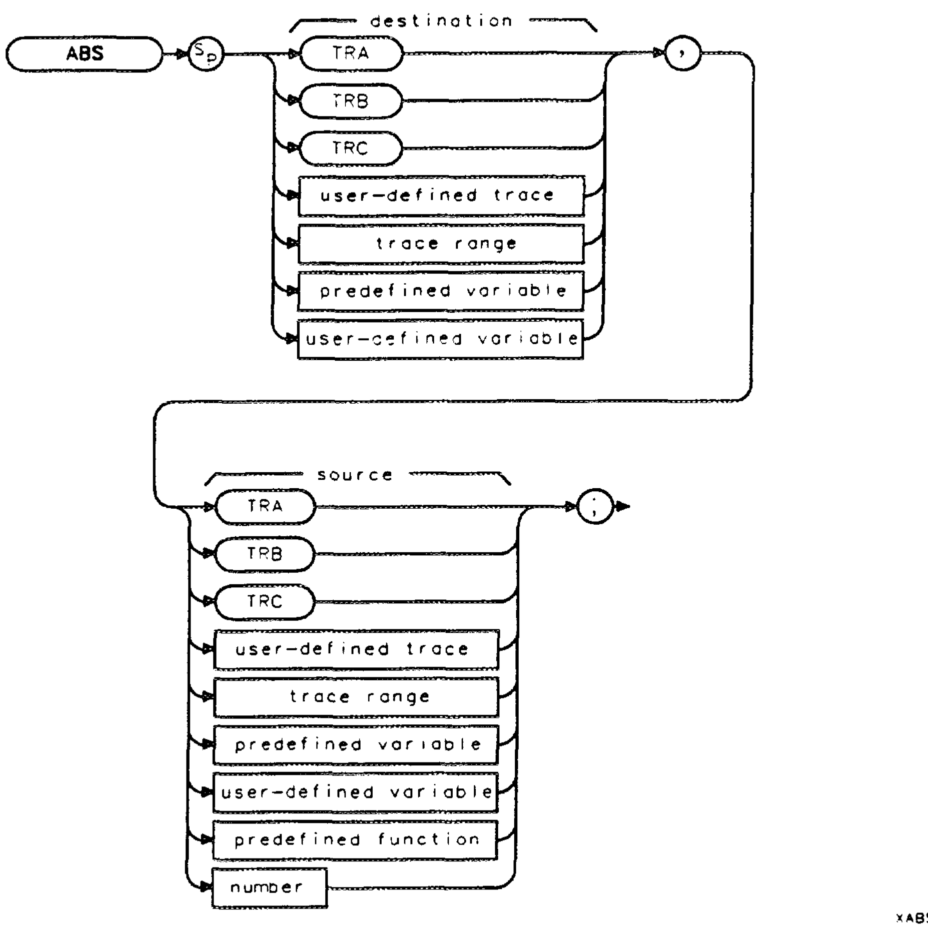
If the ABORT function is nested within one or more user-defined functions, ABORT stops the execution of all user-defined functions and readies the spectrum analyzer to act on the next command received.

In comparison, the RETURN command also interrupts operation of a user-defined function, but RETURN returns the operation to the point at which the user-defined function was called. (See "RETURN" for more information.)

# ABS
# Absolute

Places the absolute value of the source values in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using user-defined trace. ACTDEF or VARDEF when using user-defined variable. TS when using trace data.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer, stops sweeping.* |
| `20 OUTPUT 718;"VARDEF P_OINT,0;"` | *Defines a variable, called P_OINT, and initializes it to 0.* |
| `30 OUTPUT 718;"ABS P_OINT,-2;"` | *Places the absolute value of −2 into POINT.* |
| `40 OUTPUT 718;"P_OINT?;";` | *Returns value of POINT to computer.* |
| `50 ENTER 718;Second` | *Assigns value to computer variable, Second.* |
| `60 DISP Second` | *Displays the absolute value (2).* |
| `70 END` | |

## Description

The source and the destination may be different lengths. The lengths of predefined traces (trace A, trace B, or trace C) is 401, while user-defined traces have a length of up to 2047, and variables have a length of 1. When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# ACP
# Adjacent Channel Power

Performs the adjacent channel power measurement.

## Syntax


XACP

Equivalent Softkey: **ADJ CHAN POWER**.

Related Commands: ACPPAR, ACPSP, ACPBW, ACPSNGLM, ACPCONTM, ACPGRAPH.

## Example

`OUTPUT 718;"ACP;"` *Performs the adjacent channel power measurement.*

## Description

ACP measures the power of the carrier and the power of the channels that are adjacent to the carrier, and then computes a power ratio for each of the adjacent channels, using the carrier power as a reference. ACP performs the adjacent channel power measurement using the values for channel spacing (ACPSP) and channel bandwidth (ACPBW).

To use ACP:

1. Set the center frequency to the carrier's frequency.
2. For best accuracy, set the reference level so that the carrier signal peak is within the first (top) division of the display graticule.
3. Select the channel spacing with the ACPSP command.
4. Select the channel bandwidth with the ACPBW command.
5. If you want the spectrum analyzer settings to be set automatically, ensure that ACPPAR is set to 1. If you want to set the spectrum analyzer settings manually, set ACPPAR to 0. (See "ACPPAR" for more information about selecting the spectrum analyzer settings manually.)
6. If the spectrum analyzer is in the continuous-sweep mode, use the single sweep command (SNGLS) to select the single-sweep mode.
7. Execute the ACP command.
8. Query ACPERR to determine if there is a setup error for the ACP measurement. See the following table for more information about ACPERR.
9. If no error occurred, query ACPPWRTX, ACPMAX, ACPLOWER, and ACPUPPER variables for the numeric results of the ACP measurement. See the following table for more information about these variables.
10. If no error occurred, query trace A (TRA) for the trace results of the ACP measurement.

**Measurement Results:** The results of the ACP command are stored in the variables and trace in the following table.

## ACP Adjacent Channel Power

### ACP Measurement Results

| Variable or Trace | Description | Units |
|---|---|---|
| ACPERR | A variable that indicates if setup errors occurred for the ACP measurement. If ACPERR is 0, no errors occurred. If ACPERR is greater than 0, an error occurred. An ACPERR value of 1 to 7 indicates that the frequency span, channel spacing, or the channel bandwidth are not set correctly. An ACPERR value of 1 to 7 indicates the following:<br>1 Frequency span < (2 x channel spacing + channel bandwidth).<br>2 Channel bandwidth > 2 x channel spacing.<br>3 Frequency span < (2 x channel spacing + channel bandwidth) and channel bandwidth > 2 x channel spacing.<br>4 Channel bandwidth < frequency span/100.<br>5 Frequency span < (2 x channel spacing + channel bandwidth) and channel bandwidth < frequency span/100.<br>6 Channel bandwidth > 2 x channel spacing and channel bandwidth < frequency span/100.<br>7 Frequency span < (2 x channel spacing + channel bandwidth), channel bandwidth > 2 x channel spacing, and channel bandwidth < frequency span/100. | None |
| ACPPWRTX | A variable that contains the total transmit band carrier power. ACPPWRTX is calculated by the following:<br>$10 \times log(Power_{Carrier})$ | dBm |
| ACPMAX | A variable that contains the relative power level of the adjacent channel with the highest measured power level. | dB |
| ACPLOWER | A variable that contains the relative power level found in the lower adjacent channel. ACPLOWER is calculated by the following:<br>$10 \times log(\frac{Power_{lower\ channel}}{Power_{carrier}})$ | dB |
| ACPUPPER | A variable that contains the relative power level found in the upper adjacent channel. ACPUPPER is calculated by the following:<br>$10 \times log(\frac{Power_{upper\ channel}}{Power_{carrier}})$ | dB |
| TRA* | TRA is trace A. Trace A contains the swept RF spectrum that was used to measure adjacent channel power. | Determined by the trace data format (TDF) command. |

* Executing the ACPGRAPH command moves the contents of trace A to trace B. See "ACPGRAPH" for more information.

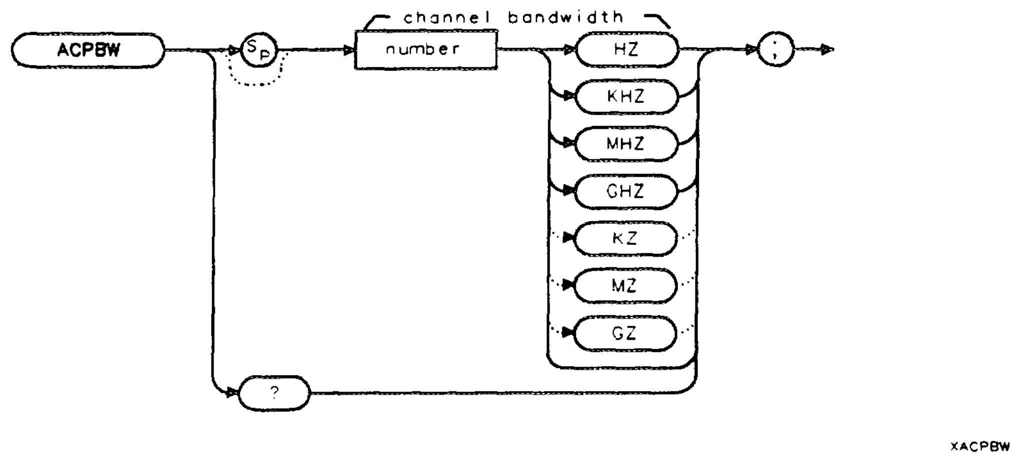
### Restrictions

Executing ACP exits the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), or peak zoom (PKZOOM).

# ACPBW
# Channel Bandwidth

Allows you to specify the channel bandwidth used for the adjacent channel power (ACP), adjacent channel power extended (ACPE), and channel power (CHP) measurements.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 1 kHz to 999.9 MHz. |

Equivalent Softkey: **CHANNEL BANDWDTH**.
Initial Value: 16 kHz.
Preset Value: last value entered.
Related Commands: ACP, ACPE, CHP.

## Example

```
OUTPUT 718;"MOV ACPBW,100KHZ;"
OUTPUT 718;"ACP;"
```

*Specifies a 100 kHz integration bandwidth.*
*Performs the adjacent channel power measurement.*

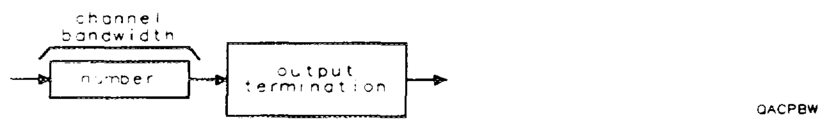
## Description

The value of ACPBW is used when calculating the results of the adjacent channel (ACP), adjacent channel extended (ACPE), or channel power (CHP) measurement. The value of ACPBW is also used when ACPPAR is set for automatic coupling the spectrum analyzer settings for the ACP, ACPE, or CHP measurement.

Once you enter a value into ACPBW, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of ACPBW.

You can execute the ACPBW command two different ways. You can either execute the ACPBW command directly (for example, "ACPBW 100KHZ;") or use the MOV command to move the value for the bandwidth into the ACPBW command (for example, "MOV ACPBW,100KHZ;"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response



# ACPCONTM
# Continuous Sweep Measurement

Changes the spectrum analyzer's sweep mode to continuous sweep, and then performs the previous power measurement (occupied bandwidth, adjacent channel, or channel power) at the end of every sweep.

## Syntax


XACPCONTM

Equivalent Softkey: `CONT MEAS`.

Related Commands: ACP, ACPSNGLM, CHP, CONTS, SNGLS, OBW.

## Example

| | |
|---|---|
| `OUTPUT 718;"ACP;"` | *Performs the adjacent channel power measurement.* |
| `OUTPUT 718;"ACPCONTM;"` | *Places the spectrum analyzer into continuous sweep mode so that the adjacent channel power measurement will be performed at the end of every sweep.* |

## Description

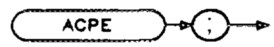
When ACPCONTM is executed, the numeric results of adjacent channel (ACP), channel power (CHP), or occupied bandwidth (OBW) measurements are calculated at the end of every sweep. While in the continuous sweep measurement, you can change the channel spacing (ACPSP), channel bandwidth (ACPBW), or another spectrum analyzer setting and the numeric results for the ACP, CHP, or OBW measurement will be automatically updated.

If ACPCONTM is executed after the adjacent channel power extended command (ACPE), only the trace results are obtained; the numeric results of the ACPE measurement are not available in continuous sweep mode.

# ACPE
# Adjacent Channel Power Extended

Performs the adjacent channel power extended measurement.

## Syntax




*ACPE

Equivalent Softkey: **ADJ CHAN PWR extd.**
Related Commands: ACPPAR, ACPSNGLM, ACPSP, ACPBW.

## Example

`OUTPUT 718;"ACPE;"` *Performs the adjacent channel power extended measurement.*

## Description

ACPE performs the adjacent channel power measurement using the values for channel spacing (ACPSP) and channel bandwidth (ACPBW). ACPE is similar to ACP, but unlike ACP, ACPE measures the adjacent channel power over an extended dynamic range. The extended range is measured by taking two measurement sweeps, with the reference level for each sweep set to different values, and then combining the data.

Executing ACPE places the spectrum analyzer in the single sweep measurement mode. If you execute the continuous sweep measurement command (ACPCONTM), only the trace results are obtained; the numeric results of the ACPE measurement are not available.

To use ACPE:

1. Set the center frequency to the carrier's frequency.
2. For best accuracy, set the reference level so that the carrier signal peak is within the first (top) division of the display graticule.
3. Select the channel spacing with the ACPSP command.
4. Select the channel bandwidth with the ACPBW command.
5. If you want the spectrum analyzer settings to be set automatically, ensure that ACPPAR is set to 1. If you want to set the spectrum analyzer settings manually, set ACPPAR to 0. See "ACPPAR" for more information about selecting the spectrum analyzer settings manually.
6. If the spectrum analyzer is in the continuous-sweep mode, use the single sweep command (SNGLS) to select the single-sweep mode.
7. Execute the ACPE command.
8. Query ACPERR to determine if there is a setup error for the ACP measurement. See the following table for more information about ACPERR.
9. If no error occurred, query ACPPWRTX, ACPMAX, ACPLOWER, and ACPUPPER variables for the numeric results of the ACPE measurement. See the following table for more information about these variables.
10. If no error occurred, query trace A (TRA) for the trace results of the ACPE measurement.

## ACPE Measurement Results

| Variable or Trace | Description | Units |
|---|---|---|
| ACPERR | A variable that indicates if setup errors occurred for the ACPE measurement. If ACPERR is 0, no errors occurred. If ACPERR is greater than 0, an error occurred. An ACPERR value of 1 to 7 indicates that the frequency span, channel spacing, or the channel bandwidth are not set correctly. An ACPERR value of 1 to 7 indicates the following:<br>1 Frequency span < (2 x channel spacing + channel bandwidth).<br>2 Channel bandwidth > 2 x channel spacing.<br>3 Frequency span < (2 x channel spacing + channel bandwidth) and channel bandwidth > 2 x channel spacing.<br>4 Channel bandwidth < frequency span/100.<br>5 Frequency span < (2 x channel spacing + channel bandwidth) and channel bandwidth < frequency span/100.<br>6 Channel bandwidth > 2 x channel spacing and channel bandwidth < frequency span/100.<br>7 Frequency span < (2 x channel spacing + channel bandwidth), channel bandwidth > 2 x channel spacing, and channel bandwidth < frequency span/100. | None |
| ACPPWRTX | A variable that contains the total transmit band carrier power. ACPPWRTX is calculated by the following:<br>$10 \times log(Power_{Carrier})$ | dBm |
| ACPMAX | A variable that contains the relative power level of the adjacent channel with the highest measured power level. | dB |
| ACPLOWER | A variable that contains the relative power level found in the lower adjacent channel. ACPLOWER is calculated by the following:<br>$10 \times log(\frac{Power_{lower\ channel}}{Power_{carrier}})$ | dB |
| ACPUPPER | A variable that contains the relative power level found in the upper adjacent channel. ACPUPPER is calculated by the following:<br>$10 \times log(\frac{Power_{upper\ channel}}{Power_{carrier}})$ | dB |
| TRA | TRA is trace A. Trace A contains the swept RF spectrum that was used to measure adjacent channel power. | Determined by the trace data format (TDF) command. |

### Restrictions

Executing ACPE exits the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), or peak zoom (PKZOOM).

# ACPGRAPH
## Compute the Adjacent Channel Power Graph

Computes and displays an adjacent channel power (ACP) graph.

### Syntax


XACPGRAPH

Equivalent Softkey: **COMPUTE ACPGRAPH**.
Related Commands: ACP.

### Example

| | |
|---|---|
| `OUTPUT 718;"ACP;"` | *Performs the adjacent channel power measurement.* |
| `OUTPUT 718;"ACPGRAPH;"` | *Creates a graph of ACP as a function of the frequency offset from the carrier, and places the graph into trace A.* |

### Description

ACPGRAPH uses the ACP spectrum data that was obtained by the previous adjacent channel power measurement to generate the graph. (Use the ACP command to perform the adjacent channel power measurement; ACPGRAPH does not work with the ACPE command.) ACPGRAPH does the following:

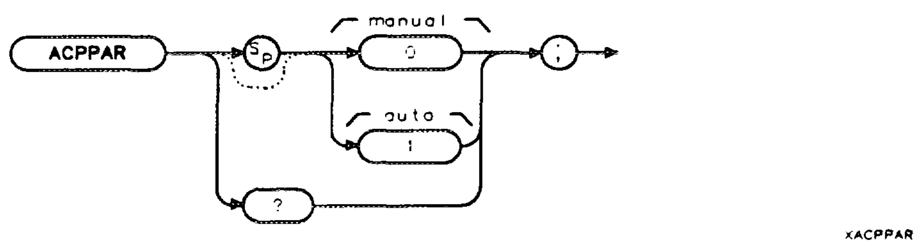
- Generates a graph of the adjacent channel power ratio, for the selected channel bandwidth, as a function of channel spacing from the carrier.
- Places the graph in trace A, and the swept RF spectrum in trace B. The units for trace A and trace B are determined by the trace data format (TDF) command.
- Positions a marker at the center frequency, and then a delta marker is placed at the center frequency of the upper adjacent channel.

When the graph is generated, the reference level represents an adjacent channel power ratio of 0, and the horizontal center represents a frequency offset (and channel spacing) of 0 Hz. The results of ACPGRAPH are not defined for channel spacings where the graph is drawn at the bottom graticule line.

# ACPPAR
# ACP Manual or Auto

Determines if the spectrum analyzer settings used for the adjacent channel power (ACP), adjacent channel power extended (ACPE), channel power (CHP), or occupied bandwidth (OBW) measurement are set manually or automatically.

## Syntax




Equivalent Softkey: **PARAM AUTO MAN**.
Related Commands: ACP, ACPE, ACPSP, ACPBW, OBW, CHP, DET, ST, VB, RB, SS.

## Example

```
OUTPUT 718;"MOV ACPPAR,1;"
```
*Sets the parameters for the adjacent channel power parameters automatically.*

## Description

When ACPPAR is set to 1, the spectrum analyzer settings for the ACP, ACPE, CHP, or OBW measurement are set by the spectrum analyzer. When ACPPAR is set to 1, the spectrum analyzer does the following before the measurement is performed:

- Performs the trace preset (TRPRST) command.
- Turns off the video averaging.
- Changes the trigger mode to free run.
- Sets the amplitude units to dBm.
- Changes the detector mode to sample.
- Changes the amplitude scale to 10 dB per division.
- Sets the frequency span, resolution bandwidth, video bandwidth, center frequency step size, and sweep time based on the channel spacing (ACPSP) and channel bandwidth (ACPBW). See the following table for more information about the spectrum analyzer settings for each measurement.
- Takes a sweep.

### ACPPAR ACP Manual or Auto

**Table 5-5. Spectrum Analyzer Settings, ACPPAR is Set to Automatic**

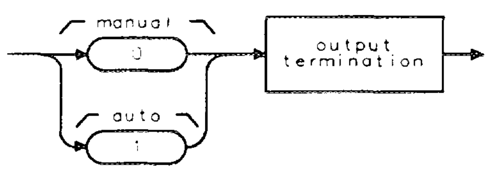
| Measurement | Res Bandwidth | Video Bandwidth | Span | Step Size | Sweep Time |
|---|---|---|---|---|---|
| Adjacent Channel Power (ACP) | Highest setting that does not exceed 0.025 x ACPBW* | 10 x RB | $\frac{(400 \times ACPSP)}{INT[\frac{(400 \times ACPSP)}{(2 \times ACPSP + 1.2 \times ACPBW)}]}$ | ACPSP | Auto |
| Channel Power (CHP) | Highest setting that does not exceed 0.025 x ACPBW* | 10 x RB | 2 x ACPBW | ACPSP | Auto |
| Occupied Bandwidth (OBW) | Highest setting that does not exceed 0.02 x ACPSP* | 10 x RB | 3 x ACPSP | ACPSP | Auto |

* If Option 130 is *not* installed in the spectrum analyzer, the narrowest resolution bandwidth is limited to 1 kHz.

When ACPPAR is set to 0, you must set the spectrum analyzer settings for the ACP, ACPE, CHP, or OBW measurement. You must ensure that trace A contains the RF spectrum to be measured, and that the frequency span, resolution bandwidth, video bandwidth, and the detector are set appropriately for the measurement. When ACPPAR is set to 0, the measurement commands (ACP, ACPE, OBW, CHP) do not take a sweep before making the measurement.

You can execute the ACPPAR command two different ways. You can either execute the ACPPAR command directly (for example, "`ACPPAR 1;`") or use the MOV command to move the 1 or 0 into the ACPPAR command (for example, "`MOV ACPPAR,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response




QACPPAR

# ACPSNGLM
# Single Sweep Measurement

Changes the spectrum analyzer's sweep mode to single sweep, performs a take sweep (TS), and then performs the previous power measurement (occupied bandwidth, adjacent channel, adjacent channel extended, or channel power).

## Syntax


XACPSNGLM

Equivalent Softkey: **SINGLE MEAS** .

Related Commands: ACP, ACPCONTM, ACPE, CHP, CONTS, SNGLS, OBW.

## Example

| | |
|---|---|
| `OUTPUT 718;"ACP;"` | *Performs the adjacent channel power measurement.* |
| `OUTPUT 718;"ACPSNGLM;"` | *Repeats the previous measurement once.* |

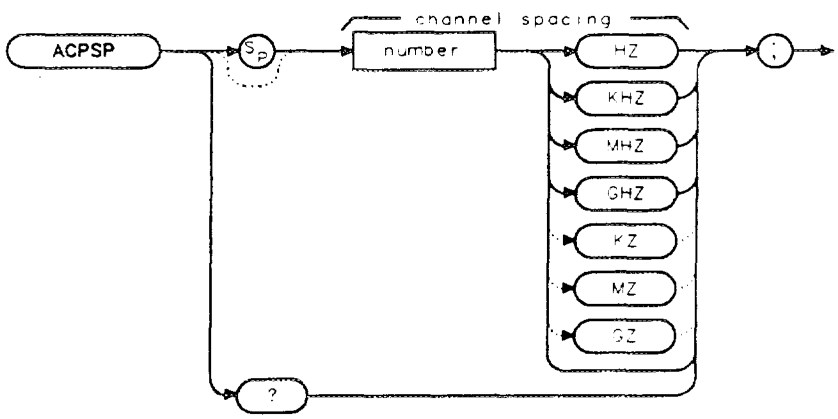
## Description

See the "ACP," "ACPE," "CHP," and "OBW" for more information about the measurement results of each measurement.

# ACPSP
# Channel Spacing

Allows you to specify the frequency spacing between channels.

## Syntax




XACPSP

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 1 kHz to 999.9 MHz. |

Equivalent Softkey: **CHANNEL SPACING** .
Initial Value: 25 kHz.
Preset Value: last value entered.
Related Commands: ACP, ACPE.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV ACPSP,100KHZ;"` | *Specifies 100 kHz frequency spacing between channels.* |
| `OUTPUT 718;"ACP;"` | *Performs the adjacent channel power measurement.* |

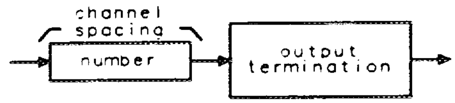
## Description

The value of ACPSP is used when calculating the results of the adjacent channel (ACP) or adjacent channel extended (ACPE) measurement. The value of ACPSP is also used when ACPPAR is set for automatic coupling of the spectrum analyzer settings for the ACP, ACPE, CHP, or OBW measurement.

Once you enter a value into ACPSP, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of ACPSP.

You can execute the ACPSP command two different ways. You can either execute the ACPSP command directly (for example, "ACPSP 100KHZ;") or use the MOV command to move the frequency value into the ACPSP command (for example, "MOV ACPSP,100KHZ;"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response

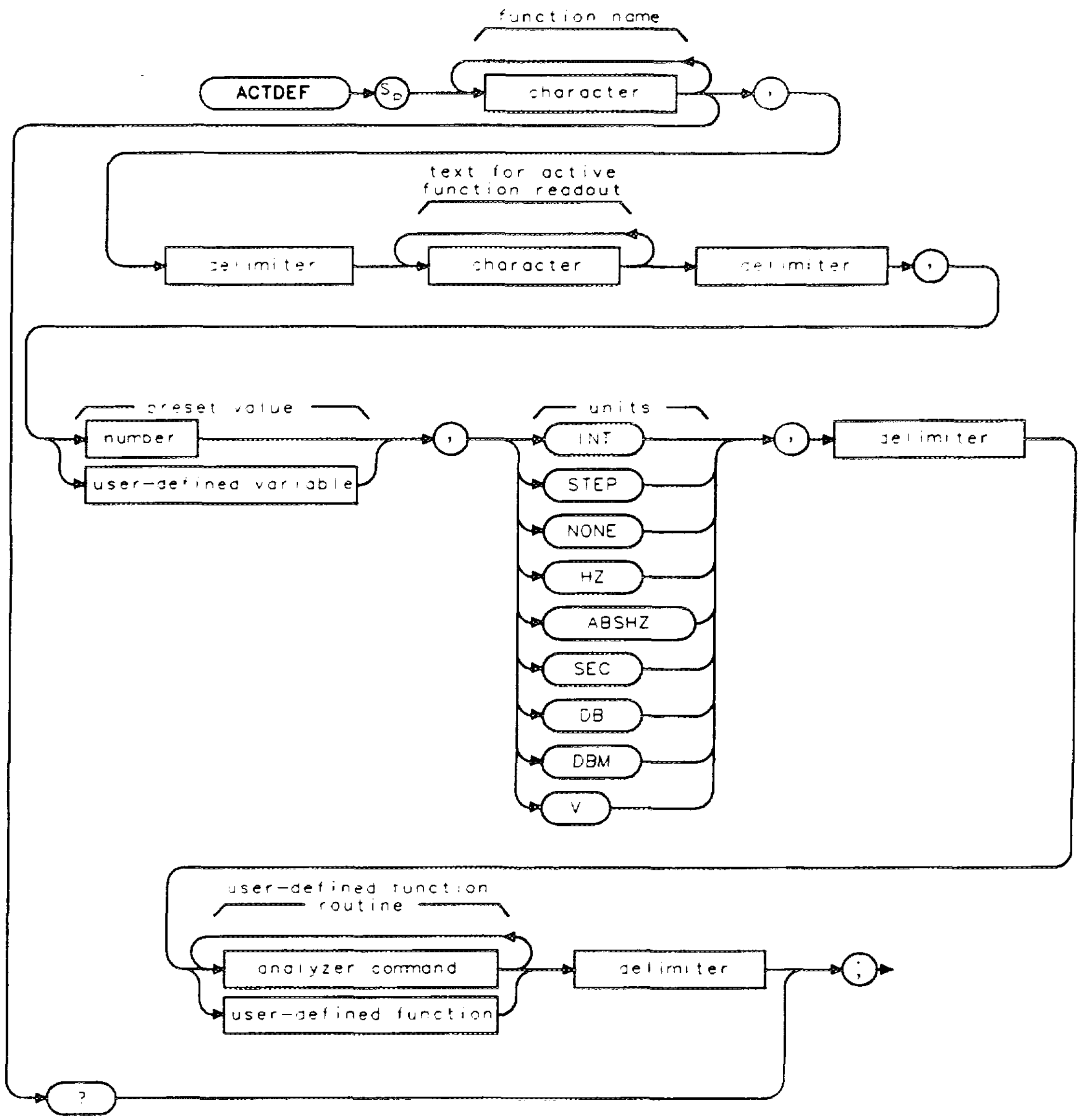



QACPSP

# ACTDEF
# Active Function Definition

Creates a user-defined active function.

## Syntax




XACTDEF

| Item | Description/Default | Range |
|---|---|---|
| Character (function name) | Any valid character. Use the function name as the remote command name. | 2 to 11 characters long, A through Z and the underscore (the underscore should be used as the second character of the label). |
| Character (text for active function label) | Any valid character. The active function label is displayed in the active function block (when the function is active). | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Number | Any real or integer number. Default value is 0, default unit is none. | Real number range. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ˜ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any valid spectrum analyzer command. | |
| User-defined function | A function defined by the FUNCDEF command. | Any valid function name. |

Prerequisite Command: FUNCDEF when using a user-defined function. VARDEF when using a user-defined variable.

## Example 1

| | |
|---|---|
| `10 DIM A$[150]` | *Dimensions array to hold query response.* |
| `20 OUTPUT 718;"ACTDEF M_BW,%MY BANDWIDTH%,5MHZ,STEP,@";`<br>`30 OUTPUT 718;"MOV RB,M_BW@;";` | *Defines a function called M_BW. M_BW allows manipulation of the initial value of RES BW (5 MHz) by the step keys and the knob. The resolution bandwidth will be rounded to the nearest allowable bandwidth, however. The "@" symbol marks the end of the ACTDEF declaration.* |
| `40 OUTPUT 718;"M_BW;"` | *Activates the M_BW function.* |
| `50 OUTPUT 718;"ACTDEF M_BW?;"` | *Queries the definition of the M_BW function.* |
| `60 ENTER 718;A$` | |
| `70 DISP A$` | *Displays the definition of the M_BW function.* |
| `80 END` | |

## Example 2

This example uses ACTDEF in a downloadable program that is created by the KEYDEF command. In this example, the ACTDEF function D_SPAN is assigned to softkey 1. When softkey 1 is pressed, ENTER FFT SPAN is displayed on the spectrum analyzer display. When a value is entered, the sweep time is changed to prepare the spectrum analyzer for making a fast Fourier transform measurement. (See "FFT" for more information about making a fast Fourier transform measurement.)

| | |
|---|---|
| `OUTPUT 718;"KEYDEF 1,D_SPAN,@ FFT\|SPAN@;"` | *Assigns D_SPAN to softkey 1.* |
| `OUTPUT 718;"ACTDEF D_SPAN,@ENTER FFT SPAN@,100,HZ,@";` | *Defines the D_SPAN function. The D_SPAN function displays* ENTER FFT SPAN *on the spectrum analyzer display, and has an initial value of 100 Hz.* |
| `OUTPUT 718;"MOV SP,0;";` | *The frequency span must be zero to make a FFT measurement.* |
| `OUTPUT 718;"DIV ST,200,D_SPAN;";` | *Changes the spectrum analyzer sweep time according to the value of D_SPAN. D_SPAN is divided by 200, which represents the number of buckets.* |
| `OUTPUT 718;"@;"` | *Ends the ACTDEF declaration.* |
| `LOCAL 718` | |

After executing this example, the softkey label of softkey 1 is **FFT SPAN**. Softkey 1 can be accessed by pressing (MEAS/USER), **User Menus**.

## Description

With the ACTDEF command, you can create an active function that is similar to the active functions that are already provided by the spectrum analyzer. For example, CF, DL, AT, MKA, MKFCR, MKD, MKF, MKN, RB, SS, ST, TH, VAVG, VB, VBR are all active functions that are provided by the spectrum analyzer.

The ACTDEF command consists of the function name, the text for the active function readout, the preset value, the unit, and the analyzer commands or user-defined function.

**Function name:** The function name is the name that will be used to invoke the ACTDEF function. See line 40 of Example 1 for an example of invoking an ACTDEF function.

**Text for the active function readout:** This is the text is displayed, when the ACTDEF function is active, in the active function readout area of the spectrum analyzer display.

**Preset value:** The preset value is the value of the ACTDEF function until you change it. Executing an instrument preset (IP) resets the ACTDEF function's value back to the preset value.

**Units:** The ACTDEF function's value can be manipulated in different ways depending on the units parameter that is specified. For example, if you select INT (integer) units, the value of the ACTDEF function can only be incremented or decremented by 1. For the INT unit, the step keys and the knob can be used to change the function's value.

Refer to the following table for a description of the different unit parameter.

**Behavior of Unit Parameters for ACTDEF Command**

| Parameter | Step Increment Value | Knob Increment Value | Unit-Keys |
|---|---|---|---|
| INT | Integer, increment or decrement by 1 only | 1 | None |
| STEP | Increment or decrement by 1 only | 1 | None |
| NONE | Not applicable | Not applicable | None |
| HZ | Resolution bandwidth during zero-span mode; otherwise, 10% of span. | Resolution bandwidth, during zero-span mode; otherwise, 0.05% of span. | Frequency |
| ABSHZ | 1.5, 2, 3, 5, 7.5 | 1% | Frequency, in absolute Hz |
| SEC | 1.5, 2, 3, 5, 7.5 | 1% | Time |
| DB | dB per division | 1% of dB per division | Relative amplitude |
| DBM | dB per division | 1% of dB per division | Absolute amplitude |
| V | 1.5, 2, 3, 5, 7.5 | 1% | Volts |

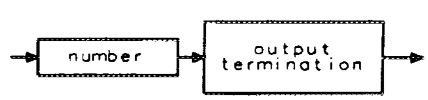
Some of the unit parameters specify the units of the function value (Hz, seconds, dB, dBm, V). The STEP, INT, and NONE parameters are unitless values. The STEP unit parameter works the same as the INT unit parameter. When using the INT, STEP, and NONE parameters in an ACTDEF declaration, the value displayed on spectrum analyzer display for the ACTDEF function value is rounded to the nearest integer; however the actual value in spectrum analyzer memory is not rounded.

Use the following guidelines when defining ACTDEF:

- The function name used in the ACTDEF declaration must be unique. Do not use an existing programming command mnemonic or other reserved words, see Table 5-2 for a list of reserved words.
- Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

## Query Response

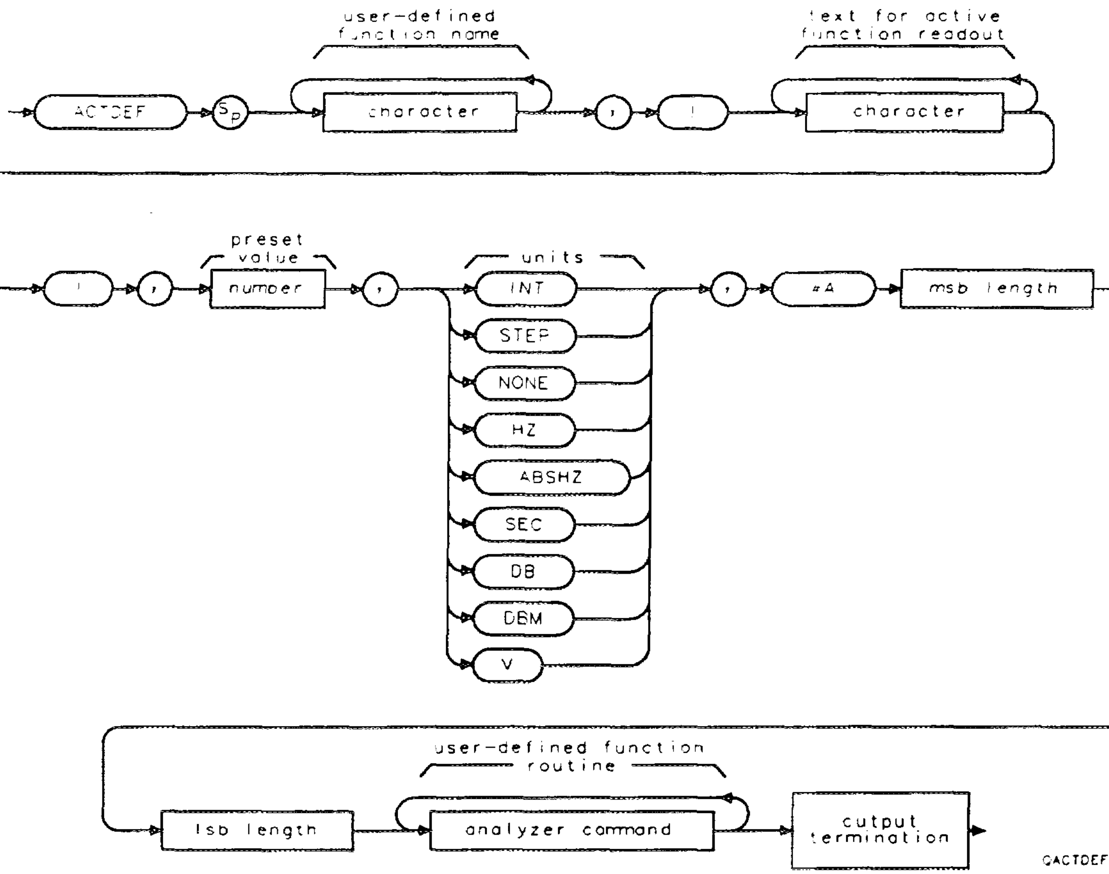
There are two ways to query the ACTDEF command. Querying the ACTDEF function's name returns the value of the ACTDEF function. For example, if the ACTDEF function's name is TEST, executing `OUTPUT 718;"TEST?;"` returns the value of ACTDEF function TEST in the following format:




001

**ACTDEF Active Function Definition**

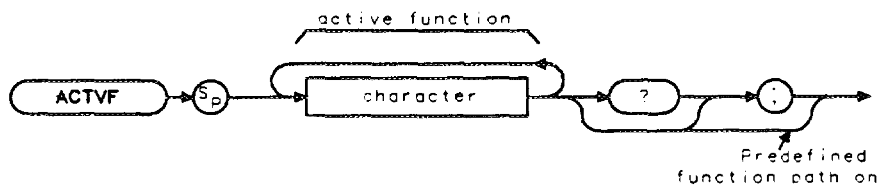
Querying both "ACTDEF" and the ACTDEF function's name returns the definition of the function. For example, execute OUTPUT 718;"ACTDEF TEST?;" (TEST is the ACTDEF function's name).



# ACTVF
# Active Function

Returns a "0" if the given function is not active, a "1" if it is active.

## Syntax




XACTVF

| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | Any active function name. |

Related Commands: Any active function (see the list of active functions in the description below), IP.

## Example

```
OUTPUT 718;"RB 100KHZ;"   Makes resolution bandwidth the active function.
OUTPUT 718;"ACTVF RB;"    Determines if resolution bandwidth is the active function.
ENTER 718;A               Gets the response from the spectrum analyzer.
DISP A                    Displays response from the spectrum analyzer.
```

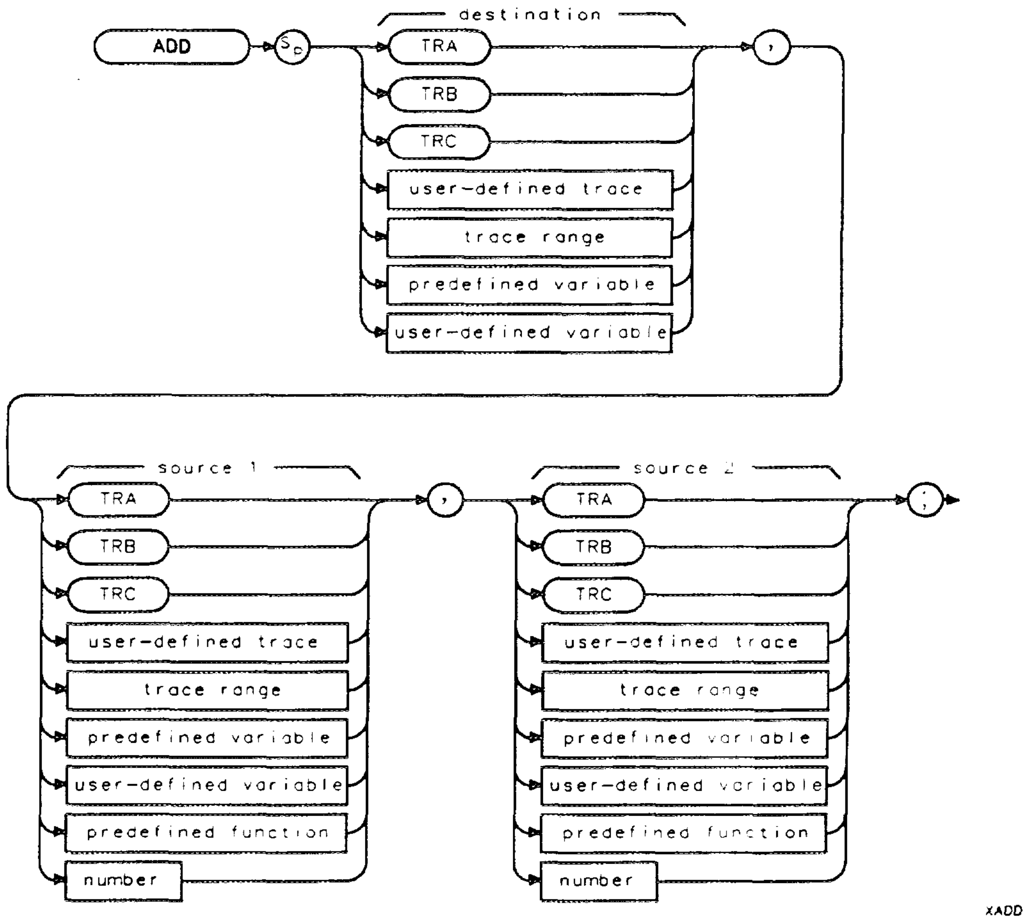
## Description

The active functions are ACPBW, ACPSP, AT, BAUDRATE, CF, COUPLE, CRTHPOS, CRTVPOS, DA, DET, DL, DOTDENS, FA, FB, FFTSTOP, FMGAIN, FOFFSET, GATECTL, GD, GL, GP, INZ, LG, MKA, MKD, MKFC, MKFCR, MKN, MKPAUSE, MKPX, ML, MODE, MSI, M4, NDB, NRL, PREAMPG, PRNTADRS, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCALC, SRCAT, SRCPOFS, SRCPSTP, SRCPSWP, SRCPWR, SRCTK, SWPCPL, SS, ST, TH, TIMEDATE, TVSYNC, TVLINE, VAVG, VB, VBR, ZMKSPAN, ZMKCNTR and user-defined active function specified by the ACTDEF command.

# ADD
# Add

*Adds the sources and sends the sum to the destination.*

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using user-defined trace. ACTDEF or VARDEF when using user-defined variable. TS when using trace data.
Related Commands: AMBPL, APB, SUB.

## Example

Add 38 MHz to the center frequency, then store the sum in a user-defined variable.

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"CF 300MHZ;" | *Changes the center frequency.* |
| 30 OUTPUT 718;"VARDEF N_EW,0;" | *Defines a variable, N_EW, and initializes it to 0.* |
| 40 OUTPUT 718;"ADD N_EW,CF,38E6;" | *Adds 38 MHz to the center frequency, then places the sum in N_EW.* |
| 50 OUTPUT 718;"N_EW?;" | *Returns value of N_EW to the computer.* |
| 60 ENTER 718;Freq | *Assigns value to variable, Freq.* |
| 70 DISP Freq | *Displays Freq on computer display.* |
| 80 END | |

## Description

The ADD command adds values of source 1 and source 2 (point by point), and sends the sum to the destination.

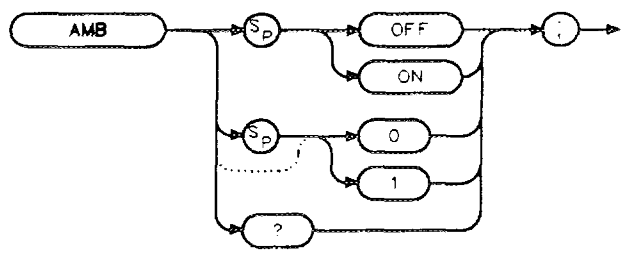
Traces, user-defined traces, and trace ranges are added as 16-bit integers. Negative numbers are represented in two's complement format. Single variables and numbers are treated as floating point numbers and must be within the real number range as defined in Table 5-1.

The sources and destination may be different lengths. The length of predefined traces (trace A, trace B, or trace C) is 401. User-defined traces have a length of up to 2047, and variables have a length of 1. When sources differ in length, the last element of the shorter source is repeated for the addition process. After the addition, the last element is repeated if the destination is longer than the sum trace. When the sources are longer than the destination, they are truncated to fit.

# AMB
# Trace A Minus Trace B

Subtracts trace B from trace A and sends the result to trace A during every sweep of the spectrum analyzer.

## Syntax




XAMB

Preset State: AMB OFF.
Related Commands: CLRW, CONTS, MXMH, SNGLS, TS, VAVG, VIEW.
Restrictions: Not compatible with Analog+ display mode. See "ANLGPLUS" for more information.

Equivalent Softkey: **A – B -> A ON OFF**.

## Example 1

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"CLRW TRB;TS;VIEW TRB;AMB ON;"` | *Displays trace B and turns on the AMB function. If trace A and trace B contain exactly the same trace data, the result is trace data at 0 measurement units, at the bottom of the display.* |
| `30 OUTPUT 718;"AMB?;"` | *Queries the state of the AMB function.* |
| `40 ENTER 718;Reply$` | *The query response is placed in a string variable.* |
| `50 DISP Reply$` | *"ON" is displayed on the computer display.* |
| `60 END` | |

## Example 2

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"MOV TRA, 8000;"` | *Each element of trace A is set to 8000 measurement units, which is equal to 0 dBm.* |
| `30 OUTPUT 718;"VIEW TRA;"` | *Places trace A in the view mode.* |
| `40 OUTPUT 718;"MOV TRB,7000;"` | *Each element of trace B is set to 7000 measurement units, which is equal to –10 dBm.* |
| `50 OUTPUT 718;"VIEW TRB;"` | *Places trace B in the view mode.* |
| `60 OUTPUT 718;"AMB ON;"` | *Subtracts trace B from trace A.* |

```
70 OUTPUT 718;"BLANK TRB;VIEW TRA;"
```
*The result is displayed at 1000 measurement units, which is equal to −70 dBm.*

```
80 END
```

## Example 3

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;RL 20DB;"` | *Initializes the spectrum analyzer and sets the reference level.* |
| `20 OUTPUT 718;"MOV TRA,5000;"` | *Sets trace A to 5000 measurement units, which is equal to −10 dBm.* |
| `30 OUTPUT 718;"VIEW TRA;"` | *Places trace A in the view mode.* |
| `40 OUTPUT 718;"MOV TRB,4000;"` | *Sets trace B to 4000 measurement units, which is equal to −20 dBm.* |
| `50 OUTPUT 718;"VIEW TRB;"` | |
| `60 OUTPUT 718;"DL 0DB;"` | *Sets display line to 0 dBm, which is at 6000 measurement units.* |
| `70 OUTPUT 718;"BML;"` | *Subtracts trace B minus display line. Result is 4000 − 6000 = −2000 measurements units (off screen).* |
| `80 OUTPUT 718;"AMB ON;"` | *Subtracts trace A minus modified trace B (5000 −(−2000) = 7000 or 10 dBm. Notice that this has resulted in a subtraction of amplitude in dBm, −10 dBm −(−20 dBm) = 10 dBm.* |
| `90 OUTPUT 718;"BLANK TRB;VIEW TRA;"` | |
| `100 END` | |

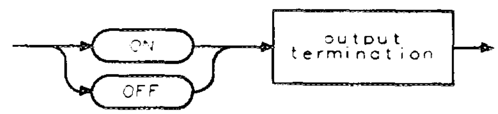
## Description

The AMB command subtracts trace B from trace A (point by point), and sends the result to trace A. The AMB function remains in effect until it is turned off by executing "AMB OFF;".

The AMB command is a trace math command and subtracts trace B from trace A in measurement units (see "CTA" for information about measurement units). Because subtracting trace B from trace A can cause the result in trace A to be displayed off screen, the trace A minus trace B plus display line (AMBPL) command can be used. As shown in example 2, if the trace data value of trace A is 0 dBm (8000 measurement units), and trace B is −10 dBm (7000 measurement units), the result of executing AMB is 1000 measurement units. If the AMBPL command is used instead of AMB, and the display line is set at −50 dBm (mid-screen), the result in trace A is kept at mid-screen.

A common use of trace subtraction is to normalize one trace with respect to another. For example, traces are frequently subtracted to normalize the spectrum analyzer response when a tracking generator is used. In such applications, amplitude units in dBm should be subtracted. As shown in example 2, subtraction of measurement units is not equivalent to subtraction of amplitude units. Correct results are obtained if the display line is set to 0 dBm using DL, and BML is used to subtract the display line from trace B. See example 3 for an example of subtracting the display line from trace B.

## Query Response

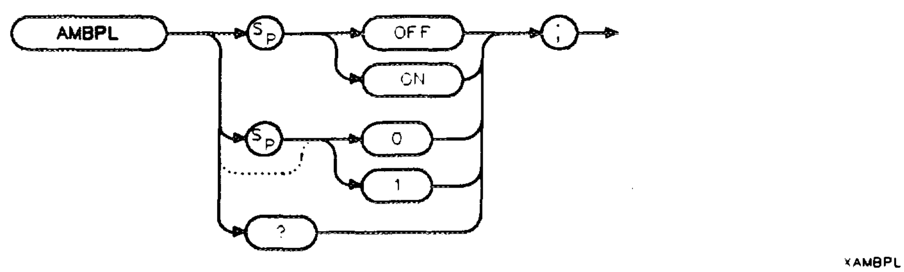



002

# AMBPL
# Trace A Minus Trace B Plus Display Line

Subtracts trace B from trace A, adds the display line value to the difference, and sends the result to trace A during every sweep of the spectrum analyzer.

## Syntax




Equivalent Softkey: **NORMLIZE ON OFF**.
Preset State: AMBPL OFF.
Related Commands: ADD, AMB, CONTS, CLRW, DL, MXMH, SNGLS, SUB, TS, VAVG, VIEW.
Restrictions: Not compatible with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;RL 20DB;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 OUTPUT 718;"MOV TRA,5000;"` | *Sets trace A to 5000 measurement units, which is equal to −10 dBm.* |
| `30 OUTPUT 718;"VIEW TRA;"` | |
| `40 OUTPUT 718;"MOV TRB,4000;"` | *Sets trace B to 4000 measurement units, which is equal to −20 dBm.* |
| `50 OUTPUT 718;"VIEW TRB;"` | |
| `60 OUTPUT 718;"DL ODM;"` | *Sets display line to 0 dBm, which is at 6000 measurement units.* |
| `70 OUTPUT 718;"AMBPL ON;"` | *Performs trace A − trace B + display line. The result is 5000 − 4000 + 6000 = 7000 or 10 dBm. Note that this has resulted in a subtraction of amplitude in dBm, −10 dBm −(−20 dBm) = 10 dBm.* |
| `80 OUTPUT 718;"BLANK TRB;VIEW TRA;"` | |
| `90 END` | |

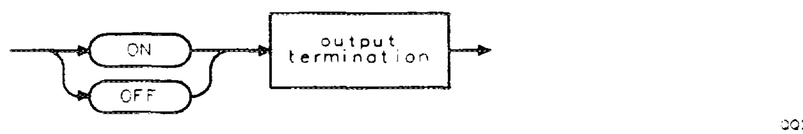
**AMBPL Trace A Minus Trace B Plus Display Line**

## Description

The AMBPL command subtracts trace B from trace A (point by point), adds the display line value to the difference, and sends the result to trace A. The AMBPL function remains in effect until it is turned off by executing "AMBPL OFF;".

A common use of trace subtraction is to normalize one trace with respect to another. For example, traces are frequently subtracted to normalize the spectrum analyzer response when a tracking generator is used. In such applications, amplitude units in dBm should be subtracted. To accomplish this, the display line should be set to 0 dBm using DL as shown in the example. To compare how you would use the AMB command to do the same operation, see examples 2 and 3 for the AMB command.

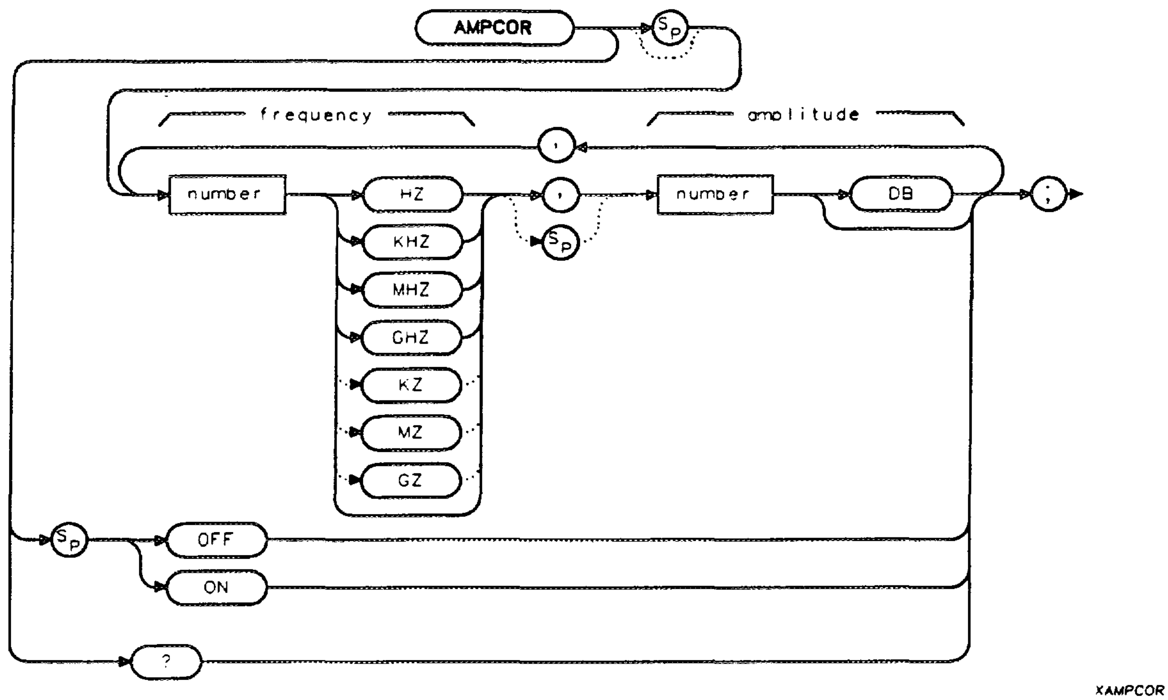
## Query Response



# AMPCOR
# Amplitude Correction

Applies amplitude corrections at specified frequencies.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dB. | Frequency: 0 to 1000 GHz Amplitude: ±327 dB. |

Equivalent Softkeys: the softkeys accessed by **Amp Cor**.
Preset State: AMPCOR OFF.
Related Commands: AMPLEN, AT, RL.

## Example

Compensate for frequency-dependent amplitude inaccuracies at the input.

| | |
|---|---|
| 10 DIM A$[200] | |
| 20 OUTPUT 718;"CF 1GHZ;SP 200MHZ;" | *Sets center frequency and span.* |
| 30 OUTPUT 718;"AMPCOR 100MHZ,5DB, 1GHZ,-5DB,1.5GHZ,10DB;" | *Stores frequency-amplitude pairs in spectrum analyzer. Notice that frequencies are in ascending order.* |
| 40 OUTPUT 718;"AMPCOR?;" | *Returns correction values to computer.* |
| 50 ENTER 718;A$ | |
| 60 PRINT A$ | *Displays the frequency-amplitude pairs.* |
| 70 OUTPUT 718;"AMPCOR OFF;" | *Turns off the amplitude correction constants.* |

```
80     OUTPUT 718;"AMPCOR?;"
90     ENTER 718;A$
100    PRINT A$
110    END
```

*Because AMPCOR is off, "0,0" is displayed.*

## Description

Use AMPCOR to compensate for frequency-dependent amplitude variations at the spectrum analyzer input. Up to 79 pairs of frequency-amplitude correction points can be entered. The frequency values entered must either be equal or in increasing order, or an error condition results. Whenever AMPCOR is on, the correction values are added to all measurement results. Executing "AMPCOR ON;" or entering frequency and amplitude corrections, turns on the amplitude correction factors. Performing an instrument preset (IP) or turning off the spectrum analyzer sets AMPCOR to OFF. (Setting AMPCOR to OFF does not change the frequency-amplitude correction factors that have been entered.)

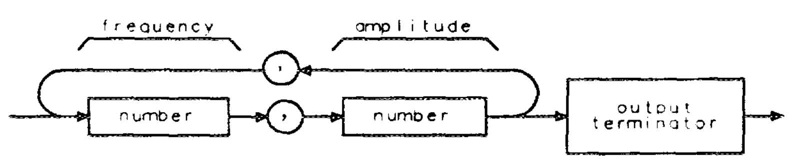
The values of the correction points are applied across the active measurement range. Between points, the correction values are interpolated. When measuring at frequencies outside the first and last correction points, these values are used as the correction value. If you do not want any amplitude correction outside of the first and last correction points, set the amplitude correction to 0 at the frequencies that are outside of the first and last correction values.

**With the Analog+ display mode:** When the Analog+ display mode is turned on, AMPCOR applies only one amplitude correction across the displayed frequency span. When the Analog+ display mode is turned on, the amplitude correction for the current center frequency is used over the entire frequency span.

Amplitude correction factors can be stored in spectrum analyzer memory with the SAVET or SAVRCLN commands, or on the memory card with the STOR or SAVRCLN commands. The amplitude correction factors can be edited and viewed with the Amp Cor softkey functions.

## Query Response

AMPCOR? returns the frequency and amplitude correction pairs.



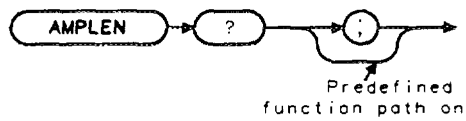

QAMPCOR

Returned values are 0,0 when AMPCOR is set to OFF.

# AMPLEN
# Amplitude Correction Length

Returns the number of frequency-amplitude correction factors that have been entered.

## Syntax




XAMPLEN

Related Commands: AMPCOR.

## Example

```
OUTPUT 718;"AMPLEN?;"
```

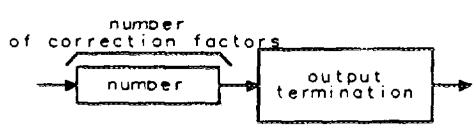
## Description

The absolute value of the number that AMPLEN? returns is the number of frequency-amplitude correction factors that have been entered. If no amplitude correction factors have been entered, AMPLEN? returns a 0. (See "AMPCOR" for more information about frequency-amplitude correction factors.)

AMPLEN returns the number of frequency-amplitude correction factors as a positive or negative number. If AMPLEN returns a positive number, the frequency-amplitude correction factors are turned on. If AMPLEN returns a negative number, the frequency-amplitude correction factors are turned off.

## Query Response

AMPLEN can return a number from 80 to −80.

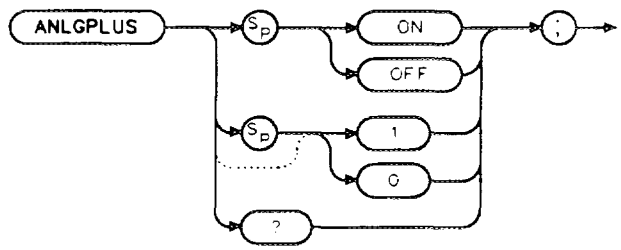



OAMPLEN

# ANLGPLUS
# Analog Plus

Turns on or off the Analog+ display mode.

## Syntax




XANLGPLUS

Equivalent Softkey: **ANALOG+ ON OFF** .
Required Option: Option 101 or 301.
Preset State: ANLGPLUS OFF.
Related Commands: DOTDENS.

## Example

`OUTPUT 718;"ANLGPLUS ON;"` *Turns on the Analog+ display mode.*

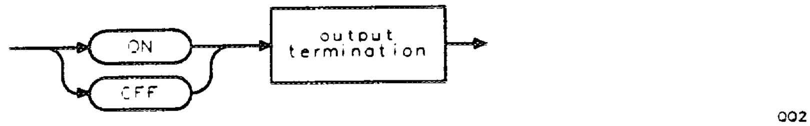
## Description

The Analog+ display mode enables the trace display to emulate an analog display. Emulating an analog display means that a dot density of up to 40 dots per trace element can be obtained instead of the usual one point per trace element.

**Restrictions:** Analog+ display mode is only available with sweeptimes greater than 200 ms. Certain programming commands are not compatible with the Analog+ display mode. You should not use the Analog+ display mode with the following programming commands: AMB, AMBPL, AXB, BML, CLRW (TRB or TRC only), DEMOD, FFT, FFTAUTO, FFTCONTS, FFTSNGLS, LIMITEST, MEANTH, MINH, MKFC, MKPAUSE, MKSTOP, MKTRACK, MXMH, ONMKR, PLOT, PP, SPZOOM, SRCTKPK, TH, TRDSP, VAVG, and VIEW.

Some programming commands allow you to specify a destination trace for the trace results. If you are using the Analog+ display mode and you specify trace A as the destination trace, the trace results are moved into the 401 point trace and not into the dots on the display. The dots on the display remain unchanged. The programming commands that allow you to specify trace A as the destination trace are as follows: ABS, ADD, APB, AVG, COMPRESS, CONCAT, DIV, EXP, INT, LOG, MIN, MIRROR, MOD, MOV, MPY, MXM, PDA, PDF, PEAKS, SMOOTH, SQR, SUB, TRA, TWNDOW, XCH.

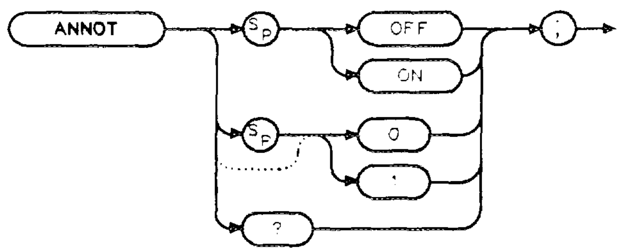
## Query Response



# ANNOT
# Annotation

Turns on or off the display annotation.

## Syntax




XANNOT

Equivalent Softkey: **ANNOTATN ON OFF** .
Preset State: ANNOT ON.
Related Commands: GRAT, TITLE.

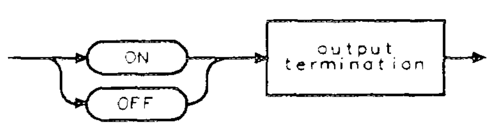
## Example

```
10 OUTPUT 718;"ANNOT ON;"    Turns on the annotation.
20 OUTPUT 718;"ANNOT?;"      Queries state of the annotation function.
30 ENTER 718;Reply$          Places response in a variable.
40 DISP Reply$               Displays response on the computer screen.
50 END
```

## Description

The ANNOT command turns on or off all the words and numbers (annotation) on the spectrum analyzer display (except for the softkey labels).

## Query Response




QQ2

# APB
# Trace A Plus Trace B

Adds trace A to trace B and sends the result to trace A.

## Syntax


XAPB

Related Commands: CLRW, SNGLS, TS, VIEW.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer, changes to single-sweep mode.* |
| `20 OUTPUT 718;"TS;"` | *Updates the trace.* |
| `30 OUTPUT 718;"VIEW TRA;RL -20DM;CLRW TRB;"` | *Changes the reference level.* |
| `40 OUTPUT 718;"TS;VIEW TRB;"` | *Takes a measurement sweep.* |
| `50 OUTPUT 718;"APB;"` | *Activates APB command.* |
| `60 OUTPUT 718;"BLANK TRB;VIEW TRA;"` | *Displays the result of APB.* |
| `70 END` | |

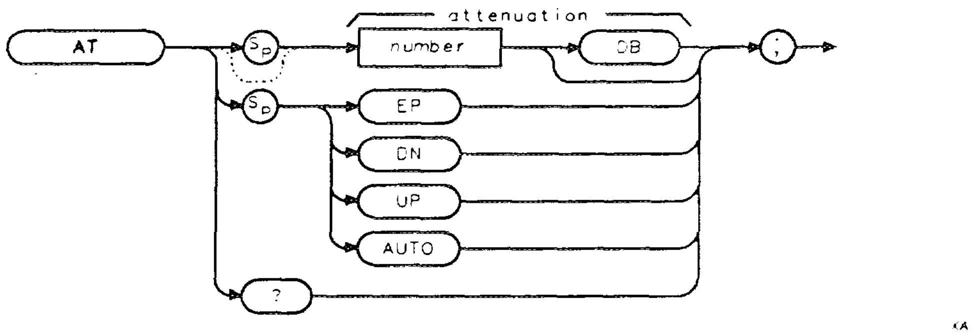
## Description

The traces are added as 16-bit integers. Negative numbers are represented in two's complement format. The two's complement representation of a negative number is obtained by changing the 1s to 0s in the binary representation of the number, and then binarily adding 1.

# AT
# Attenuation

Specifies the RF input attenuation.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer. Default units are dB. | Input attenuator range of spectrum analyzer. |

Equivalent Softkey: **ATTEN AUTO MAN** is similar.
Preset State: 10 dB.
Step Increment: in 10 dB steps.
Related Commands: AUTO, ML, RL.

## Example

`OUTPUT 718;"AT 40DB;"` *Sets the attenuation to 40 dB.*
`OUTPUT 718;"AT UP;"` *Increases the attenuation to 50 dB.*

## Description

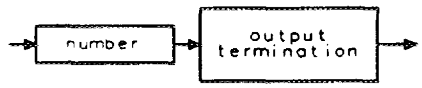
The AT command specifies the input attenuation in 10 dB steps. Normally, the input attenuator is coupled to the reference level. When a continuous wave signal is displayed with its peak at or below the reference level, the coupling keeps the mixer input level at or below the specified level (also see the command "ML"). The AT command allows less than the specified value at the mixer input.

When the attenuation is increased with the AT command, the reference level does not change. If the attenuation is decreased from the coupled value using the AT command, the reference level will be decreased. When the reference level is changed using the RL command, the input attenuation changes to maintain a constant signal level on the screen if attenuation is auto-coupled. Using auto-coupling resets the attenuation value so that a continuous wave signal displayed at the reference level yields −10 dBm (or the specified mixer level) at the mixer input.

The step keys, knob, and DN parameter do not allow an attenuation entry below 10 dB. Only direct entry of "AT 0DB;" will achieve 0 dB attenuation.

**Caution** Signal levels above +30 dBm will damage the spectrum analyzer.

## Query Response

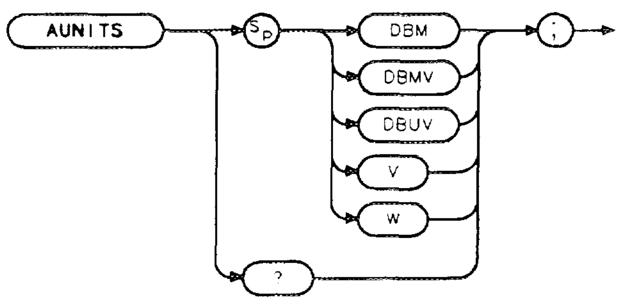



001

# AUNITS
# Amplitude Units

Specifies the amplitude units for input, output, and display.

## Syntax




YAUNITS

Equivalent Softkey: **Amptd Units** .

Related Commands: CAL, DL, MKA, RL, TH.

## Example

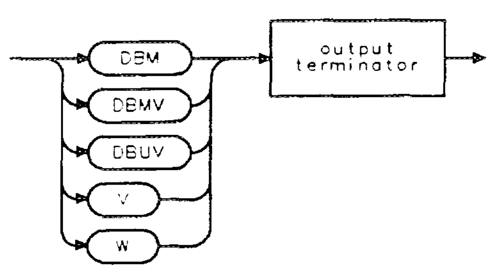
| | |
|---|---|
| `OUTPUT 718;"LN;"` | *Changes spectrum analyzer to linear mode.* |
| `OUTPUT 718;"AUNITS DBMV;"` | *Changes the linear amplitude units to DBMV.* |
| `OUTPUT 718;"AUNITS?;"` | *Queries current amplitude units.* |
| `ENTER 718;Reply$` | *Puts response in a variable.* |
| `DISP Reply$` | *Displays response on the computer screen.* |

## Description

The AUNITS command sets the amplitude readouts (reference level, marker, display line, and threshold) to the specified units. Different amplitude units can be set for log and linear amplitude scales.

## Query Response

The query response returns the current amplitude units for the current amplitude scale.

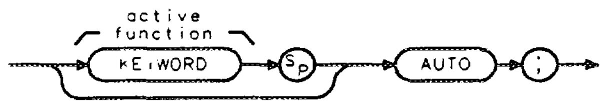



QAUNITS

# AUTO
# Auto Couple

Couples the active functions automatically.

## Syntax




QAUTO

Related Commands: AT, DL, HD, MKA, MKD, MKF, MKFCR, MKN, RB, SRCPSTP, SRCPSWP, SRCPWR, SS, ST, TH, VAVG, VB, VBR.

## Example

| | |
|---|---|
| `OUTPUT 718;"AT AUTO;"` | *Couples the attenuation.* |
| `OUTPUT 718;"HD;AUTO;"` | *Couples all functions.* |
| `OUTPUT 718;"AUTO;"` | *Couples and deactivates a related function (if one was active), or couples all functions (if no functions were active).* |

## Description

The result of the AUTO command depends on the active function it acts upon. The following are the functions that are affected by the AUTO parameter:

| | |
|---|---|
| AT | couples attenuation to the reference level. |
| DL | turns off display of line but does not change the value of the display line. |
| MKA | turns off marker. |
| MKD | turns off marker. |
| MKF | turns off marker. |
| MKFCR | deactivates use of user-supplied counter resolution value, however, the value remains unchanged. |
| MKN | turns off marker. |
| RB | couples resolution bandwidth to frequency span. |
| SRCPSTP | sets source power step to 0 (it may value may be displayed at 10 however). |
| SRCPSWP | turns off power sweep. |
| SRCPWR | turns off source power. |
| SS | couples step size to frequency span. |
| ST | couples sweep time to frequency span. |
| TH | turns off display of threshold, but does not change its value or prevent usage in peak searching. |
| VAVG | stops averaging. |
| VB | couples video bandwidth to resolution bandwidth. |
| VBR | sets the video to bandwidth ratio to 0.3. |

Individual functions can be coupled by entering the keyword for the command before AUTO, (for example, "AT AUTO;").

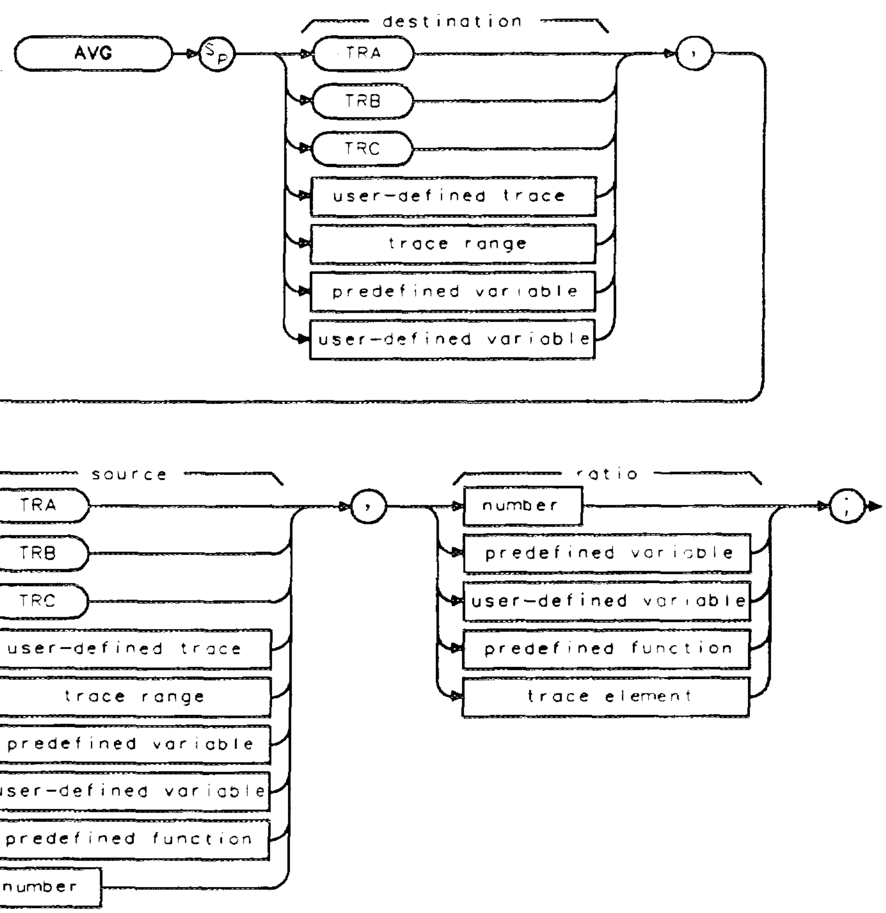
AUTO has no effect if the active function is not in the above list.

Executing "AUTO;" if no functions are active couples all functions. Executing "HD;AUTO;" couples all functions, turns off the reference position, and turns off normalization.

# AVG
# Average

Averages the source and the destination.

## Syntax




XAVG

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: CLRAVG, TS.

## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"SNGLS;" | *Activates single-sweep mode.* |
| 30 OUTPUT 718;"DET POS;TS;" | *Activates the positive-peak detector and updates the trace.* |
| 40 OUTPUT 718;"VIEW TRA;" | *Stores results and displays trace A.* |
| 50 OUTPUT 718;"DET SMP;" | *Activates sample detection.* |
| 60 OUTPUT 718;"CLRW TRB;TS;" | *Activates trace B and takes a sweep of trace B.* |
| 70 OUTPUT 718;"VIEW TRB;" | *Displays trace B.* |
| 80 OUTPUT 718;"AVG TRA,TRB,2;" | *Averages traces B and A with ratio of 2 and stores the result in trace A.* |
| 90 OUTPUT 718;"BLANK TRB;" | *Blanks trace B and displays result in trace A.* |
| 100 END | |

## Description

The AVG command averages the source and the destination and then stores the result in the destination according to the following algorithm:

$$\text{Average} = \frac{((\text{ratio} - 1) \times \text{destination}) + \text{source}}{\text{ratio}}$$

The results of AVG are invalid if the ratio is equal to zero.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# AXB
# Exchange Trace A and Trace B

Exchanges trace A and trace B.

## Syntax


XAXB

Equivalent Softkey: **A <- -> B**.

Related Commands: CLRW, SNGLS, TS, VIEW.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `30 OUTPUT 718;"DET POS;TS;"` | *Activates positive-peak detection of trace A.* |
| `40 OUTPUT 718;"VIEW TRA;"` | *Stores results, displays trace A.* |
| `50 OUTPUT 718;"DET SMP;"` | *Activates sample detection.* |
| `60 OUTPUT 718;"CLRW TRB;TS;"` | *Clear-writes trace B and takes sweep.* |
| `70 OUTPUT 718;"VIEW TRB;"` | *Stores results of sweep in trace B.* |
| `80 OUTPUT 718;"AXB;"` | *Exchanges trace A with trace B.* |
| `90 OUTPUT 718;"BLANK TRB;"` | *Blanks trace B, leaving only trace A on screen.* |
| `100 END` | |

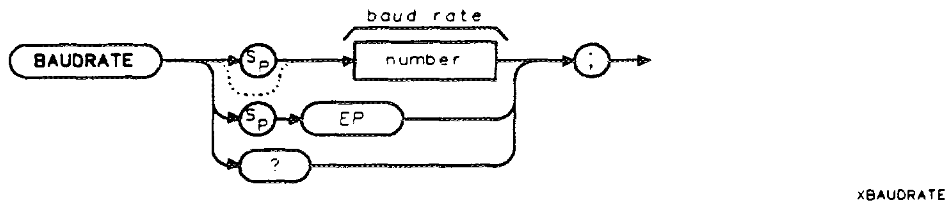
## Description

The AXB command exchanges trace A and trace B, point by point. AXB sets trace A and trace B to the view mode.

# BAUDRATE
# Baud Rate of Spectrum Analyzer

Specifies the baud rate of a spectrum analyzer with Option 023 (the RS-232 interface) installed in it.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 4 to 57600. |

Equivalent Softkey: **BAUD RATE**.
Option Required: Option 023.

## Example

The following example allows you to use a softkey to change the baud rate of the spectrum analyzer to 2400 baud. The softkey (key number 1) can be accessed by pressing (USER/MEAS), **User Menus**.

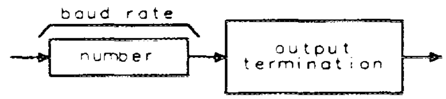
```
PRINT #1,"KEYDEF 1,%BAUDRATE 2400;%,$BAUDRATE|2400$;"
```

## Description

The BAUDRATE command changes the baud rate of the spectrum analyzer to one of the standard baud rates. The standard baud rates are as follows: 300, 1200, 2400, 4800, 9600, and 19200. If you specify a baud rate other than one of the standard baud rates, the nearest standard baud rate will be used.

To communicate with the computer, the baud rates of the spectrum analyzer and the computer must be the same. Because changing the baud rate of the spectrum analyzer within a program ends communication with the computer, you should only use BAUDRATE within a downloadable program or when using the external keyboard to enter programming commands. To reestablish communication with the computer, you must set the baud rate back to the baud rate of the computer.

## Query Response

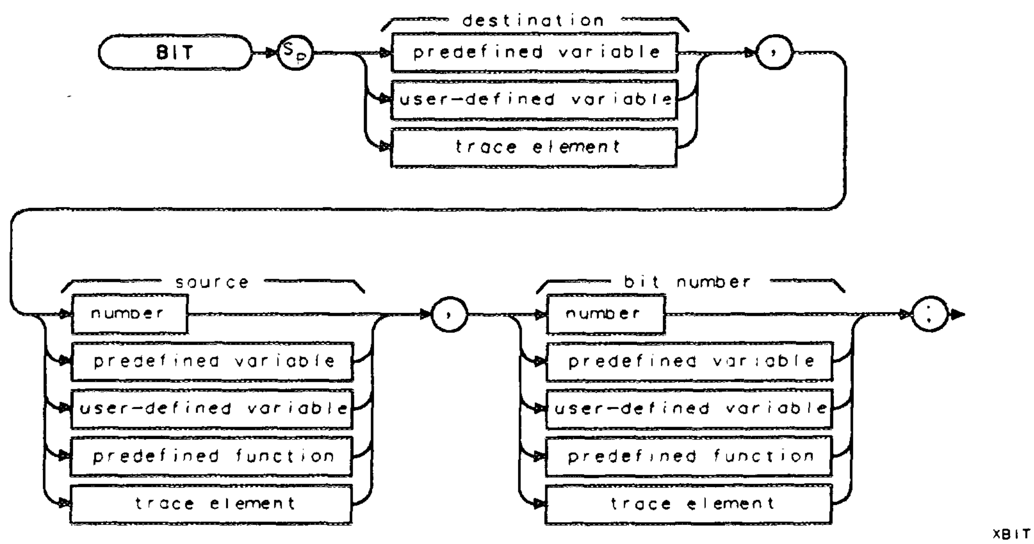



QBAUDRATE

# BIT
# Bit

Places the state ("1" or "0") of a bit in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number (source) | Any valid integer number. | 64-bit integer. |
| Number (bit number) | Any valid integer number. | 0 to 63. |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: INT, STB.

## Example

| | |
|---|---|
| `10 CLEAR 718` | *Clears HP-IB bus.* |
| `20 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `30 OUTPUT 718;"VARDEF E_RROR,0;"` | *Defines user-defined variable E_RROR and sets it equal to 0.* |
| `40 OUTPUT 718;"BIT E_RROR,STB,5;"` | *Stores value of bit 5 of status byte in E_RROR.* |
| `50 OUTPUT 718;"E_RROR?;"` | *Returns value of E_RROR.* |
| `60 ENTER 718;Err` | *Assigns value to computer variable, Err.* |
| `70 IF NOT Err THEN DISP "NO ";` | *If Err equals zero, displays "NO" on computer screen.* |
| `80 DISP "ERROR PRESENT";` | *Displays "ERROR PRESENT" on computer screen.* |
| `90 END` | |

## Description

The BIT places either a "0" or a "1" in the destination. A "0" indicates the bit is off, a "1" indicates the bit is on.

**Specifying the bit number:** When you specify the bit number, remember the following:

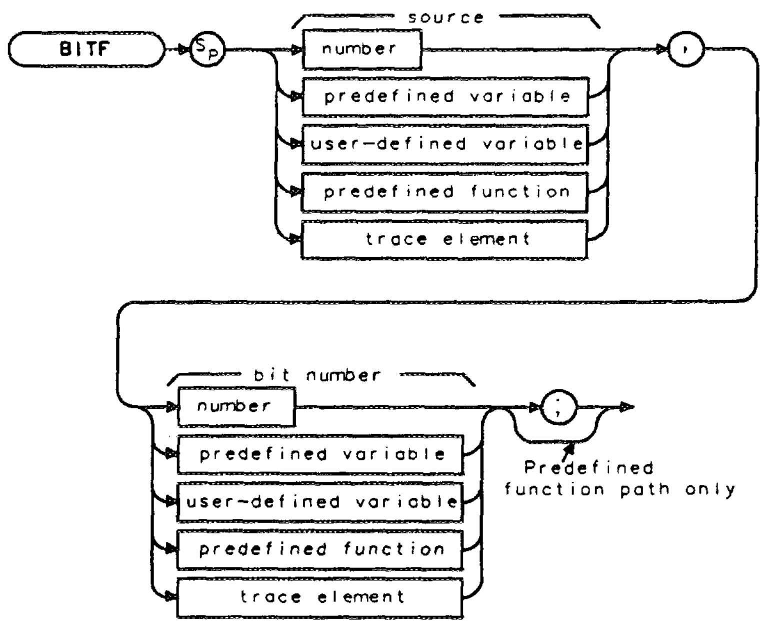
- The bit number is limited from 0 to 63. If you enter a negative number for the bit number, the bit number defaults to 0. If you enter a number that is greater than 63, the bit number defaults to the remainder of the number divided by 64.
- The least significant bit is bit 0. The most significant bit is bit 63.
- Floating-point numbers are changed to a 64-bit integer before BIT is executed.

The BIT command can be used to determine information about the status byte or a memory card inserted into the spectrum analyzer's memory card reader. (See "HAVE" for more information about determining information about the memory card.)

# BITF
# Bit Flag

Returns the state ("1" or "0") of a bit.

## Syntax




XBITF

| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number (source) | Any valid integer number. | 64-bit integer. |
| Number (bit number) | Any valid integer number. | 0 to 63. |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: BIT.

## Example

```
10 CLEAR 718                        Clears HP-IB bus.
20 OUTPUT 718;"IP;"                 Initializes spectrum analyzer.
30 OUTPUT 718;"BITF STB,5;"         Determines the value of bit 5 of status byte.
40 ENTER 718;Err                    Assigns value to computer variable, Err.
50 IF NOT Err THEN DISP "NO ";      If Err equals zero, displays "NO" on computer screen.
60 DISP "ERROR PRESENT";            Displays "ERROR PRESENT" on computer screen.
70 END
```

## Description

The value returned by BITF is either a "0" or a "1." A "0" indicates the bit is off, a "1" indicates the bit is on. Unlike BIT, BITF returns the state of the bit directly; the state of the bit is not stored in a destination.

**Specifying the bit number:** When you specify the bit number, remember the following:

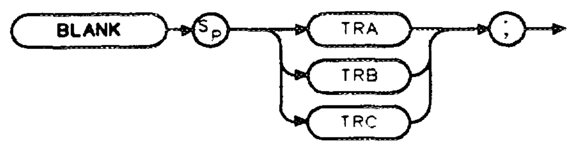
- The bit number is limited from 0 to 63. If you enter a negative number for the bit number, the bit number defaults to 0. If you enter a number that is greater than 63, the bit number defaults to the remainder of the number divided by 64.
- The least significant bit is bit 0. The most significant bit is bit 63.
- Floating-point numbers are changed to a 64-bit integer before BITF is executed.

The BITF command can be used to determine information about the status byte or a memory card inserted into the spectrum analyzer's memory card reader. (See "HAVE" for more information about determining information about the memory card.)

# BLANK
# Blank Trace

Blanks trace A, trace B, or trace C and stops taking new data into the specified trace.

## Syntax




XBLANK

Equivalent Softkeys: **BLANK A**, **BLANK B**, and **BLANK C**.
Preset State: BLANK TRB, BLANK TRC.
Related Commands: CLRW, MXMH, TRDSP, VIEW.

## Example

```
OUTPUT 718;"BLANK TRA;"
```

# BML
# Trace B Minus Display Line

Subtracts display line from trace B and places the result in trace B.

## Syntax


XBML

Equivalent Softkey: `B – DL -> B`.

Related Commands: BLANK, CLRW, SUB, TS.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 OUTPUT 718;"BLANK TRA;"` | *Blanks trace A.* |
| `30 OUTPUT 718;"CLRW TRB;TS;"` | *Clear-writes trace B, takes sweep.* |
| `40 OUTPUT 718;"DL -70DM;"` | *Sets the display line to −70 dBm.* |
| `50 OUTPUT 718;"BML;"` | *Activates BML function.* |
| `60 END` | |

## Description

The BML command subtracts the display line from trace B (point by point), and sends the difference to trace B.

# BTC
# Transfer Trace B to Trace C

Transfers trace B into trace C.

## Syntax


XBTC

Equivalent Softkey: `B -> C`.

Related Commands: BLANK, CLRW, SNGLS, TS, VIEW.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `30 OUTPUT 718;"BLANK TRA;"` | *Blanks trace A.* |
| `40 OUTPUT 718;"CF 300 MHZ;SP 1MHZ;"` | *Sets up measurement range.* |
| `50 OUTPUT 718;"CLRW TRB;TS;"` | *Takes measurement sweep.* |
| `60 OUTPUT 718;"BTC;"` | *Moves trace B to trace C.* |
| `70 OUTPUT 718;"BLANK TRB;VIEW TRC;"` | *Displays result in trace C.* |
| `80 END` | |

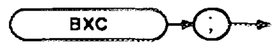
## Description

The BTC command moves trace B into trace C, then stops updating trace C by placing it in the view mode. Trace B is unchanged by BTC. Trace B must contain a complete sweep of measurement information.

# BXC
# Trace B Exchange Trace C

Exchanges trace B and trace C.

## Syntax




xBxC

Equivalent Softkey: B <--> C .
Related Commands: BLANK, CLRW, SNGLS, TS.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;BLANK TRA"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `30 OUTPUT 718;"DET POS;CLRW TRB;TS;"` | *Activates positive-peak detection of trace B.* |
| `40 OUTPUT 718;"VIEW TRB;"` | *Stores results and displays trace B.* |
| `50 OUTPUT 718;"DET SMP;CLRW TRC;"` | *Activates sample detection.* |
| `60 OUTPUT 718;"TS;"` | |
| `70 OUTPUT 718;"VIEW TRC;"` | *Stores results of sweep in trace C.* |
| `80 OUTPUT 718;"BXC;"` | *Exchanges trace B with trace C.* |
| `90 OUTPUT 718;"BLANK TRB;"` | *Blanks trace B leaving only trace C on screen.* |
| `100 END` | |

## Description

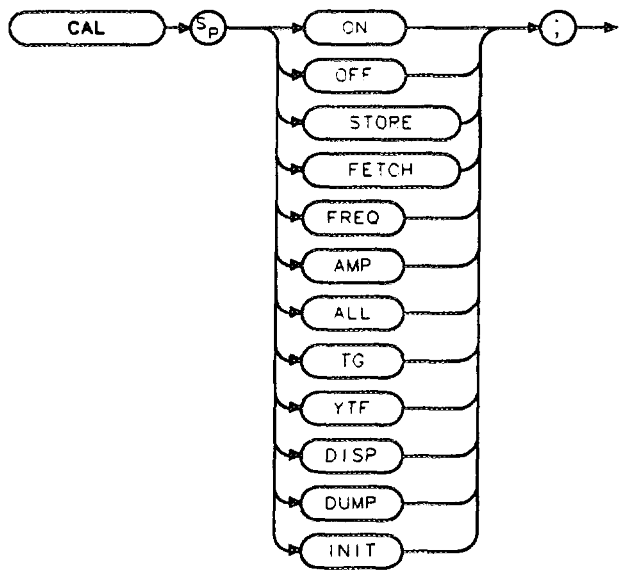
The BXC command exchanges the contents of traces B and C, then places both traces in the view mode.

To retain all data, trace B and trace C should contain a complete sweep of measurement data before BXC is executed.

# CAL
# Calibration

Initiates self-calibration routines.

## Syntax




XCAL

## Example

OUTPUT 718;"CAL FREQ;" *Performs the frequency correction routine.*

## Description

The CAL command controls calibration functions. CAL initiates action according to the CAL parameters. The various parameters correspond to spectrum analyzer softkeys as shown below.

**ON** turns correction factors on and corresponds to **CORRECT ON OFF** (ON is underlined). (See also "CORREK.")

**OFF** turns correction factors off and corresponds to **CORRECT ON OFF** (OFF is underlined). (See also "CORREK.")

**STORE** moves the correction factors to an area of spectrum analyzer memory that is accessed when the spectrum analyzer is powered on. STORE corresponds to **CAL STORE**. The CAL STORE command cannot be executed if the correction data is not valid. Correction data is valid if **CORRECT ON OFF** (ON is underlined) causes CORR to be displayed on the spectrum analyzer display. Executing the CAL STORE command with invalid data generates an SRQ 110.

**FETCH** recalls the correction factors from the "working" random-access memory. The "working" random-access memory is the section of memory that is accessed when the spectrum analyzer is turned on. CAL FETCH corresponds to **CAL FETCH**.

**Note**

Execute CAL STORE after successful completion of the self-calibration routines.

Connect a cable between CAL OUT and the spectrum analyzer input before running the CAL FREQ, CAL AMP, or CAL ALL correction routines.

**FREQ** initiates the frequency correction routine and corresponds to **CAL FREQ**.

**AMP** initiates the amplitude correction routine and corresponds to **CAL AMPTD**.

**ALL** initiates frequency and amplitude correction routines. It corresponds to **CAL FREQ & AMPTD**.

**Note**

*For an HP 8592D, HP 8593E, HP 8596E only:* A cable must be connected between COMB OUT and the spectrum analyzer input to use the comb signal for CAL YTF.
*For the HP 8595E only:* Connect the cable between the CAL OUT connector and the spectrum analyzer input.

**YTF** initiates the correction routine for the YIG-tuned filter. The CAL YTF command corresponds to **CAL YTF**. (HP 8592D, HP 8593E, HP 8595E, or HP 8596E only.)

**DISP** displays some of the correction factors on the spectrum analyzer display.

**DUMP** returns correction factors to the controller.

**INIT** sets the calibration data back to predetermined values. CAL INIT corresponds to **DEFAULT CAL DATA**. Before executing CAL INIT, you must set the spectrum analyzer's center frequency −37 Hz to access this function. After CAL INIT has been performed, you should perform CAL YTF for an HP 8592D, HP 8593E, HP 8595E, or HP 8596E.

**Note**

Before executing the CAL TG command, a cable must be connected between the tracking generator output and the spectrum analyzer input.

**TG** performs the calibration routines if the tracking generator is installed (Option 010 or 011). CAL TG corresponds to **CAL TRK GEN**.

Refer to the *HP 8590 Series Spectrum Analyzer User's Guide* for more information about the self-calibration routines, including the correct instrument set-up for each routine.

CAL DISP and CAL DUMP do not return all of the correction factors because the number of characters that can be displayed on the spectrum analyzer screen is limited. CAL DUMP only returns the correction factors (as ASCII values) that would be displayed on the spectrum analyzer screen. Refer to the Service Guide for your spectrum analyzer for more information about displaying calibration data and reinitializing calibration data.

If the calibration data has been corrupted or is obviously inaccurate, use CAL FETCH to retrieve the calibration data that has previously been saved. If the calibration data fetched is corrupt, the following example can be used to set the calibration data back to predetermined values. Execute `OUTPUT 718;"CF -37HZ;CAL INIT;"`, then perform the CAL AMP, CAL FREQ, or CAL ALL calibration routines. Use CAL STORE if the calibration routines have finished successfully.

**Note**

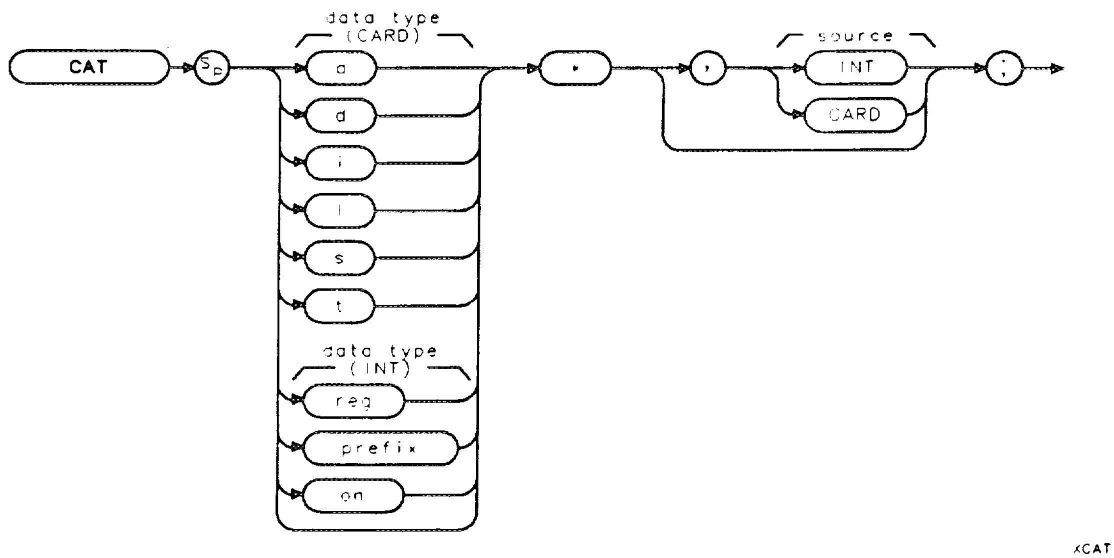
Using the default calibration data may cause the calibration routine to fail. If this occurs, execute "OUTPUT 718;CF -37HZ;" before performing the CAL FREQ or CAL ALL calibration routines.

The take sweep (TS) and DONE commands can be used to indicate that the correction routine has finished. Query the CORREK command to check that the calibration routines have finished successfully.

# CAT
# Catalog

Catalogs either spectrum analyzer memory or the memory card and returns the catalog information to the controller.

## Syntax




Equivalent Softkeys: the functions accessed by **Catalog Internal** or **Catalog Card**.
Related Commands: LOAD, MSI, STOR.

## Example

This example returns the catalog information for the states stored on the memory card. Catalog information is sent as individual catalog lines that are separated by a carriage return and a line feed. A carriage return, a line feed, and a line feed with an EOI (equivalent to a carriage return, a line feed, and a line feed) is asserted after the last item.

| | | |
|---|---|---|
| 10 | `DIM User$[2000],Catalog$(1:100)[80]` | *Dimensions strings to store the catalog information. User$ stores the entire string of catalog information. Catalog$ stores the catalog information line by line (up to 80 lines and 100 characters long).* |
| 20 | `INTEGER I,Pos_lf` | *I and Pos_lf are used to search through User$ string.* |
| 30 | `OUTPUT 718;"CAT s*,CARD;"` | *The spectrum analyzer sends catalog information for all the states stored on the memory card.* |
| 40 | `ENTER 718 USING "#,-K";User$` | *Reads the catalog information into the User$ string.* |
| 50 | `I=0` | |
| 60 | `WHILE LEN(User$)>1` | *Loops until the User$ string is empty.* |

```
70      I=I+1
80      Pos_lf=POS(User$,CHR$(10))         Checks for line feeds. CHR$(10) repre-
                                           sents the line feed, the ASCII code for a
                                           line feed is "10."
90      Catalog$(I)=User$[1,Pos_lf-2]      Extracts catalog line.
100     OUTPUT CRT;Catalog$(I)             Displays catalog line.
120     User$=User$[Pos_lf+1]
130   END WHILE
140   END
```

## Description

To use the CAT command, you must specify the type of information to be cataloged and either the spectrum analyzer memory or the memory card as the catalog source. After the spectrum analyzer has sent the catalog information to the controller, the spectrum analyzer sends two line feed characters to the controller.

**Specifying the type of information:** The types of information that can be cataloged depend on the source. See the following sections, "Cataloging the Memory Card" and "Cataloging Spectrum Analyzer Memory" for more information.

**Specifying the source:** You can specify the spectrum analyzer memory or the memory card as the source by specifying INT or CARD, respectively. If source (CARD or INT) is omitted, the default is the current mass storage device. See "MSI" for more information about setting the current mass storage device.

**Note** When CAT is executed from a remote port, the catalog information is sent to the remote port.

### Cataloging the Memory Card

When cataloging a memory card, you can specify the type of information to be cataloged by specifying the letter (a, d, l, i, s, or t) that represents the data type. For example, if you execute "CAT l*,CARD;" all of the limit line files on the memory card will be returned. The letters correspond to the data types are as follows:

a* Amplitude correction files.

d* Downloadable programs.

l* Limit line files.

i* Display files.

s* Saved spectrum analyzer state.

t* Saved spectrum analyzer traces.

The asterisk (*) character is interpreted as a wild card. The asterisk can be used with the data type to catalog all files of that data type, or alone to catalog all files on the memory card.

CAT returns the directory information only if a file has been found.

**What is returned when the memory card is cataloged:** When the memory card is the catalog source, the cataloged information is returned to the computer as a series of strings. Each string contains information about one file that has been saved on the memory card. The information is placed in specific fields within a string as shown in the following table.

| Information | Position within String | Description |
|---|---|---|
| File name | 1 through 10 | Name of the file. |
| File Type | 11 through 16 | ASCII or binary data (in LIF -2 format). |
| Data Type | 17 through 22 | a - amplitude correction factors, d - downloadable program, l - limit line, i - display files s - spectrum analyzer state, t - trace. |
| Start Record | 23 through 30 | Physical record number of the start of file. |
| Length | 31 through 38 | Number of records in the file. |
| Time of creation | 39 through 52 | The time the file was created in year, month, day, hour, minute, second (YYMMDDHHMMSS) format. |

Each string is right-justified within its field, with spaces separating the fields.

## Cataloging Spectrum Analyzer Memory

When cataloging analyzer memory, you can use "prefix", "reg," or "on" to specify the type of information to be cataloged.

prefix* Catalogs the programs and variables in spectrum analyzer memory according to the current prefix. (Use **Change Prefix** or PREFX to change the current prefix.)

reg* Catalogs the contents of the state and trace registers. The center frequency and span of the state registers are displayed; the title and date of the trace registers are displayed.

on* Catalogs the on event commands and their status. See the "Cataloging the on event commands" for more information.

* Catalogs all the programs and variables stored in spectrum analyzer memory, but does not return the on event commands or the contents of the state and trace registers.

**Cataloging the on event commands:** When the on event programming commands have not been set or an instrument preset has been performed, cataloging the on events displays the status of the on events as UNDEFINED. If the ONEOS, ONSWP, TRMATH, ONMKR, and ONSRQ commands have been set, "CAT on*;" displays their status as ACTIVE. When ONCYCLE, ONDELAY, or ONTIME have been set, "CAT on*;" returns the information shown in the following table.

| Programming Command | Description of the Catalog On Event Response |
|---|---|
| ONCYCLE | The entry for ONCYCLE displays the number of seconds left until the event occurs, followed by the number of seconds ONCYCLE was set for. |
| ONDELAY | The entry for ONDELAY displays either a positive or negative number. A positive number indicates the number of seconds left until the event occurs, a negative number indicates the amount of time that has passed (in seconds) since the event. |
| ONTIME | The date (in year, month, and day format) and the time (in 24 hour format) that ONTIME is set for. |

If you want to catalog all user-defined variables, user-defined softkeys, or user-defined functions in spectrum analyzer, use the asterisk without "prefix," "reg," or "on" preceding the asterisk. For example "CAT *,INT;".

Cataloging spectrum analyzer (internal) memory returns the following information:

- MSI device (internal).
- Bytes of spectrum analyzer memory used.

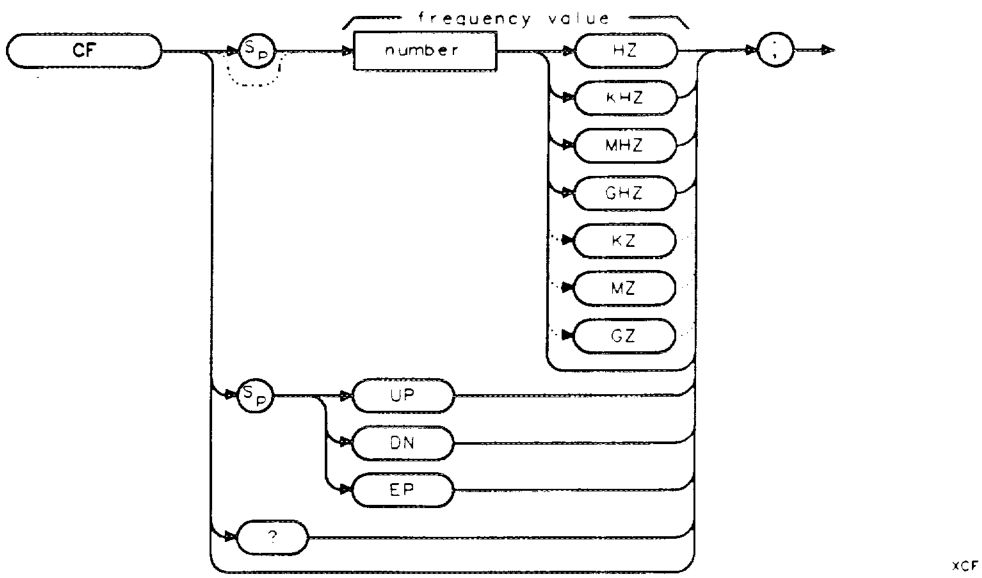
- Total amount of spectrum analyzer memory (in bytes). This number includes the amount of spectrum analyzer memory in use and the amount of spectrum analyzer memory available.
- Name of the stored data and the number of bytes used.

**Note** The difference between the bytes of spectrum analyzer memory used and the total spectrum analyzer memory available is the amount of spectrum analyzer memory available.

# CF
# Center Frequency

Specifies the center frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency range of the spectrum analyzer. |

Equivalent Softkey: **CENTER FREQ** .

Step Increment: If uncoupled, step size is determined by the SS command. If coupled, step size is 10% of span.

Related Commands: HNLOCK, FA, FB, FOFFSET, FS, MKCF, MKSS, SP, SS.

**Note** Although the spectrum analyzer allows entry of frequencies not in the specified frequency range, using frequencies outside the frequency span of the spectrum analyzer is not recommended and is not warranted to meet specifications.

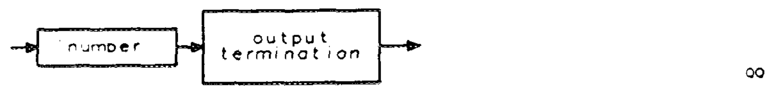
## Example

`OUTPUT 718;"CF 300MHZ;"` *Sets the center frequency to 300 MHz.*

## Description

The CF command specifies the value of the center frequency.

## Query Response



# CHP
# Channel Power

Performs the channel power measurement.

## Syntax


xCHP

Equivalent Softkey: **CHANNEL POWER**.

Related Commands: ACPPAR, ACPCONTM, ACPSNGLM, ACPSP, ACPBW.

## Example

`OUTPUT 718;"CHP;"` *Performs the channel power measurement.*

## Description

CHP measures the total power in the specified channel bandwidth (ACPBW).

To use CHP:

1. Set the center frequency to the carrier's frequency.
2. For best accuracy, set the reference level so that the carrier signal peak is within the first (top) division of the screen graticule.
3. Select the channel bandwidth with the ACPBW command.
4. Select the channel spacing with the ACPSP command. (For the channel power measurement, ACPSP is only used to set the center frequency step size.)
5. If you want the spectrum analyzer settings to be set automatically, ensure that ACPPAR is set to 1. If you want to set the spectrum analyzer settings manually, set ACPPAR to 0. See "ACPPAR" for more information about selecting the spectrum analyzer settings manually.
6. If the spectrum analyzer is in the continuous-sweep mode, use the single sweep command (SNGLS) to select the single-sweep mode.
7. Execute the CHP command.
8. Query ACPERR to determine if there is a setup error for the CHP measurement. See the following table for more information about ACPERR.
9. If no error occurred, query the CHPWR variable for the numeric results of the CHP measurement. See the following table for more information about CHPWR.
10. If no error occurred, query trace A (TRA) for the trace results of the CHP measurement.

**Measurement Results:** The results of the CHP command are stored in the variable and trace described in the following table.

### CHP Measurement Results

| Variable or Trace | Description | Units |
|---|---|---|
| ACPERR | A variable that indicates setup errors for the CHP measurement. The value of ACPERR indicates the following:<br>■ If no errors occurred, ACPERR is 0.<br>■ If ACPERR is 1, channel bandwidth > frequency span.<br>■ If ACPERR is 2, the channel bandwidth < frequency span/100. | |
| CHPWR | A variable that contains the channel power. | dBm |
| TRA | TRA is trace A. Trace A contains the swept RF spectrum. | Determined by the trace data format (TDF) command. |

## Restrictions

Executing ACPE exits the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), or peak zoom (PKZOOM).

# CLRAVG
# Clear Average

Restarts video averaging.

## Syntax


XCLRAVG

Related Commands: AMB, CLRW, MINH, MXMH, VAVG.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `OUTPUT 718;"VAVG 100;"` | *Initializes video averaging.* |
| `WAIT 30` | |
| `OUTPUT 718;"CLRAVG;"` | *Restarts video averaging.* |

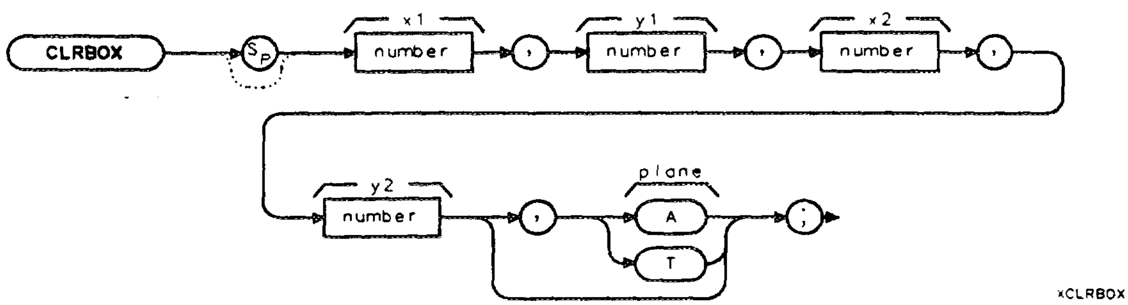
## Description

The CLRAVG command restarts the VAVG command by resetting the number of averaged sweeps to one. The video averaging routine resets the number of sweeps, but does not stop video averaging. Use "VAVG OFF;" to stop video averaging.

# CLRBOX
# Clear Box

Clears a rectangular area on the spectrum analyzer display.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | For x1 or x2, −40 to 471.<br>For y1 or y2, −22 to 233. |

Related Commands: CLRDSP.

## Example

The following programming line results in the spectrum analyzer display shown in Figure 5-2.

`OUTPUT 718;"CLRBOX 1,1,200,200,A;"` *Clears the annotation and graticule from the rectangular area of 1,1 to 200,200.*

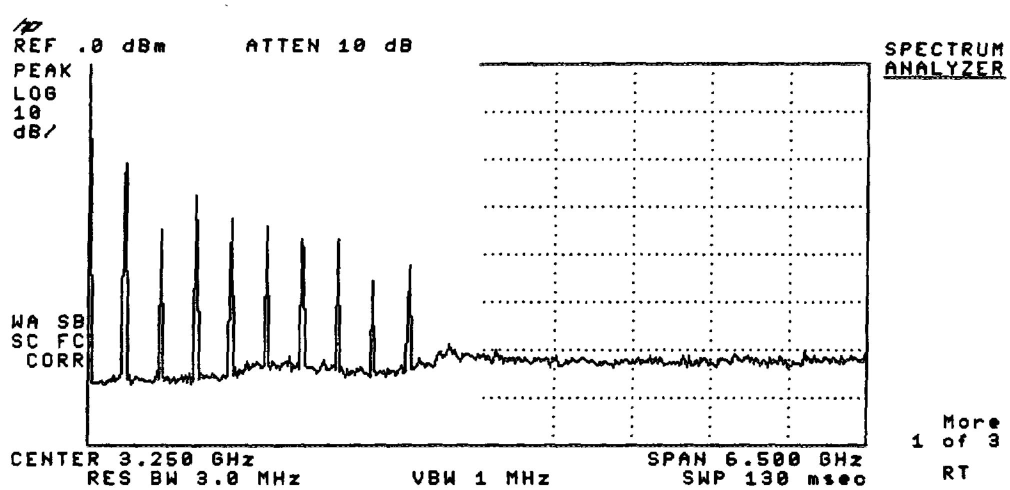



**Figure 5-2. Using the CLRBOX Command**

## Description

To use CLRBOX, you must specify the rectangular area of the box. You can also specify whether the annotation or trace planes are to be cleared.

**Specifying the rectangular area of the box** You specify the rectangular area by specifying the coordinates of the lower left corner (x1, y1) and the upper right corner (x2, y2) of the rectangle in display units. (The cleared area includes the x1, y1, x2, and y2 coordinates).

**Specifying the annotation or trace plane** You can specify whether the annotation or the traces are to be cleared by specifying an "A" for the annotation plane or a "T" for the trace plane. If you specify the annotation plane, everything but the trace display will be cleared. If you specify the trace plane, the trace display will be cleared. (The cleared trace display can be overwritten if the spectrum analyzer is in the clear-write mode, however.) If you do not specify the annotation or trace plane, both the annotation and trace planes are cleared.

CLRBOX affects only the spectrum analyzer display and printing of the spectrum analyzer display. CLRBOX does *not* change the plot of the spectrum analyzer display; the area that is cleared by CLRBOX will still be plotted.

# CLRDSP
# Clear Display

Erases user-generated graphics and text.

## Syntax


XCLRDSP

Related Commands: CLRBOX, DA, DRAWBOX, DSPLY, PA, PD, PR, PU, TEXT.

## Example

| | |
|---|---|
| `OUTPUT 718;"CLRDSP;BLANK TRA;BLANK TRB; GRAT OFF;TH OFF;DL OFF;"` | *Blanks the spectrum analyzer screen, except for trace C and annotation.* |
| `OUTPUT 718;"CLRW TRA;GRAT ON;ANNOT ON;"` | *Reinstates the display of trace A, the graticule, and the annotation.* |

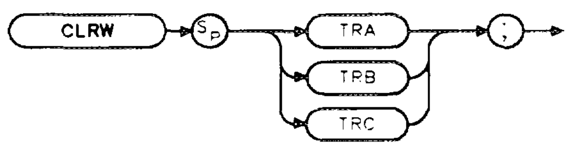
## Description

The CLRDSP command removes all user-created graphics and text from the spectrum analyzer screen and memory. CLRDSP also removes the graphics and text from the display list. See "DA" for more information about the display list.

# CLRW
# Clear Write

Clears the specified trace and enables trace data acquisition.

## Syntax




XCLRW

Equivalent Softkeys: **CLEAR WRITE A**, **CLEAR WRITE B**, and **CLEAR WRITE C**.
Preset State: CLRW TRA.
Related Commands: BLANK, DET, MINH, MXMH, VAVG, VIEW.
Restrictions: CLRW TRB and CLRW TRC are not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"CLRW TRA;"
```

## Description

The CLRW command places the indicated trace in the clear-write mode. Data acquisition begins at the next sweep. (See "TS" for more information about data acquisition.)

# CLS
# Clear Status Byte

Clears all status bits.

## Syntax


Related Commands: RQS, SRQ, STB.

## Example

```
OUTPUT 718;"CLS;"
```

## Description

The CLS command clears all the status bits in the status byte. (See "SRQ" for more information on the status byte.)

# CNF
# Confidence Test

Performs the confidence test.

## Syntax


XCNF

Equivalent Softkey: **CONF TEST** .

## Example

```
OUTPUT 718;"CNF;"
```

## Description

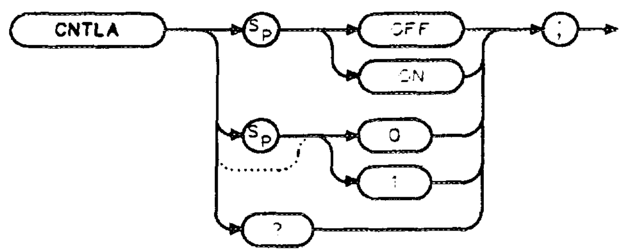
The CNF command initiates a confidence test of the resolution bandwidth, video bandwidth, and step gain.

**Note** Connect a cable between CAL OUT and the spectrum analyzer input before executing the CNF command.

# CNTLA
# Auxiliary Interface Control Line A

Sets the control line A of the auxiliary interface high or low.

## Syntax




XCNTLA

Equivalent Softkey: **CNTL A 0 1**.
Related Commands: CNTLB, CNTLC, CNTLD, CNTLI.

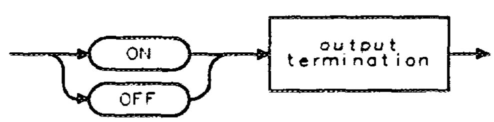
## Example

| | |
|---|---|
| `OUTPUT 718;"CNTLA ON;"` | *Sets control line A high.* |
| `OUTPUT 718;"CNTLA?;"` | *Queries the state of control line A.* |
| `ENTER 718;A$` | *Gets the response from the spectrum analyzer.* |
| `DISP A$` | *Displays the response.* |

## Description

CNTLA ON sets control line A to high, CNTLA OFF sets it to low (the auxiliary interface connector outputs use transistor-transistor logic).

## Query Response

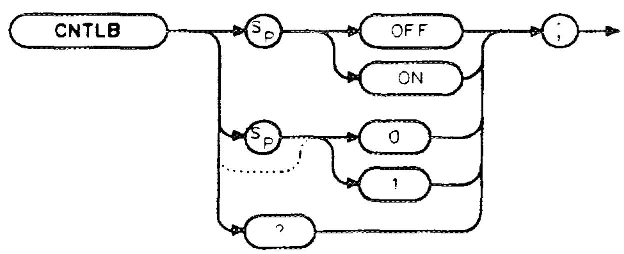



002

# CNTLB
# Auxiliary Interface Control Line B

Sets the control line B of the auxiliary interface high or low.

## Syntax




XCNTLB

Equivalent Softkey: **CNTL B 0 1**.

Related Commands: CNTLA, CNTLC, CNTLD, CNTLI.

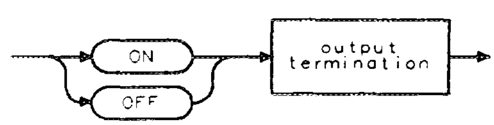
## Example

| | |
|---|---|
| `OUTPUT 718;"CNTLB ON;"` | *Sets control line B high.* |
| `OUTPUT 718;"CNTLB?;"` | *Queries the state of control line B.* |
| `ENTER 718;A$` | *Gets the response from the spectrum analyzer.* |
| `DISP A$` | *Displays the response.* |

## Description

CNTLB ON sets control line B to high, CNTLB OFF sets it to low (the auxiliary connector outputs use transistor-transistor logic).

## Query Response

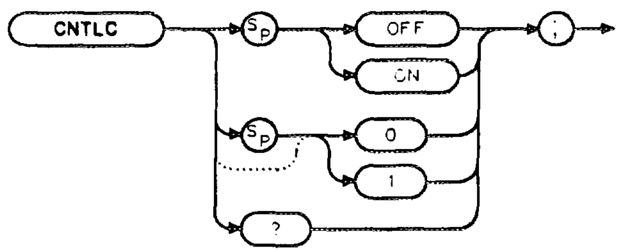



QQ2

# CNTLC
# Auxiliary Interface Control Line C

Sets the interface control line C of the auxiliary interface high or low.

## Syntax




XCNTLC

Equivalent Softkey: CNTL C 0 1.

Related Commands: CNTLA, CNTLB, CNTLD, CNTLI.

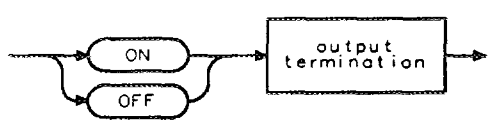
## Example

| | |
|---|---|
| OUTPUT 718;"CNTLC ON;" | *Sets control line C high.* |
| OUTPUT 718;"CNTLC?;" | *Queries the state of control line C.* |
| ENTER 718;A$ | *Gets the response from the spectrum analyzer.* |
| DISP A$ | *Displays the response.* |

## Description

CNTLC ON sets control line C to high, CNTLC OFF sets it to low (the auxiliary interface connector outputs use transistor-transistor logic).

## Query Response

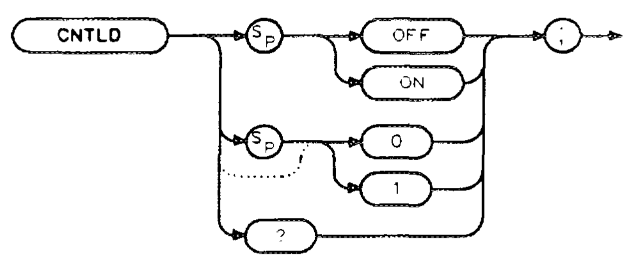



002

# CNTLD
# Auxiliary Interface Control Line D

Sets the interface control line D of the auxiliary interface high or low.

## Syntax




XCNTLD

Equivalent Softkey: **CNTL D 0 1**.

Related Commands: CNTLA, CNTLB, CNTLC, CNTLI.

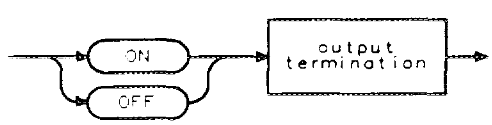
## Example

| | |
|---|---|
| `OUTPUT 718;"CNTLD ON;"` | *Sets control line D high.* |
| `OUTPUT 718;"CNTLD?;"` | *Queries the state of control line D.* |
| `ENTER 718;A$` | *Gets the response from the spectrum analyzer.* |
| `DISP A$` | *Displays the response.* |

## Description

CNTLD ON sets control line D to high, CNTLD OFF sets it to low (the auxiliary connector outputs use transistor-transistor logic).

## Query Response

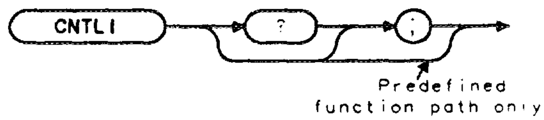



QQ2

# CNTLI
# Auxiliary Interface Control Line Input

Returns a "1" when the interface control line I of the auxiliary interface is high, and "0" if the line input is low.

## Syntax




XCNTLI

Equivalent Softkey: `DISPLAY CNTL I`.
Related Commands: CNTLA, CNTLB, CNTLC, CNTLD.

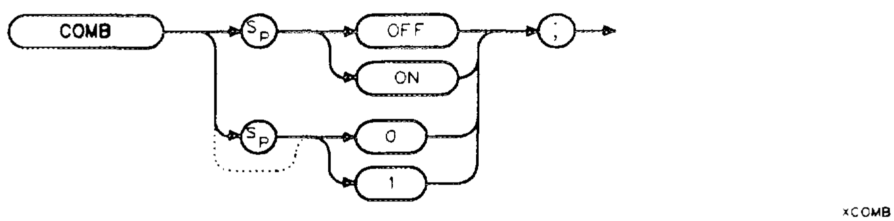
## Example

| | |
|---|---|
| `OUTPUT 718;"CNTLI;"` | *Gets the status of control line I.* |
| `ENTER 718;A` | |
| `DISP A` | *Displays status.* |

# COMB
# Comb

Turns on or off the comb generator.

## Syntax




Equivalent Softkey: **COMB GEN ON OFF**.

Model Required: HP 8592D, HP 8593E, or HP 8596E.

## Example

`OUTPUT 718;"COMB ON;"` *Turns on the comb generator.*

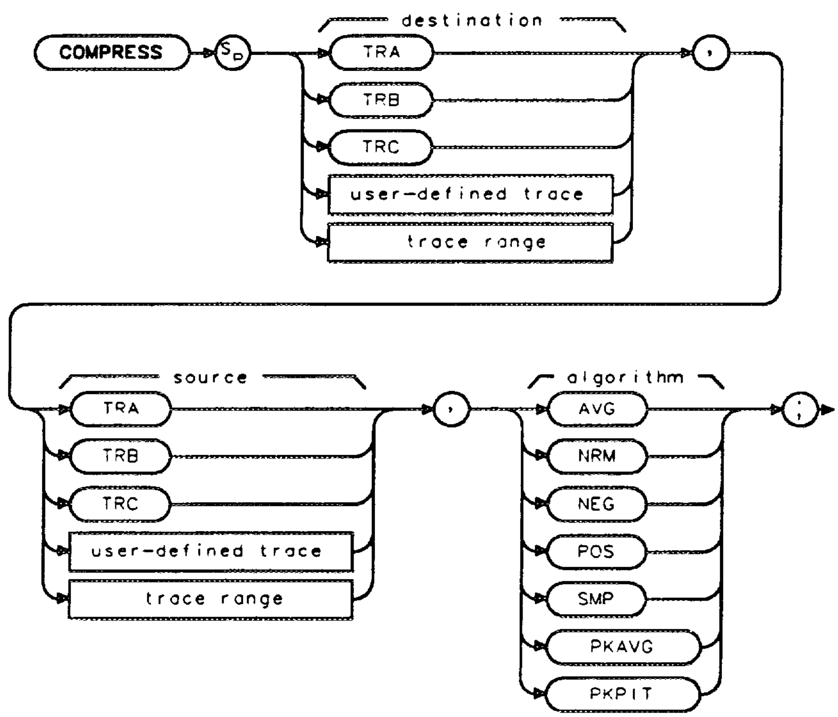
## Description

To use the comb signal, a cable must be connected from the COMB OUT connector to the spectrum analyzer input.

# COMPRESS
## Compress Trace

Reduces the number of trace elements while retaining the relative frequency and amplitude characteristics of the trace data.

### Syntax




XCOMPRESS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command | Any valid trace name. |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using user-defined trace. TS when using trace data.

### Example

This example compresses trace B into "C_OMPTRAC" using the positive (POS) algorithm.

```
10 OUTPUT 718;"IP;"                           Initializes spectrum analyzer.
20 OUTPUT 718;"TRDEF C_OMPTRAC,100;"          Creates a trace called C_OMPTRAC with
                                              a length of 100 elements.
30 OUTPUT 718;"BLANK TRA;SNGLS;"              Blanks trace A, activates single-sweep
                                              mode.
40 OUTPUT 718;"CLRW TRB;TS;"                  Measures with trace B.
50 OUTPUT 718;"COMPRESS C_OMPTRAC,TRB,POS;"   Compresses trace B into C_OMPTRAC.
```

```
60 OUTPUT 718;"BLANK TRB;"              Blanks trace B.
70 OUTPUT 718;"MOV TRA,C_OMPTRAC;"      Moves C_OMPTRAC into trace A.
80 OUTPUT 718;"VIEW TRA;"               Displays the result.
90 END
```

## Description

The COMPRESS command stores a compressed copy of the source trace into a smaller destination trace. The source trace is divided into the same number of intervals as there are points in the destination trace, and the data within each interval are compressed into the value for the corresponding destination trace point. The algorithm used to compress the data is given as an parameter to the command.

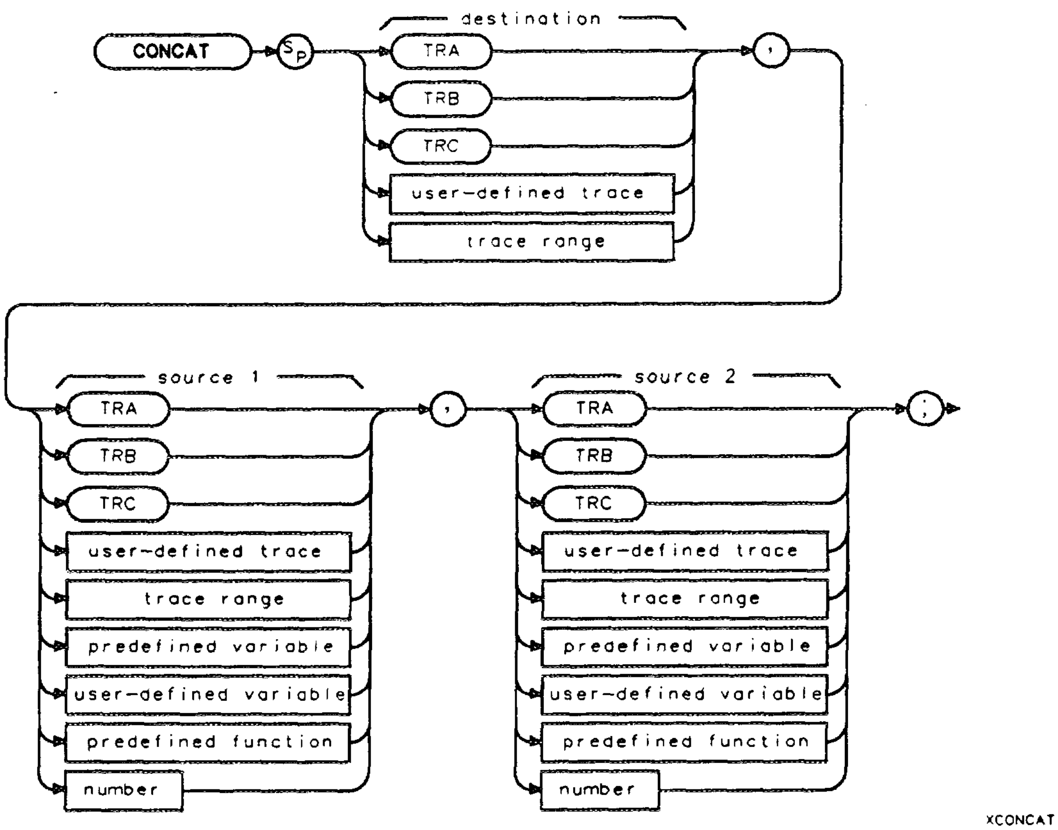
The algorithms available are as follows:

| | |
|---|---|
| AVERAGE (AVG) | The average of the points within an interval is used. |
| NORMAL (NRM) | NRM computes the compressed value of the interval by using a rosenfell algorithm. The rosenfell algorithm is a mathematical operation defined in spectrum analyzer firmware. The algorithm compresses a locally continuously rising or falling signal into the peak value detected in each interval. If the detected signal is not continuously rising or falling, then the data value alternates between minimum and maximum in the compressed interval. This shows the peak-to-peak noise variations. The rosenfell option is useful for accurately displaying noise, because peak detection can give misleading representation of noise. |
| NEGATIVE (NEG) | The lowest value in each interval is used. |
| POSITIVE (POS) | Specifying POS selects the highest point in the interval as the compressed value. |
| SAMPLE (SMP) | Specifying SMP selects the last point in the interval as the compressed value. |
| PEAK AVERAGE (PKAVG) | The PKAVG algorithm selects the difference between the peak and the average value of the interval as the compressed value. |
| PEAK PIT (PKPIT) | The PKPIT algorithm returns the difference between the positive and the negative peaks within the interval. |

# CONCAT
# Concatenate

Combines two traces.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that return a value. Refer to Table 5-1. | |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: MOV, VIEW.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates the single-sweep mode.* |
| `30 OUTPUT 718;"TS;VIEW TRA;"` | *Stores and displays trace A.* |
| `40 OUTPUT 718;"CLRW TRB;TS;"` | *Takes a measurement sweep with trace B.* |
| `50 OUTPUT 718;"CONCAT TRC,TRA[1,200],TRB[201,401];"` | *Concatenates the last half of trace B to the first half of trace A.* |
| `60 OUTPUT 718;"BLANK TRA;BLANK TRB;"` | *Blanks trace A and trace B.* |
| `70 OUTPUT 718;"VIEW TRC;"` | *Displays the result.* |
| `80 END` | |

## Description

The CONCAT command concatenates source 2 to the end of source 1, then stores the result in the destination. If the destination length is less than the length of source 1 and source 2, the list is truncated. For example, executing "CONCAT TRA[1,15],TRB[3,6],TRB[7,207];" results in trace A elements 1 to 4 being replaced by trace B elements 3 to 6, and trace A elements 5 to 15 being replaced by trace B elements 7 to 17. Trace B elements 18 to 207 are ignored. If necessary, reduce trace lengths with the COMPRESS command.

If the length of the destination is greater than the length of source 1 and source 2, the last value is repeated. For example, executing "CONCAT TRA[1,15],TRB[3,6],TRB[7,9];" results in trace A elements 1 to 4 being equal to trace B elements 3 to 6, trace A elements 5 and 6 being replaced by trace B elements 7 and 8, and trace A elements 7 to 15 being replaced by trace B element 9.

# CONTS
# Continuous Sweep

Sets the spectrum analyzer to the continuous sweep mode.

## Syntax


XCONTS

Equivalent Softkey: `SWEEP CONT SGL` (when CONT is underlined).
Preset State: CONTS.
Related Commands: SNGLS, ST, TM.

## Example

```
OUTPUT 718;"CONTS;"
```

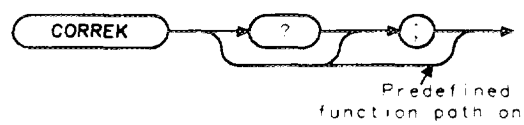
## Description

The CONTS command sets the spectrum analyzer to continuous sweep mode. In the continuous sweep mode, the spectrum analyzer takes its next sweep as soon as possible after the current sweep (as long as the trigger conditions are met). A sweep may temporarily be interrupted by data entries made from the front panel or over the remote interface.

# CORREK
# Correction Factors On

Returns a "1" if the correction factors are on, a "0" if they are off.

## Syntax



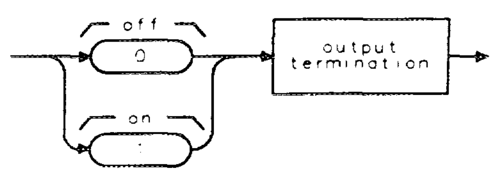

XCORREK

Equivalent Softkey: **CORRECT ON OFF**.
Related Commands: CAL.

## Example

```
OUTPUT 718;"CORREK;"
ENTER 718;A
DISP A
```

## Query Response

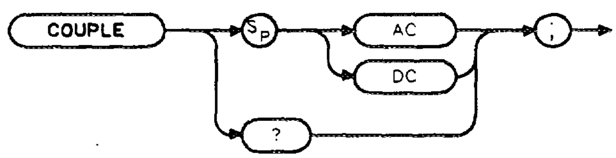



003

# COUPLE
# Couple

Selects direct-current (dc) coupling or alternating-current (ac) coupling.

## Syntax




XCOUPLE

Equivalent Softkey: **COUPLE AC DC**.
Model Required: HP 8594E, HP 8595E, or HP 8596E.
Preset State: AC
Related Commands: IP.

## Example

```
OUTPUT 718;"COUPLE DC;"
```

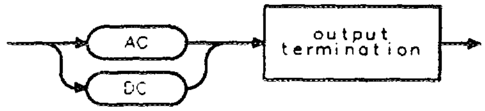
## Description

**Caution** Do not use dc coupling if there is *any* dc voltage at the spectrum analyzer input. Do not exceed the power stated on the spectrum analyzer input. See the specifications for the spectrum analyzer in the Calibration Guide for your spectrum analyzer for more information.

If there is no dc voltage at the spectrum analyzer input, dc coupling is useful for observing low frequency signals at the spectrum analyzer input. Use ac coupling when there is dc voltage at the spectrum analyzer input (ac coupling blocks the dc voltage and allows only the ac voltage at the spectrum analyzer input).

When used as a predefined variable, COUPLE returns a "0" if COUPLE has been set to DC, a "1" if COUPLE has been set to AC.

## Query Response

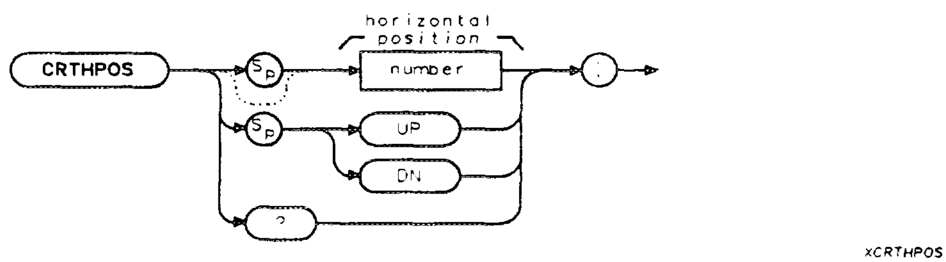



QCOUPLE

# CRTHPOS
# Horizontal Position of CRT Display

Specifies the horizontal position of the text and graticule on the spectrum analyzer's display.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 1 to 34. |

Equivalent Softkey: `CRT HORZ POSITION`.
Default Value: 10.
Step Increment: by 1.
Related Commands: CRTVPOS, SYNCMODE.

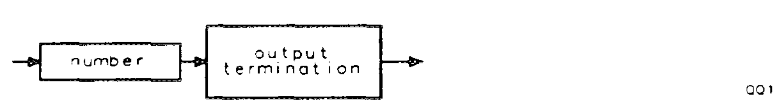
## Example

```
OUTPUT 718;"CRTHPOS 15;"
```

## Description

The CRTHPOS command specifies the horizontal position of the information on the spectrum analyzer's display. Each CRTHPOS number represents four screen pixels. (The spectrum analyzer display is 512 screen pixels wide by 256 screen pixels high.) Execute CAL STORE to store the current CRTHPOS value as the default value of the horizontal position.

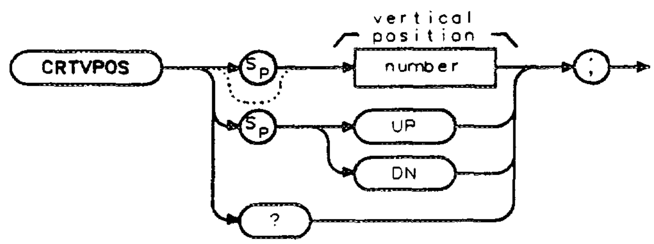
## Query Response



# CRTVPOS
# Vertical Position of CRT Display

Specifies the vertical position of the text and graticule on the spectrum analyzer's display.

## Syntax




XCRTVPOS

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 10 to 58. |

Equivalent Softkey: **CRT VERT POSITION**.
Default Value: 48.
Step Increment: by 1.
Related Commands: CRTHPOS, SYNCMODE.

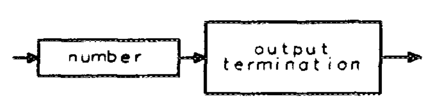
## Example

```
OUTPUT 718;"CRTVPOS 50;"
```

## Description

The CRTVPOS command specifies the vertical position of the information on the spectrum analyzer's display. Each CRTVPOS number represents four screen pixels. (The spectrum analyzer display is 512 screen pixels wide by 256 screen pixels high.) Execute CAL STORE to store the current CRTVPOS value as the default value of the vertical position.

## Query Response

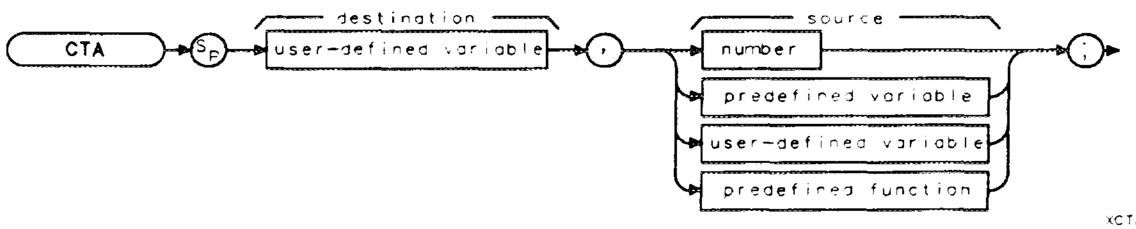



QQ1

# CTA
# Convert to Absolute Units

Converts the source values from measurement units to the current absolute amplitude units and then stores the result in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Number | Any valid integer number. | −32,768 to +32,767. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that return a value. Refer to Table 5-1. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: AUNITS, LG, LN, RL.

## Example

```
10 OUTPUT 718;"VARDEF C_ONLV,0;"     Declares a variable called C_ONLV.
20 OUTPUT 718;"LG;"                  Puts the spectrum analyzer in log mode.
30 OUTPUT 718;"RL -10DB;"            Changes the reference level.
40 OUTPUT 718;"CTA C_ONLV, 8000;"    Stores -10 in C_ONLV.
50 OUTPUT 718;"RL -20DB;"            Changes the reference level.
60 OUTPUT 718;"CTA C_ONLV,8000;"     Stores -20 in C_ONLV.
70 OUTPUT 718;"C_ONLV?;"
80 ENTER 718;A
90 DISP A
100 END
```

## Description

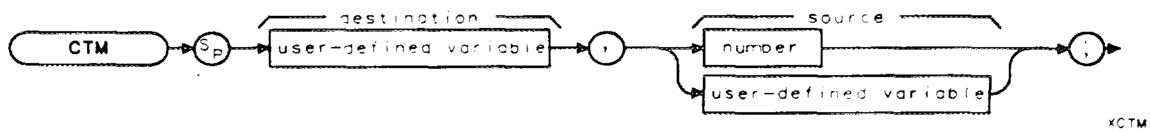
The result of the CTA command depends on the reference level, the current amplitude units, and the amplitude scale (log or linear).

Measurement units are the internal binary data representation of measured results. The internal binary data representation is 16-bit amplitude values that are stored in traces. The values range from −32,768 to 32,767. The value of 8000 corresponds to an amplitude equal to the reference level. In log mode, each count represents 0.01 dBm. A signal 0.01 dBm above the reference level is at 8001, and a signal 1.0 dBm below the reference level is at 8000 minus 100, or 7900. In linear mode, 8000 is the reference level and 0 is the 0 volt level. If the reference level is at 80 mV, each count would represent 0.080 divided by 8000 or 10 $\mu$V, but a reference level of 2.4 volts would represent 2.4 divided by 8000 or 300 $\mu$V per count.

# CTM
# Convert to Measurement Units

Converts the source values to measurement units and places the result in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands | Any valid variable name. |
| Number | A number expressed in integer, decimal, or exponential form. | Real number range. |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: AUNITS, CTA, LG, LN, RL.

## Example

| | |
|---|---|
| `OUTPUT 718;"VARDEF A_MPV,0;"` | *Declares a variable called A_MPV.* |
| `OUTPUT 718;"LG;"` | *Puts the spectrum analyzer in log mode.* |
| `OUTPUT 718;"RL -10DB;"` | *Changes the reference level.* |
| `OUTPUT 718;"CTM A_MPV,-10;"` | *Stores 8000 in A_MPV.* |
| `OUTPUT 718;"DSPLY A_MPV,13.5;"` | *Displays A_MPV.* |

## Description

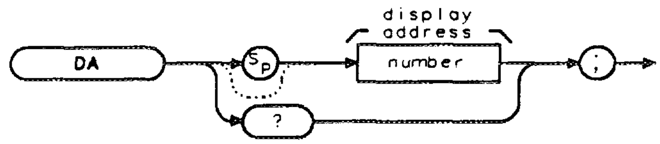
The result of the CTM command depends on the reference level, the current amplitude units, and the amplitude scale (log or linear).

Measurement units are the 16-bit amplitude values stored in traces. The values range from −32,768 to 32,767. The value of 8000 corresponds to an amplitude equal to the reference level. In log mode, each count represents 0.01 dBm. A signal 0.01 dBm above the reference level is at 8001, and a signal 1.0 dBm below the reference level is at 8000 minus 100, or 7900. In linear mode, 8000 is the reference level and 0 is the 0 volt level. If the reference level is at 80 mV, each count would represent 0.080 divided by 8000 or 10 $\mu$V, but a reference level of 2.4 volts would represent 2.4 divided by 8000 or 300 $\mu$V per count.

# DA
# Display Address

Accesses the current address of the display list.

## Syntax




XDA

| Item | Description/Default | Range |
|---|---|---|
| Number | Any integer number. | 0 to 16383. |

Preset State: 0.
Related Commands: DSPLY, GR, LB, PA, PD, PR, PU, TEXT.

## Example

This example allows you to display a message on the spectrum analyzer display, blank the message, and then display another message on the spectrum analyzer display.

| | |
|---|---|
| `OUTPUT 718;"VARDEF D_ADDRESS,0;"` | *Defines a variable called D_ADDRESS.* |
| `OUTPUT 718;"CLRDSP;"` | *Erases the display list and clears all text and graphics from the spectrum analyzer display.* |
| `OUTPUT 718;"PUPA 100,180;TEXT %Measurement%;"` | *Displays "Measurement" on the spectrum analyzer display. The text is also added to the display list.* |
| `OUTPUT 718;"MOV D_ADDRESS,DA;"` | *Saves the value of the display address by moving the display address into D_ADDRESS.* |
| `OUTPUT 718;"PUPA 100,100;TEXT %Signal found%;"` | *Displays text on the spectrum analyzer display. The text is also saved in the display list, and the display address is increased. (The display address is increased proportionally to the length of the displayed text.)* |
| ⋮ | *You can add code for continuing the measurement here.* |
| `OUTPUT 718;"PUPA 100,100;TEXT %             %;"` | *Blanks the message "Signal found" on the analyzer screen and adds the blank spaces to the display list.* |

**DA Display Address**

| | |
|---|---|
| `OUTPUT 718;"MOV DA,D_ADDRESS;"` | *Restores the display address.* |
| `OUTPUT 718;"PUPA 100,120;TEXT %Done%;"` | *Displays the message "Done" on the analyzer screen, and replaces the text "Signal found" and the blank spaces that were in the display list. The text "Measurement" remains on the spectrum analyzer display and in the display list.* |

## Description

The DA command allows you to access the current address of the display list. The display list is a buffer that contains all of the text and graphics that have been displayed on the spectrum analyzer screen with the DSPLY, GR, LB, or TEXT commands.

**How the display list works:** Every time you use a programming command to display text or graphics on the analyzer display, the text or graphics is also entered into the display list. While you can change or erase what is displayed on the analyzer screen, the list for screen graphics accumulates *all* of the text and graphics. For example, if you execute the following programming lines:

```
OUTPUT 718;"PUPA 100,100;TEXT %Signal found%;"
OUTPUT 718;"PUPA 100,100;TEXT %            %;"
OUTPUT 718;"PUPA 100,100;TEXT %Done%;"
```

the text "Signal found" would be displayed on the analyzer screen, and then be erased by the blank spaces, and then "Done" would be displayed. The display list would save the text "Signal found," the blank spaces, and the text "Done," in separate (and sequential) locations in the display list.

The display list is important because the contents of the display list are used to restore the screen text when the annotation or graticule is turned off and then turned back on, or when the screen display is plotted. When the screen text is restored on the spectrum analyzer display, or the screen display is plotted, the *entire* display list is used. Because the entire display list is used, there can be some text "flashing" on the spectrum analyzer display or the plot can contain unwanted text. The DA command can be used to avoid this situation.

**What the DA command does:** The DA command allows you to save and then restore the current address of the display list, thus controlling where text is written in the display list. For example, if you want your program to display the messages "Signal found," and "Done," and you want only the messages that are currently displayed on the spectrum analyzer screen to be stored in the display list, you would do the following:

1. Save the display address in a variable.
2. Execute the commands that display the first message on the spectrum analyzer display.

When you want to change the message, you would do the following:

1. Execute the commands that put blank spaces over the message (to clear the message from the analyzer display). You do not need to use blank spaces the clear the previous message if the number of characters in the new message is equal to or greater than the original message.
2. Copy the display address from the variable back into DA (this recalls the previous display address).
3. Execute the commands that display the new message on the spectrum analyzer display.

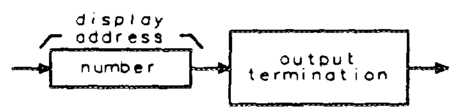
**Note** Assigning random values to the display address can have undesirable effects.

**Restrictions:** You cannot alter earlier entries to the display list without rewriting all subsequent entries in the display list. For example, the display list, with three messages in it, could be represented as follows:

| | | | |
|---|---|---|---|
| Display List Contents: | <first message> | <second message> | <third message> |
| Display Address: | ↑ | ↑ | ↑ |

Because the display address is proportional to the length of the text, you could not change the second message without affecting the display address of the third message. In this case you should rewrite both the second and third message.

## Query Response

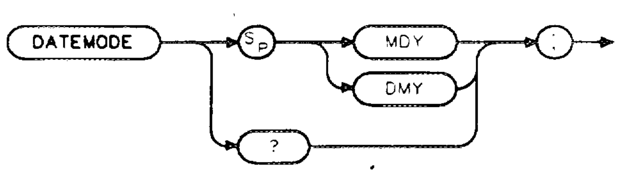



QDA

# DATEMODE
# Date Mode

Allows you to set the format for displaying the real-time clock in either the month, day, year format or the day, month, year format.

## Syntax




XDATEMODE

Equivalent Softkey: **DATEMODE MDY DMY** .

## Example 1

| | |
|---|---|
| `OUTPUT 718;"DATEMODE DMY;"` | *Sets the date mode to day, month, year format.* |
| `OUTPUT 718;"DATEMODE?;"` | *Queries the format of the display of the real-time clock.* |
| `ENTER 718;A$` | |
| `DISP A$` | |

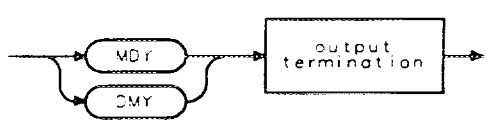
## Example 2

| | |
|---|---|
| `OUTPUT 718;"VARDEF T_EMP,0;"` | *Creates a variable.* |
| `OUTPUT 718;"DATEMODE DMY;"` | *Sets the date mode to day, month, year format.* |
| `OUTPUT 718;"MOV T_EMP,DATEMODE?;"` | *Queries the format of the display of the real-time clock as a predefined variable.* |
| `OUTPUT 718;"T_EMP?;"` | *Gets the result.* |
| `ENTER 718;A` | |
| `DISP A` | |

## Description

When used as a predefined variable, DATEMODE returns a "0" if DATEMODE has been set to MDY, a "1" if DATEMODE has been set to DMY. See example 2.

## Query Response

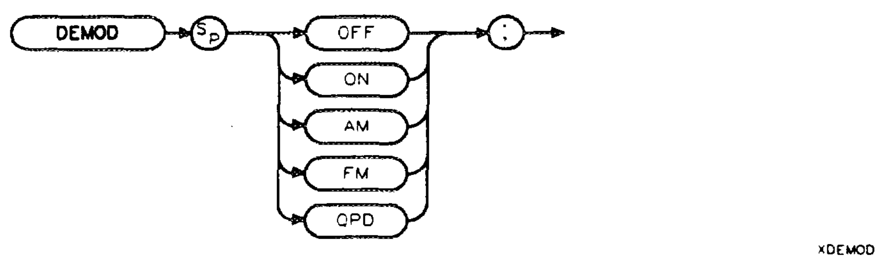



QDATEMODE

# DEMOD
# Demodulation

Turns the demodulator on or off, and selects between AM, FM, or quasi-peak demodulation.

## Syntax




Equivalent Softkey: **DEMOD ON OFF** is similar.
Option Required: Option 102, 103, or 301.
Related Commands: DET, FMGAIN, HAVE, MKPAUSE, SP, SPEAKER, SQLCH.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

This example demonstrates FM demodulation in a span greater than zero.

| | |
|---|---|
| `10 OUTPUT 718;"IP;FA 90MHZ;"` | *Sets start frequency.* |
| `20 OUTPUT 718;"FB 110MHZ;"` | *Sets stop frequency.* |
| `30 OUTPUT 718;"TS;MKPK HI;MKCF;"` | *Places marker on the highest peak and brings the peak to center frequency.* |
| `40 OUTPUT 718;"DEMOD ON;DEMOD FM;"` | *Turns on FM demodulation.* |
| `50 OUTPUT 718;"MKPAUSE 500MS;"` | *Turns on marker pause. The detector switches automatically to the FMV detector during the dwell time.* |
| `60 END` | |

## Description

Execute "DEMOD ON;" to turn on the demodulator. "DEMOD AM;", "DEMOD FM;", or "DEMOD QPD;" selects the demodulation mode, but does not turn on the demodulator.

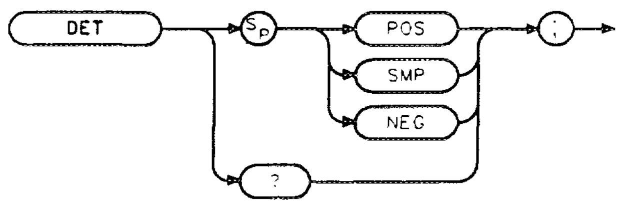
For AM or FM demodulation in nonzero frequency spans, use MKPAUSE to set the dwell time of the marker.

Quasi-peak demodulation (QPD) is available with Option 103. See the Option 103 Manual Supplement for more information about operating the quasi-peak detector remotely.

# DET
# Detection Mode

Selects the spectrum analyzer detection mode.

## Syntax




XDET

Equivalent Softkey: DETECTOR PK SP NG or DETECTOR SMP PK .
Preset State: DET POS.
Related Commands: DEMOD, MEANTH, TV.

## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes the spectrum analyzer.* |
| 20 OUTPUT 718;"SNGLS;" | *Activates single-sweep mode.* |
| 30 OUTPUT 718;"DET POS;TS;" | *Activates the positive-peak detection of trace A.* |
| 40 OUTPUT 718;"VIEW TRA;" | *Stores results in trace A.* |
| 50 OUTPUT 718;"DET SMP;" | *Activates sample detection for trace B.* |
| 60 OUTPUT 718;"CLRW TRB;TS;" | *Measures with trace B.* |
| 70 OUTPUT 718;"VIEW TRB;" | *Stores results in trace B.* |
| 80 OUTPUT 718;"AVG TRA,TRB,2;" | *Averages trace A and B with a ratio of 2, and stores the results in trace A.* |
| 90 OUTPUT 718;"BLANK TRB;" | *Blanks trace B, leaving only averaged results on screen.* |
| 100 END | |

## Description

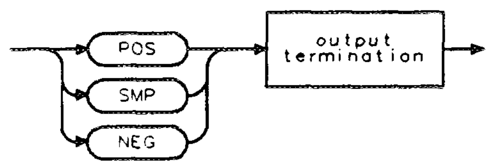
The DET command selects the type of spectrum analyzer detection (positive-peak, sample, or negative) and accesses service-diagnostic detection functions.

- **POS** enables positive-peak detection, which displays the maximum video signal detected over a number of instantaneous samples for a particular frequency.
- **SMP** enables sample detection, which uses the instantaneous video signal value. Video averaging and noise-level markers, when activated, activate sample detection automatically.
- **NEG** enables negative peak detection in sweep times of less than or equal to 200 ms. The negative peak detector is available with Option 101 or Option 301 only.

When used as a predefined variable, DET returns a number. The number that is returned corresponds to the DET parameter as shown in the following table.

| DET Parameter Setting | Value DET Returns |
|---|---|
| SMP | 0 |
| POS | 1 |
| NEG | 49 |

## Query Response

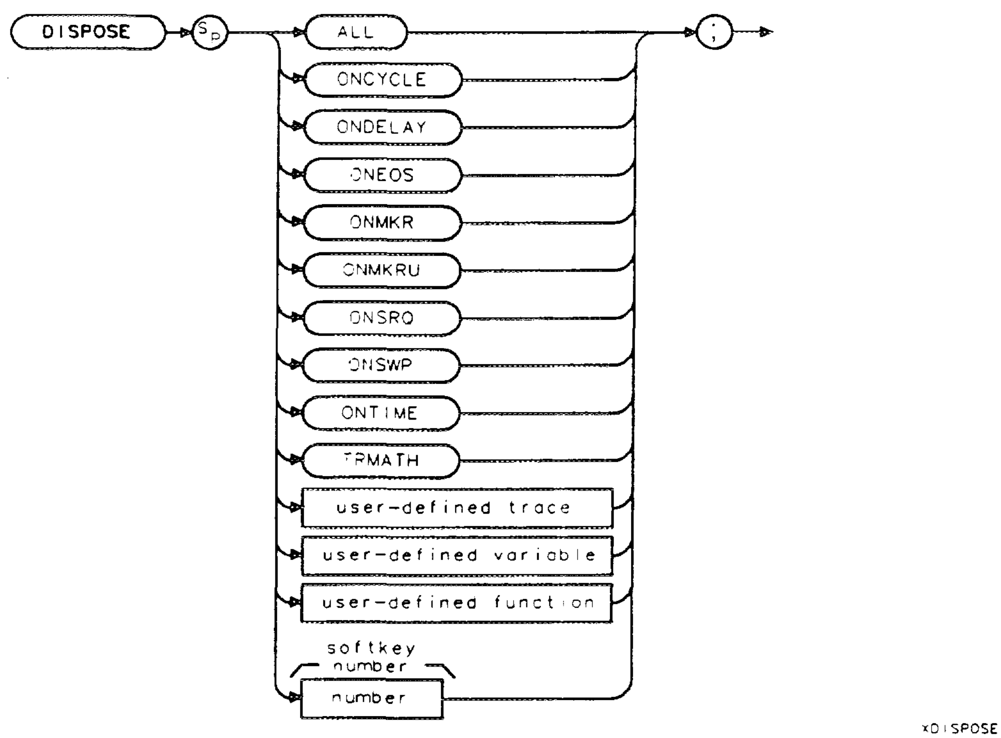



QDET

# DISPOSE
# Dispose

Frees spectrum analyzer memory that was previously allocated for user-defined operands.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by the VARDEF or ACTDEF commands. | Any valid variable name. |
| User-defined function | A subroutine defined by the FUNCDEF command. | Any valid function name. |
| Number | Any valid softkey number. | 1 to 6, 601 to 1200. |

Equivalent Softkey: DISPOSE ALL and **DISPOSE USER MEM** are equivalent.

Prerequisite Commands: TRDEF when using a user-defined trace. VARDEF or ACTDEF when using a user-defined variable.

Related Commands: ERASE, KEYCMD, KEYDEF, KEYLBL, LIMIDEL, ONCYCLE, ONMKRU, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME, TRMATH.

## Example

| | |
|---|---|
| `OUTPUT 718;"VARDEF T_EMP,10;"` | *Defines a variable for use in a program. When the variable is no longer needed, it can be deleted using the DISPOSE command* |
| `OUTPUT 718;"DISPOSE T_EMP;"` | *Deletes T_EMP from spectrum analyzer memory.* |

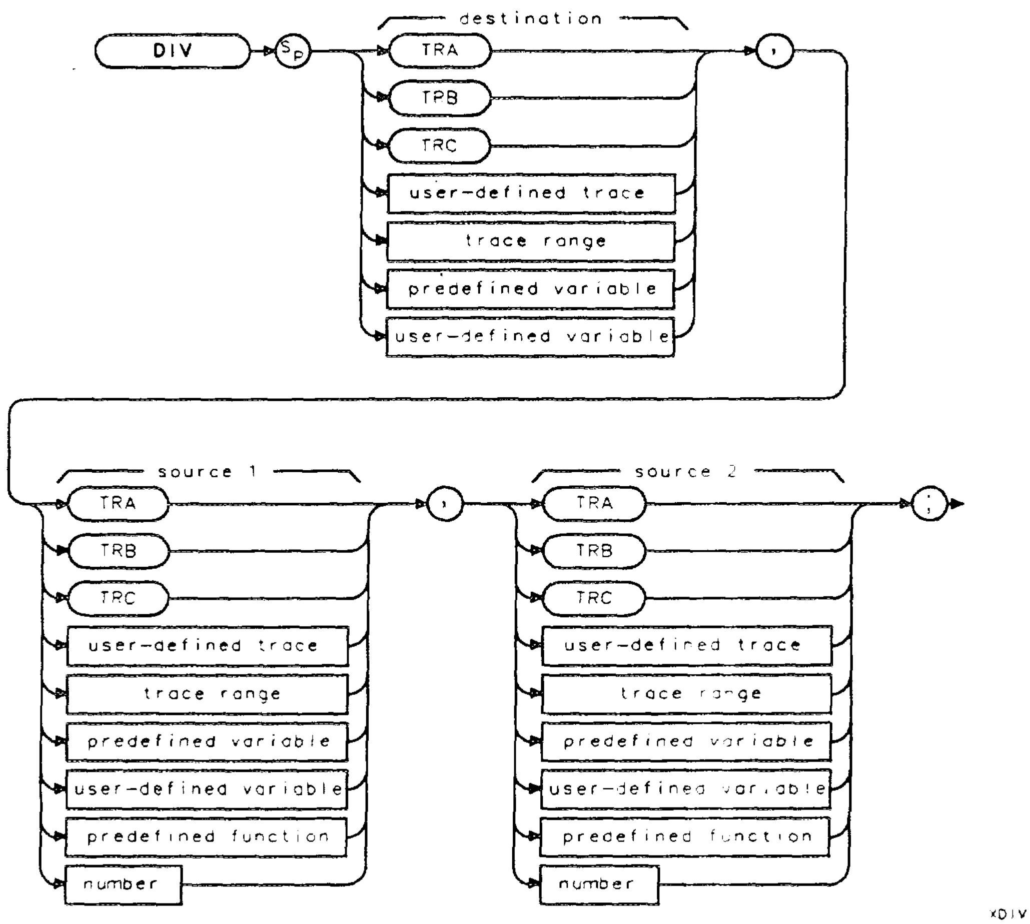
## Description

Using the ONCYCLE, ONDELAY, ONEOS, ONMKR, ONMKRU, ONSRQ, ONSWP, ONTIME, TRMATH, TRDEF, VARDEF, FUNCDEF, ACTDEF, KEYDEF, KEYENH, or KEYCMD programming commands create a trace, variable, function, softkey, or "on-event" function that remains in the spectrum analyzer's memory until you delete it with the DISPOSE command, or execute the ERASE command. With the DISPOSE command, you can select which item is to be deleted (for example, executing "DISPOSE ONMKR;" would delete any ONMKR functions that you have created). Or, if you execute DISPOSE ALL, all of the traces, variables, functions, softkeys, and "on-event" functions that you have created will be deleted from spectrum analyzer memory. Executing "DISPOSE ALL;" or the ERASE command frees all available spectrum analyzer memory (except the state registers and predefined traces), to make the total available user-allotted memory the maximum size.

# DIV
# Divide

Divides source 1 by source 2 and places the result in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: MPY, SNGLS, TS.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `OUTPUT 718;"TS;"` | *Updates trace information.* |
| `OUTPUT 718;"DIV TRB,TRA,2;"` | *Divides trace A by two and places it in trace B.* |
| `OUTPUT 718;"VIEW TRB;"` | *Displays the result.* |

## Description

Integer values are used when a trace is either the destination or one of the sources. If trace data is used both as the source and the destination, the DIV function is done with 32-bit arithmetic on 16-bit integer data. If a user-defined variable or predefined variable is used as either the source or the destination, the DIV function is done in floating-point format. If a real number is used as a source, but the destination is an integer value, the result is truncated.
If a trace is used as a source, be sure the trace contains a complete sweep of measurement information before executing DIV.

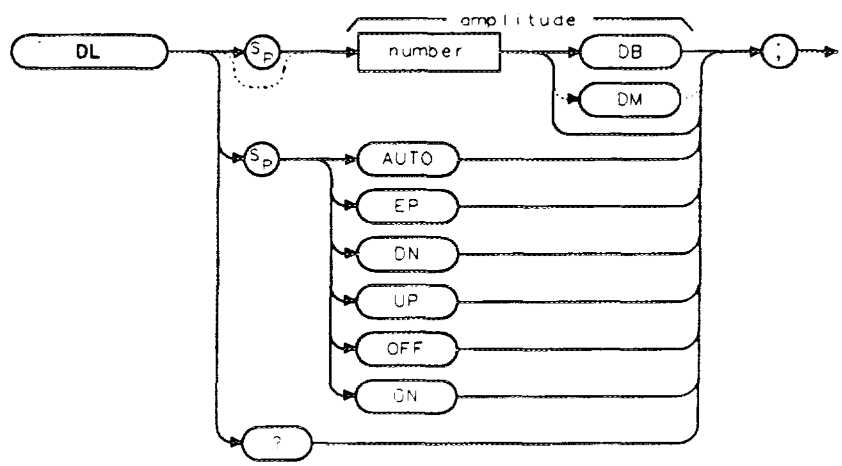
When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

The results of the DIV function are invalid if source 2 is equal to zero.

# DL
# Display Line

Defines the level of the display line in the active amplitude units and displays the display line on the spectrum analyzer screen.

## Syntax



XDL

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default units are dBm. | Dependent on the reference level. |

Equivalent Softkey: **DSP LINE ON OFF** .

Preset State: DL OFF.

Step Increment: 1 major division.

Related Commands: AUNITS, AUTO, LG, LN, NRL, RL, ROFFSET, TH.

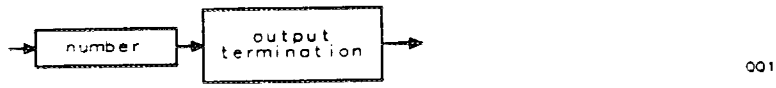
## Example

```
OUTPUT 718;"AUNITS DBM;"   Changes the active amplitude units to dBm.
OUTPUT 718;"DL ON;"        Turns on the display line.
OUTPUT 718;"DL -5DM;"      Changes display line to -5 dBm.
```

## Description

Activating video trigger mode activates the display line. The AUTO command and "DL OFF;" turn off the display line. See "AUNITS" for more information on changing the active amplitude units.

## Query Response



# DN
# Down

Reduces the active function by the applicable step size.

## Syntax


Related Commands: See the list of active functions listed in the description for DN.

## Example

| | |
|---|---|
| `OUTPUT 718;"SS 1MHZ;CF 1GHZ;DN;"` | *Sets center frequency to 1 GHz.* |
| `OUTPUT 718;"SP 40MHZ;MKPK;DN;"` | *Decreases the frequency span.* |

## Description

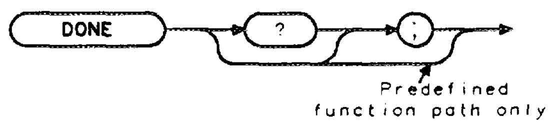
Before executing DN, be sure that the function to be decreased is the active function. For example, the second line of the programming example decreases the span, because marker peak (MKPK) is not an active function.

The active functions are ACPBW, ACPSP, AT, CF, CRTHPOS, CRTVPOS, DL, DOTDENS, FA, FB, FMGAIN, GD, GL, LG, MKA, MKD, MKFCR, MKN, MKPAUSE, MKPX, ML, NDB, NRL, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCALC, SRCAT, SRCPOFS, SRCPSWP, SRCPWR, SRCTK, SS, ST, TH, TVLINE, VB, VBR, and user-defined active function specified by the ACTDEF command.

# DONE
# Done

Allows you to determine when the spectrum analyzer has separated the spectrum analyzer commands and has started to execute all commands prior to and including DONE. The spectrum analyzer returns a value of "1" when all commands in a command string entered before DONE have been started.

## Syntax




XDONE

Related Commands: TS.

## Example

```
OUTPUT 718;"IP;SNGLS;CF 1GHZ;SP 1GHZ;DONE;"
```

*Because TS does not precede the DONE command in this line, the center frequency and span values are set before DONE returns a "1." Functions coupled to SP, such as RB, have not been changed, and there is no trace data associated with the new frequency settings.*

```
ENTER 718;Done
DISP Done
```

## Example 2

```
OUTPUT 718;"IP;SNGLS;CF 1GHZ;SP 1GHZ;TS;DONE;"
```

*Because the take sweep (TS) must be completed before the DONE command is executed, the autocoupled functions and trace data have been changed before the DONE command is executed.*

```
ENTER 718;Done
```

*Stores 1 in computer variable, called Done.*

```
DISP Done
```

**DONE Done**

## Description

As shown by the example, if a take sweep (TS) precedes the DONE command, DONE is executed after all the preceding commands have been completed. Use a take sweep (TS) to ensure all previous commands have completed before DONE returns a "1."

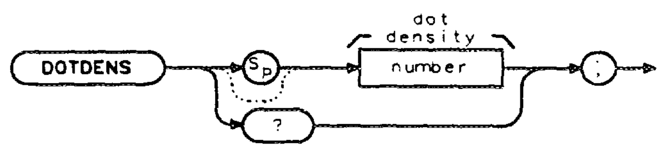
## Query Response


QDONE

# DOTDENS
# Dot Density

Sets the dot density value in the Analog+ display mode.

## Syntax




XDOTDENS

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 1 to 40. |

Equivalent Softkey: **ANALOG+ ON OFF**.
Option Required: Option 101 or 301.
Preset State: 15.
Related Commands: ANLGPLUS.

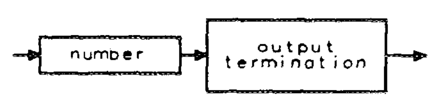
## Example

```
OUTPUT 718;"ANLGPLUS ON;"     Turns on the Analog+ display mode.
OUTPUT 718;"DOTDENS 40;"      Sets the dot density to 40.
```

## Description

The dot density value can be set from 1 to 40 dots per trace element. This command is specific to the Analog+ display mode; see "ANLGPLUS" for more information about the Analog+ display mode.

## Query Response

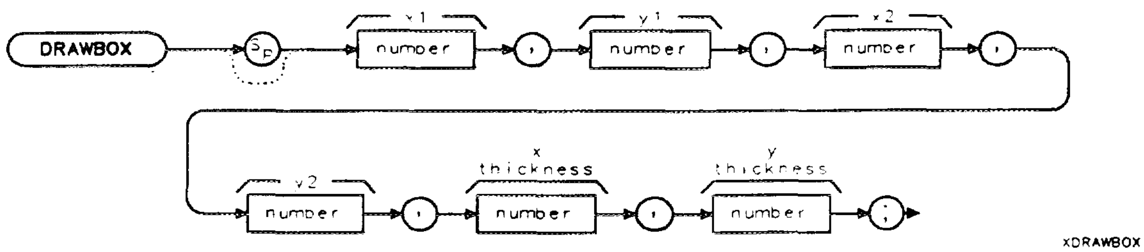



QQ1

## DRAWBOX
## Draw Box

Draws a rectangular box on the spectrum analyzer display.

### Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | For x1 or x2, −40 to 471.<br>For y1 or y2, −22 to 233.<br>For x thickness, 1 to x2 − x1, for y thickness, 1 to y2 − y1. |

Related Commands: CLRDSP.

### Example

The following programming line results in the spectrum analyzer display shown in Figure 5-3.

```
OUTPUT 718;"DRAWBOX 1,1,200,200,10,5;"
```

*Draws a box from 1,1 to 200,200. The box has horizontal borders that are 10 display units wide, and a vertical borders that are 5 display units wide.*

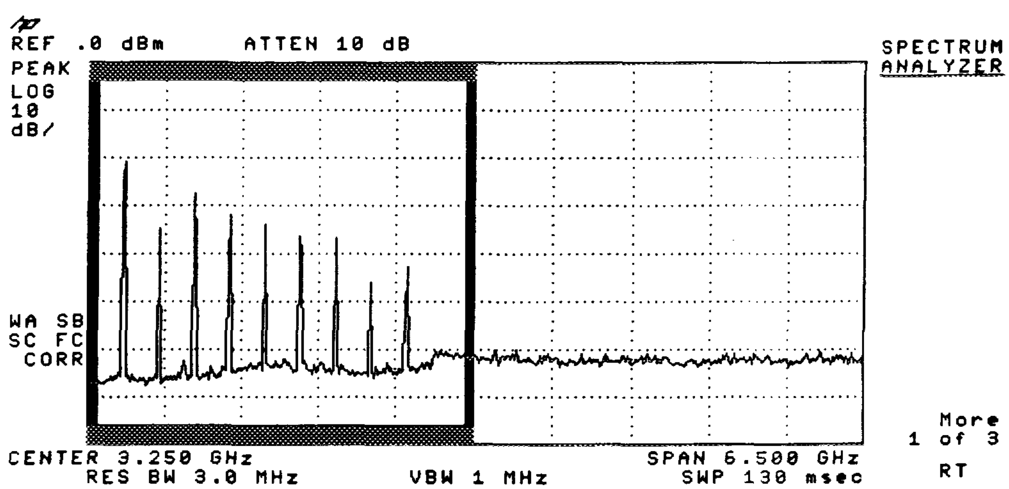



**Figure 5-3. Using the DRAWBOX Command**

## Description

You must specify the rectangular area and the thickness of the horizontal and vertical borders of the box.

**Specifying the rectangular area:** You specify the rectangular area by specifying the coordinates of the lower left corner (x1, y1), and the upper right corner (x2, y2) of the rectangle in display units. If you select a value of x2 that is equal to x1, the result will be a vertical line instead of a box, and the border will be on the right side of the line. If y2 is equal to y1, a horizontal line will be drawn instead of a box, and the border will be below the line.

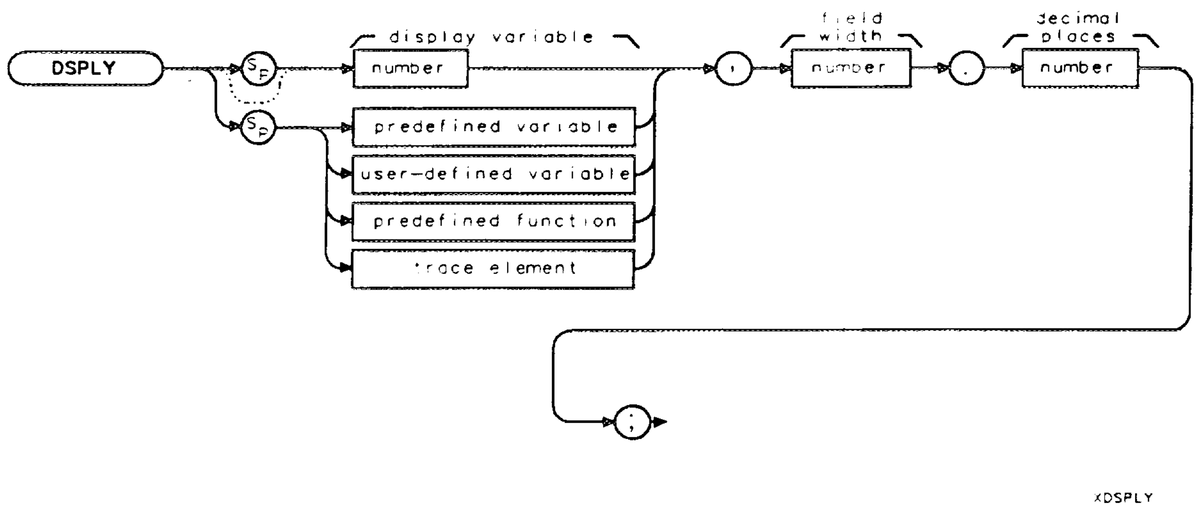
**Specifying the border thickness:** The value of x thickness allows you to specify the width of the horizontal borders, and the value of y thickness allows you to specify the width of the vertical borders. If you select a thickness value that is equal to or greater than half of x2 minus x1 or greater than half of y2 minus y1, the result will be a solid box.

DRAWBOX affects only the spectrum analyzer display and printing of the spectrum analyzer display. DRAWBOX does *not* change the plot of the spectrum analyzer display; the rectangular box drawn by DRAWBOX will not be plotted. The rectangular box can be erased by executing CLRDSP.

# DSPLY
# Display

Displays the value of a variable on the spectrum analyzer screen.

## Syntax




"Field width" specifies the number of digits displayed, including sign and decimal point. (Places to the right of the decimal point are limited by the decimal places field.) For example, the number 123.45 has a field width of 7 (even though the sign is not displayed) and 2 decimal places.

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Real number range. |
| Number (field width or decimal places) | Any integer number. | Integer number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: DA, PA, PD, PR, PU.

## Example

| | |
|---|---|
| `OUTPUT 718;"CF 300MHZ;"` | *Sets center frequency to 300 MHz.* |
| `OUTPUT 718;"PU;PA 50,150;DSPLY CF, 13.3;"` | *Center frequency is displayed to three decimal places in a field width of 13.* |

## Description

The DSPLY command displays the value of a variable anywhere on the spectrum analyzer display. Use the PU, PR, and PA commands to position the variable on the screen. (You do not have to specify the PU or PD commands; DSPLY can display the data independent of PU or PD commands.)

The coordinates given relate to the lower left corner of the first character. For example, "PU;PA 50,100;DSPLY CF,13.3;" would display the center frequency with the first digit to the right and above the point represented by 50, 100. (Position the pen before executing the DSPLY command.)

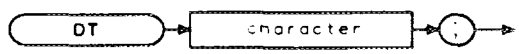
If the number to be displayed is larger than the field width, the number is displayed in scientific notation.

The DSPLY command also places the value of the variable in the display list. See "DA" for more information about the display list.

# DT
# Define Terminator

Defines any character as a label terminator. The label terminator is only used with the LB command.

## Syntax




XDT

| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | |

Related Commands: LB.

## Example

| | |
|---|---|
| `OUTPUT 718;"DT@;"` | *Defines the "@" symbol as the text terminator.* |
| `OUTPUT 718;"CF 600MHZ;"` | *Sets center frequency to 600 MHz.* |
| `OUTPUT 718;"PU;PA 100,100;LB CAL OUT 2ND HARMONIC@RL ODM;"` | *Displays the label "CAL OUT 2ND HARMONIC" on the spectrum analyzer screen then executes the RL command.* |

## Description

The DT command is used by the LB command to separate text from spectrum analyzer commands.

# EE
# Enable Entry

Sends the controller the values entered on the spectrum analyzer numeric keypad by the operator.

## Syntax


XEE

Related Commands: RQS.

## Example

The following example works with both RS-232 and HP-IB interfaces; however, the address (718) must be changed for RS-232 operation.

The program polls the spectrum analyzer for its status byte.

| | |
|---|---|
| `10 PRINTER IS 1` | *Outputs to the computer screen.* |
| `20 DISP "Enter new value with spectrum analyzer number pad and terminate with units key"` | |
| `30 OUTPUT 718;"RQS 2;CF EE;"` | *Sets up SRQ mask, then uses the enable entry mode.* |
| `40 REPEAT` | *Polls the spectrum analyzer until entry is complete.* |
| `50   OUTPUT 718;"STB?;"` | *Asks the spectrum analyzer for status byte.* |
| `60   ENTER 718;A` | |
| `70 UNTIL BIT(A,1)=1` | *Does REPEAT UNTIL loop until user presses a terminating key.* |
| `80 DISP` | *Asks for entry.* |
| `90 OUTPUT 718;"?;"` | |
| `100 ENTER 718;New_value` | |
| `110 PRINT "You entered the value of "; New_value` | *Displays value.* |
| `120 OUTPUT 718;"HD;"` | *Turns off enable entry mode.* |
| `130 END` | |

**EE Enable Entry**

## Description

Unlike enter parameter (EP), EE does not terminate the entry mode when the operator completes an entry.

The EE command is used generally in the following sequence of events:

1. A program loop prevents the controller from using the entered value until the operator signals that the entry is complete.
2. The operator makes a data entry, which is stored in the spectrum analyzer internal data register.
3. The operator indicates completion of the entry.
4. The controller reads the value of the entry and continues to the next program step.

# EK
# Enable Knob

Allows data entry with the front-panel knob when the spectrum analyzer is under remote control.

## Syntax


XEK

## Example

| | |
|---|---|
| `1 PRINTER IS 1` | |
| `10 OUTPUT 718;"MKN;EK;"` | *Activates a marker and enables the front-panel knob.* |
| `20 PRINT "USE KNOB TO PLACE MARKER"` | *While the program pauses, the operator positions a marker on a signal that needs further analysis.* |
| `30 PRINT "PRESS CONTINUE WHEN DONE"` | *Prompts user.* |
| `40 PAUSE` | *The operator positions a marker on a signal that needs further analysis.* |
| ⋮ | *Insert analysis program here.* |
| `100 END` | |

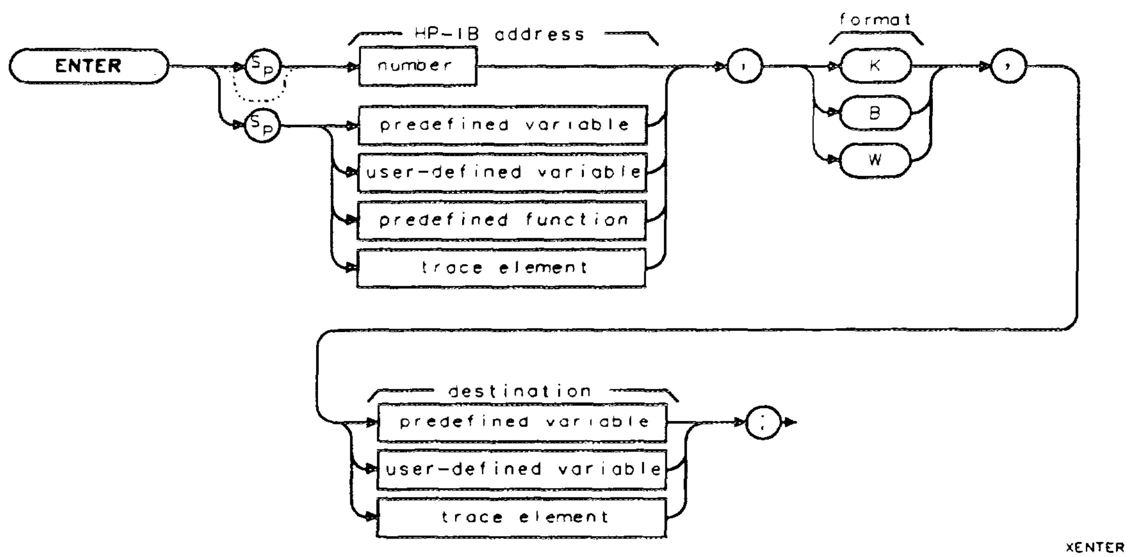
## Description

With the EK command, the knob is functional, but other front-panel functions remain inoperative. Moving the knob changes the active function. If no function is active, moving the knob has no effect.

# ENTER
# Enter From HP-IB

Allows the spectrum analyzer to receive data from other devices on the HP-IB.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 0 to 30. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: FUNCDEF, OUTPUT, RELHPIB.
Required Options: Option 021.

## Example

**Note** The plotter is at address 5 and the spectrum analyzer is at address 18. (The program is only valid for HP 9000 Series 200 and 300 computers.)

The example uses the spectrum analyzer to send the ASCII code for OP; (output parameter) to the plotter. The ENTER command is used to receive the coordinates from the plotter. Program lines 110 to 140 display the coordinates on the spectrum analyzer screen. Softkey 1 is programmed to display the plotter coordinates. Softkey 1 can be accessed by pressing (MEAS/USER), **User Menus** .

**Note**

Disconnect the computer before pressing softkey 1 or execute ABORT 7, LOCAL 7 from the computer. To execute the P_OP function, the spectrum analyzer must be the only controller on the HP-IB.

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF P_ONEX,1,VARDEF P_ONEY,1;"` | *Declares the variables used to hold the plotter coordinates.* |
| `20 OUTPUT 718;"VARDEF P_TWOX,1;VARDEF P_TWOY,1;"` | *Declares the variables used to hold the plotter coordinates.* |
| `30 OUTPUT 718;"FUNCDEF P_OP,@";` | *Defines a function called P_OP.* |
| `40 OUTPUT 718;"OUTPUT 5,B,79;";` | *Sends ASCII code for "O".* |
| `50 OUTPUT 718;"OUTPUT 5,B,80;";` | *Sends ASCII code for "P".* |
| `60 OUTPUT 718;"OUTPUT 5,B,59;";` | *Sends ASCII code for ";".* |
| `70 OUTPUT 718;"ENTER 5,K,P_ONEX;";` | *Gets plotter coordinates from plotter.* |
| `80 OUTPUT 718;"ENTER 5,K,P_ONEY;";` | *Gets Y coordinate from plotter.* |
| `90 OUTPUT 718;"ENTER 5,K,P_TWOX;";` | *Gets X coordinate from plotter.* |
| `100 OUTPUT 718;"ENTER 5,K,P_TWOY;";` | *Gets Y coordinate from plotter.* |
| `110 OUTPUT 718;"PU;PA 200,190;DSPLY P_ONEX,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `120 OUTPUT 718;"PU;PA 200,180;DSPLY P_ONEY,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `130 OUTPUT 718;"PU;PA 200,170;DSPLY P_TWOX,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `140 OUTPUT 718;"PU;PA 200,160;DSPLY P_TWOY,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `150 OUTPUT 718;"RELHPIB;";` | *Releases spectrum analyzer control of the HP-IB.* |
| `160 OUTPUT 718;"@;"` | *Marks the end of the function, P_OP.* |
| `170 OUTPUT 718;"KEYDEF 1,P_OP,!DSP OP;!;"` | *Assigns the P_OP function to softkey 1.* |
| `180 END` | |

## Description

Use the ENTER command to request data from an HP-IB device. The ENTER command causes the spectrum analyzer to assume controller capabilities on HP-IB. The RELHPIB command may be used to disable these capabilities. The returned data is formatted according to the format specified in the format field:

K: Free field. ASCII real number format.

B: One-byte binary.

W: One-word (2 bytes) binary.

# EP
# Enter Parameter Function

Sends values entered on the spectrum analyzer number keyboard to the present active function value. EP must be invoked each time a new value is entered.

## Syntax


XEP

Related Commands: See the list of active functions listed in the description for EP.

## Example

`OUTPUT 718;"ST;EP;"` *The sweep time can be entered by using the front-panel keys.*

## Description

The EP command allows the user to enter a value manually through the numeric keypad. When the value is terminated by a unit or (ENTER) key on the spectrum analyzer, the spectrum analyzer will be ready to execute more remote commands.

**Note** Because the EP command uses the current active function, confirm that the desired function is active before executing the EP command.

The active functions are ACPBW, ACPSP, AT, BAUDRATE, CF, CRTHPOS, CRTVPOS, DL, DOTDENS, FA, FB, FFTSTOP, FMGAIN, FOFFSET, GD, GL, LG, MKA, MKD, MKFCR, MKN, MKPAUSE, MKPX, ML, M4, NDB, NRL, PREAMPG, PRNTADRS, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCAT, SRCPOFS, SRCPSTP, SRCPSWP, SRCPWR, SRCTK, SS, ST, TH, TIMEDATE, TVLINE, VB, VBR, and user-defined active function specified by the ACTDEF command.

# ERASE
# Erase

Clears trace A and trace B, disposes of the contents of the user memory, and resets the state registers and the spectrum analyzer to the instrument preset state.

## Syntax


XERASE

Related Commands: DISPOSE, ONCYCLE, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME, PSTATE, TRDEF, TRMATH, VARDEF.

## Example

```
OUTPUT 718;"ERASE;"
```

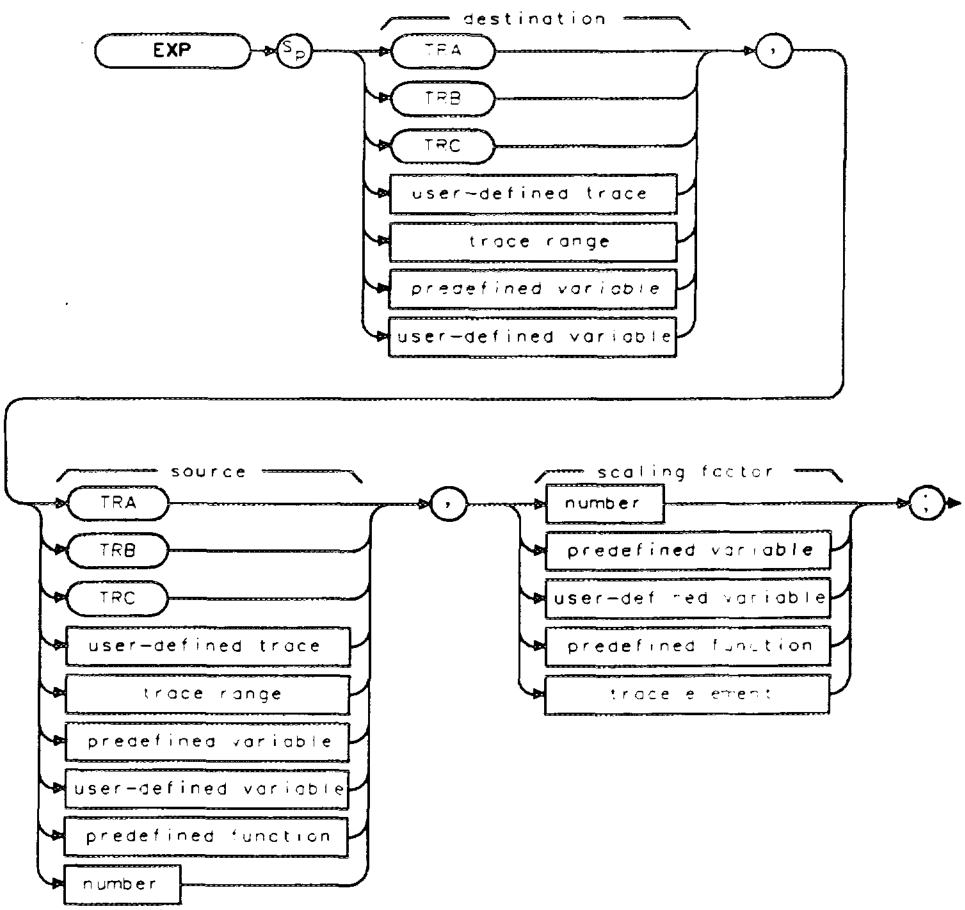
## Description

The ERASE command erases *all* of the user memory by performing a DISPOSE ALL, moving zeros into the trace elements of trace B, and performing an instrument preset (IP). If PSTATE is set to OFF, ERASE clears the state registers also. All user-defined functions, traces, variables, softkeys, and on-event algorithms are erased. (The on-event algorithms are ONCYCLE, ONDELAY, ONEOS, ONMKR, ONMKRU, ONSRQ, ONSWP, ONTIME, and TRMATH.)

# EXP
# Exponent

Places the exponential of the source in the destination. The EXP command is useful for converting log values to linear values.

## Syntax




XEXP

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: FUNCDEF, LOG.

## Example 1

This example converts the marker amplitude to power units.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates the single-sweep mode.* |
| `30 OUTPUT 718;"VARDEF P_MW,0;"` | *Initializes variable P_MW to 0.* |
| `40 OUTPUT 718;"TS;MKPK HI;"` | *Finds highest peak of sweep.* |
| `50 OUTPUT 718;"EXP P_MW,MKA,10;"` | *Divides the marker amplitude by 10, raises the value of the marker amplitude to the power of 10, and stores the results in P_MW.* |
| `60 OUTPUT 718;"P_MW?;"` | *Returns the value of P_MW to computer.* |
| `70 ENTER 718;Number` | *Assigns value to computer variable.* |
| `80 DISP Number;"mW"` | *Displays result on the computer screen.* |
| `90 END` | |

## Example 2

This example finds the natural exponential of a number and uses the LOG command to return the original source value of the EXP function.

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF E_XP,0;"` | *Defines a variable called E_XP.* |
| `20 OUTPUT 718;"EXP E_XP,2,2.30259;"` | *Finds the natural exponential of 2.* |
| `30 OUTPUT 718;"E_XP?;"` | *Returns the natural exponent of 2.* |
| `40 ENTER 718;Value` | |
| `50 PRINT Value` | *Prints the value of the exponential.* |
| `60 OUTPUT 718;"LOG E_XP,E_XP,2.30259;"` | *Uses the log function on the exponential value.* |
| `70 OUTPUT 718;"E_XP?;"` | *The log of the exponential value is approximately 2.* |
| `80 ENTER 718;Logvalue` | |
| `90 PRINT Logvalue` | *Prints value.* |
| `100 OUTPUT 718;"VARDEF E_XPY,0;"` | *Declares a variable called E_XPY.* |
| `110 OUTPUT 718;"EXP E_XPY,-5,2.30259;"` | *Finds the natural exponential of −5.* |
| `120 OUTPUT 718;"E_XPY?;"` | *Returns the value of the natural exponential of −5.* |
| `130 ENTER 718;Value2` | |
| `140 PRINT Value2` | *Prints the value of the exponential.* |
| `150 OUTPUT 718;"LOG E_XPY,E_XPY,2.30259;"` | *Uses the log function on the exponential value.* |
| `160 OUTPUT 718;"E_XPY?;"` | *The log of the exponential value is approximately −5.* |
| `170 ENTER 718;Logval` | |
| `180 PRINT Logval` | |
| `190 END` | |

## Description

The EXP command first divides the source by the scaling factor, then uses the quotient as an exponent of 10:

$10^{source/scaling\ factor}$ is placed into the destination.

The EXP command can be used to evaluate a natural exponential function by using 2.30259 as the scaling factor. Because EXP and LOG are inverse functions, the EXP command has a scaling factor that may be used to "undo" the scaling factor of the LOG command. (See example 2.)

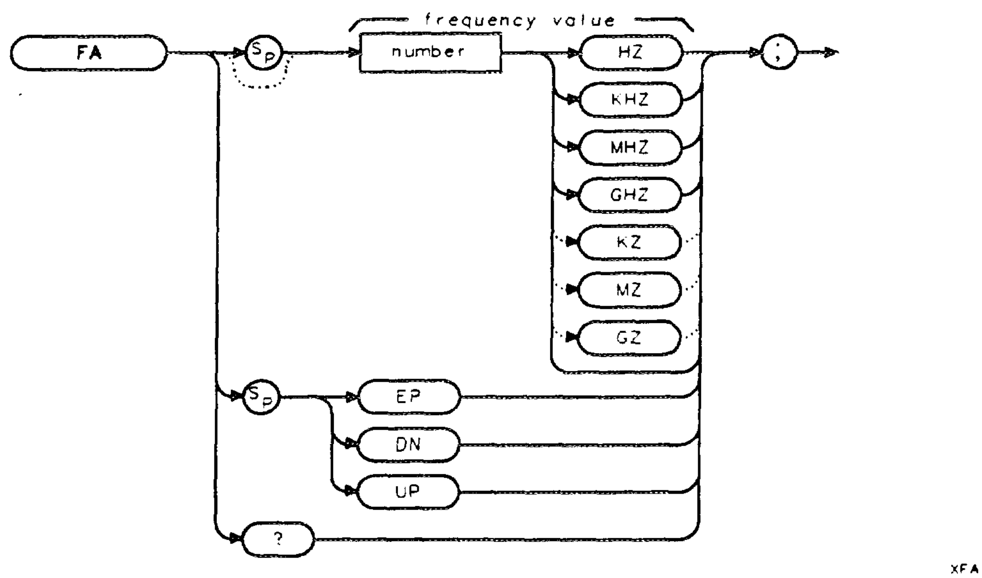
When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

See "LOG" for more information on the scaling factor.

# FA
# Start Frequency

Specifies the start frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency range of the spectrum analyzer. |

Equivalent Softkey: **START FREQ** .

Step Increment: Frequency span divided by 10.

Related Commands: CF, FB, FOFFSET, FS, HNLOCK, HNUNLK, MKF, SP.

## Example

| | |
|---|---|
| `OUTPUT 718;"FA 88MHZ;FB 108MHZ;"` | *Sets the start frequency to 88 MHz, the stop frequency to 108 MHz.* |
| `OUTPUT 718;"FA?;"` | *Returns the start frequency.* |
| `ENTER 718;Freq` | *Stores the response from the spectrum analyzer.* |
| `DISP Freq` | *Displays the frequency on the computer screen.* |

FA Start Frequency

## Description

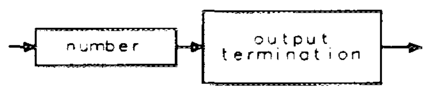
The FA command specifies the start frequency value. The start frequency is equal to the center frequency minus the span divided by two (FA = CF − SP/2).

---

**Note** Changing the start frequency changes the center frequency and span. *For the HP 8592D, HP 8593E, HP 8595E, HP 8596E only:* The start frequency may be limited by the harmonic band, if harmonic band locking is used.

---

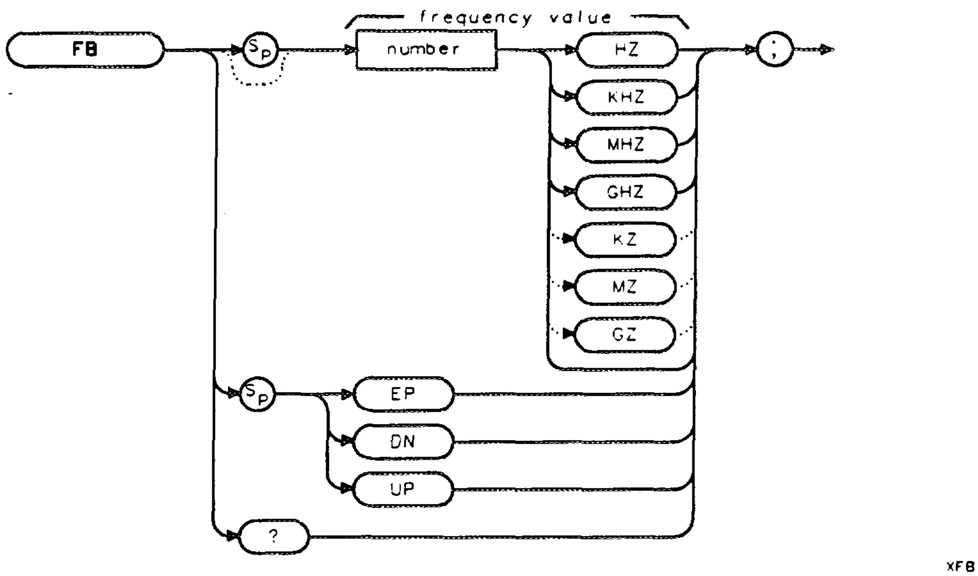
## Query Response



# FB
# Stop Frequency

Specifies the stop frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency range of the spectrum analyzer. |

Equivalent Softkey: **STOP FREQ**.
Step Increment: Frequency span divided by 10.
Related Commands: CF, FA, FOFFSET, FS, HNLOCK, MKF, SP.

## Example

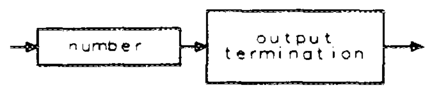
| | |
|---|---|
| `OUTPUT 718;"FA 88MHZ;FB 108MHZ;"` | *Sets the start frequency to 88 MHz, the stop frequency to 108 MHz.* |
| `OUTPUT 718;"FB?;"` | *Returns the stop frequency.* |
| `ENTER 718;Freq` | *Stores the response from the spectrum analyzer.* |
| `DISP Freq` | *Displays the frequency on the computer screen.* |

## Description

The FB command specifies the stop frequency value. The stop frequency is equal to the center frequency plus the span divided by two (FA = CF + SP/2).

**Note** Changing the stop frequency changes the center frequency and span. *For the HP 8592D, HP 8593E, HP 8595E, or HP 8596E only:* The stop frequency may be limited by the harmonic band, if harmonic band locking is used.

## Query Response

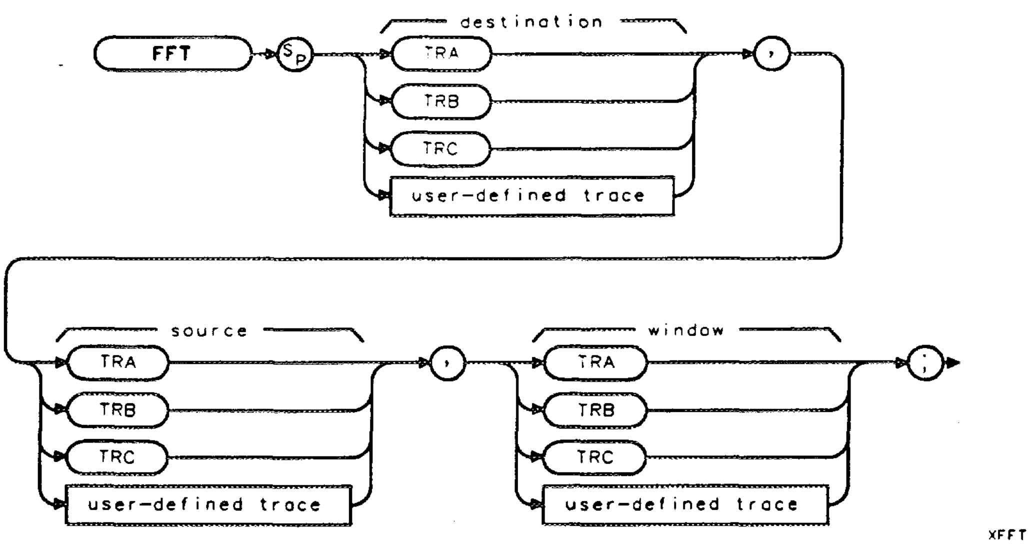



QQ1

# FFT
# Fast Fourier Transform

Performs a discrete fast Fourier transform on the source trace array and stores the result in the destination array.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |

Prerequisite Commands: TWNDOW.
Related Commands: MKREAD, TWNDOW.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"CF 300MHZ;TS;MKPK HI;MKTRACK ON;"` | *Tunes center frequency to the carrier and decreases span.* |
| `OUTPUT 718;"CONTS;SP 200KHZ;RB 100KHZ;"` | *Changes resolution bandwidth to capture modulation.* |
| `OUTPUT 718;"MKTRACK OFF;SP 0HZ;"` | *Reduces span to zero Hz to demodulate carrier.* |
| `OUTPUT 718;"MKPK HI;MKRL;LN;SNGLS;"` | *Changes to linear amplitude scale.* |
| `OUTPUT 718;"ST 800MS;TS;"` | *Sets sweep time to correspond to modulation frequency, the executes FFT function.* |
| `OUTPUT 718;"TWNDOW TRB,FLATTOP;"` | *The TWNDOW must be defined before using the FFT function.* |

```
OUTPUT 718;"FFT TRA,TRA,TRB;VIEW TRA;"     Executes the FFT function with the
                                           trace window function.
OUTPUT 718;"MKPK HI;"                      Finds the highest signal.
OUTPUT 718;"MKD;"                          Activates the marker delta function.
OUTPUT 718;"MKPK NR;"                      Finds the next peak to the right.
OUTPUT 718;"MKREAD FFT;"                   Selects the FFT marker to display
                                           the marker delta value as a fre-
                                           quency instead of time value.
OUTPUT 718;"MKF?;"                         Finds the difference between the two
                                           peaks.
ENTER 718;A
DISP A                                     Displays the frequency difference.
```

## Description

FFT weights the source trace with the function in the window trace (the window trace is described below). The transform is computed and the results are placed in the destination trace. Unlike FFTAUTO and FFTCONTS, FFT performs the FFT measurement only once. Use FFTAUTO or FFTCONTS if you want the FFT measurement to be performed at the end of every measurement sweep.

The spectrum analyzer should be in linear mode when using the FFT command. The FFT results are displayed on the spectrum analyzer in logarithmic scale. For the horizontal dimension, the frequency at the left side of the graph is 0 Hz, and at the right side is Fmax.

Fmax can be calculated using a few simple equations and the sweep time of the spectrum analyzer. The sweep time divided by the number of trace array elements containing amplitude information is equal to the sampling period. The reciprocal of the sampling period is the sampling rate. The sampling rate divided by two yields Fmax.

For example, let the sweep time of the spectrum analyzer be 20 ms and the number of trace elements be 400. The sweep time (20 ms) divided by 400 equals 50 $\mu$s, the sampling period. The sample rate is 1/50 $\mu$s. Fmax equals 1/50 $\mu$s divided by 2, or 10 kHz.

FFT is designed to be used in transforming zero span information into the frequency domain. Performing FFT on a frequency sweep (when the frequency span is greater than zero) will not provide time-domain results.

The windowing function stored in the window trace may be selected with the trace window (TWNDOW) command or you can store your own values in that trace. The trace window function modifies the contents of a trace array according to one of three built-in algorithms: UNIFORM, HANNING, or FLATTOP. See Figure 5-4, Figure 5-5, and Figure 5-6. The TWNDOW command multiplies a trace array with one of these windows.

**Selecting a window:** The amplitude and frequency uncertainty of the Fourier-transformed display depends on both the choice of trace windows and the spectrum analyzer sweep time. Amplitude uncertainty is maximum when the spectral component falls midway between the filter shapes. Passbands that are flatter in shape, like the FLATTOP filter, contribute less amplitude uncertainty, but frequency resolution and sensitivity are compromised.

The UNIFORM window algorithm has the least frequency uncertainty and greatest amplitude uncertainty. The UNIFORM window does not contain time-domain weighing and leaves the data alone. Use the UNIFORM window for transforming noise signals or transients that decay within one sweep time period. The UNIFORM window yields the best frequency resolution, but also produces the highest side lobes for periodic signals.

The FLATTOP window has the greatest frequency uncertainty of the windows, but it has outstanding side lobe suppression and amplitude flatness. Use FLATTOP to transform periodic signals.

The HANNING window is a traditional passband window found in most real-time spectrum analyzers. The HANNING window offers a compromise between the FLATTOP and UNIFORM windows. Use the HANNING window when transforming periodic or random data.

The values in the window trace range from −32,768 to 32,767 and are treated as fractional numbers. No offset is used. When FFT is called, the average window value is computed and used to correct the results in absolute units.

The Fourier transforms of the window functions (created with TWNDOW) are shown below. Use the graphs to estimate resolution and amplitude uncertainty of a Fourier transform display. Each horizontal division of the graphs equals 1/sweep-time or Fmax/200, and represents two trace array elements.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

**Note** TWNDOW should always be set before FFT is executed. Execute `MKREAD FFT` to read the marker value as a frequency value instead of time value.

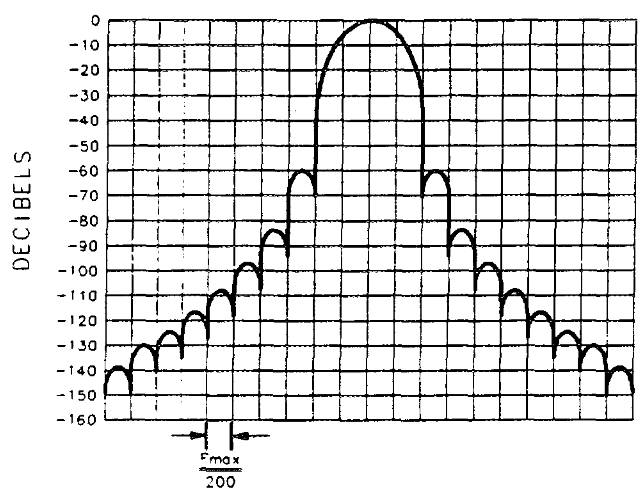



**Figure 5-4. Hanning Filter Window**

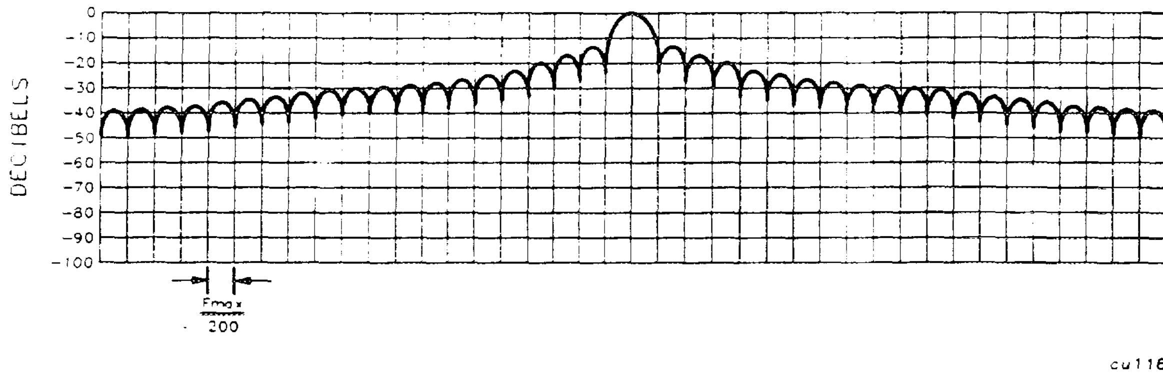



**Figure 5-5. Uniform Filter Window**

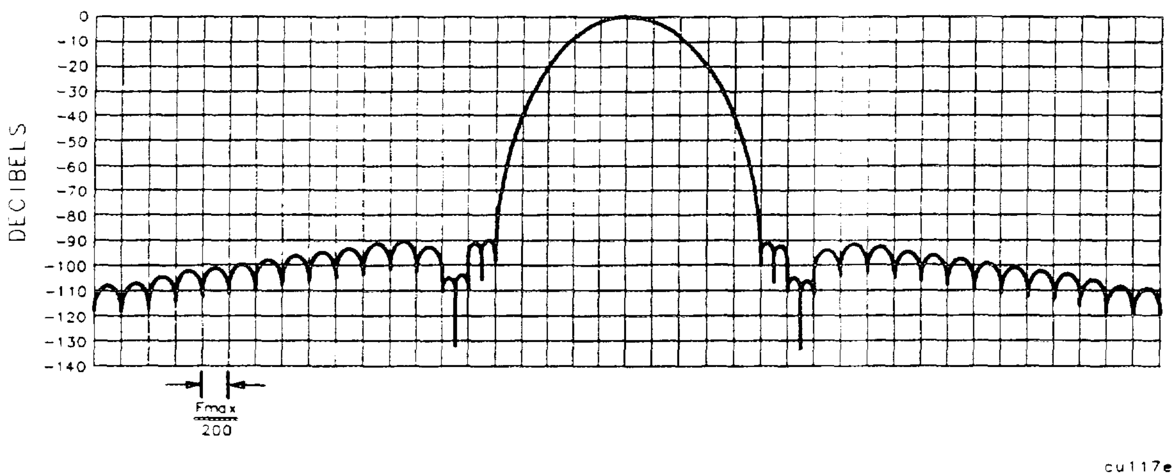



**Figure 5-6. Flat Top Filter Window**

# FFTAUTO
# Marker to Auto FFT

Performs a fast Fourier transform (FFT) on the signal on which the marker is placed.

## Syntax


XFFTAUTO

Equivalent Softkey: **MARKER -> AUTO FFT**.

Prerequisite Commands: Use a marker command to place a marker on the signal of interest. See Table 5-4 for a list of the marker commands.

Related Commands: FFTCONTS, FFTOFF, FFTSNGLS.

## Example

This example can be used to perform an FFT continuously on an amplitude modulated signal at 100 MHz.

| | |
|---|---|
| `OUTPUT 718;"RL 0DB;"` | *Sets reference level to 0 dBm.* |
| `OUTPUT 718;"CF 100MHZ;"` | *Sets the center frequency to 100 MHz.* |
| `OUTPUT 718;"SP 10MHZ;"` | *Decreases the frequency span.* |
| `OUTPUT 718;"MKPK HI;"` | *Places the marker on a signal (this example assumes that there is only one signal present).* |
| `OUTPUT 718;"FFTAUTO;"` | *Zooms in on the signal, and then does an FFT continuously on the modulated signal.* |

## Description

FFTAUTO uses the marker's position to determine which signal is to be measured. FFTAUTO centers the signal and, if the frequency span of the spectrum analyzer is greater than zero, decreases the frequency span to zero before performing an FFT on the signal. When the FFT is performed, the spectrum analyzer does the following:

- Changes to the continuous sweep mode.
- Changes to the linear amplitude scale.
- If the current detector is the peak detector, changes to the sample detector.
- If the initial frequency span was greater than 0 Hz, the spectrum analyzer adjusts the signal peak to within 0.5 division of the top graticule.
- Does an FFT on trace A and then places trace A in both the clear-write and store-blank modes. (When the spectrum analyzer is in both the clear-write and store-blank modes, the trace data is still taken from the spectrum analyzer input during every measurement sweep, but the trace is *not* shown on the spectrum analyzer display.)
- Places the results of the FFT in trace B, and then changes trace B to the view mode.

FFTAUTO performs the FFT on the signal at the end of every sweep. After executing FFTAUTO, you should adjust the values for the resolution bandwidth, video bandwidth, and sweep time according to the highest modulation frequency of interest. The resolution bandwidth should be about ten times greater than the highest modulation frequency of interest, and the video bandwidth should be about 10 times higher than the highest modulation frequency of interest. The sweep time should be set according to the chart shown in

"Measuring Amplitude Modulation with the Fast Fourier Transform Function" in Chapter 4 of the *HP 8590 Series Spectrum Analyzer User's Guide*. You can use the results of the FFTCLIP command to determine if the FFT data is valid.

**Restrictions**

Executing FFTAUTO turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), power menu measurements (ACP, ACPE, CHP, and OBW), and Analog+ display mode (ANLGPLUS).

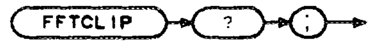
FFTAUTO uses the following when performing an FFT:

- The flat top filter window. (See "FFT" for more information about the flat top filter window.)
- Trace B and trace C. If you want to save the trace data that is in trace B or trace C, you should save the trace data before executing FFTAUTO, FFTCONTS, or FFTSNGLS. (See "SAVET" for more information about saving trace data.)
- The FFTMKR command to turn on the FFT markers (you can use the MKA or MKF to determine the amplitude or frequency of the marker).

# FFTCLIP
# FFT Signal Clipped

Indicates if the FFT results are valid.

## Syntax




XFFTCLIP

Prerequisite Commands: FFTAUTO, FFTSNGLS, FFTCONTS.
Related Commands: FFTSTAT.

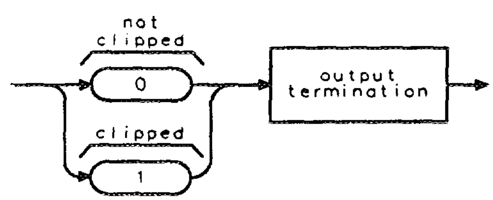
## Example

| | |
|---|---|
| `OUTPUT 718;"FFTCONTS;"` | *Starts the FFT.* |
| `OUTPUT 718;"FFTCLIP?;"` | *Queries FFTCLIP.* |
| `ENTER 718;Fftclipped` | *Returns the value of FFTCLIP.* |

## Description

Whenever you use FFTAUTO, FFTCONTS, or FFTSNGLS to perform an FFT on a signal, you can use the FFTCLIP command to determine if the FFT data is valid. If the current measurement sweep resulted in a trace that is above the top graticule line on the spectrum analyzer display, the input trace (trace A) has been "clipped," and the FFT data is not valid. If the input trace is not clipped, the FFT data is valid.

## Query Response




QFFTCLIP

# FFTCONTS
## FFT Continuous Sweep

Performs a fast Fourier transform (FFT) continuously on the current signal.

### Syntax


XFFTCONTS

Equivalent Softkey: `CONTINUS FFT`.
Prerequisite Commands: LN, SP.
Related Commands: FFTOFF, FFTSNGLS.

### Example

| | |
|---|---|
| `OUTPUT 718;"SP OHZ;"` | *Sets the spectrum analyzer to zero span.* |
| `OUTPUT 718;"LN;"` | *Changes the amplitude scale to linear.* |
| `OUTPUT 718;"FFTCONTS;"` | *Starts the continuous FFT.* |

### Description

You should change the frequency span to 0 Hz and the amplitude scale to linear before executing FFTCONTS. When FFTCONTS is executed, the spectrum analyzer does the following:

- Changes to the continuous sweep mode.
- If the current detector is the peak detector, changes to the sample detector.
- Does an FFT on trace A. Trace A is then placed in both the clear-write and store-blank modes. (When the spectrum analyzer is in both the clear-write and store-blank modes, the trace data is still taken from the spectrum analyzer input during every measurement sweep, but the trace is *not* shown on the spectrum analyzer display.)
- Places the results in trace B (trace B is placed in the view mode).

You can use the results of the FFTCLIP command to determine if the FFT data is valid. If you want to view the input data (trace A), execute `"TRDSP TRA,ON;"`.

**Restrictions**
Executing FFTCONTS turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), power menu measurements (ACP, ACPE, CHP, and OBW), or Analog+ display mode (ANLGPLUS).

FFTCONTS uses the following when performing an FFT:

- The flat top filter window. See "FFT" for more information about the flat top filter window.
- Trace B and trace C. If you want to save the trace data that is in trace B or trace C, you should save the trace data before executing FFTAUTO, FFTCONTS, or FFTSNGLS. (See "SAVET" for more information about saving trace data.)
- The FFTMKR command to turn on the FFT markers (you can use the MKA or MKF to determine the amplitude or frequency of the marker).

You should execute the FFTOFF command when you are finished using the FFT measurement.

# FFTMKR
# FFT Markers

Activates the FFT markers and displays the FFT annotation on the spectrum analyzer display.

## Syntax


XFFTMKR

Equivalent Softkey: **FFT MARKERS**.

Related Commands: FFTCONTS, FFTOFF, FFTSNGLS, FFTPCTAM, FFTPCTAMR, MKA, MKF.

## Example

| | |
|---|---|
| `OUTPUT 718;"RCLT TRA,1;"` | *Recalls the FFT trace.* |
| `OUTPUT 718;"FFTMKR;"` | *Activates the FFT markers.* |

## Description

If the spectrum analyzer is not performing an FFT measurement, the FFTMKR command displays the FFT annotation below the last graticule on the spectrum analyzer display, and activates the marker in the FFT readout mode. (FFTMKR uses the current sweep time to determine the FFT stop frequency that is displayed.) If the spectrum analyzer is already performing an FFT, executing FFTMKR activates only the FFT markers. You need to execute FFTOFF to exit out of the FFT measurement and return to normal spectrum analyzer operation.

**Restrictions**

Executing FFTMKR turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), power menu measurements (ACP, ACPE, CHP, and OBW), and Analog+ display mode (ANLGPLUS).

The purpose of the FFTMKR command is to allow you to restore the FFT annotation when you recall FFT trace data (the FFT annotation is not saved when you save trace data). The percent AM readout can also be restored by executing the FFTPCTAM command after FFTMKR. (See "FFTPCTAM" for more information about the percent AM measurement.)

You can use the MKF or MKA commands to determine the amplitude or frequency of an FFT marker.

# FFTMM
# FFT Marker to Midscreen

Changes the FFT midscreen frequency of the spectrum analyzer to the frequency of the FFT marker.

## Syntax


XFFTMM

Equivalent Softkey: **MARKER -> MID SCRN** .
Prerequisite Commands: FFTAUTO, FFTSNGLS, FFTCONTS.
Related Commands: FFTMS, MKA, MKF.

## Example

| | |
|---|---|
| `OUTPUT 718;"FFTCONTS;"` | *Starts the continuous FFT.* |
| `OUTPUT 718;"MKPK HI;"` | *Finds the signal with the highest amplitude (usually the signal at 0 Hz).* |
| `OUTPUT 718;"MKPK NH;"` | *Finds the signal with the next highest amplitude (usually the dominant modulation frequency).* |
| `OUTPUT 718;"FFTMM;"` | *Moves the signal to FFT midscreen.* |

## Description

FFTMM is performed only if the spectrum analyzer is performing a FFT measurement. Changing the FFT midscreen frequency of the spectrum analyzer also changes the FFT stop frequency of the spectrum analyzer. Because the FFT stop frequency is limited by sweep time of the spectrum analyzer, it may not be possible to change the FFT midscreen frequency to the frequency of the FFT marker. If the FFTMM command does not move the signal to the FFT midscreen frequency, you should check if the FFT stop frequency is limited by the sweep time range or the sweep time increments for your spectrum analyzer. The FFT stop frequency is related to the sweep time as follows:

$$FFT\ stop\ frequency = \frac{400}{(Sweep\ time\ \times 2)}$$

# FFTMS
# FFT Marker to FFT Stop Frequency

Changes the FFT stop frequency of the spectrum analyzer to the frequency of the FFT marker.

## Syntax


XFFTMS

Equivalent Softkey: **MARKER -> FFT STOP** .
Prerequisite Commands: FFTAUTO, FFTSNGLS, FFTCONTS.
Related Commands: FFTMM, MKA, MKF.

## Example

| | |
|---|---|
| `OUTPUT 718;"FFTCONTS;"` | *Starts the continuous FFT.* |
| `OUTPUT 718;"MKPK HI;"` | *Finds the signal with the highest amplitude (usually the signal at 0 Hz).* |
| `OUTPUT 718;"MKPK NH;"` | *Finds the signal with the next highest amplitude (usually the dominant modulation frequency).* |
| `OUTPUT 718;"FFTMS;"` | *Changes the FFT stop frequency to the signal frequency.* |

## Description

FFTMS is performed only if the spectrum analyzer is performing a FFT measurement. If a marker is on a signal, FFTMS will move that signal to the right side of the graticule. FFTMS is useful because moving the signal toward the FFT stop frequency increases the frequency resolution of the FFT measurement. For best results, the signal of interest should be placed slightly left of the FFT stop frequency (the signal should not touch the right side of the graticule). If the signal is placed at the FFT stop frequency, small variations in acquired data can cause large changes in the displayed amplitude of the signal which do not reflect the actual signal amplitude.

Because the FFT stop frequency is limited by sweep time of the spectrum analyzer, it may not be possible to change the FFT midscreen frequency to the frequency of the FFT marker. If the FFTMS command does not move the signal to the FFT stop frequency, you should check if the FFT stop frequency is limited by the sweep time range or sweep time increments for your spectrum analyzer. The FFT stop frequency is related to the sweep time as follows:

$$FFT\ stop\ frequency = \frac{400}{(Sweep\ time\ \times 2)}$$

# FFTOFF
# FFT Off

Exits the fast Fourier transform (FFT) measurement and FFT settings.

## Syntax


XFFTOFF

Equivalent Softkey: **FFT OFF** .

Prerequisite Commands: FFTAUTO, FFTSNGLS, FFTCONTS, FFTMKR.
Related Commands: FFTMKR, FFTAUTO, FFTCONTS, FFTSNGLS.

## Example

```
OUTPUT 718;"FFTCONTS;"
OUTPUT 718;"FFTOFF;"
```

| | |
|---|---|
| OUTPUT 718;"FFTCONTS;" | *Starts the continuous FFT.* |
| OUTPUT 718;"FFTOFF;" | *Turns off the FFT.* |

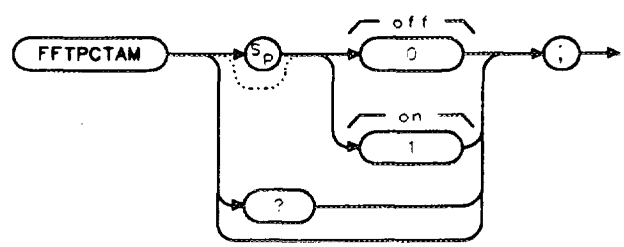
## Description

The FFTOFF command aborts any of the FFT functions (FFTAUTO, FFTCONTS, FFTMKR, or FFTSNGLS) and returns the spectrum analyzer display back to normal.

# FFTPCTAM
# FFT Percent Amplitude Modulation

Turns on or off the percent AM function.

## Syntax




XFFTPCTAM

Equivalent Softkey: FFTPCTAM is equivalent to using **% AM ON OFF** during an FFT measurement.
Prerequisite Commands: FFTCONTS, FFTMKR, FFTSNGLS, FFTAUTO.
Related Commands: FFTPCTAMR.

## Example

```
OUTPUT 718;"FFTCONTS;"              Starts the FFT.
OUTPUT 718;"MOV FFTPCTAM,1;"        Turns on the percent AM function.
```

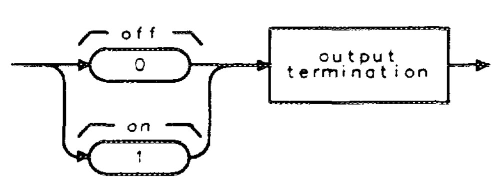
## Description

The FFTPCTAM command turns the percent AM function on or off. The percent AM modulation is calculated using only the largest single frequency of modulation.

FFTPCTAM can be executed on FFT trace data even if an FFT measurement is not being performed, as long as the FFT marker (FFTMKR) is invoked. For example, you can restore the percent AM readout of a recalled FFT trace by executing the FFTMKR command, and then the FFTPCTAM command.

You can execute the FFTPCTAM command two different ways. You can either execute the FFTPCTAM command directly (for example, "FFTPCTAM 1;") or use the MOV command to move the 1 or 0 into the FFTPCTAM command (for example, "MOV FFTPCTAM,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response




OFFTPCTAM

# FFTPCTAMR
# FFT Percent Amplitude Modulation Readout

Returns the percent of amplitude modulation (AM).

## Syntax


XFFTPCTAMR

Prerequisite Commands: FFTCONTS, FFTMKR, FFTSNGLS, FFTAUTO, FFTPCTAM.
Related Commands: FFTPCTAM.

## Example

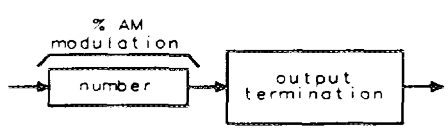
| | |
|---|---|
| `OUTPUT 718;"FFTCONTS;"` | *Starts the FFT.* |
| `OUTPUT 718;"MOV FFTPCTAM,1;"` | *Turns on the percent AM function.* |
| `OUTPUT 718;"FFTPCTAMR?;"` | *Queries the percent AM reading.* |
| `ENTER 718;Percentam` | *Gets the percent AM reading.* |

## Description

FFTPCTAMR returns either a positive real number, a "0," or a "−1" as follows:

| | |
|---|---|
| A real number | If the a valid signal could be measured, FFTPCTAMR returns a real number that represents the percent AM of the FFT signal (the percent AM is calculated using only the largest single frequency of modulation). |
| 0 | If no modulation was detected, FFTPCTAMR returns a "0." |
| −1 | If the FFT input was above the top graticule (clipped), FFTPCTAMR returns a "−1." |

## Query Response




QFFTPCTAMR

# FFTSNGLS
# FFT Single Sweep

Changes the spectrum analyzer's sweep mode to single sweep mode (if necessary), and then performs a fast Fourier transform (FFT) on trace A.

## Syntax


XFFTSNGLS

Equivalent Softkey: `SINGLE FFT`.
Prerequisite Commands: LN, SP.
Related Commands: FFTCONTS, FFTOFF.

## Example

| | |
|---|---|
| `OUTPUT 718;"SP 0HZ;"` | *Sets the spectrum analyzer to zero span.* |
| `OUTPUT 718;"LN;"` | *Changes the amplitude scale to linear.* |
| `OUTPUT 718;"FFTSNGLS;"` | *Performs the FFT.* |

## Description

You should change the frequency span to 0 Hz and the amplitude scale to linear before executing FFTSNGLS. How FFTSNGLS performs the FFT depends on the current sweep mode, the trace status of trace A, and if FFTSNGLS is already active.

- If the spectrum analyzer is in the single-sweep mode or trace A is in the view mode when FFTSNGLS is first executed, the spectrum analyzer does an FFT on trace A without updating the contents of trace A.
- If the spectrum analyzer is in the continuous-sweep mode when FFTSNGLS is executed, the spectrum analyzer changes to the single sweep mode, and then does an FFT on trace A.
- If the spectrum analyzer is currently performing the FFTSNGLS command, a take sweep is performed and then an FFT is performed on trace A.

FFTSNGLS does the following when performing an FFT:

- If the current detector is the peak detector, the detector is changed to the sample detector.
- Places trace A in both the clear-write and store-blank modes. (When the spectrum analyzer is in both the clear-write and store-blank modes, the trace data is still taken from the spectrum analyzer input during every measurement sweep, but the trace is *not* shown on the spectrum analyzer display.)
- Places the results of the FFT in trace B, and then changes trace B to the view mode.

**Restrictions**

Executing FFTSNGLS exits the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), power menu measurements (ACP, ACPE, CHP, and OBW), and Analog+ display mode (ANLGPLUS).

You can use the results of the FFTCLIP command to determine if the FFT data is valid.

FFTSNGLS uses the following when performing an FFT:

**FFTSNGLS FFT Single Sweep**

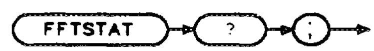
- The flat top filter window. See "FFT" for more information about the flat top filter window.
- Trace B and trace C. If you want to save the trace data that is in trace B or trace C, you should save the trace data before executing FFTAUTO, FFTCONTS, or FFTSNGLS. (See "SAVET" for more information about saving trace data.)
- The FFTMKR command to turn on the FFT markers (you can use the MKA or MKF to determine the amplitude or frequency of the marker).

You should execute the FFTOFF command when you are finished using the FFT measurement.

# FFTSTAT
# FFT Status

Returns the status of the spectrum analyzer's FFT measurement functions.

## Syntax




XFFTSTAT

Prerequisite Commands: FFTAUTO, FFTSNGLS, FFTCONTS, FFTMKR.
Related Commands: FFTCLIP.

## Example

| | |
|---|---|
| `OUTPUT 718;"FFTCONTS;"` | *Starts the FFT.* |
| `OUTPUT 718;"FFTSTAT?;"` | *Queries FFTSTAT.* |
| `ENTER 718;Fftstatus` | *Returns the value of FFTSTAT.* |

## Description

FFTSTAT returns either a "0," a "1," or a "2" as follows:

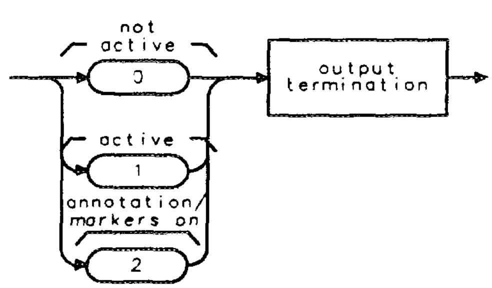
0 If the spectrum analyzer is not performing an FFT measurement, FFTSTAT returns a "0."

1 If the spectrum analyzer is performing an FFT measurement, FFTSTAT returns a "1."

2 If the spectrum analyzer is not performing an FFT measurement but the FFT markers and FFT annotation are on, FFTSTAT returns a "2."

FFTSTAT returns a "0" if FFTOFF has been executed.

## Query Response

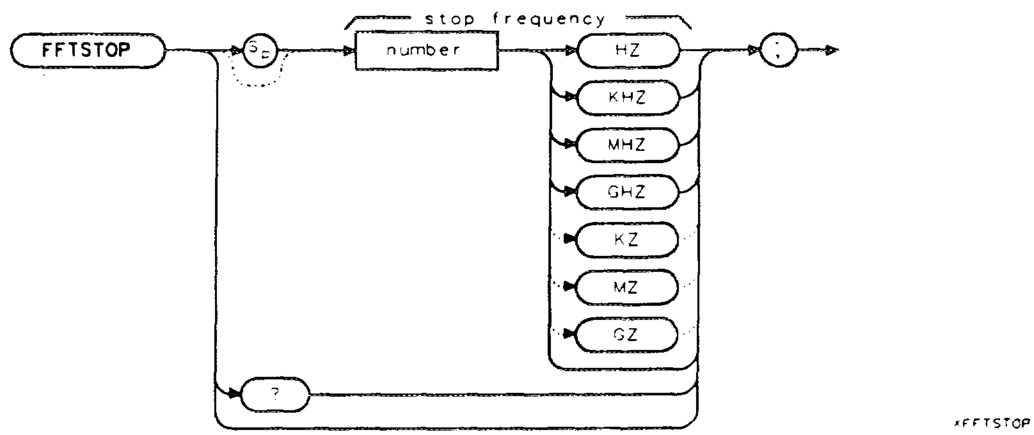



QFFTSTAT

# FFTSTOP
# FFT Stop Frequency

Sets the FFT stop frequency of the FFT measurement.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Range is limited by the range of the sweep time for the spectrum analyzer. |

Prerequisite Commands: FFTAUTO, FFTSNGLS, FFTCONTS.
Related Commands: ST.

## Example

| | |
|---|---|
| `OUTPUT 718;"FFTCONTS;"` | *Starts the FFT.* |
| `OUTPUT 718;"FFTSTOP 1KHZ;"` | *Sets the FFT stop frequency to 1 kHz.* |

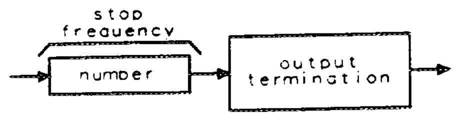
## Description

To change the FFT stop frequency, FFTSTOP changes the sweep time of the spectrum analyzer as follows:

$$FFT\ stop\ frequency = \frac{400}{(Sweep\ time\ \times 2)}$$

You can execute the FFTSTOP command two different ways. You can either execute the FFTSTOP command directly (for example, "`FFTSTOP 1;`") or use the MOV command to move the 1 or 0 into the FFTSTOP command (for example, "`MOV FFTSTOP,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response

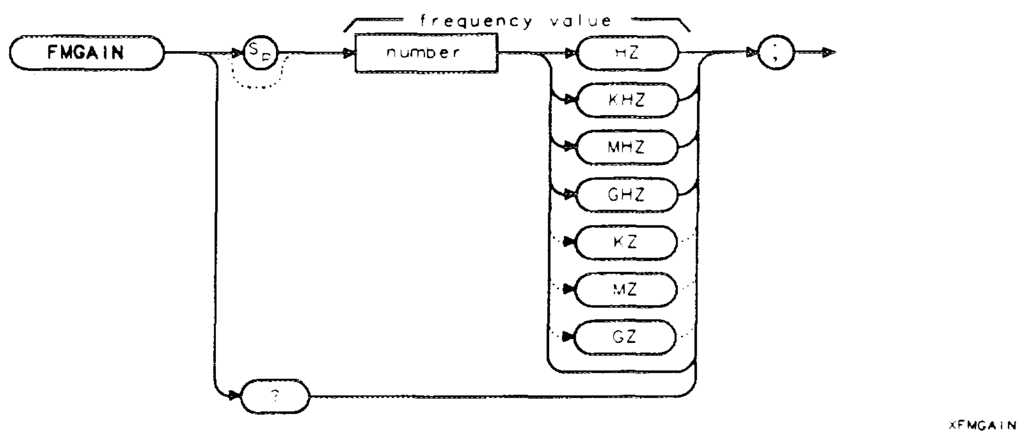



QFFTSTOP

# FMGAIN
# FM Gain

Sets the total FM frequency deviation for full screen demodulation.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 10 kHz to 500 kHz. |

Equivalent Softkey: **FM GAIN**.
Option Required: Option 102, 103, or 301.
Preset Value: 100 kHz.
Related Commands: DEMOD, SPEAKER, SQLCH.

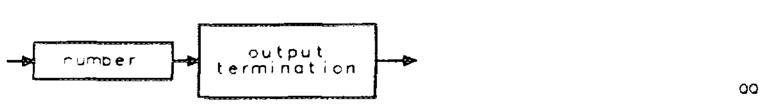
## Example

`OUTPUT 718;"FMGAIN 10KHZ;"` *Sets the FM gain.*

## Description

The center of the display (the fourth graticule) represents zero frequency deviation from the spectrum analyzer center frequency. The top graticule and the bottom graticule represent a positive or negative value of FM gain frequency deviation from the spectrum analyzer center frequency. The value of FMGAIN divided by four yields the FM gain per division.

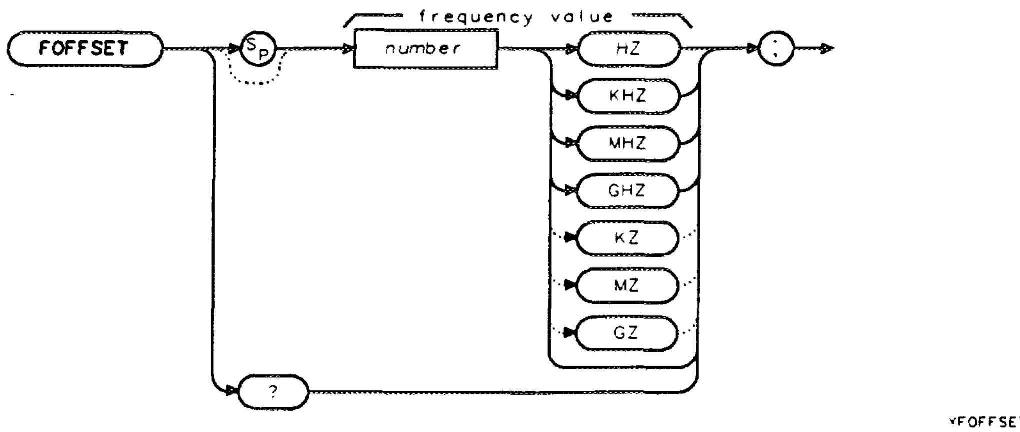
## Query Response



# FOFFSET
# Frequency Offset

Specifies the frequency offset for all absolute frequency readouts such as center frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | |

Equivalent Softkey: **FREQ OFFSET**.
Preset State: 0 Hz.
Related Commands: CF, FA, FB, MKN, MKF, MKSP, MKSS.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;FA 200MZ;"` | *Initializes spectrum analyzer. Sets start frequency.* |
| `20 OUTPUT 718;"FB 1GZ;"` | *Sets stop frequency.* |
| `30 OUTPUT 718;"TS;MKPK HI;"` | *Places marker on signal peak.* |
| `40 OUTPUT 718;"MF;"` | *Finds frequency of marker.* |
| `50 ENTER 718;A` | |
| `60 PRINT A` | *Prints frequency of marker.* |
| `70 OUTPUT 718;"FOFFSET 500MZ;"` | *Adds a frequency offset.* |
| `80 OUTPUT 718;"TS;MF;"` | *The frequency of the marker now is the frequency of the signal peak plus the frequency offset.* |
| `90 ENTER 718;A` | |
| `100 PRINT A` | *The displayed frequency is 500 MHz greater than the frequency displayed in line 60.* |
| `110 END` | |

**FOFFSET Frequency Offset**

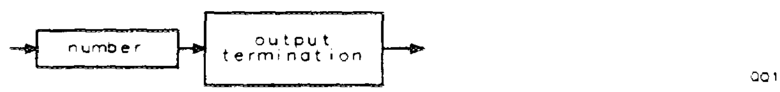
## Description

The FOFFSET command selects a value that offsets the frequency scale for all absolute frequency readouts (for example, center frequency). Relative values such as span and marker delta are not offset.

After execution, the FOFFSET command displays the frequency offset in the active function readout. When an offset is in effect, it is displayed beneath the bottom graticule line on the spectrum analyzer screen.

Execute "FOFFSET 0;" or "IP;" to turn off the offset.

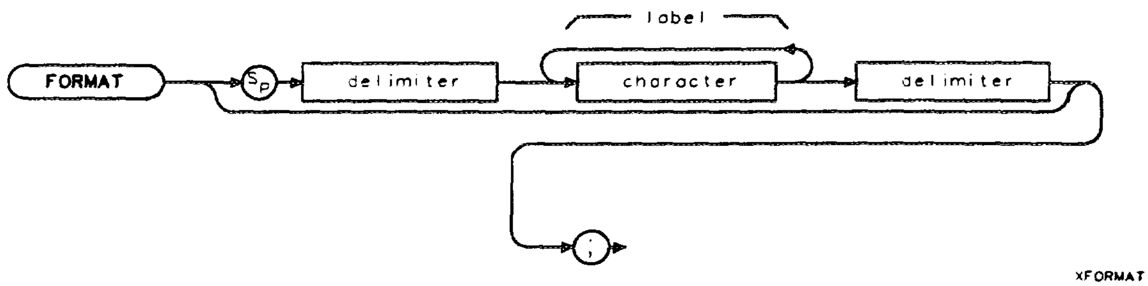
## Query Response



# FORMAT
# Format Card

Formats the memory card.

## Syntax




Equivalent Softkey: `FORMAT CARD` .

| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | 0 to 6 characters long, A through Z and the underscore (the underscore cannot be the first character of the label). |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Option Required: An HP 8590D or HP 8592D needs to have Option 003 installed in the spectrum analyzer to use the FORMAT command.

## Example

`OUTPUT 718;"FORMAT %MYCARD%;"` *Formats a memory card with the label "MYCARD."*

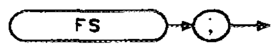
## Description

The memory card if formatted with the LIF format. If a label is not specified, the label defaults to HP859X.

# FS
# Full Span

Sets the frequency span of the spectrum analyzer to full span.

## Syntax




XFS

Equivalent Softkey: **FULL SPAN**.
Related Commands: CF, FA, FB, HNLOCK, SP, SS.

## Example

`OUTPUT 718;"FS;"` *Puts the spectrum analyzer in full-span mode.*

## Description

The FS command selects both the start frequency and the stop frequency according to the frequency span of the spectrum analyzer. Resolution bandwidth, video bandwidth, and sweep time are all set to autocoupled.

| Spectrum Analyzer Model | Start Frequency | Stop Frequency |
|---|---|---|
| HP 8590D or HP 8591E | 0 Hz | 1.8 GHz |
| HP 8592D* or HP 8593E* | 2.750 GHz | 22 GHz |
| HP 8594E | 0 Hz | 2.9 GHz |
| HP 8595E* | 0 Hz | 6.5 GHz |
| HP 8596E* | 0 | 12.8 GHz |

*In harmonic unlock.

In harmonic lock, "FS;" sets both the center frequency and the span according to the harmonic band shown in the following table.

**Center Frequency and Span Settings**

| Harmonic Band | Center Frequency | Span |
|---|---|---|
| 0 | 1.45 GHz | 2.9 GHz |
| 1 | 4.638 GHz | 3.6 GHz |
| 2* | 9.4 GHz | 6.8 GHz |
| 3† | 15.9 GHz | 7.0 GHz |
| 4† | 20.55 GHz | 2.9 GHz |

* HP 8592D, HP 8593E, or HP 8596E only.
† HP 8592D or HP 8593E only.

## Measuring Harmonic Distortion

The harmonic distortion program presented here illustrates how the spectrum analyzer can be directed by a computer to make a complete measurement. Measuring the percent of total harmonic distortion is tedious when performed manually: it involves tuning to the fundamental and to each harmonic of interest, recording the amplitude of each signal, converting these amplitudes to linear units (volts), and calculating the result using a formula. The following program measures percent of total harmonic distortion automatically, quickly, and accurately.

The program operates as if we were making the measurement manually.

**Note** This program is designed to measure harmonics of a signal that is greater than 20 MHz.

### Program Example for the HP-IB Interface

```
10  !FILE: "THD_TEST"
20 ASSIGN @Sa TO 718      ! assign IO path to spectrum analyzer
30 Variables:             ! define variables:
40  REAL Fundamental,Fund_amptd_v,Fund_amptd_dbm
50  REAL Prcnt_distort,Sum_sqr
60  INTEGER Max_harmonic,I,Number
70   !allow user to change the number of harmonics:
80  Max_harmonic=4
90 ALLOCATE REAL Harmonic_v(2:Max_harmonic)
100 ALLOCATE REAL Harmonic_dbc(2:Max_harmonic)
110 GOSUB Clearscreen   ! clear the alpha screen
120  !ask for the frequency of the fundamental:
130 OUTPUT CRT USING "4/,10X,K,3/";"***HARMONIC
DISTORTION***"
140 OUTPUT CRT USING "10X,K";"CONNECT SOURCE TO INPUT"
150 OUTPUT CRT USING "10X,K";"ENTER FUNDAMENTAL FREQUENCY IN
MHz"
160 OUTPUT CRT USING "10X,K";"WHEN READY, PRESS ENTER "
170 INPUT Fundamental
180 GOSUB Clearscreen ! clear the alpha screen
190 Fundamental:      ! write message on screen:
200 DISP "MEASURING FUNDAMENTAL"
210  !preset the spectrum analyzer, set single sweep mode, and
220  !take sweep:
230 OUTPUT @Sa;"IP; SNGLS; TS;"
240  !tune the spectrum analyzer to the fundamental freq and set
250  !20 MHz span:
260 OUTPUT @Sa;"CF ";Fundamental;"MZ;"
270 OUTPUT @Sa;"SP 20MZ; TS;"
280  !put a marker on signal peak, move marker to
290  !reference level:
300 OUTPUT @Sa;"MKPK HI; MKRL; TS;"
310  !find signal peak, activate signal track, and
320  !narrow span:
330 OUTPUT @Sa;"MKPK HI; TS;"
340 OUTPUT @Sa;"MKTRACK ON; SP 100KZ; TS;"
350  !turn off signal track:
```

```
360 OUTPUT @Sa;"MKTRACK OFF;"
370  !find the peak of the signal; move peak to center
380  !of screen:
390 OUTPUT @Sa;"AUNITS V;"! MAKE READOUT UNITS VOLTS
400  !find peak of signal; send amplitude value to
410  !computer
420  !enter the amplitude of the fundamental:
430 OUTPUT @Sa;"MKPK HI; MKA?;"
440 ENTER @Sa;Fund_amptd_v
450  !send marker frequency to the computer, enter
460  !frequency value:
470 OUTPUT @Sa;"MKF?;"
480 ENTER @Sa;Fundamental
490  !make the fundamental frequency the center freq
500  !step size:
510 OUTPUT @Sa;"MKSS;"
520  !set the fundamental frequency units to MHz:
530 Fundamental=Fundamental/1.E+6
540 Harmonics:    !measure the amplitudes of the harmonics:
550 FOR Number=2 TO Max_harmonic
560 DISP "MEASURING HARMONIC #";Number
570 OUTPUT @Sa;"SP 20MZ;" !set span to 20 MHz
580 OUTPUT @Sa;"CF UP; TS;" !tune to next harmonic
590  !take second sweep to allow spectrum analyzer to move to the
600  !center frequency; find the signal peak; activate
610  !signal track:
620 OUTPUT @Sa;"TS;"
630 OUTPUT @Sa;"MKPK HI; MKTRACK ON; SP 100KZ; TS;"
640  !turn off signal track:
650 OUTPUT @Sa;"MKTRACK OFF;"
660  !find signal peak; send amplitude value to computer
670  !enter the amplitude of the harmonic:
680 OUTPUT @Sa;"MKPK HI; MKA?;"
690 ENTER @Sa;Harmonic_v(Number)
700 NEXT Number
710  !set amplitude units to dBm:
720 OUTPUT @Sa;"AUNITS DBM;"
730  !calculate the fundamental amplitude in dBm because
740  !it was measured in volts:
750 Fund_amptd_dbm=10*LGT(Fund_amptd_v^2/.05)
760  !calculate the sum of the squares of the amplitudes
770  !of the harmonics; calculate amplitudes of
780  !harmonics (dBm):
790 Sum_sqr=0
800 FOR I=2 TO Max_harmonic
810  Sum_sqr=Sum_sqr+Harmonic_v(I)^2
820  Harmonic_dbc(I)=20*LGT(Fund_amptd_v/Harmonic_v(I))
830 NEXT I
840  !calculate the percent distortion:
850 Prcnt_distort=SQR(Sum_sqr)/Fund_amptd_v*100
860 GOSUB Clearscreen   !clear the alpha screen:
870 !Output_data:
880  !send data to the screen of the computer:
890 OUTPUT CRT USING "7/,1X,K";"HARMONIC DISTORTION RESULTS"
900 OUTPUT CRT USING "11X,K,DDDD.D,K";"FREQ = "
```

## Preparing the Memory Card for Use

**Note** Improper insertion causes error messages to occur, but generally does not damage the card or instrument. Care must be taken, however, not to force the card into place. The cards are easy to insert when installed properly.

1. Locate the arrow printed on the card's label.
2. Insert the card with its arrow matching the raised arrow on the bezel around the card-insertion slot. See Figure 5-3.

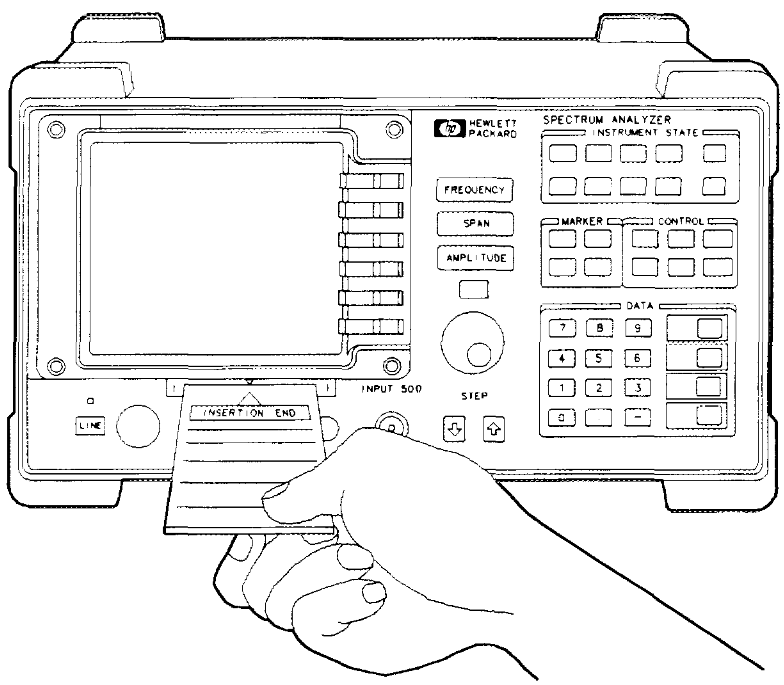



**Figure 5-3. Inserting the Memory Card**

3. Press the card into the slot. When correctly inserted, about 19 mm (0.75 in) of the card is exposed.
4. If this is a new memory card, it must be formatted before use. Since formatting a card deletes any data stored on the memory card, catalog the card before using the format card function if you suspect the memory card might contain data.

To format a new card, press (CONFIG), **More 1 of 3**, **Card Config**, **FORMAT CARD**. The message If you are sure, press key again to purge data appears on the spectrum analyzer screen. Press **FORMAT CARD** again. (**FORMAT CARD** requires a double key press.)

To catalog a memory card, press (CONFIG), **More 1 of 3**, **Card Config**, **Catalog Card**. **Catalog Card** either displays any existing data that is on the memory card (if the memory card has been formatted) or, displays INVALID CARD: DIRECTORY if the card has not been formatted. Use **BLANK CARD** if you wish to delete the files from the memory card.

## To Enter a Prefix

Memory card data can be stored and recalled using a prefix. To enter a prefix, press (DISPLAY) or (CONFIG), **Change Prefix**.

Pressing **Change Prefix** accesses a menu containing the letters of the alphabet, the underscore symbol (_), the number symbol (#), a space, and the clear function. To select a character, press the softkey that displays the group of characters that contains the desired character. The softkey menu changes to allow you to select an individual character. If you make a mistake, press (BK SP) to space back over the incorrect character. Additional characters are available by pressing **More 1 of 2**. Numbers may be selected with the numeric keypad.

The prefix can be from one to seven characters long. The longer the prefix, the shorter the register number must be. The total length of the prefix and register number cannot exceed eight characters. The prefix can be any character; however, the underscore should not be the first character of the prefix.

An existing prefix can be cleared with the clear function. Press (CONFIG) or (DISPLAY), **Change Prefix**, **YZ_# Spc Clear**, then **Clear** to clear the current prefix. To change a prefix, clear the existing prefix and then enter a new prefix.

## To Save a State

1. Press (DISPLAY) or (CONFIG), **Change Prefix**. Use the softkeys to enter the prefix under which you want the state saved. A prefix can be one to seven characters long.

   If you do not specify a prefix, the state will be saved with a file name consisting of s_(register number).
2. Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Selecting CARD selects the memory card as the mass storage device.
3. Press **STATE → CARD**. REGISTER # and PREFIX= are displayed on the spectrum analyzer display.
4. Use the numeric keypad to enter a register number and then press (ENTER).

## To Recall a State

1. Press SAVE or RECALL. If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.
2. Press **Catalog Card** then **CATALOG STATES**. Use the knob to highlight the state data to be retrieved.
3. Press **LOAD FILE**.

State data can also be recalled by specifying the prefix and the register number:

1. Use **Change Prefix** to enter the prefix, or use the existing prefix.
2. Press RECALL. If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.
3. Press **CARD → STATE**.
4. Enter the register number that the state was saved under, and then press ENTER.

## To Save a Trace

Saving trace data saves the trace data and the state data.

1. Press DISPLAY or CONFIG, and then **Change Prefix** to enter a new prefix or change the existing prefix.

   If you do not specify a prefix, the trace will be saved with a file name consisting of s_(register number).
2. Enter a screen title, if desired, by using DISPLAY then **Change Title**.
3. Set up the trace to be stored.
4. Press SAVE. If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Press **Trace → Card** to access the menu that displays **TRACE A**, **TRACE B**, and **TRACE C**.
5. Press the softkey label of the trace that you want to save: **TRACE A**, **TRACE B**, or **TRACE C**. REGISTER # and PREFIX= are displayed on the spectrum analyzer display.
6. Use the numeric keypad to enter a register number and then press ENTER.

   The trace data is saved with a file name consisting of a "t," the current prefix, an underscore (_), and the register number. The "t" denotes that the file contains trace data.

## To Recall a Trace

1. Press SAVE or RECALL. If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.
2. Press **Catalog Card** then **CATALOG TRACES**. Use the knob to highlight the trace data to be retrieved.
3. Press **LOAD FILE**. The trace data is placed in trace B.

Trace data can also be recalled by specifying the prefix and the register number:

1. Use **Change Prefix** to enter the prefix, or use the existing prefix.
2. Press RECALL. If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3. Press **Card → Trace** to access the menu that displays **TRACE A**, **TRACE B**, and **TRACE C**.

4. Select the trace in which you want the trace data stored by pressing **TRACE A**, **TRACE B**, or **TRACE C**.

5. Enter the register number that the trace was saved under and then press (ENTER). The recalled trace is placed in view mode.

## To Save a Display Image

1. Press (DISPLAY) or (CONFIG), **Change Prefix**. Use the softkeys to enter a prefix under which you want the state saved. A prefix can be one to seven characters long.

   If you do not specify a prefix, the display image will be saved with a file name consisting of i_(register number).

2. Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Selecting CARD selects the memory card as the mass storage device.

3. Press **DISPLAY → CARD**. REGISTER # and PREFIX= are displayed on the spectrum analyzer display.

4. Use the numeric keypad to enter a register number and then press (ENTER).

## To Recall a Display Image

1. Use **Change Prefix** to enter the prefix, or use the existing prefix.

2. Press (SAVE) or (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3. Press **Catalog Card** then **CATALOG ALL**. Use the knob to highlight the display image data to be retrieved.

4. Press **LOAD FILE**.

---

**Note** The intensity of some screen items may differ if the window configuration of the current spectrum analyzer state does not match the recalled display image. This will not affect the ability to copy the screen.

---

Display image data can also be recalled by specifying the prefix and the register number:

1. Press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

2. Press **CARD →DISPLAY**.

3. Enter the register number that the state was saved under, and then press (ENTER).

## To Save Limit-Line Tables or Amplitude Correction Factors

The procedure for saving limit-line tables or amplitude correction factors is similar to saving trace data. State and trace data is not recalled when the limit-line tables or amplitude correction factors are recalled.

1. Press (DISPLAY) or (CONFIG), **Change Prefix** to enter a new prefix or change the existing prefix.

   If you do not specify a prefix, the limit line table will be saved with a file name consisting of l_(register number). A table of amplitude correction factors will be saved with a file name consisting of a_(register number).

2. When saving tables, set up the table to be stored. See "Using the Limit-Line Functions" or "Using Amplitude Correction Functions" for more information about entering data.

3. Press (SAVE). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD. Press **Trace → Card** to access the menu with **LIMIT LINES** and **AMP COR**.

4. Press either **LIMIT LINES**, to save limit-line tables, or **AMP COR**, to save amplitude-correction factors. REGISTER # and PREFIX= are displayed on the spectrum analyzer display.

5. Use the numeric keypad to enter a register number and then press (ENTER).

   The data is saved with a file name consisting of a "l" (for limit-line tables) or "a" (for amplitude-correction factors), the prefix that was entered, an underscore (_), and the register number.

## To Recall Limit-Line Tables or Amplitude Correction Factors

1. Use **Change Prefix** to enter the prefix, or use the existing prefix.

2. press (RECALL). If INTERNAL is underlined, press **INTERNAL CARD** to select CARD.

3. Press **Card → Trace** to access the menu with **LIMIT LINES** and **AMP COR**.

4. Press either **LIMIT LINES**, to recall a limit-line table, or **AMP COR**, to recall amplitude-correction factors.

5. Enter the register number that the limit-line data or amplitude-correction factors was saved under and then press (ENTER).

**Note** If **LOAD FILE** is used to recall limit-line files or amplitude-correction factor files, the traces are set to the store-blank mode. Press (TRACE), **CLEAR WRITE A** to view trace A data, or press (PRESET).

## Using Limit-Line Functions

Limit lines provide an easy way to compare trace data to a set of amplitude and frequency parameters while the spectrum analyzer is sweeping the measurement range. An upper and/or lower limit line can be displayed. Every measurement sweep of trace A is compared to the limit lines. If trace A is at or within the bounds of the limit lines, `LIMIT PASS` is displayed. If trace A is out of the limit-line boundaries, `LIMIT FAIL` is displayed. Figure 5-4 shows a sample limit-line display.

Limit lines are constructed from a table of frequency and amplitude coordinate pairs. Limit line segments are created by connecting these points. Everything except the segment length is defined by the entry for its beginning point. There are several different ways of entering the frequency/amplitude pairs. These are described in the following section.

**Note** Limit lines can only by created and edited from the front panel in the format of limit line tables. Limit lines that are in a trace format can only be created using remote commands or a down-loadable program. See *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for more information.

Though coordinates of frequency and amplitude are used most often, limit line data can also be entered in terms of time and amplitude. Use the **LIMITS FRQ TIME** softkey, to underline the desired choice of either frequency or time parameters. Frequency is the default selection. If TIME is selected **SELECT TIME** will replace **SELECT FREQ** in the Edit Limit menus.

This section provides an overview of limit lines, a procedure for creating a sample upper limit line, and descriptions of the limit-line functions. A procedure for creating an upper and a lower limit line is at the end of this section. Refer to Chapter 6 for more information on a specific limit-line function.

### Procedure for Creating an Upper Limit Line

This procedure demonstrates how to create a sample upper limit line for the CAL OUT signal and activate testing. Detailed descriptions of the limit-line functions follow this procedure.

1. Press (PRESET).
2. Set the center frequency and span by pressing (FREQUENCY), 300 (MHz), and (SPAN), 500 (MHz).
3. Connect the spectrum analyzer's CAL OUT and INPUT 50 Ω on the spectrum analyzer using an appropriate cable. (The calibration signal is used as the "test" signal for this demonstration.)

**Note** If the amplitude units are anything other than dBm at this time, change the amplitude units to dBm for this demonstration. Press (AMPLITUDE), **More 1 of 2**, **Amptd Units**, **dBm**.

4. Press (DISPLAY), **Limit Lines** to access the limit-line menus.

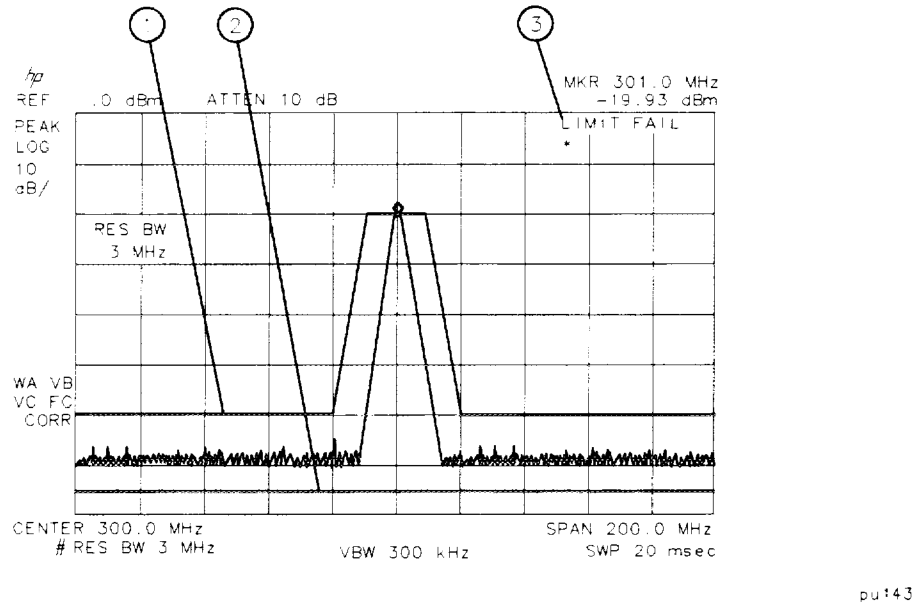



**Figure 5-4. Typical Limit-Line Display**

| Item | Description of Items in Figure 5-4 |
|---|---|
| 1 | Upper limit line |
| 2 | Lower limit line |
| 3 | Screen message |

5. Press **Edit Limit** then **Edit Upper** to create an upper limit line.

   The table defaults to frequency parameters, the second column should be labeled START_FREQ. If it is labeled START_TIME, press **More 1 of 2**, **EDIT DONE**, and **Edit Limit**. Press **LIMITS FRQ TIME** so that FRQ is underlined. **LIMITS FRQ TIME** specifies that the limit line parameters be entered in either frequency or time.

**Note** To clear an existing limit-line table, press **More 1 of 2**. Then press **PURGE LIMITS** two times.

After pressing **PURGE LIMITS** the first time, the message `If you are sure, press key again to purge data` will appear. Pressing **PURGE LIMITS** a second time purges the limit-line table. (PRESET) turns limit-line testing off (if it is on), but does not clear an existing limit-line table.

6. Press **Edit Upper** to edit or create an upper limit line.
7. The table defaults to fixed parameters, the upper right corner of the table should be labeled FIXED. If it is labeled RELATIVE, press **More 1 of 2**. Then press **LIMITS FIX REL** so that FIX is underlined. **LIMITS FIX REL** specifies whether or not the limit line is relative to the spectrum analyzer's center frequency and reference-level settings.

   When time parameters are used, the RELATIVE format only affects the amplitude part of the coordinate pairs. The time parameters are always fixed beginning at the left edge of the graticule.
8. Specify the first limit-line segment to begin at 50 MHz and have an amplitude of −60 dBm by using the following key sequence:

   **SELECT FREQ** 50 MHz 60 −dBm **FLAT**

**Note** The coordinates for the second point must be entered before the first and limit-line segment is displayed.

9. Enter the second limit-line segment by pressing the following keys: 250 MHz 60 −dBm **SLOPE**.

**Note** Table entries can be edited if you make a mistake. To edit an existing segment, use **SELECT SEGMENT** to specify the segment. Use **SELECT FREQ**, **SELECT AMPLITUD**, or **SELECT TYPE** to specify the column you wish to edit.

10. Specify the third limit-line segment by pressing the following keys: 400 MHz 15 −dBm **FLAT**.

    You may notice that the end coordinate of segment three is drawn to a point off the top of the spectrum analyzer display. This assures that no trace data beyond the end of the limit line will cause the test to fail.
11. Specify the fourth limit-line segment by pressing the following keys: 600 MHz 15 −dBm **POINT**.

    Since the limit line in this procedure has only four segments specified, the frequency value of segment four (the last segment) is set to 600 MHz, which is greater than the stop frequency of the display.

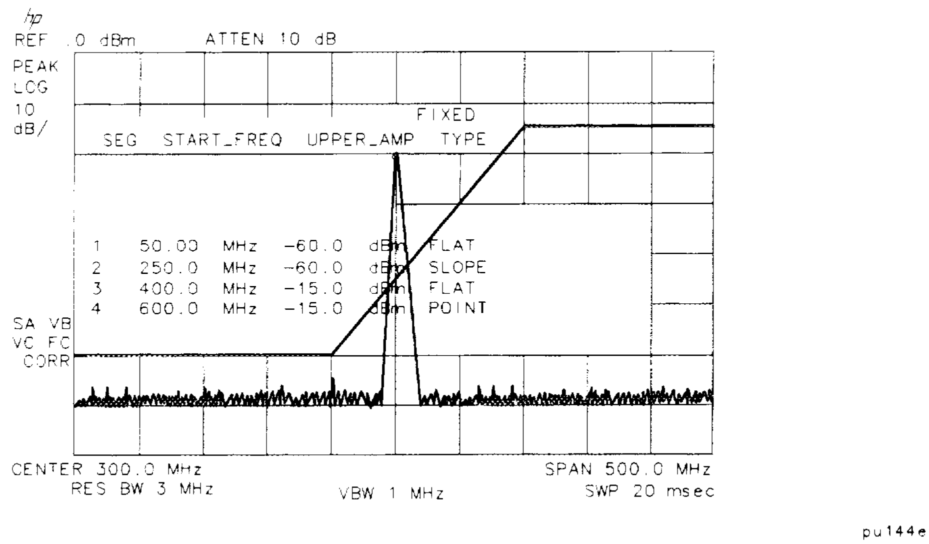



**Figure 5-5. The Completed Limit-Line Table**

12. Press **More 1 of 2**, then **EDIT DONE** when all the segments have been entered.
13. Press **LMT TEST ON OFF** so that ON is underlined. This turns the limit testing on. For example, `LIMIT FAIL` is displayed because the calibration signal exceeds the limit line.
14. Disconnect the CAL OUT from the spectrum analyzer INPUT 50Ω. `LIMIT PASS` is displayed since no signal exceeds the limit line.

## Limit-Line Functions

This section describes the limit-line functions in the order that they are usually used.

### Editing, Creating, or Viewing a Limit-Line

Pressing (DISPLAY), then **Limit Lines** accesses the softkey menus used for creating a limit line.

Press **Edit Limit** to edit an existing limit-line table or. If no limit-line table currently exists this will allow you to create one.

If a limit line exists currently, and you would like to purge it and create a new one, press **Edit Upper**, and **More 1 of 2**. Then press **PURGE LIMITS** two times to clear the existing limit-line table and access the limit-line editing menu.

**Note** After pressing **PURGE LIMITS** the first time, the message `If you are sure, press key again to purge data` will appear. Pressing **PURGE LIMITS** a second time purges the limit-line table. (PRESET) turns limit-line testing off (if it is on), but does not clear an existing limit-line table.

## Selecting the Type of Limit-Line Table

The **LIMITS FRQ TIME** key selects the type of limit line parameters. Parameters can be entered as frequency/amplitude coordinates, or as time/amplitude coordinates. Use the **LIMITS FRQ TIME** key, to underline the desired choice of either frequency or time parameters. Frequency is the default selection. If TIME is selected **SELECT TIME** will replace **SELECT FREQ** in the Edit Limit menus.

The second column of the limit line table is labeled START_FREQ when frequency is selected. It is labeled START_TIME when time is selected.

The **LIMITS FIX REL** key selects the type of limit line. There are two types of limit lines: fixed and relative. Fixed limit lines contain only absolute amplitude and frequency (or time) values. Relative limit lines consist of frequency values that are referenced to the spectrum analyzer's center frequency and amplitude values that are relative to the analyzer's reference level. The relative setting does not affect time values. They always begin at the left edge of the graticule.

As an example fixed versus relative limit lines, if a limit line is specified as fixed, entering a limit-line segment with a frequency coordinate of 300 MHz displays the limit-line segment at 300 MHz. If the same limit-line table is specified as relative, it is displayed relative to the spectrum analyzer's center frequency and reference level. If the center frequency is at 1.2 GHz, a relative limit-line segment with a frequency coordinate of 300 MHz will display the limit-line segment at 1.5 GHz. If the amplitude component of a relative limit-line segment is −10 dB and the spectrum analyzer's reference level is −15 dB, then −10 dB is added to the reference-level value and the amplitude component of the limit line will be at −25 dB.

RELATIVE is displayed in the limit-line table when the limit-line type is relative; FIXED is displayed when the limit-line type is fixed. A limit line entered as fixed may be changed to relative, and one entered as relative may be changed to fixed. When the limit-line type is changed, the frequency and amplitude values in the limit-line table are modified by the current center frequency and reference level settings to keep the limit line in the same position on the spectrum analyzer.

## Selecting the Limit-Line Table Format

Press **Edit Upper**, **Edit Lower**, **Edit Up/Low**, or **Edit Mid/Delt** to edit or create a limit-line table. Each of the edit softkeys represents a different type of limit-line table format. The choice of edit softkey depends upon whether you want an upper limit line only, a lower limit line only, or both an upper and a lower limit line. If you want both lower limit lines, then the characteristics of the limit lines being entered affect your choice of using the upper/lower or mid/delta functions.

The four limit-line table formats are described below:

- The upper limit-line table format is accessed by **Edit Upper**. With the upper limit-line table format, the coordinates of only the upper limit line are displayed for editing; lower limit-line coordinates are not specified. Even if lower limit-line values exist or the values had been entered as an upper and lower limit-line table, the upper limit-line values are treated as a separate table from the lower limit-line values. Upper limit-line entries can have independent frequency and amplitude coordinates from lower limit-line table entries.
- The lower limit-line table format is accessed by **Edit Lower**. With the lower limit-line table format, the coordinates of only the lower limit line are displayed for editing; upper limit-line coordinates are not specified. Even if upper limit-line values exist or the values had been entered as an upper and lower limit-line table, the lower limit-line values are treated as a separate table from the upper limit-line values. Lower limit-line entries can have independent frequency and amplitude coordinates from upper limit-line table entries.

- The upper and lower limit-line table format is accessed by **Edit Up/Low**. With the upper and lower limit-line table format, the upper and lower limit-line coordinates can be entered at the same time: the frequency (or time), upper amplitude, lower amplitude, and type are specified. The frequency (or time) and upper amplitude comprise the coordinate point for the upper limit line; the frequency (or time) and lower amplitude value comprise the coordinate point for the lower limit line. It is not necessary to specify both an upper- and lower-amplitude component for every frequency component. Three asterisks in the table indicate that an amplitude value has not been entered for the segment.
- The mid/delta limit-line table format is accessed by **Edit Mid/Delt**. Like the upper and lower limit-line table format, the mid/delta limit-line table format provides a means of specifying the upper and lower limit lines at the same time. Unlike the upper and lower table format, the amplitude values are specified as a middle amplitude value with a delta: the upper and lower limit lines are then drawn at an equal positive and negative distance from the middle amplitude. With the mid/delta format, the frequency (or time) and the mid-amplitude plus the delta comprise the upper limit line; the frequency (or time) and the mid-amplitude minus the delta comprise the lower limit line. The difference between the mid/delta format and the upper/lower format is the way the amplitude values are entered; however, in both formats, the frequency coordinate begins a segment. The mid/delta format can be used if the upper and lower limit lines are symmetrical with respect to the amplitude axis.

**Note** Editing a limit line table can be done using a different format than the one that was used for creating it.

### Selecting the Segment Number

Pressing **SELECT SEGMENT** specifies the segment number to be entered or edited. Limit lines are created by entering frequency or time values and amplitude values into a limit-line table. The frequency/time and amplitude values specify a coordinate point from which a limit-line segment is drawn. The coordinate point is the lowest frequency or time point of the line segment. Limit lines are constructed from left to right. The segment is defined by its beginning point. See Figure 5-6.

**Note** Up to 20 segments can be specified for an upper or lower limit-line table.

When entering a limit-line segment, the frequency/time and amplitude values will be listed as asterisks (***) until new values are entered. The new segment will be listed last until both the frequency (or time) and the amplitude values have been entered. Once the frequency/time and an amplitude value are entered, the segment will be sorted into the limit-line table according to frequency or time.

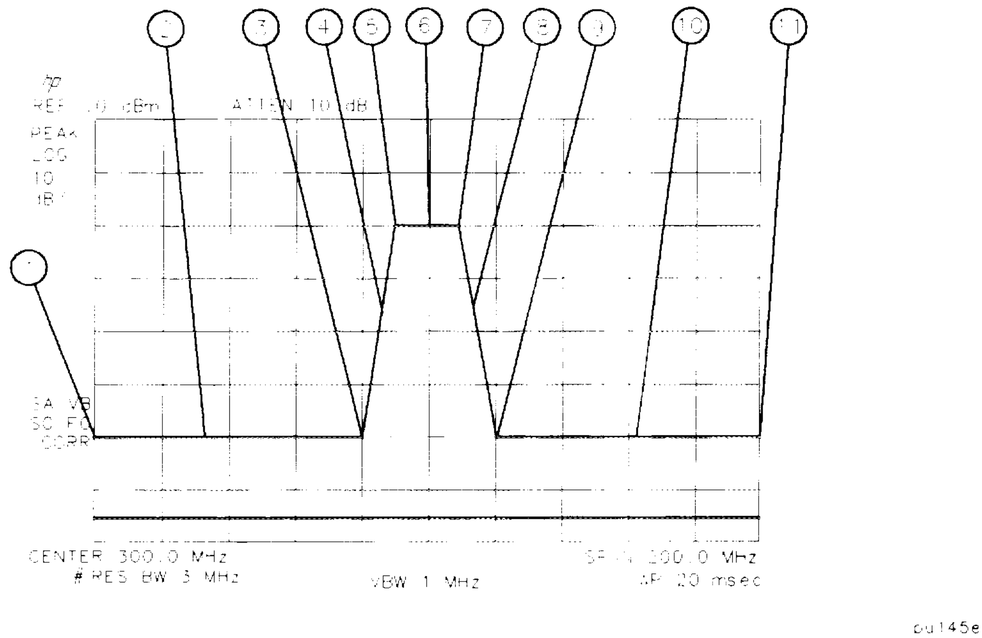


Figure 5-6. Limit-Line Segments

| Item | Description of Items in Figure 5-6 |
|---|---|
| 1 | Frequency and amplitude coordinate that starts the first segment. |
| 2 | First segment. |
| 3 | Frequency and amplitude coordinate that starts the second segment. |
| 4 | Second segment. |
| 5 | Frequency and amplitude coordinate that starts the third segment. |
| 6 | Third segment. |
| 7 | Frequency and amplitude coordinate that starts the fourth segment. |
| 8 | Fourth segment. |
| 9 | Frequency and amplitude coordinate that starts the fifth segment. |
| 10 | Fifth segment. |
| 11 | Frequency and amplitude coordinate that starts the sixth segment. |

## Selecting the Frequency or Time Coordinate

Press **SELECT FREQ**, then enter a frequency value, or press **SELECT TIME** and enter a time value, for the segment. Regardless of the table format, a frequency/time coordinate must be specified.

**Note** Limit line coordinates may be entered in terms of either frequency and amplitude, or time and amplitude. Press **LIMITS FRQ TIME** until the desired choice of either frequency or time has be selected (underlined). If TIME has been selected as the limit line parameter **SELECT TIME** will replace **SELECT FREQ** in the Edit Limit menus.

### Selecting the Amplitude Coordinate

In the previous procedure, pressing SELECT AMPLITUD and then entering an amplitude value, specified the amplitude coordinate for the upper limit line. The limit-line table formats dictate how the amplitude values are treated:

- With the upper limit-line table format, one amplitude component (representing an upper limit-line segment) is specified per frequency/time component. The amplitude value is entered by pressing SELECT AMPLITUD, entering an amplitude value, and pressing a units key.
- With the lower limit-line table format, one amplitude component (representing a lower limit-line segment) is specified per frequency/time component. The amplitude value is entered by pressing SELECT AMPLITUD, entering an amplitude value, and pressing a units key.
- With the upper/lower limit-line table format, two amplitude components (one each for the upper and lower limit-line segments) can be specified per frequency or time component. It is not necessary to specify both an upper and a lower amplitude value. Specifying only upper amplitude values results in an upper limit line, but not a lower limit line. Omitting an amplitude point on one limit line does not affect the other limit line. The amplitude of the upper limit line is entered by pressing SELECT UPR AMPL, entering an amplitude value, and pressing a units key. The amplitude of the lower limit line is entered by pressing SELECT LWR AMPL, entering an amplitude value, and pressing a units key.
- With the mid/delta limit-line table format, two amplitude components (one representing a mid-amplitude value, one representing a deviation [positive and negative values] from either side of this value) is specified per frequency component. If no deviation is entered, the deviation defaults to zero. The middle amplitude value is entered by pressing SELECT MID AMPL, entering an amplitude value, and pressing a units key. The deviation is entered by pressing SELECT DLT AMPL, entering an amplitude value, and pressing a units key.

---

**Note** Frequency or amplitude values that are not within the limit-line range will be modified. For example, a frequency value of 60 GHz will be modified to 30 GHz.

---

### Selecting the Segment Type

Press SEGMENT TYPE, then FLAT, SLOPE, or POINT to specify the segment type. The segment type determines how to connect the coordinate point of the current line segment with the coordinate point of the next line segment. The segment type determines whether the line segment is horizontal, vertical, sloped, or a single point. The three segment types are:

1. Flat draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all frequencies or times between the two points. If the amplitude values of the two segments differ, the limit-line will "step" to the value of the second segment. See Figure 5-7.
2. Slope draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all frequencies between the two points.
3. Point specifies a limit value for the coordinate point. It specifies a limit at a single frequency or time, and for no other frequency/time points. For an upper limit line, a point segment is indicated by a line drawn from the coordinate point, vertically off the top of screen. For a lower limit line, a point segment is indicated by a line drawn from the coordinate point, vertically off the bottom of screen. The point segment type should be used as the last

segment in the limit-line table. However, if the last segment in the table is not specified as the point segment type, an implicit point is automatically used. (If a visible point segment at the right-hand edge of the display is not desired, add an explicit last point segment to the limit-line table that is higher in frequency than the stop frequency.)

Figure 5-7 demonstrates the different segment types.

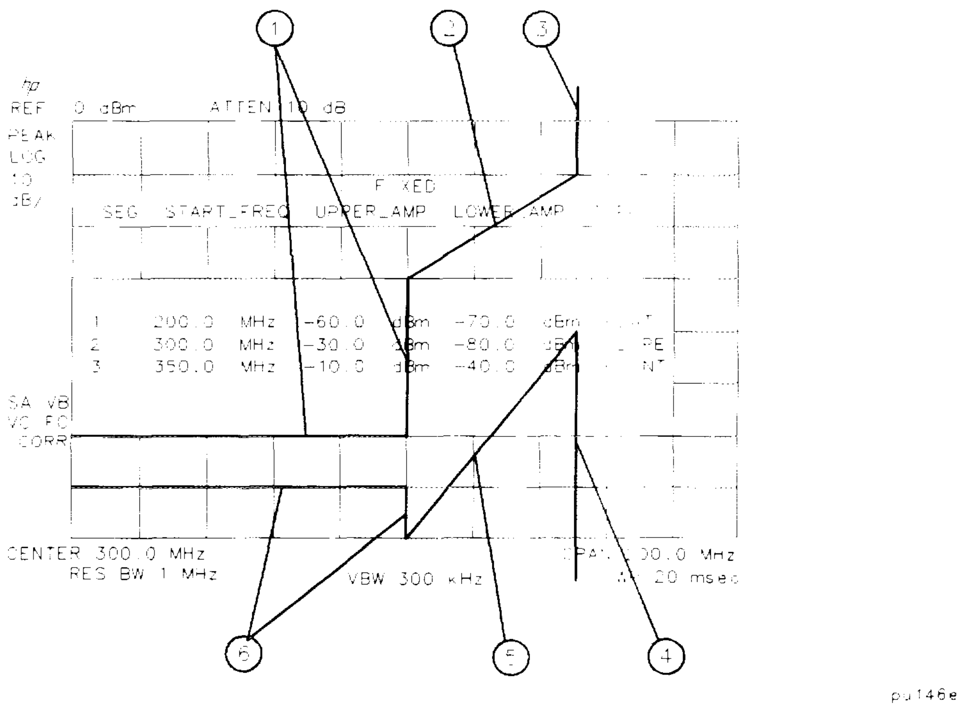



**Figure 5-7. Segment Types**

| Item | Segment Types |
|---|---|
| 1 | Flat (upper limit line) |
| 2 | Slope (upper limit line) |
| 3 | Point (upper limit line) |
| 4 | Point (lower limit line) |
| 5 | Slope (lower limit line) |
| 6 | Flat (lower limit line) |

## Completing Table Entry and Activating Limit-Line Testing

Pressing **EDIT DONE** blanks the limit-line table from the screen and accesses the menu with **LMT TEST ON OFF** and **LMT DISP Y N AUTO** softkeys.

Pressing **LMT TEST ON OFF** turns the limit-line testing on and off.

Pressing **LMT DISP Y N AUTO** (Y) turns the limit lines display on. Pressing **LMT DISP Y N AUTO** (N) turns the limit lines display off. Pressing **LMT DISP Y N AUTO** (AUTO) sets the limit line display to match the limit line test function. With AUTO underlined the limit lines are only displayed when limit line testing is turned on.

## Saving or Recalling Limit-Line Tables

Pressing (DISPLAY) then **Limit Lines** accesses **SAVE LIMIT** and **RECALL LIMIT**. These softkey functions provide an easy way to save or recall current limit-line tables. **SAVE LIMIT** saves the current limit-line tables in the current mass storage device (either spectrum analyzer memory or a memory card). To determine the current mass storage device, press **SAVE LIMIT**. If MAX REG # appears on the spectrum analyzer display, the current mass storage device is analyzer memory. If PREFIX= is displayed, the memory card is the mass storage device. Enter a register number, then press (ENTER) to save the current limit-line table in the current mass storage location.

**RECALL LIMIT** recalls limit-line tables from the current mass storage device (either spectrum analyzer memory or a memory card). To determine the current mass storage device, press **RECALL LIMIT**. If MAX REG # appears on the spectrum analyzer display, the current mass storage device is analyzer memory. If PREFIX= is displayed, the memory card is the mass storage device. To recall a limit line, enter the register number that the limit-line table was saved under, then press (ENTER). When recalling a limit line from the memory card, it is necessary that the current prefix matches the prefix that the limit line was stored with. Use **Change Prefix** to change the current prefix.

## Procedure for Creating an Upper and Lower Limit Line

This is a basic procedure for creating a sample of upper and lower limit lines. The CAL OUT signal is used for the test signal.

1. Press (PRESET).
2. Since this procedure uses the calibration signal as the test signal, connect the spectrum analyzer's CAL OUT to the INPUT 50 Ω with an appropriate cable.
3. Set the spectrum analyzer controls as follows:

   (FREQUENCY) 300 MHz
   (SPAN) 50 MHz
   (BW) 3 MHz

4. Press (DISPLAY) and **Limit Lines** to access the limit-line menus.
5. At this point you may need to do the following:
   a. To save the current limit-line table, press **SAVE LIMIT** and enter the register number. Then press (ENTER).
   b. To clear an existing limit-line table, press **Edit Limit**, **Edit Upper**, and **More 1 of 2**. Then press **PURGE LIMITS** two times.
6. (If necessary, press **Edit Limit** to access the **LIMITS FRQ TIME** softkey.) Press **LIMITS FRQ TIME** so that FRQ is underlined to select the frequency type of limit line, if it is not already selected.)
7. Press **Edit Up/Low** to create upper and lower limit lines simultaneously.
8. Press **More 1 of 2**, **LIMITS FIX REL** so that FIX is underlined to select the fixed type of limit line (if it is not already selected.)

9. Specify the first limit-line segment by using the following key sequence:

   **SELECT FREQ** 275 MHz
   60 –dBm
   75 –dBm
   **FLAT**

10. Repeat the above step for the values listed in the following table to complete the limit-line table. (It is not necessary to repeat the **SELECT FREQ** softkey for successive entries.)

| Segment Number | Frequency | Upper Amplitude | Lower Amplitude | Type |
|---|---|---|---|---|
| 2 | 290 MHz | –60 dBm | –75 dBm | Slope |
| 3 | 295 MHz | –15 dBm | –75 dBm | Slope |
| 4 | 297 MHz | –15 dBm | –75 dBm | Slope |
| 5 | 300 MHz | –15 dBm | –29 dBm | Slope |
| 6 | 303 MHz | –15 dBm | –75 dBm | Slope |
| 7 | 305 MHz | –15 dBm | –75 dBm | Slope |
| 8 | 310 MHz | –60 dBm | –75 dBm | Flat |
| 9 | 400 MHz | –60 dBm | –75 dBm | Point |

**Note** When entering a limit-line segment, the frequency, and amplitude values will be listed as asterisks (***) until new values are entered. The new segment will be listed last until both the frequency and amplitude values have been entered. Once the frequency and at least one amplitude value are entered, the segment will be sorted into the limit-line table according to frequency.

To edit an existing segment, use **SELECT SEGMENT** to specify the segment. Then use **SELECT FREQ**, **SELECT AMPLITUD**, or **SELECT TYPE** to specify the column that you wish to edit.

11. Press **More 1 of 2**, then **EDIT DONE** when all values have been entered into the limit-line table.

12. Press **LMT TEST ON OFF** so that ON is underlined. LIMIT PASS is displayed on the spectrum analyzer screen if the measurement sweep is within the limit lines. LIMIT FAIL is displayed if the measurement sweep is not within the limit lines.

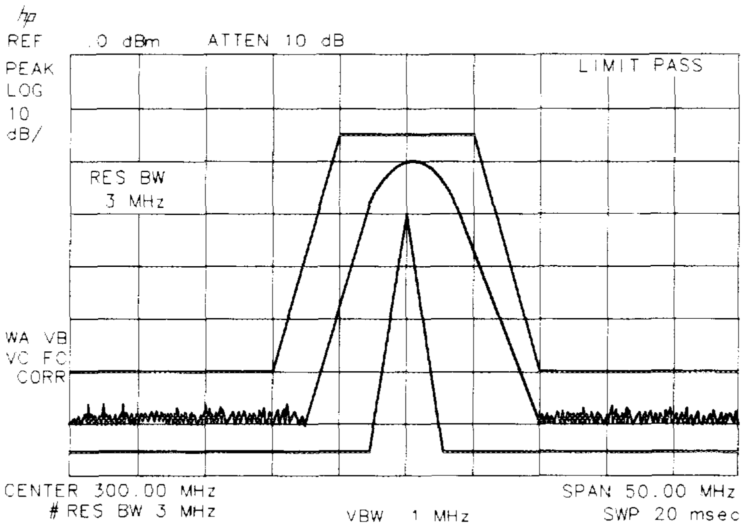



**Figure 5-8. Upper and Lower Limit-Line Testing**

To turn the limit-line testing on and off, use **LMT TEST ON OFF**. Use **PURGE LIMITS** to clear the limit-line tables. To remove the limit lines from the display, use **LMT DISP Y N AUTO**. Underlining Y displays the limit lines, N turns them off, and AUTO displays them if the testing is turned on or turns them off if testing is turned off.

## Learn About the Analog+ Display Mode (Option 101 only)

The analog+ display mode combines traditional analog display performance with digital display benefits. Analog+ display mode gives the spectrum analyzer the look and feel of older analog displays, such as the HP 8558B, but it has the added benefit of features common to digital displays. Display features include:

- Hard-copy output directly to a printer
- Complete marker functionality such as peak search and noise readout
- Screen annotation functions such as title, linear and log scales, and graticule
- Negative peak detector (included with Option 101)

The analog+ display mode is only available on spectrum analyzers with Option 101. (It is also available with Option 301 which is a combination of Options 101 and 102.) Option 101 also includes a negative peak detector, useful for video modulator balance adjustments and intermodulation distortion measurements.

The analog+ display mode can be used to view interfering intermodulation products on a live television channel. It can be used to set the residual carrier level and check the linearity of a video modulator. Refer to Product Note 8590-3, HP part number 5091-2480, for more information about these measurements.

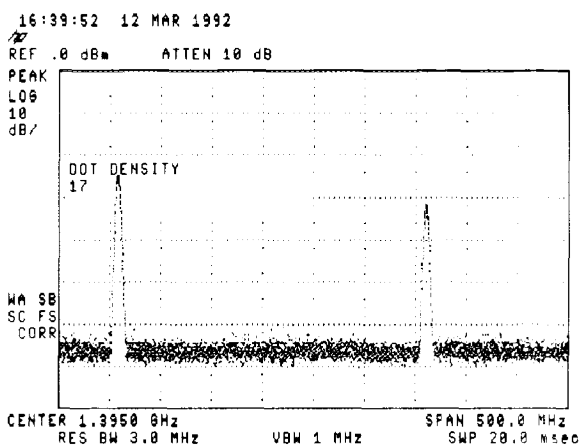



**Figure 5-9. Analog+ Display Mode**

**Example:** Use the analog+ display mode to look at the calibrator signal.

1. Connect the CAL OUT signal to the spectrum analyzer's INPUT 50Ω. Press (PRESET), (FREQUENCY), **START FREQ** 0 (Hz), **STOP FREQ** 1.5 (GHz).
2. Press (DISPLAY) and **ANALOG+ ON OFF** (ON) to turn on the analog+ display mode. Use the knob, step keys, or the data entry keys to change the DOT DENSITY.
3. Press (MKR) to activate a marker and use the knob to move it.
4. Press (DISPLAY). Then press **ANALOG+ ON OFF** to underline OFF to turn the analog+ display off.

**Note** Limit lines can be used to test data on an analog+ display, but they cannot be displayed.

## Learn About the Windows Display

The windows display feature is only available on the HP 8591E, HP 8593E, HP 8594E, HP 8595E, and HP 8596E. Windows display mode splits the spectrum analyzer display into two frequency or time displays.

When windows is first turned on, the top window will contain an inactive copy of the previous display. The lower window will be active and will display a subset of the frequency span of the upper window. The span of the lower window will be indicated on the upper window by two vertical lines called zone markers. The zone markers can be moved using the zone center and zone span softkeys to look at different portions of the upper window span.

The instrument state of the active window can be changed without affecting the state of the inactive window. The state of the active window will be used as the state of the spectrum analyzer for sweeping and updating trace data.

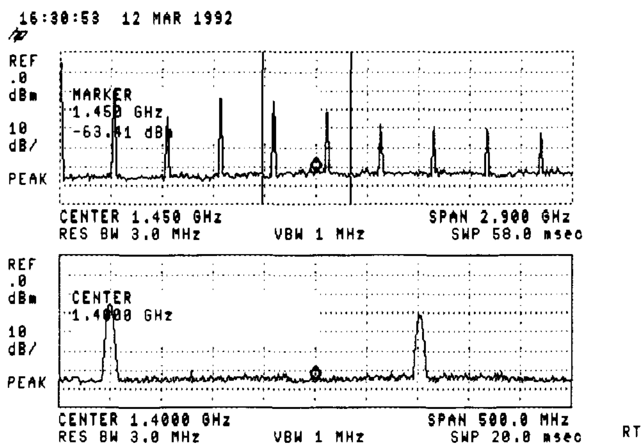



**Figure 5-10. Windows Display Mode**

**Example:** Use the windows display format to view the calibrator signal.

1. Connect the CAL OUT signal to the spectrum analyzer's INPUT 50Ω. Press (PRESET), (FREQUENCY), **START FREQ** 0 (Hz), **STOP FREQ** 2 (GHz).
2. Turn on the windows display by pressing the WINDOWS (ON) key. The active window is indicated by a solid line around the display, rather than a broken line. Press **ZONE CENTER** use the knob or step keys to move the zone to include one of the harmonics. Notice that the span marked by the zone markers in the upper window is shown as a full display in the lower window.

**Note** The upper window is not active so the trace is not updated, though the zone position is updated. The upper window must be activated by pressing WINDOWS (NEXT) to update the trace data.

3. Press **ZONE PK RIGHT**. The spectrum analyzer identifies the first signal to the right of the zone and moves the zone so that it is centered around the new signal.
4. Press **ZONE SPAN** and use the knob, step keys, or the data entry keys to change the zone span to include two signals. If the lower window is active you will notice that the span changes corresponding to the changes in the zone marked on the upper window. (If the lower window is not active press WINDOWS (NEXT) to make it active.)

5. Press **ZONE PK RIGHT** and **ZONE PK LEFT** and observe the movement of the zone and the changes in the lower window.

6. Press WINDOWS (ZOOM). Now a full-sized display of the lower window will be displayed. Notice the increase in the displayed annotation.

7. Pressing WINDOWS (NEXT) activates the upper window. A full- sized display of it will be shown, and the inactive lower window will not be displayed. Press WINDOWS (NEXT) again to activate the lower window and display it again. Notice that the zone markers can be used to tell which window is active and being displayed while in the zoom state.

8. Press WINDOWS (ZOOM) to return to the dual windows display. The lower window will still be active.

9. Press **WINDOWS OFF** and the spectrum analyzer returns to normal operation with the active window as the spectrum analyzer state.

10. Pressing WINDOWS (ON) at this point turns the windows display format on again with the current display as the new upper window. A new lower window will be generated based on the zone in the upper window.

---

**Note** Markers and limit lines can be used in both windows, but they must be turned on independently in each window. The current limit lines will be common to both windows.

---

# Learn How to Enter Amplitude Correction Factors

This section provides an overview of amplitude correction, a procedure for creating amplitude-correction data, and descriptions of the amplitude-correction functions. Refer to "Key Descriptions" in Chapter 6 for more information on a specific amplitude-correction function.

Amplitude corrections provide an easy way to adjust trace data with a set of amplitude and frequency parameters while the spectrum analyzer is sweeping the measurement range. Every measurement sweep of data is adjusted by the amplitude-correction values. When using the amplitude-correction functions, an A is displayed at the left-hand side of the graticule edge.

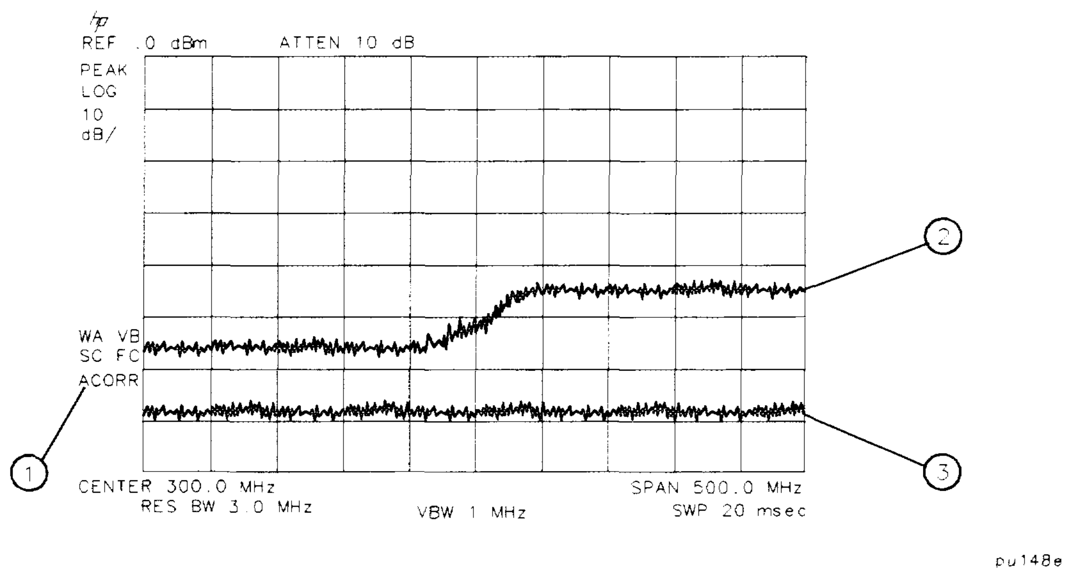



**Figure 5-11. Amplitude-Correction Display**

| Item | Description of Items in Figure 5-11 |
|---|---|
| 1 | Indicates amplitude-correction factors are on. |
| 2 | Amplitude corrections ON. |
| 3 | Amplitude corrections OFF. |

## Procedure for Creating Amplitude-Correction Factors

This procedure demonstrates how to create and activate amplitude correction data. Detailed descriptions of the amplitude-correction functions follow this procedure.

1. Press (PRESET).

**Note** A signal is not used in this procedure for demonstrating how to create amplitude-correction data. Disconnect any cable on the spectrum analyzer input.

2. Set the center frequency to 300 MHz and the span to 500 MHz by pressing:

   (FREQUENCY) 300 (MHz)
   (SPAN) 500 (MHz)

3. Press (CAL), **More 1 of 4**, **More 2 of 4**, **More 3 of 4**, then **Amp Cor** to access the amplitude-correction menus.
4. Press **Edit Amp Cor** to access the editing menus for amplitude-correction factors.
5. To clear any existing amplitude-correction data, press **PURGE AMP COR** two times consecutively.

**Note** After pressing **PURGE AMP COR** the first time, the message `If you are sure, press key again to purge data` will appear. Pressing **PURGE AMP COR** a second time erases the amplitude-correction data.

6. Specify the first amplitude-correction point by pressing the following keys:

   **SELECT FREQ**
   50 (MHz)
   12 (+dBm)

7. Specify the second amplitude-correction point by pressing the following keys:

   250 (MHz)
   10 (+dBm)

**Note** Table entries can be edited if you make a mistake. To edit an existing point, use **SELECT POINT** to specify the point. Then use **SELECT FREQ** or **SELECT AMPLITUD** to specify the entry that you wish to edit.

8. Specify the third and fourth amplitude-correction points by using the following key sequence:

   300 (MHz) 15 (+dBm)
   350 (MHz) 22 (+dBm)

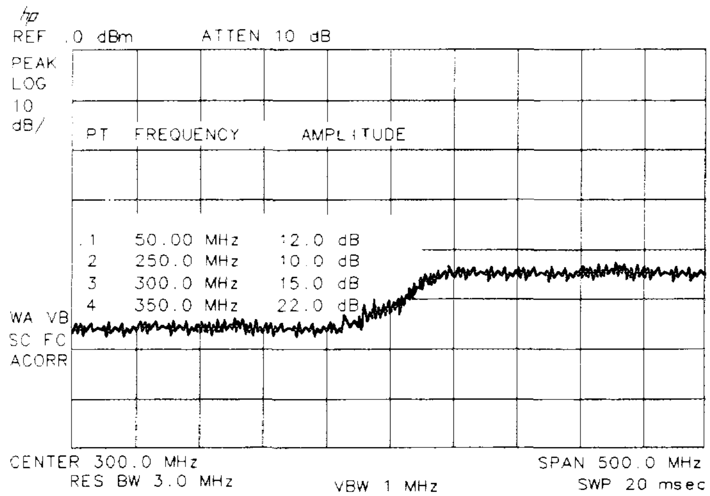



**Figure 5-12. Completed Amplitude-Correction Table**

9. Press **EDIT DONE** when all the points have been entered.

   Use steps 10 and 11 to display corrected versus uncorrected amplitude trace data for trace comparison.

10. Display the amplitude-corrected trace in trace A by pressing the following keys:

    (TRACE)

    **CLEAR WRITE A**

    **VIEW A**

11. Display the uncorrected amplitude trace in trace B by pressing the following keys:

    **TRACE A B C** until B is selected

    **CLEAR WRITE B**

    (CAL), **More 1 of 4**, **More 2 of 4**, **More 3 of 4**, **Amp Cor**

    **AMP COR ON OFF** until OFF is selected

## Amplitude-Correction Functions

This section describes the amplitude-correction functions in the order they are usually used.

### Editing or Viewing the Amplitude-Correction Tables

Pressing (CAL), **More 1 of 4**, **More 2 of 4**, **More 3 of 4**, **Amp Cor** accesses the softkey menus for creating an amplitude-correction table.

**Note** (PRESET) turns amplitude-correction factors off (if it is on), but does not clear an existing amplitude-correction table. Use **PURGE AMP COR** to clear an existing amplitude-correction table.

Press **Edit Amp Cor** to edit an existing amplitude-correction table or, if no amplitude-correction table currently exists, to create an amplitude-correction table.

Pressing **PURGE AMP COR** two times consecutively clears an existing amplitude-correction table.

### Selecting the Amplitude-Correction Point

Pressing **SELECT POINT** specifies the amplitude-correction point to be entered or edited. Amplitude-correction data is constructed from left to right and is created by entering frequency and amplitude values into an amplitude-correction table. The frequency and amplitude values specify a coordinate point from which amplitude-corrections are interpolated. See Figure 5-13. Up to 79 points can be specified for the amplitude-corrections table.

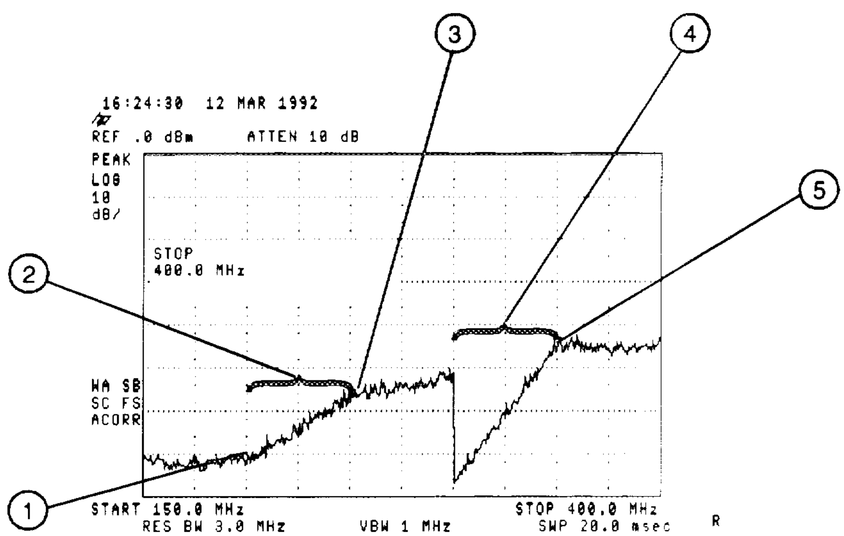



**Figure 5-13. Amplitude-Correction Points**

| Item | Description of Items in Figure 5-13 |
|---|---|
| 1 | Frequencies below first point use first amplitude level. |
| 2 | First segment interpolated with the 10 dB amplitude level. |
| 3 | Frequency and amplitude coordinate that starts the second segment. |
| 4 | Third segment interpolated with the −10 dB amplitude level. |
| 5 | Frequency and amplitude coordinate that starts the fourth segment. |

### Selecting the Frequency Coordinate

Press **SELECT FREQ**, then enter a frequency value for the point.

**Note** Only two entries per frequency are used. If more points with the same frequency are entered, only the first and last entries are used. All other amplitude values are ignored. See Figure 5-13 for an example of two entries at the same frequency.

**Note** When entering amplitude-correction data, the frequency and amplitude values will be listed as asterisks (***) until new values are entered. Once the frequency value is entered, the segment is immediately sorted into the table according to this value.

### Selecting the Amplitude Coordinate

The amplitude value is entered by pressing **SELECT AMPLITUD**, entering an amplitude value, and pressing a units key.

**Note** Frequency or amplitude values that are not within range will be modified. For example, a frequency value of 60 GHz will be modified to 30 GHz.

### Completing Table Entry and Activating Amplitude Corrections

Pressing **EDIT DONE** blanks the amplitude-correction table from the screen and accesses the menu with **AMP COR ON OFF**.

Pressing **AMP COR ON OFF** turns the amplitude corrections on and off.

### Saving or Recalling Amplitude Correction Tables

Pressing **Amp Cor** under the (DISPLAY) key accesses **SAVE AMP COR** and **RECALL AMP COR**. These softkey functions provide an easy way to save or recall current amplitude-correction tables. **SAVE AMP COR** saves the current amplitude-correction table in the current mass storage device (spectrum analyzer memory or memory card). To determine the current mass storage device, press **SAVE AMP COR**. If MAX REG # appears on the spectrum analyzer display, the current mass storage device is analyzer memory. If PREFIX= is displayed, the memory card is the mass storage device. (Press (SAVE) or (RECALL), **INTERNAL CARD** to change the current mass storage device.) Press **SAVE AMP COR**, enter a register number, then press (ENTER) to save the current amplitude-correction table in spectrum analyzer memory or on the memory card.

**RECALL AMP COR** recalls amplitude-correction tables from the current mass storage device (spectrum analyzer memory or memory card). To determine the current mass storage device, press **RECALL AMP COR**. If MAX REG # appears on the spectrum analyzer display, the current mass storage device is analyzer memory. If PREFIX= is displayed, the memory card is the mass storage device. (Press (SAVE) or (RECALL), **INTERNAL CARD** to change the current mass storage device.) When recalling an amplitude-correction table from the memory card, it is necessary that the current prefix match the prefix that the table was originally stored with. Use **Change Prefix** to change the current prefix. To recall an amplitude-correction table, enter the register number that the table was saved under, then press (ENTER).

## External Keyboard

The HP C1405A Option ABA Keyboard is an IBM AT compatible keyboard that can be connected to the external keyboard connector on the rear panel of the spectrum analyzer (Options 021, 023, or 024 only). The external keyboard allows a convenient way to enter

6

# Key Descriptions

This chapter describes functions and controls of the spectrum analyzer. The front-panel keys and softkey functions are listed alphabetically followed by a complete and detailed description.

Brief descriptions for service functions have also been included in this chapter. However, for more detailed descriptions and information about the use of each function, refer to the respective service guide for your instrument. A listing of all service calibration and service diagnostic functions has been provided in the following "Service Functions" section.

All softkeys and their relationship to the front-panel keys are shown in Chapter 7, "Key Menus."

# Service Functions

Two types of functions are available for service use only:

- Service calibration functions.
- Service diagnostic functions.

These service functions are designed for service use only. However, brief descriptions for each function are provided in this chapter. For more detailed descriptions and information about the use of each function, refer to the Service Guide for your instrument.

Service documentation can be obtained by ordering Option 915 through your HP Sales and Service office. Option 915 is described in more detail under Chapter 9 "Options and Accessories" in this manual.

## Service Calibration Functions

**Service Cal** accesses the following service calibration softkeys:

CAL MXR (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only)

CAL TIMEBASE
EDIT FLATNESS
EXECUTE TITLE
EXIT
Flatness Data
IDNUM
INIT FLT
SET ATTN ERROR
STOR PWR ON UNITS

## Service Diagnostic Functions

**Service Diag** accesses the following diagnostic softkeys:

$\phi$ LOCK ON OFF
+10V REF DETECTOR
−10V REF DETECTOR
2v REF DETECTOR
ALC TEST (HP 8590L or HP 8591E with Option 010 or 011 only)

ANALYZER GAINS
AUXB (HP 8590L or HP 8591E only)

BINARY SPAN (HP 8590L or HP 8591E only)

COARSE TUNE DAC
DACS
DISPLAY CAL DATA
DROOP
FINE TUNE DAC
FM COIL DRIVE
FM GAIN (Option 102 or 103 only)

| | |
|---|---|
| FM OFFST | (Option 102 or 103 only) |
| FM SPAN | |
| FREQ DIAG | |
| FRQ DISC NORM OFF | |
| GND REF DETECTOR | |
| MAIN COIL DR | |
| MAIN SPAN | |
| MIXER BIAS DAC | (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only) |
| PRESEL DAC | (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only) |
| QP DET ON OFF | (Option 103 only) |
| QP GAIN ON OFF | (Option 103 only) |
| QPD RST ON OFF | (Option 103 only) |
| QPD OFFSET | (Option 103 only) |
| STP GAIN ZERO | |
| SWEEP RAMP | |
| SWEEP TIME DAC | |
| X FINE TUNE DAC | |
| YTF DRIVER | (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only) |
| YTF SPAN | (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only) |
| YTF TUNE COARSE | (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only) |
| YTF TUNE FINE | (HP 8592L, HP 8593E, HP 8595E, or HP 8596E only) |

## Analyzer Functions

**% AM ON OFF** determines the percent of amplitude modulation of the largest displayed signal and its two sidebands. The sidebands are assumed to be entirely from amplitude modulation. If there are differences in the sideband amplitude, the larger value is used. The measurement runs continuously, re-executing at the end of each sweep.

All three signal must be displayed. The frequency spacing of the sideband signals must be the same within the span accuracy of the measurement. All of the signals must be greater than the PEAK EXCURSION above the THRESHOLD. The amplitude scale may be either linear or logarithmic.
Front-Panel Key Access: (MEAS/USER)

**φ LOCK ON OFF** turns off the spectrum analyzer phase locking. The counter is turned off so frequency correction is no longer done at the start of each sweep. Turning the phase locking off increases measurement speed, but it decreases frequency accuracy. This is a service diagnostic function and is for service use.
Front-Panel Key Access: (CAL)

**+10V REF DETECTOR** displays the output of the +10 V reference from the A7 Analog Interface assembly as a horizontal line at the top graticule. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**−10V REF DETECTOR** displays the output of the −10 V reference from the A7 Analog Interface assembly as a horizontal line at the bottom graticule. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**2v REF DETECTOR** displays the output of the 2 V reference produced on the A16 Processor/Video assembly as a horizontal line at the top graticule. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**0-2.9 Gz BAND 0** *HP 8592L, HP 8593E, HP 8595E, and HP 8596E only.*
locks onto harmonic band 0. Harmonic band 0 uses low-pass filtering instead of bandpass preselection. It has a specified tuning range of 0 to 2.9 GHz.
Front-Panel Key Access: (FREQUENCY)

**2.75-6.5 BAND 1** *HP 8592L, HP 8593E, HP 8595E, and HP 8596E only.*
locks onto harmonic band 1. Harmonic band 1 is preselected and has a specified tuning range of 2.75 GHz to 6.5 GHz.
Front-Panel Key Access: (FREQUENCY)

**6.0-12.8 BAND 2** *HP 8592L, HP 8593E, and HP 8596E only.*
locks onto harmonic band 2. Harmonic band 2 is preselected and has a specified tuning range of 6.0 to 12.8 GHz.
Front-Panel Key Access: (FREQUENCY)

**12.4-19. BAND 3** *HP 8592L and HP 8593E only.*
locks onto harmonic band 3. Harmonic band 3 is preselected and has a specified tuning range of 12.4 to 19.4 GHz.
Front-Panel Key Access: (FREQUENCY)

**19.1-22 BAND 4** — *HP 8592L and HP 8593E only.*
locks onto harmonic band 4. Harmonic band 4 is preselected and has a specified tuning range of 19.1 to 22 GHz.
Front-Panel Key Access: (FREQUENCY)

**9 kHz EMI BW** — allows a 6 dB resolution bandwidth of 9 kHz. This bandwidth is useful when performing electromagnetic interference (EMI) measurements.
Front-Panel Key Access: (BW)

**120 kHz EMI BW** — allows a 6 dB resolution bandwidth of 120 kHz. This bandwidth is useful when performing electromagnetic interference (EMI) measurements.
Front-Panel Key Access: (BW)

**200 Hz EMI BW** — *For Option 130 only.*
allows a 6 dB resolution bandwidth of 200 Hz. This bandwidth is useful when performing electromagnetic interference (EMI) measurements.
Front-Panel Key Access: (BW)

**A<-->B** — exchanges the contents of the trace A register with the trace B register and puts trace A in view mode.
Front-Panel Key Access: (TRACE)

**A−B → A ON OFF** — when ON is underlined, subtracts the data in trace B from the measured data in trace A. A minus sign (−) appears between the trace A status and the trace B status in the screen annotation while the function is active.

To deactivate this function, press **A − B → A ON OFF** so that OFF is underlined. The A−B → A and B−DL → B functions are math functions. Unlike operations on dBm units, math functions operate on measurement units. Measurement units are used to format trace data for data within the graticule limits. The displayed amplitude of each element falls on one of 8000 vertical points with the value of 8000 being equal to the reference level. For log scale data, each point is equal to 0.01 dB. The peak of a signal equal to −10 dBm, or one division below the reference level, is equal to 7000 measurement units (8000 − 1000 = 7000). In linear mode, each point has a resolution of [reference level in volts/8000].

For example, if trace A contains amplitude values of −10 dBm and trace B contains amplitude values of −40 dBm, the result of the A − B → A function would be −10.004 dBm if dBm units were used. Since measurement units are used for the A − B → A function, the result of A − B → A is −50 dBm (−10 dBm = 7000 measurement units, −40 dBm = 4000 measurement units; the result is 3000 measurement units, which is equal to −50 dBm).
Front-Panel Key Access: (TRACE)

**A → C** — copies trace A into trace C.
Front-Panel Key Access: (TRACE)

**ABCDEF** — accesses the softkey menu for selecting screen title characters A through F.
Front-Panel Key Access: (CAL), (CONFIG), (DISPLAY), (RECALL), or (SAVE)

**ACCEPT QP DATA**

*For Option 103 only.*
displays the quasi-peak amplitude value of the marker. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: (AUX CTRL)

**ACPGRAPH ON OFF**

turns the adjacent channel power graph ON or OFF. With ACPGRAPH ON, the ACP ratio graph is calculated and displayed and the numeric results are not displayed. The value of the ACP ratio is displayed at the selected marker frequency offset from the center frequency. This graph function is used after doing an adjacent channel power measurement with the **ADJ CHAN POWER** or **ADJ CHAN PWR extd** softkeys.

Front-Panel Key Access: (MEAS/USER)

**ADJ CHAN POWER**

measures the power leakage into the adjacent channels and calculates the adjacent channel power ratio of both the upper and lower channels, with respect to the total power. The total power of the carrier is displayed. The adjacent channel power ratios of both channels are also displayed and the larger number is marked with a $\wedge$. (Vertical lines on the display indicate the bandwidth edges of the three different channels being measured.)

The measurement can be made on a single sweep or continuously updated at the end of each sweep. (See **SINGLE MEAS** and **CONT MEAS** .) The measurement stops and the spectrum analyzer is returned to its prior state when other measurement functions are activated.

The center frequency must be set to the intended carrier frequency and the reference level set to optimize the displayed signal. The channel bandwidth and channel spacing must be entered by the user. If PARAM AUTO is selected (so AUTO is underlined), other spectrum analyzer settings will then be coupled and set automatically. The adjacent channel power measurement responds to signals like an rms power measurement. This means that the measurement of the total channel power and the adjacent channel power ratios are accurately reported, whether the transmitted signal contains tones, noise, or both. If PARAM AUTO is selected the parameters of the instrument state are set for a valid measurement. When using PARAM MAN, the following conditions must be maintained to make a valid rms measurement. If these conditions are not met, errors of up to −2.5 dB can occur for noise-like signals.

- Video bandwidth is at least 10 times the resolution bandwidth.
- Detector mode is sample (SMP). (You can use **DETECTOR SMP PK** to select the detector mode.)
- Resolution bandwidth is less than or equal to 100 kHz.
- Video averaging is OFF.
- Neither MAX HOLD nor MIN HOLD trace mode is selected.

Front-Panel Key Access: (MEAS/USER)

**ADJ CHAN PWR extd** measures the power leakage into the adjacent channels and calculates the adjacent channel power ratio of both the upper and lower channels, with respect to the reference channel. **ADJ CHAN POWER extd** has an extended dynamic range compared with **ADJ CHAN POWER**. The extended range is measured by taking two different sweeps with different reference levels and combining the trace data. The displayed dynamic range is 104 dB and the log scale is set to 13 dB/ division.

The total power of the channel is displayed. The adjacent channel power ratios of both channels are also displayed and the larger number is marked with a ∧. (Vertical lines on the display indicate the six edges of the upper, lower, and reference channels being measured.)

The measurement stops and the spectrum analyzer is returned to its prior state when other measurement functions are activated.

The center frequency must be set to the intended carrier frequency and the reference level set to optimize the displayed signal. The channel bandwidth and channel spacing must be entered by the user. If PARAM AUTO is selected (so AUTO is underlined), other spectrum analyzer settings will then be coupled and set automatically. The adjacent channel power measurement is an rms measurement. This means that the measurement of the total channel power and the adjacent channel power ratios are accurately reported, whether the transmitted signal contains tones, noise, or both. IF PARAM AUTO is selected the parameters of the instrument state are set for a valid measurement. When using PARAM MAN, the following conditions must be maintained to make a valid rms measurement:

- Video bandwidth is at least 10 times the resolution bandwidth.
- Detector mode is sample (SMP). (You can use **DETECTOR SMP PK** to select the detector mode.)
- Resolution bandwidth is less than or equal to 100 kHz.
- Video averaging is OFF.
- Neither MAX HOLD nor MIN HOLD trace mode is selected.

Front-Panel Key Access: (MEAS/USER)

**ALC INT EXT** *HP 8593E, HP 8594E, HP 8595E, or HP 8596E with Option 010 only.* activates internal (INT) leveling or external (EXT) leveling.
Front-Panel Key Access: (AUX CTRL)

**ALC MTR INT XTAL**

*HP 8590L or HP 8591E with Option 010 or 011 only.*
activates the automatic leveling control (ALC) function for internal (INT) leveling or external (XTAL or MTR) leveling. The external leveling input (located on the rear panel of the spectrum analyzer) can be used with a power meter or crystal that has a positive or negative voltage output. See specifications and characteristics in your calibration guide for the leveling input characteristics. External leveling increases the amplitude accuracy by improving the effective source match. The meter (MTR) position narrows ALC loop bandwidth so an HP power meter can be used.
Front-Panel Key Access: (AUX CTRL)

**ALC TEST**

*HP 8590L or HP 8591E with Option 010 or 011 only*
breaks the leveling loop of the automatic leveling control in the tracking generator. This is a service diagnostic function and is for service use only. Refer to the service guide for more information.
Front-Panel Key Access: (CAL)

**ALL DLP → CARD**

*Requires Option 003 for an HP 8590L or HP 8592L.*
saves all the downloadable programs and key definitions that are in spectrum analyzer memory onto the memory card. If the downloadable program was stored using a prefix, the file name for the downloadable program consists of d(prefix)_(register number). If no prefix was specified, the data is stored with the file name d_(register number).
Front-Panel Key Access: (SAVE)

**Amp Cor**

accessed by (CAL). **Amp Cor** accesses the menus for entering and editing the current amplitude-correction factors.
Front-Panel Key Access: (CAL)

**AMP COR**

when accessed by (SAVE), **AMP COR** stores the current amplitude-correction factors table in spectrum analyzer memory or on the memory card.

When accessed by (RECALL), **AMP COR** recalls the amplitude-correction factors table from either spectrum analyzer memory or the memory card. Amplitude-correction factors are saved with an "a" before the memory-card file name. Screen titles are not recalled with the data. Refer to "To Save a Limit-Line Table or Amplitude Correction Factors" in Chapter 5 for more information.

Amplitude-correction-factor memory-card files can be catalogued using **CATALOG AMP COR** .
Front-Panel Key Access: (RECALL) or (SAVE)

**AMP COR ON OFF**

turns the current amplitude-correction factors on or off.
Front-Panel Key Access: (CAL)

AMPLITUDE — activates the reference level function and accesses the amplitude menu. The softkeys accessed when you press AMPLITUDE change reference level, input attenuation, vertical scale, mixer level, amplitude units, input impedance, and amplitude offset. For the HP 8593E, HP 8594E, HP 8595E, or HP 8596E, pressing AMPLITUDE accesses the preselector peaking and preselector default functions also.

**Amptd Units** — accesses the softkeys that change the amplitude units. The amplitude units can be changed by pressing **dBm**, **dBmV**, **dBuV**, **Volts**, or **Watts**.
Front-Panel Key Access: AMPLITUDE

**ANALOG+ ON OFF** — *For the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only. Requires Option 101 or 301.*
turns on the analog+ display mode. This is a digital implementation of an analog display, combining the advantages of both types of displays. The display is made up of 401 horizontal points or trace elements. In the analog+ display mode each trace element can display from 1 to 40 dots, or measurements.

Pressing **ANALOG+ ON OFF** makes dot density the active function. The dot density function sets the desired number of measurements per trace element. Each dot requires an additional analog-to-digital conversion for each trace element, so the sweep time can limit the actual number of dots available. Lengthening the sweep time can increase the actual dot density.

Markers and marker functions as well as the screen text and title capabilities of a digital display are available along with the analog type trace information. Some functions are not available with analog+ display mode. See Table 6-1 for a list of functions that are not available with analog+ displays. If a trace is blanked while using an analog+ display, the data is permanently blanked and cannot be recalled, even if you use the view function.

The copy function can be used to provide a printout of the display. It must be configured to use a printer and not a plotter. After using other functions, press **ANALOG+ ON OFF** to return to the dot density function.

Limit lines can be used to test data in an analog+ display, but they cannot be displayed.

**AUTO QP AT MKR** *For Option 103 only.*
executes a quasi-peak routine. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: [AUX CTRL]

**Aux Conn Control** accesses the softkey menu used to control the auxiliary outputs and input. The auxiliary outputs are controlled by pressing **CNTL A 0 1**, **CNTL B 0 1**, **CNTL C 0 1**, and **CNTL D 0 1**. The status of the auxiliary input (control line I), can be displayed on the spectrum analyzer screen with **DISPLAY CNTL I**.
Front-Panel Key Access: [AUX CTRL]

**[AUX CTRL]** accesses the softkey menu used for control of the auxiliary interface connector.

*For the HP 8592L, HP 8593E, and HP 8596E:* [AUX CTRL] also accesses the comb generator function. *For Option 102 or 103:* [AUX CTRL] accesses demodulation functions. *For Option 010 or 011:* it accesses tracking generator functions.

**AUXB** *HP 8590L or HP 8591E only.*
displays the voltage level present at an unused input to the Test Point MUX circuitry located on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: [CAL]

**B → C** copies trace B into trace C.
Front-Panel Key Access: [TRACE]

**B <--> C** exchanges the contents of trace B with trace C and puts trace B in view mode.
Front-Panel Key Access: [TRACE]

**B−DL → B** subtracts the display line from trace B and places the result in trace B. The B−DL → B function is a math operation. See the **A−B → A ON OFF** softkey description for information about math operations.
Front-Panel Key Access: [TRACE]

**Band Lock** *HP 8592L, HP 8593E, HP 8595E, and HP 8596E only.*
accesses the harmonic band menu and the band lock function. Selecting a harmonic band causes the spectrum analyzer to lock onto the specified harmonic band and automatically select the settings shown in Table 6-2.

**Table 6-2.**
**Center Frequency and Span Settings for Harmonic Bands**

| Softkey | Center Frequency | Span | Description |
|---|---|---|---|
| 0-2.9 Gz BAND 0 | 1.45 GHz | 2.9 GHz | Low-pass filtered, first harmonic mixing. |
| 2.75-6.5 BAND 1 | 4.638 GHz | 3.6 GHz | Preselected, first harmonic mixing. |
| 6.0-12.8 BAND 2 * | 9.4 GHz | 6.8 GHz | Preselected, second harmonic mixing. |
| 12.4-19.4 BAND 3 † | 15.9 GHz | 7 GHz | Preselected, third harmonic mixing. |
| 19.1-22 BAND 4 † | 20.55 GHz | 2.9 GHz | Preselected, fourth harmonic mixing. |

* Not available with the HP 8595E.
† Not available with the HP 8595E or HP 8596E.

**BND LOCK ON OFF** locks the spectrum analyzer onto a selected frequency band (local oscillator harmonic number). When only one frequency band is being swept the corresponding softkey will be underlined, even if band lock is off.

**Note** When using the spectrum analyzer in a band lock mode, the span is limited to 3.6 GHz in band 0 and 1, and to 7 GHz in bands 2 through 4. To select the maximum span in a given band, use the start frequency, stop frequency, or span function.

Front-Panel Key Access: (FREQUENCY)

**BAUD RATE** *Option 023 (RS-232 interface) only.*
sets the data transmission speed. (Also see the description for the (COPY) key.)
The baud rate is set to 1200 by pressing **DEFAULT CONFIG**.
Front-Panel Key Access: (CONFIG)

**BINARY SPAN** *HP 8590L and HP 8591E only.*
displays the output of the span DAC that is located on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**BLANK A** stores the amplitude data for trace A and removes it from the screen. The trace A register will not be updated as the spectrum analyzer sweeps.
Front-Panel Key Access: (TRACE)

**BLANK B** stores the amplitude data for trace B and removes it from the screen. The trace B register will not be updated as the spectrum analyzer sweeps.
Front-Panel Key Access: (TRACE)

**BLANK C** stores the amplitude data for trace C and removes it from the screen. The trace C register will not be updated as the spectrum analyzer sweeps.
Front-Panel Key Access: (TRACE)

**BLANK CARD** *Requires Option 003 for an HP 8590L or HP 8592L.*
deletes all the files from the memory card. Pressing **BLANK CARD** displays the message: `If you are sure, press key again to purge data.` Press **BLANK CARD** again if you want to delete all files from the memory card.
Front-Panel Key Access: (CONFIG)

**BND LOCK ON OFF** *HP 8592L, HP 8593E, HP 8595E, and HP 8596E only.*
underlining ON locks the spectrum analyzer to the lowest frequency band (local oscillator harmonic number) containing the correct center frequency. Start and stop frequencies will be changed if necessary. Executing a band lock limits the spectrum analyzer's tuning range to the selected harmonic number. Selecting the softkeys for band 0 through band 4 turns on the band lock function automatically.

If the start frequency is well within a lower band, turning band lock off will result in a multiband sweep. If a specific band had been selected prior to changing to a multiband sweep, the selected band's softkey label will no longer be underlined indicating that it is not selected. Sweep of a single band is indicated by the selected band's softkey label being underlined.

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**Note** Before changing the frequency range to another harmonic band, unlock the band by pressing **BND LOCK ON OFF** so that OFF is underlined.

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Front-Panel Key Access: (FREQUENCY)

**(BW)** activates the resolution bandwidth function and accesses the softkeys that control the bandwidth functions: **RES BW AUTO MAN**, **VID BW AUTO MAN**, **VBW/RBW RATIO**, **VID AVG ON OFF**, and the **EMI BW Menu**. (Also see the **RES BW AUTO MAN** softkey description.)

**CAL** accesses the softkey menus used for the self-calibration, service-diagnostics, and service-calibration functions. For more information about self-calibrating the spectrum analyzer, see "Improving Accuracy with Self-Calibration Routines" in Chapter 2.

**CAL AMPTD** initiates an amplitude self-calibration routine. Connect CAL OUT to the spectrum analyzer input before pressing **CAL AMPTD**. If Option 105 is installed, remove the cable from the rear panel GATE INPUT before starting the self-calibration routine.

**Note** If the frequency calibration and amplitude calibration self-calibration routines are both used, the **CAL FREQ** softkey function should always be initiated before the **CAL AMPTD** softkey function.

Front-Panel Key Access: CAL

**CAL FETCH** retrieves stored self-calibration correction factors from the last calibration saved using **CAL STORE**.
Front-Panel Key Access: CAL

**CAL FREQ** initiates a frequency self-calibration routine. Connect CAL OUT to the spectrum analyzer input before pressing **CAL FREQ** . If Option 105 is installed, remove the cable from the rear panel GATE INPUT before starting the self-calibration routine.
Front-Panel Key Access: CAL

**CAL FREQ & AMPTD** initiates both the frequency and amplitude self-calibration routines. Connect CAL OUT to the spectrum analyzer input before pressing **CAL FREQ & AMPTD**. If Option 105 is installed, remove the cable from the rear panel GATE INPUT before starting the self-calibration routine.
Front-Panel Key Access: CAL

**CAL MXR** *HP 8592L, HP 8593E, HP 8595E or HP 8596E only.*
adjusts the bias-current DAC setting for the optimum displayed-signal amplitude. The HP 8592L, HP 8593E, and HP 8596E use the 100 MHz COMB OUT signal for the test signal. The HP 8595E uses the 300 MHz CAL OUT signal. This is a service calibration function and is for service use only.
Front-Panel Key Access: CAL

**CAL STORE** stores the correction factors from the last calibration. The stored correction factors are automatically retrieved when the spectrum analyzer is turned on. If correction factors are not stored, they will be retained only until the spectrum analyzer is turned off. See the description for the **CAL FETCH** softkey.
Front-Panel Key Access: CAL

**CAL TIMEBASE** changes the setting of the 10 MHz reference (standard timebase) DAC that is located on the A25 Counter Lock assembly. This is a service calibration function and is for service use only.
Front-Panel Key Access: CAL

**CAL TRK GEN**

*Option 010 or 011 only.*
performs absolute amplitude, vernier, and tracking peak self-calibration routines. (It only performs the tracking peak self-calibration for the HP 8590L and HP 8591E.) The spectrum analyzer should be amplitude calibrated by pressing **CAL AMPTD** prior to using the CAL TRK GEN function. Connect the tracking generator output to the spectrum analyzer input before pressing **CAL TRK GEN**.
Front-Panel Key Access: (CAL)

**CAL YTF**

*HP 8592L, HP 8593E, HP 8595E, and HP 8596E only.*
generates the best slope and offset adjustment to calibrate the YIG-tuned filter (YTF) for each harmonic band. Connect COMB OUT to the spectrum analyzer input before pressing **CAL YTF** on the HP 8592L, HP 8593E, or HP 8596E. Connect the CAL OUT to the spectrum analyzer input for an HP 8595E. The frequency self-calibration routine should be performed before running the CAL YTF routine.
Front-Panel Key Access: (CAL)

**Card Config**

*Requires Option 003 for an HP 8590L or HP 8592L.*
accesses the softkey menu that allows you to catalog, format, and delete data from a memory card.
Front-Panel Key Access: (CONFIG)

**CARD → DISPLAY**

*Requires Option 003 for an HP 8590L or HP 8592L.*
recalls into spectrum analyzer memory a display image saved on the memory card. It does not recall the associated instrument state, but the restored display can be viewed and copied. Before recalling a display that was saved under a prefix other than the current prefix, change the current prefix to the prefix used when the display was saved.

The intensity of some screen items may differ if the current spectrum analyzer state does not match the state of the recalled image. This will not affect the spectrum analyzer ability to output a copy of the screen.

It is possible to have more functionality than just viewing and copying a recalled display image. For example, you can set the spectrum analyzer to the identical window configuration as when the display was saved. Then recall the trace that corresponds to the display image. This will restore the trace and state information. Finally, you can recall the display image. At this point, markers and display line can be used to examine the data. If an attempt is made to update the trace data, the display will be erased and redrawn to reflect the current instrument state.

Pressing **LOAD FILE** is an alternate way to load display image from the memory card into spectrum analyzer memory. See "Saving and Recalling Data from the Memory Card" in Chapter 5 for more information.
Front-Panel Key Access: (RECALL)

**CARD → DLP**

*Requires Option 003 for an HP 8590L or HP 8592L.*
recalls into the spectrum analyzer memory a downloadable program (DLP) saved on the memory card. Before recalling data that was saved under a prefix other than the current prefix, change the current prefix to the prefix used when the data was saved. Pressing **LOAD FILE** is an alternate way to load program data from the memory card into spectrum analyzer memory. See "Saving and Recalling Data from the Memory Card" in Chapter 5 for more information. See also the **Change Prefix** softkey description.
Front-Panel Key Access: (RECALL)

**CARD → STATE** *Requires Option 003 for an HP 8590L or HP 8592L.* recalls into spectrum analyzer memory a state saved on the memory card. **CARD → STATE** also displays the time and date when the state data was stored. Before recalling a state that was saved under a prefix other than the current prefix, change the current prefix to the prefix used when the state was saved.

If the windows display mode is being used, the instrument state can only be recalled into the active window.

Pressing **LOAD FILE** is an alternate way to load state data from the memory card into spectrum analyzer memory. See "Saving and Recalling Data from the Memory Card" in Chapter 5 for more information.
Front-Panel Key Access: (RECALL)

**Card → Trace** *Requires Option 003 for an HP 8590L or HP 8592L.* recalls into spectrum analyzer memory a trace saved on the memory card. Limit lines and amplitude correction factors are recalled by pressing **Card → Trace**, **LIMIT LINES** or **AMP COR**. If the screen title does not exceed 34 characters, the time and date when the trace data was stored is also displayed with the recalled trace data. The screen title and date are not recalled with limit-line files or amplitude correction factor files. Before recalling a trace, limit-line file, or amplitude correction factors file that was saved under a prefix other than the current prefix, change the current prefix to the prefix used when the data was saved. If windows are being used, only the trace of the active window can be recalled.

Pressing **LOAD FILE** is an alternate way to load trace data (but not recommended for recalling limit-line files or amplitude correction factor files) from the memory card into spectrum analyzer memory. See "Saving and Recalling Data from the Memory Card" in Chapter 5 for more information.
Front-Panel Key Access: (RECALL)

**CATALOG ALL** catalogs all the programs and variables stored in spectrum analyzer memory in bytes along with the remaining memory available in bytes. Press **CATALOG REGISTER** to catalog states, traces, limit-line tables, and amplitude correction factors saved in spectrum analyzer memory. Pressing **CATALOG ALL** catalogs all traces, states, amplitude correction factors, programs, display images, and limit-line tables stored on the memory card when cataloging the memory card.
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG AMP COR** *Requires Option 003 for an HP 8590L or HP 8592L.* catalogs the amplitude correction factor files that are on the memory card. Use the **CATALOG REGISTER** softkey to catalog amplitude factors saved in spectrum analyzer memory (amplitude correction factors saved in analyzer memory are stored in trace registers). Amplitude correction factors are saved with an "a" before the memory card file name. Amplitude factors can be saved in spectrum analyzer memory by either loading in amplitude correction factors from a memory card, defining amplitude correction factors using a remote programming command (AMPCOR), or using **EDIT AMP COR**. See "Entering Amplitude Correction Factors" in Chapter 5 for more information.
Front-Panel Key Access: (RECALL) or (SAVE)

**Catalog Card**

*Requires Option 003 for an HP 8590L or HP 8592L.*
accesses a menu with the cataloging functions for the memory card: **CATALOG ALL**, **CATALOG STATES**, **CATALOG TRACES**, **CATALOG PREFIX**, **CATALOG DLP**, **CATALOG AMP COR**, **CATALOG LMT LINE**, and **CATALOG DISPLAY**. Each catalog function displays catalog information and accesses a menu containing **LOAD FILE** and **DELETE FILE**. The catalog contains information about the items stored on the memory card. (See Figure 6-1 and Table 6-3.)

Use the step keys to view different sections of the directory, and the knob to select a file. Press **LOAD FILE** to load the selected file into spectrum analyzer memory. Press **DELETE FILE** to delete the selected file from the memory card.

Unlike saving to the internal memory, data is saved as a file on the memory card. The files stored on the memory card are in the logical interchange format (LIF).

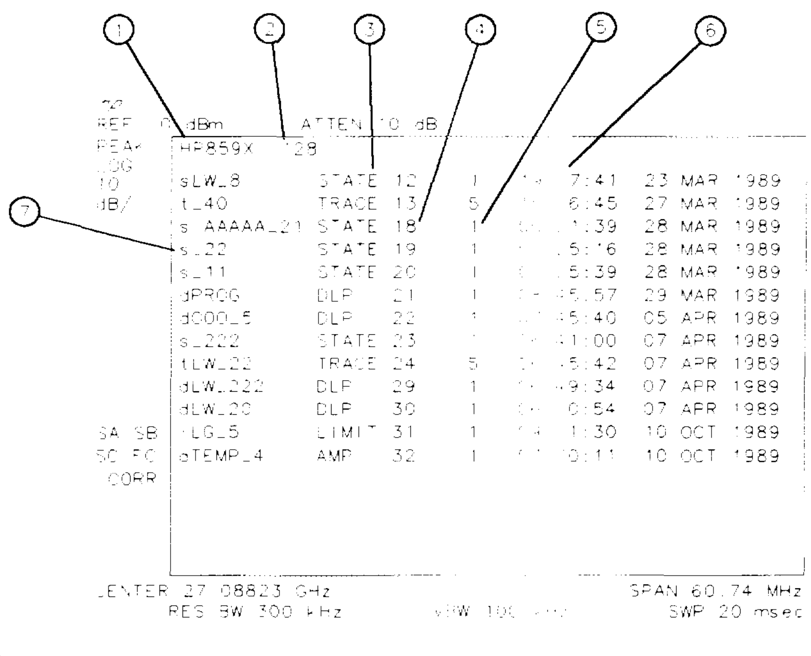


**Figure 6-1. Memory Card Catalog Information**

**Table 6-3. Memory Card Catalog Information**

| Item | Title | Description |
|---|---|---|
| 1 | Volume Label | A label to identify the memory card. **FORMAT CARD** automatically assigns the volume label "HP859X" to the card. |
| 2 | Number of kilobytes | Displays the size of the memory card. 128 is the number of 256-byte blocks or records. 128 indicates that the card is a 32-Kbyte memory card (128 blocks x 256 bytes per block). |
| 3 | Data Type | Indicates the type of data—trace, state, downloadable program (DLP), limit line (LIMIT), amplitude factors (AMP), display image (DSPLY). The data type is determined by the letter t, s, d, l, a, or i preceding the filename. |
| 4 | Starting Address | Indicates the physical record number of the start of the file. |
| 5 | File Length | Indicates number of records in the file. |
| 6 | Time of Creation | Indicates the time and date of file creation. |
| 7 | File name | The letter preceding the file name indicates the type of data of the file: t = trace data, s = state data, d = program data (downloadable program), l = limit line, a = amplitude factors, i = display image. If the data was saved using a prefix, the prefix follows the first character in the file name. An underscore and the register number follow the prefix. |

Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG CARD** *Requires Option 003 for an HP 8590L or HP 8592L.*
displays a catalog of the items stored on the memory card, while accessing the memory card configuration menu.
Front-Panel Key Access: (CONFIG)

**CATALOG DISPLAY** *Requires Option 003 for an HP 8590L or HP 8592L.*
catalogs all of the display images that are on the memory card. A display image can be recalled to the spectrum analyzer by using the **CARD→DISPLAY** softkey.
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG DLP** catalogs all of the downloadable programs (DLPs) that are in spectrum analyzer memory or on the memory card. Downloadable programs can be saved in spectrum analyzer memory by either loading in a downloadable program from the memory card or defining a function using remote programming commands (FUNCDEF or ACTDEF).
Front-Panel Key Access: (RECALL) or (SAVE)

**Catalog Internal** accesses a menu that has the cataloging functions for spectrum analyzer memory: **CATALOG ALL**, **CATALOG REGISTER**, **CATALOG VARIABLS**, **CATALOG PREFIX**, **CATALOG DLP**, and **CATALOG ON EVENT**. Each catalog function displays catalog information. The catalog contains information about the data stored in internal memory. See Figure 6-2 and Table 6-4.

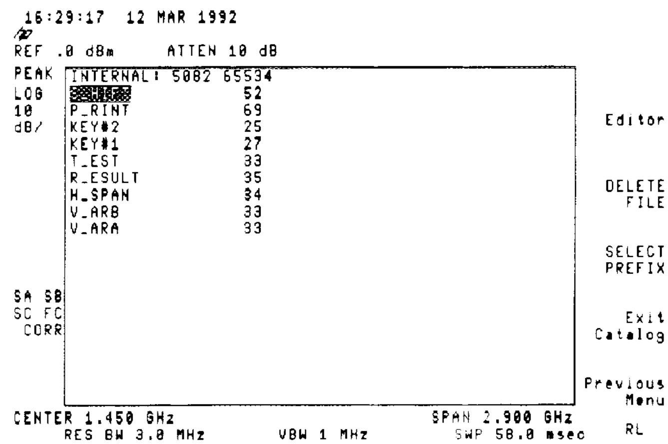


**Figure 6-2. Analyzer Memory Catalog Information**

**Table 6-4. Analyzer Memory Catalog Information***

| Callout Number | Description of Items in Figure 6-2 |
|---|---|
| 1 | Name of the catalog source. |
| 2 | Bytes of spectrum analyzer memory used. |
| 3 | Total bytes of spectrum analyzer memory available. |
| 4 | Bytes used by item. |
| 5 | Name of item. |

* This table is not applicable when using **CATALOG REGISTER** or **CATALOG ON EVENT**.

Unlike saving to the memory card, data is saved as an item in spectrum analyzer memory.

Use the step keys to view different sections of the directory, and the knob to select a file. The selected file is highlighted in inverse video.

Each of the catalog softkey functions access the menu that has the **DELETE FILE** function. Use **DELETE FILE** to delete the item from spectrum analyzer memory. (**DELETE FILE** will not delete a **CATALOG ON EVENT** item.)

Pressing **CATALOG REGISTER** accesses a menu that has the **LOAD FILE** function. Use **LOAD FILE** to load a state or trace from spectrum analyzer memory. Do not use **LOAD FILE** to load limit-line table and amplitude correction factor items.

Also see the **CATALOG ALL** and **CATALOG VARIABLS** softkey descriptions.
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG LMT LINE** *Requires Option 003 for an HP 8590L or HP 8592L.*
catalogs the limit-lines on the memory card. Press **CATALOG REGISTER** to catalog limit-line tables stored in spectrum analyzer memory (limit-line tables saved in analyzer memory are stored in trace registers).
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG ON EVENT** displays the "on event" programming commands and their status. The on event programming commands are as follows:

| | |
|---|---|
| ONEOS | Performs command list at end of every sweep. |
| ONSWP | Performs command list at beginning of every sweep. |
| TRMATH | Performs trace math. |
| ONCYCLE | Performs command list periodically. |
| ONDELAY | Performs command list once after a time period. |
| ONMKR | Performs command list at the marker. |
| ONSRQ | Performs command list on every service request. |
| ONTIME | Performs command list at a specific time. |
| ONPWRUP | Performs command list once at power up. |

**Note** If you get into an infinite loop with ONPWRUP, press (PRESET) to abort the command list, then press **ERASE DLP MEM** to clear all DLPs.

The on event programming commands can be set remotely; see the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for more information about setting the commands.

When the on event programming commands have not been set, or when an instrument preset has been performed, pressing **CATALOG ON EVENT** displays the status of the on event programming commands as UNDEFINED. If the ONEOS, ONSWP, TRMATH, ONMKR, ONPWRUP, and ONSRQ commands have been set, pressing **CATALOG ON EVENT** displays their status as ACTIVE. When ONCYCLE, ONDELAY, or ONTIME have been set, pressing **CATALOG ON EVENT** displays the information in Table 6-5. (See Figure 6-3.)

**Table 6-5. CATALOG ON EVENT Display Description**

| Programming Command | Description of CATALOG ON EVENT Display |
|---|---|
| ONCYCLE | The number of seconds left until the event occurs, followed by the number of seconds ONCYCLE was set for. |
| ONDELAY | **CATALOG ON EVENT** displays either a positive number or negative number of seconds. A positive number indicates the number of seconds left until the event occurs. A negative number indicates the number of seconds that has passed since the event occurred. |
| ONTIME | The date (in year, month, and day format) and the time (in 24 hour format) that ONTIME is set for. |

Front-Panel Key Access: (RECALL) or (SAVE)

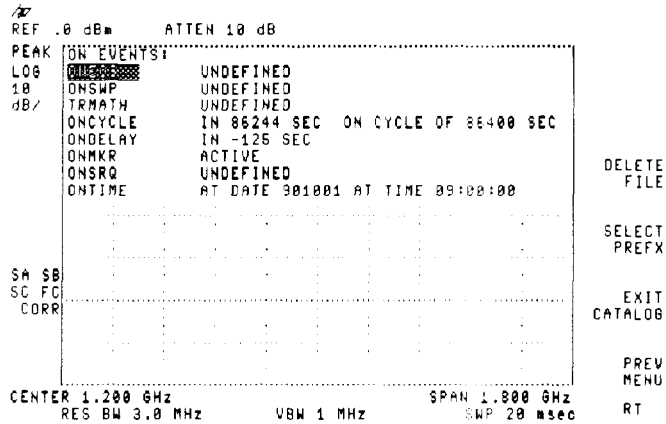


**Figure 6-3. CATALOG ON EVENT Display**

**CATALOG PREFIX** catalogs all of the saved data, that has the specified prefix, that is either on the memory card or in spectrum analyzer memory. The entire prefix does not have to be specified. For example, if you want to catalog all the files beginning with the prefix S, specify S as the prefix and then use **CATALOG PREFIX**. Prefixed items can be saved in spectrum analyzer memory by either loading in from a memory card or using remote programming commands to define them.
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG REGISTER** displays the status of state and trace registers in spectrum analyzer memory. States 1 through 8 are displayed with the center frequency (denoted by CF) and span (denoted by SP). The status of trace registers 0 to the maximum number of traces is displayed also. If a trace, limit-line tables, or amplitude correction factors have been saved in the trace register, the screen title (denoted by "TL:") is displayed, otherwise UNUSED is displayed. If the screen title length allows, or if no title is saved with the trace, the time and date are displayed. To load the contents of the state or trace register into spectrum analyzer memory, use the knob or step keys to select the register and press **LOAD FILE**. The **DELETE FILE** key can be used to delete a state or trace register from spectrum analyzer memory.

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**Note** Do not use **LOAD FILE** to load the contents of a trace register containing limit-line tables or amplitude correction factors.

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Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG STATES** — *Requires Option 003 for an HP 8590L or HP 8592L.*
catalogs all of the states stored on the memory card.
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG TRACES** — *Requires Option 003 for an HP 8590L or HP 8592L.*
catalogs all of the traces stored on the memory card.
Front-Panel Key Access: (RECALL) or (SAVE)

**CATALOG VARIABLS** — catalogs all of the variables saved in spectrum analyzer memory. Variables can be saved in analyzer memory by loading in a downloadable program from the memory card or defining a function using remote programming commands (VARDEF or TRDEF).
Front-Panel Key Access: (RECALL) or (SAVE)

**CENTER FREQ** — activates the center-frequency function to allow the selection of frequency that will be at the center of the screen.
Front-Panel Key Access: (AUX CTRL), (MEAS/USER), or (FREQUENCY)

**CF STEP AUTO MAN** — changes the step size for the center frequency function. Once a step size has been selected and the center frequency function is activated, the step keys change center frequency by the step-size value. The step size function is useful for finding harmonics and sidebands beyond the spectrum analyzer's current frequency span. When auto-coupled, the center frequency step size is set to one graticule (10 percent of the span).
Front-Panel Key Access: (AUTO COUPLE) or (FREQUENCY)

**Change Prefix** — allows you to enter a prefix that can be used for saving and recalling data to and from the memory card, and for cataloging by the prefix. The prefix can be from one to seven characters long. The longer the prefix, the shorter the register number must be. The total length of the prefix and register number cannot exceed eight characters. The prefix can be any character; however, the underscore should not be the first character of the prefix. Pressing **Change Prefix** accesses a menu containing the letters of the alphabet, the underscore symbol (_), the number symbol (#), a space, and the clear function. To select a character, press the softkey that displays the group of characters that contains the desired character. The softkey menu changes to allow you to select an individual character. If you make a mistake, press (BK SP) to space back over the incorrect character. Additional characters are available by pressing **More 1 of 2**. Numbers may be selected with the numeric keypad.

A prefix can be cleared with the clear function. Press (CONFIG) or (DISPLAY), **Change Prefix**, **YZ_# Spc Clear**, **Clear** to clear the current prefix. The current prefix is blanked by pressing **DEFAULT CONFIG**.
Front-Panel Key Access: (CONFIG), (DISPLAY), (RECALL), or (SAVE)

**Change Title** allows you to write a 53-character screen title across the top of the screen. The marker readout may interfere with the last 26 characters. The markers can be turned off by pressing (MKR), **More 1 of 2**, and **MARKER ALL OFF**.

Pressing **Change Title** accesses the softkey menus that contain the available characters and symbols. A programming command can be entered in the screen title area. It can then be executed from the front panel by pressing **EXECUTE TITLE**.

The screen title will remain on the screen until either **Change Title** is pressed again or a trace is recalled that was saved with a screen title. A screen title can also be cleared by using the clear function. Press (DISPLAY), **Change Title**, **YZ_# Spc Clear**, **Clear** to clear the current screen title.

Pressing **Change Title** accesses a menu containing the letters of the alphabet, the underscore symbol (_), the number symbol (#), a space, and the **Clear** softkey. To select a character, press the softkey that displays the group of characters that contains the desired character. The softkey menu changes to allow you to select an individual character. If you make a mistake, press (BK SP) to space back over the incorrect character. Additional characters are available by pressing **More 1 of 2**. Numbers may be selected by using the numeric keypad.

Pressing **RPG TITLE** provides additional characters for the menu accessed by pressing **Change Title**. Pressing **RPG TITLE** provides lowercase letters, numbers, Greek letters, and punctuation symbols. To access additional characters, press **RPG TITLE**. When **RPG TITLE** is pressed, a character table appears on the screen. To select a character, turn the knob to position the cursor under the desired character and press the (ENTER) key. The step keys move the cursor between rows. When all desired characters have been entered, press WINDOWS (NEXT) or for an HP 8590L or an HP 8592L press (HOLD). All other spectrum analyzer functions are inoperative until the (NEXT) or (HOLD) key is pressed.
Front-Panel Key Access: (CAL) or (DISPLAY)

**CHANNEL BANDWDTH** allows the user to enter the channel bandwidth to set up the spectrum analyzer when using the measurement functions under the **Power Menu** softkey. When the power measurements are first accessed the initial value for channel bandwidth is 16 kHz. If the value is changed, the new value will be saved through an instrument preset or power on. An error message will occur for invalid values of channel bandwidth and channel spacing.

If one of the power measurements is active and the channel bandwidth is changed, with PARAM AUTO selected, then the coupled spectrum analyzer settings are immediately updated. If **CONT MEAS** is also selected, then another sweep is taken and the measured results are updated.
Front-Panel Key Access: (MEAS/USER)

**CHANNEL POWER** measures the power and power spectral density in the channel bandwidth specified by the user. Two vertical lines on the display indicate the edges of the channel bandwidth. The measurement can be made on a single sweep or to continuously update at the end of each sweep. The center frequency, reference level, and channel bandwidth must be set by the user. If **PARAM AUTO MAN** is selected (AUTO is underlined), other settings will be coupled and set automatically. **PARAM AUTO MAN** can be selected to manually control all settings by underlining MAN. The measurement stops and the spectrum analyzer is returned to its prior state when other functions are activated. The channel power measurement responds like an rms power measurement.
Front-Panel Key Access: (MEAS/USER)

**CHANNEL SPACING** allows the user to enter the channel spacing to set up the spectrum analyzer when using the measurement functions under the **Power Menu** softkey. When the power measurements are first accessed the initial value for channel spacing is 25 kHz. Once the value is changed, the new value will be saved through an instrument preset or power on. An error message will occur for invalid values of channel spacing and channel bandwidth.

If one of the power measurements is active and the channel spacing is changed, with PARAM AUTO selected, then the coupled spectrum analyzer settings are immediately updated. If **CONT MEAS** is also selected, then another sweep is taken and the measured results are updated.
Front-Panel Key Access: (MEAS/USER)

**Clear** clears the current screen title or prefix. This softkey is accessed under the **YZ_# Spc Clear** softkey when using **Change Title** or **Change Prefix**.
Front-Panel Key Access: (CAL), (CONFIG), (DISPLAY), (RECALL), or (SAVE)

**CLEAR PARAM** *Option 105 only. Option 101 is recommended.*
clears all of the pulse parameters in the gate utility. It sets the value of pulse width, pulse repetition interval, and reference edge to zero and turns off the coupling of the pulse parameters to the resolution bandwidth, video bandwidth, and sweep time.
Front-Panel Key Access: (SWEEP)

**CLEAR QP DATA** *For Option 103 only.*
clears the displayed quasi-peak amplitude and quasi-peak marker (represented by a diode symbol) from the spectrum analyzer screen. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: (AUX CTRL)

**CLEAR WRITE A** erases any data previously stored in trace A and continuously displays any signals during the sweep of the spectrum analyzer. This function is activated at power on and by pressing (PRESET).

Changing the trace mode of trace C to clear write or minimum hold can change the trace mode of trace A. If trace A is in clear-write mode or maximum-hold mode when trace C is changed to clear write or minimum hold, the trace mode of trace A is changed to store blank. The following table shows the trace mode of trace A before and after changing trace C to clear-write or minimum-hold trace mode.

| Trace Mode of Trace A Before | Trace Mode of Trace A After |
|---|---|
| Clear write | Store blank |
| Maximum hold | Store blank |
| View | View |

Changing the trace mode of trace A to clear write or maximum hold can change the trace mode of trace C. If trace C is in clear-write mode when trace A is changed to clear write or minimum hold, the trace mode of trace C is changed to minimum hold.

| Trace Mode of Trace C Before | Trace Mode of Trace C After |
|---|---|
| Clear write | Minimum hold |
| Minimum hold | Minimum hold |
| View | View |

Front-Panel Key Access: (TRACE)

**CLEAR WRITE B** erases any data previously stored in trace B and continuously displays any signals detected during the sweep of the spectrum analyzer. This function is activated at power on and by pressing (PRESET).

Changing the trace mode of trace C to clear write or minimum hold can change the trace mode of trace B. If trace B is in clear-write mode or maximum-hold mode when trace C is changed to clear write or minimum hold, the trace mode of trace B is changed to store blank.

The following table shows the trace mode of trace B before and after changing trace C to clear-write or minimum-hold trace mode.

| Trace Mode of Trace B Before | Trace Mode of Trace B After |
|---|---|
| Clear write | Store blank |
| Maximum hold | Store blank |
| View | View |

Changing the trace mode of trace B to clear write or maximum hold can change the trace mode of trace C. If trace C is in clear-write mode when trace B is changed to clear write or minimum hold, the trace mode of trace C is changed to minimum hold.

| Trace Mode of Trace C Before | Trace Mode of Trace C After |
|---|---|
| Clear write | Minimum hold |
| Minimum hold | Minimum hold |
| View | View |

Front-Panel Key Access: (TRACE)

**CLEAR WRITE C**

erases any data previously stored in trace C and continuously displays any signals detected during the sweep of the spectrum analyzer. This function is activated at power on and by pressing (PRESET).

Changing the trace mode of trace C to clear write or minimum hold can change the trace mode of trace A and trace B. If trace A or trace B is in clear-write mode or maximum-hold mode when trace C is changed to clear write or minimum hold, the trace mode of trace A or trace B is changed to store blank. The following table shows the trace mode of trace A or trace B before and after changing trace C to clear-write or minimum-hold trace mode.

| Trace Mode of Trace A or B Before | Trace Mode of Trace A or B After |
|---|---|
| Clear write | Store blank |
| Maximum hold | Store blank |
| View | View |

If you want to use trace A or trace B in the clear-write or maximum-hold mode and do not want trace C to blank it, use minimum-hold or view-trace mode for trace C.
Front-Panel Key Access: (TRACE)

**CNT RES AUTO MAN**

*Does not apply to HP 8590L with Option 013.*
allows the resolution of the marker counter to be selected manually or auto-coupled. The marker counter has a resolution range of 10 Hz to 100 kHz. The available resolution values are 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz. The 1 Hz marker counter resolution is not specified. The resolution can be changed by using the step keys or by entering the resolution using the numeric keypad. The marker counter resolution can be auto coupled to the span by pressing **CNT RES AUTO MAN** so that AUTO is underlined. The **CNT RES AUTO MAN** softkey function is not affected by pressing **AUTO ALL** .
Front-Panel Key Access: (MKR FCTN)

**CNTL A 0 1**

makes the auxiliary-interface control line A output high or low (TTL).
Front-Panel Key Access: (AUX CTRL)

**CNTL B 0 1**

makes the auxiliary-interface control line B output high or low (TTL).
Front-Panel Key Access: (AUX CTRL)

**CNTL C 0 1**

makes the auxiliary-interface control line C output high or low (TTL).
Front-Panel Key Access: (AUX CTRL)

**CNTL D 0 1**

makes the auxiliary-interface control line D output high or low (TTL).
Front-Panel Key Access: (AUX CTRL)

**COARSE TUNE DAC** displays the analog output of the YTO coarse-tune DAC located on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**COMB GEN ON OFF** *HP 8592L, HP 8593E, and HP 8596E only.*
turns the internal comb generator on or off. Connect a cable between 100 MHz COMB OUT and the spectrum analyzer input.
Front-Panel Key Access: (AUX CTRL)

**CONF TEST** initiates a variety of tests to check the major functions of the spectrum analyzer. The confidence test function checks that the video bandwidths change, the noise floor level decreases as the resolution bandwidth narrows, the step gains switch, and the 3 dB bandwidths of the resolution bandwidths are correctly set. CNF TEST PASS is displayed if the confidence test passes.
Front-Panel Key Access: (CAL)

**(CONFIG)** accesses the softkey menu used for printer and plotter configurations, the time and date display functions, changing the current prefix, memory card configuration functions, disposing of user-defined variables and programs from spectrum analyzer memory, changing the spectrum analyzer address or the baud rate, displaying the installed options on screen, and changing the format of the MONITOR output. Pressing (CONFIG) will clear an SRQ error message from the screen. Pressing (CONFIG) after the spectrum analyzer has been placed in the remote mode places the spectrum analyzer in the local mode and enables front-panel control. During remote operation, an R appears in the lower-right corner of the screen indicating remote mode. Pressing (CONFIG) removes the R annotation from the lower-right corner.

**CONT MEAS** sets the functions in the **Power Menu** so that they make the measurement at the end of every sweep. After a power measurement is activated, pressing **CONT MEAS** or **SWEEP CONT** puts the spectrum analyzer into a continuous sweep mode and recalculates the results at the end of each sweep.
Front-Panel Key Access: (MEAS/USER)

**CONTINUS FFT** initializes the fast Fourier transform (FFT) function, puts the spectrum analyzer in continuous sweep and performs an FFT at the end of each sweep. If the FFT function is already active, it puts the spectrum analyzer in continuous sweep and performs FFTs.

After using the FFT function, the display is in log mode. The markers are put in the FFT mode for use in evaluating the data. The signal being transformed is in trace A and the Fourier transform of the signal is in trace B. (Any information that was in trace B and C will be lost.) Press **FFT OFF** to return the spectrum analyzer to normal operation.

Refer to Chapter 4, "Measuring Amplitude Modulation Using the Fast Fourier Transform Function," for more information.
Front-Panel Key Access: (MEAS/USER)

(COPY) *Option 021, 023, or 024 only.*
initiates an output of the screen data, without an external controller, to a previously specified graphics printer or plotter. Refer to Chapter 1 of this manual or the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for detailed information about printing and plotting.

The printer or plotter must have already been selected using (CONFIG) and either **Plot Config** (for a plotter) or **Print Config** (for a printer). To obtain a print, press (CONFIG), **COPY DEV PRNT PLT** (so that PRNT is underlined), then **Print Config**. For Option 021, use **PRINTER ADDRESS** to change the HP-IB address of the printer, if necessary. For Option 023, use **BAUD RATE** to change the baud rate of the spectrum analyzer, if necessary.

If the spectrum analyzer is connected to an HP PaintJet printer and you want a color printout, press **PAINTJET PRINTER**. If the spectrum analyzer is connected to an HP PaintJet printer and you want a black and white printout, press **HP B&W PRINTER**. More printer information can be found in the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* and chapter 1 of this manual.

If you want the softkey labels to be printed with the spectrum analyzer display printout when using (COPY), press **PRT MENU ON OFF** so that ON is underlined.

Press (COPY) and the process will begin. The screen remains frozen (no further sweeps taken) until the data transfer to the printer is complete. The spectrum analyzer works with many Hewlett-Packard printers.

The plotting process is similar to the printing process. On the spectrum analyzer, press (CONFIG), **Plot Config**. For Option 021, use **PLOTTER ADDRESS** to change the HP-IB address for the plotter, if necessary. For Option 023, use **BAUD RATE** to change the baud rate of the spectrum analyzer, if necessary.

With **PLTS/PG 1 2 4**, you can choose a full-page, half-page, or quarter-page plot. Press **PLTS/PG 1 2 4** to underline the number of plots per page desired. If two or four plots per page are chosen, a softkey function is displayed that allows you to select the location of the plotter output on the paper. If two plots per page are selected, **PLT _ _LOC _ _** is displayed. If four plots per page are selected, **PLT _ _LOC _ _** is displayed. Press the softkey until the rectangular marker is in the desired section of the softkey label. The upper and lower sections of the softkey label graphically represent the position of the page where the plotter output will be located.

**Note** The HP 7470A Plotter does not support two plots per page output. If you use an HP 7470A Plotter with an HP 8590 Series Spectrum Analyzer, you can select one or four plots per page, but not two plots per page.

For a multipen plotter, the pens of the plotter draw the different components of the screen as follows:

| Pen Number | Description |
|---|---|
| 1 | Draws the annotation and graticule. |
| 2 | Draws trace A. |
| 3 | Draws trace B. |
| 4 | Draws trace C and the display line. |
| 5 | Draws user-generated graphics and the lower limit line. |
| 6 | Draws the upper limit line. |

To plot, press **Previous Menu**, **COPY DEV PRNT PLT** (PLT should be underlined), and (COPY).

Printing is usually faster than plotting, but plotting provides higher resolution output. The spectrum analyzer works with plotters such as the HP 7440A.

Figure 6-4 shows the rear view of a typical printer/spectrum-analyzer configuration.

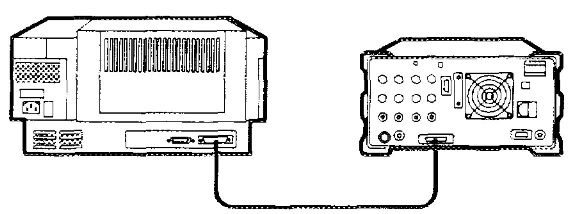

**Figure 6-4. Connecting a Printer to the Spectrum Analyzer**

**Note** Printing and plotting require an optional interface. Generally, spectrum analyzers with an HP-IB interface set the plotter address to 5 and the printer address to 1. Spectrum analyzers with an RS-232 interface must have the baud rate set to match the baud rate of the printer or plotter being used. The *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* that comes with the optional interfaces details the different interfaces. Refer to the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for more information about printing and plotting.

**COPY DEV PRNT PLT** *Option 021, 023 or 024 only.*
changes between a printer and plotter. For example, if you have been printing and want to do a plot, press **COPY DEV PRNT PLT** to underline PLT before pressing (COPY).
Front-Panel Key Access: (CONFIG)

**CORRECT ON OFF** controls use of some of the correction factors. When ON is underlined, correction factors are used and CORR appears on the display. When OFF is underlined, correction factors are not used. Turning the correction factors off degrades amplitude accuracy.

**Note** Correction factors must be on for the spectrum analyzer to meet its specified performance.

Front-Panel Key Access: (CAL)

**COUPLE AC DC** *HP 8594E, HP 8595E, or HP 8596E only.*
specifies alternating-current (AC) or direct-current (DC) coupling at the spectrum analyzer input. Selecting ac coupling blocks any dc voltage at the spectrum analyzer input; however, the ac coupling also decreases the frequency range of the spectrum analyzer. The input coupling is set to ac by an instrument preset.

Amplitude specifications apply only when coupling is set to DC.

**Caution** Do not use dc coupling if there is any dc voltage at the spectrum analyzer input.

Front-Panel Key Access: (AMPLITUDE)

**CPL RBW ON OFF** *Option 105 only. Option 101 is recommended.*
automatically selects the optimum resolution bandwidth for an unmodulated pulse if the pulse width has been entered. If the pulse width has not been determined, the resolution bandwidth will not be coupled to the pulse parameters and a warning message will occur. If a resolution bandwidth is entered manually, the coupling will be turned off.
Front-Panel Key Access: (SWEEP)

**CPL SWP ON OFF** *Option 105 only. Option 101 is recommended.*
automatically selects the optimum sweep time if the pulse repetition interval has been entered. If the pulse repetition interval has not been determined, the sweep time will not be coupled and an error message will occur. If a sweep time is entered manually, the coupling will be turned off. Sweep time coupling only applies to the frequency domain window.
Front-Panel Key Access: (SWEEP)

**CPL VBW ON OFF** *Option 105 only. Option 101 is recommended.*
automatically selects the optimum video bandwidth if the gate length has been entered. If the gate length has not been determined, the video bandwidth will not be coupled to the gate length and an error message will occur. If a gate length is entered manually, the coupling will be turned off.
Front-Panel Key Access: (SWEEP)

**CRT HORZ POSITION** changes the horizontal position of the signal on the spectrum analyzer display. Press **CAL STORE** if you want the spectrum analyzer to use this position permanently, so that it is not lost when the power is turned off.
Front-Panel Key Access: (CAL)

**CRT VERT POSITION** changes the vertical position of the signal on the spectrum analyzer display. Press **CAL STORE** if you want the spectrum analyzer to use this position permanently, so that it is not lost when the power is turned off.
Front-Panel Key Access: (CAL)

**DACS** changes the DAC numbers of the span, DAC YTO coarse-tune, DAC YTO fine-tune, and YTO FM tune DAC located on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**DATEMODE MDY DMY** changes the display of the date from a month-day-year format to a day-month-year format. It is set to a month-day-year format by pressing **DEFAULT CONFIG**.
Front-Panel Key Access: (CONFIG)

**dBm** changes the amplitude units to dBm for the current setting (log or linear).
Front-Panel Key Access: (AMPLITUDE)

**dBmV** changes the amplitude units to dBmV for the current setting (log or linear).
Front-Panel Key Access: (AMPLITUDE)

**dBuV** changes the amplitude units to dB$\mu$V for the current setting (log or linear).
Front-Panel Key Access: (AMPLITUDE)

**DEFAULT CAL DATA** accesses the factory-default correction factors. A special pass code is required for use. If the message `Self cal needed` appears when **DEFAULT CAL DATA** is pressed, the CAL FREQ and CAL AMPTD routines need to be run. The CAL FREQ and CAL AMPTD must be run to ensure specifications. If the spectrum analyzer maximum frequency is higher than 3 GHz, the CAL YTF routine must also be run. The calibration results must then be saved by pressing **CAL STORE**. See Chapter 8 for more information.
Front-Panel Key Access: (CAL)

**DEFAULT CONFIG** resets the spectrum analyzer configuration to the state it was in when it was originally shipped from the factory and performs an instrument preset. See Table 6-6 for the default user-configuration values set by pressing **DEFAULT CONFIG**.

**Table 6-6. Default Configuration Values**

| Configuration | Default Value |
|---|---|
| Analyzer address (Option 021) | 18 |
| Copy device | printer |
| CRT position (Horizontal and Vertical) | 10, 48 |
| Printer address (Option 021) | 1 |
| Plotter address (Option 021) | 5 |
| Baud rate (Option 023) | 1200 |
| External preamp | 0 dB |
| Save lock (internal states or traces) | Off |
| Printer | black and white printer |
| Print menu | on |
| Plots per page | 1 |
| Time/date display | on |
| Date mode | month-day-year format |
| Prefix | (blank) |
| Analyzer state at power on | instrument preset |

Front-Panel Key Access: (CONFIG)

**DEFAULT SYNC** restores the factory default values of the horizontal and vertical synchronization constants for the rear panel MONITOR output.

**CRT SYNC DEFAULT** can be used to exit from the NTSC or PAL modes to return to the normal monitor output and use the default synchronization constants.

Front-Panel Key Access: (CONFIG)

**Define Coupling** *Option 105 only. Option 101 is recommended.*
accesses the time gate utility menu for coupling spectrum analyzer settings to the input pulsed signal parameters. It also accesses the pulsed signal parameter entry menus.
Front-Panel Key Access: (SWEEP)

**Define Gate** *Option 105 only. Option 101 is recommended.*
accesses the menu for turning on and defining the gate, from within the time gate utility. Gate delay and gate length settings determine when the gate turns on and how long it remains on. The trigger marker can be activated from this menu. This menu also includes a function which switches the active window between the time domain window and the frequency domain window, allowing the corresponding trace to be updated.
Front-Panel Key Access: (SWEEP)

**Define Time** *Option 105 only. Option 101 is recommended.*
accesses the menu for manipulating the time domain window in the gate utility. It will automatically make the time window active and turn off the gate. The trigger marker can be activated from this menu.
Front-Panel Key Access: (SWEEP)

**DELETE FILE** function allows you to delete an item from spectrum analyzer memory or a file from the memory card. Use the step keys to view different sections of the directory and use the knob to select the file or item to delete. Pressing **DELETE FILE** causes a message to appear on the spectrum analyzer screen: `If you are sure, press key again to purge data.` Press **DELETE FILE** again if you want to delete the memory item.

**Note** Deleting items beginning with an underscore from spectrum analyzer memory is not recommended and may have unexpected results. Items beginning with an underscore are used by the spectrum analyzer.

Front-Panel Key Access: (RECALL) or (SAVE)

**DELETE POINT** deletes an amplitude-correction factor that was previously selected by **SELECT POINT**.
Front-Panel Key Access: (CAL)

**DELETE SEGMENT** deletes the limit-line entry for the selected segment number. Press **SELECT SEGMENT** then enter the segment number to select the limit-line entry for deletion.
Front-Panel Key Access: (DISPLAY)

**Demod** *Option 102 or 103 only.*

**Dispose User Mem** accesses the softkeys **ERASE MEM CARD**, **ERASE DLP MEM**, **ERASE STATEALL**, **ERASE TRACEALL**, and **ERASE MEM ALL** which are used to erase the user programs and variables that are in spectrum analyzer memory.

| | |
|---|---|
| **Note** | Use **DELETE FILE** to selectively delete stored programs or variables from spectrum analyzer memory. |

Front-Panel Key Access: (CONFIG)

**DONE** *Option 105 only. Option 101 is recommended.*
exits the pulse parameter entry menus in the gate utility assigning the current marker value to be the value of the parameter being entered. Pressing **DONE** also restores the sweep delay and sweep time, of the time domain window, to the values that existed prior to any adjustments made during pulse parameter entry.
Front-Panel Key Access: (SWEEP)

**DROOP** disables the reset of the peak detector on the A16 Processor/Video assembly after each analog-to-digital conversion. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**DSP LINE ON OFF** activates an adjustable horizontal line that is used as a visual reference line. The line, which can be used for trace arithmetic, has amplitude values that correspond to its vertical position when compared to the reference level. The value of the display line appears in the active function block and on the left side of the screen. The display line can be adjusted using the step keys, knob, or numeric keypad. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu. To deactivate the display line, press **DSP LINE ON OFF** so that OFF is underlined. (Also see the **VIDEO** softkey description.)
Front-Panel Key Access: (DISPLAY), (MKR FCTN), or (PEAK SEARCH)

**DWELL TIME** *Option 102 or 103 only.*
sets the dwell time for the marker pause, during which demodulation can take place in nonzero span sweeps. The dwell time can be set from 2 milliseconds to 100 seconds.
Front-Panel Key Access: (AUX CTRL)

**EDGE POL POS NEG** *Option 105 only. Option 101 is recommended.*
determines whether the gate triggers on the positive-going or negative-going edge of the signal at the GATE TRIGGER INPUT connector (on the rear panel of the spectrum analyzer).

If the gate utility is used and a pulse repetition interval has been entered, gate trigger position markers will be shown in the time domain window. A "⇑" indicates positive triggering. A "⇓" indicates negative triggering.
Front-Panel Key Access: (SWEEP)

**Edit Amp Cor** allows you to edit the current amplitude-correction factors table by accessing the **SELECT POINT**, **SELECT FREQ**, **SELECT AMPLITUD**, **DELETE POINT**, **Edit Done**, and **PURGE AMP COR** softkeys.
Front-Panel Key Access: (CAL)

**EDIT CAT ITEM** *For options 021, 023, and 024 only. Refer to the HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide for more information.*
starts the DLP editor function and loads the highlighted item from the catalog of spectrum analyzer user memory to be displayed and edited. It copies the item into the spectrum analyzer's DLP editor memory which is a 2500 byte memory buffer. If an item is edited, the new edited version will not be overwritten in the spectrum analyzer's user memory until it is processed by the **SAVE EDIT** softkey.
Front-Panel Key Access: (RECALL) or (SAVE)

**Edit Done** can be accessed through both the amplitude-correction menu and the the change prefix menu. When accessed from the amplitude-correction menu, the amplitude-correction factors table is erased from the spectrum analyzer's screen and the amplitude-correction menu is restored on-screen. Use **Edit Done** when all the amplitude-correction factors have been entered.

When accessed from the change prefix menu, **Edit Done** erases the prefix from the spectrum analyzer's screen and restores the previous menu. Use **Edit Done** when prefix characters have all been entered.
Front-Panel Key Access: (CAL), (CONFIG), (DISPLAY), (RECALL), or (SAVE)

**EDIT DONE** can be accessed through the limit-line menu. Pressing **EDIT DONE** erases the limit-line table from the spectrum analyzer's screen and restores the menu accessed by the **Limit Lines** softkey. Use **EDIT DONE** when all the limit-line values have been entered.
Front-Panel Key Access: (DISPLAY)

**EDIT FLATNESS** allows flatness-correction constants to be viewed or modified. This is a service calibration function and is for service use only.
Front-Panel Key Access: (CAL)

**EDIT LAST** *For options 021, 023, and 024 only. Refer to the HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide for more information.*
starts the DLP editor function and allows the most recent item that was being edited, in the DLP editor buffer, to be accessed again. The item will not be in the spectrum analyzer's user memory until it is processed by the **SAVE EDIT** softkey. The DLP editor memory remains intact when the instrument is preset and when it is powered off.
Front-Panel Key Access: (RECALL) or (SAVE)

**Edit Limit** allows you to edit the current limit-line tables by accessing **Edit Upper**, **Edit Lower**, **Edit Up/Low**, and **Edit Mid/Delt**. Use **PURGE LIMITS** under any of the above edit menus to dispose of the current limit-line table.
Front-Panel Key Access: (DISPLAY)

**Edit Lower** allows you to view or edit the lower limit-line table. Up to 20 entries are allowed for the lower limit-line table. With the lower limit-line table format, the coordinates for the lower limit-line are specified, but none are specified for the upper limit line. Even if upper limit-line values exist or the values had been entered as an upper and lower limit-line table, the lower limit-line values are treated as a separate table from the upper limit line values. The lower limit-line entries can have independent frequency (or time) and amplitude coordinates from upper limit-line table entries.
Front-Panel Key Access: (DISPLAY)

**Edit Mid/Delt** allows you to view or edit the upper and lower limit-line tables simultaneously. These tables are edited by entering a middle amplitude value and an amplitude deviation. Up to 20 entries are allowed for the upper and lower limit-line tables. Like the upper and lower limit-line table format, the mid/delta limit-line table format provides a means of specifying the upper and lower limit lines at the same time. Unlike the upper and lower table format, the amplitude values are specified as a middle amplitude value with a delta (the upper and lower limit lines are drawn an equal positive and negative distance from the middle amplitude).

With the mid/delta format the frequency (or time), and the middle amplitude plus the delta comprise the upper limit line; the frequency (or time), and the middle amplitude minus the delta comprise the lower limit line. The difference between the mid/delta and the upper/lower format is the way the amplitude values are entered; the frequency (time) coordinate begins a segment regardless of the format chosen. The mid/delta format can be used if the upper and lower limit lines are symmetrical with respect to the amplitude axis. An upper and lower amplitude component are specified for every frequency (or time) component.
Front-Panel Key Access: (DISPLAY)

**Edit Up/Low** allows you to view or edit the upper and lower limit-line tables simultaneously. Up to 20 entries are allowed for the upper and lower limit-line tables. With the upper and lower limit-line table format, the upper and lower limit-lines can be entered at the same time.

With the upper and lower limit-line format, the frequency (or time), upper amplitude, and lower amplitude are specified. The frequency (or time) and upper amplitude value comprise the coordinate point for the upper limit line, the frequency (or time) and lower amplitude value comprise the coordinate point for the lower limit line. It is not necessary to specify both an upper and lower amplitude component for every frequency (or time) component.
Front-Panel Key Access: (DISPLAY)

**Edit Upper** allows you to view or edit the upper limit-line table. Up to 20 entries are allowed for the upper limit-line table. With the upper limit-line table format, the coordinates of the upper limit line are specified, but none are specified for the lower limit line. Even if lower limit-line values exist or the values had been entered as an upper and lower limit-line table, the upper limit-line values are treated as a separate table from the lower limit-line values. The upper limit-line entries can have independent frequency (or time) and amplitude coordinates from lower limit-line table entries.
Front-Panel Key Access: (DISPLAY)

**EDIT UPR LWR** selects upper or lower limit-line tables. It switches to the limit-line table that is not currently being edited.
Front-Panel Key Access: (DISPLAY)

**Editor** *For options 021, 023, and 024 only. Refer to the HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide for more information.*
accesses the menu of down loadable program (DLP) editor softkeys. With an external keyboard programming commands can be used to write a program to control the spectrum analyzer. The built-in DLP editor uses the spectrum analyzer rather than an external computer to create, view, or edit programs. These programs can then be sent to the spectrum analyzer's command parser, which is similar to outputting them to the spectrum analyzer from an external computer.
Front-Panel Key Access: (RECALL) or (SAVE)

**EMI BW Menu** accesses the functions that set the spectrum analyzer resolution bandwidth to the values required for electromagnetic interference (EMI) testing.
(**200 Hz EMI BW** *is only available with Option 130.*)
Front-Panel Key Access: (BW)

**((ENTER))** Pressing (Hz/µV/µs) which is also the ENTER key, terminates and enters into the spectrum analyzer a numerical value that has been entered from the front panel using the keypad, knob, or step up/down keys.

**ENTER PRI** *Option 105 only. Option 101 is recommended.*
accesses the menu for entering the value of the pulse repetition interval (PRI). A delta marker can be activated by pressing **MARKER ON**. The other menu functions can be used to manipulate the marker to indicate the pulse repetition interval value. Pressing **DONE** returns to the previous menu and makes the current value of the marker the pulse repetition interval. It also restores the time domain window to the state prior to any adjustments made during entry of the pulse repetition interval. When the pulse repetition interval is entered, an arrow will appear on the display indicating the position of the gate trigger ("⇑" for positive triggering or "⇓" for negative triggering).
Front-Panel Key Access: (SWEEP)

**ENTER REF EDGE** *Option 105 only. Option 101 is recommended.*
accesses the menu used to define the edge of the pulse that will be used as the time reference. Press **MARKER ON** to activate a trigger marker. The other menu functions can be used to manipulate the marker to indicate the location of the reference edge. Pressing **DONE** returns to the previous menu and makes the current value of the marker the reference edge. It also restores the time domain window to the state prior to any adjustments made during entry of the reference edge.
Front-Panel Key Access: (SWEEP)

**ENTER WIDTH**

*Option 105 only. Option 101 is recommended.*
accesses the menu for entering the value of the pulse width. Press **MARKER ON** to activate a delta marker. The other menu functions can be used to manipulate the marker to indicate the pulse width value. Pressing **DONE** returns to the previous menu and makes the current value of the marker the pulse width. It also restores the time domain window to the state prior to any adjustments made during entry of the pulse width.
Front-Panel Key Access: (SWEEP)

**ERASE DLP MEM**

allows you to dispose of the DLPs, all traces defined by TRDEF, and all VAREF variables that are in spectrum analyzer memory. Press **Dispose User Mem**, then press **ERASE DLP MEM** which causes the message to appear on the spectrum analyzer screen: `If you are sure, Press key again to purge data.` Press **ERASE DLP MEM** again if you want to dispose of the DLPs in memory. Press any other softkey if you do not want to dispose of the DLPs in memory.

**Note** Use **DELETE FILE** to selectively delete stored programs or variables from spectrum analyzer memory.

Front-Panel Key Access: (CONFIG)

**ERASE MEM ALL**

allows you to purge all user state registers, all user trace registers, all mode registers, the editor buffer, Group delay normalization, all DLP memory, and all microprocessor stack data. The stack pointer is set to its power-up value. No system globals are erased and the calibration data is preserved. Pressing **ERASE MEM ALL** causes a message to appear on the spectrum analyzer screen: `If you are sure, Press key again to purge data.` Press **ERASE MEM ALL** again if you want to dispose of all user memory. Press any other softkey if you do not want to dispose of all user memory.

**Note** **ERASE MEM ALL** ignores the state of the **SAV LOCK**. So, even if STATES and TRACES are locked, they will still be erased by **ERASE MEM ALL**.

Front-Panel Key Access: (CONFIG)

**ERASE MEM CARD**

allows you to dispose of any data or programs stored on the memory card by formatting it. This is the same as **FORMAT CARD**. Press **Dispose User Mem**, then press **ERASE MEM CARD** which causes the message to appear on the spectrum analyzer screen: `If you are sure, Press key again to purge data.` Press **ERASE MEM CARD** again if you want to dispose of the CARD's memory. Press any other softkey if you do not want to dispose of the CARD's memory.

**Note** Use **DELETE FILE** to selectively delete stored programs or variables from spectrum analyzer memory.

Front-Panel Key Access: (CONFIG)

**ERASE STATEALL** allows you to purge all the user state registers 1 through 9. Press **Dispose User Mem**, then press **ERASE STATEALL** which causes the message to appear on the spectrum analyzer screen: `If you are sure, Press key again to purge data.` Press **ERASE STATEALL** again if you want to dispose of the user state registers. Press any other softkey if you do not want to dispose of user state registers.

**Note**

- If **SAVE LOCK ON OFF** is set to (ON), this function is disabled.
- Use **DELETE FILE** to selectively delete stored programs or variables from spectrum analyzer memory.

Front-Panel Key Access: (CONFIG)

**ERASE TRACEALL** allows you to purge all the user trace registers 0 through TRCMEM. Press **Dispose User Mem**, then press **ERASE TRACEALL** which causes the message to appear on the spectrum analyzer screen: `If you are sure, Press key again to purge data.` Press **ERASE TRACEALL** again if you want to dispose of the user trace registers. Press any other softkey if you do not want to dispose of user state registers.

**Note**

- If **SAVE LOCK ON OFF** is set to (ON), this function is disabled.
- Use **DELETE FILE** to selectively delete stored programs or variables from spectrum analyzer memory.

Front-Panel Key Access: (CONFIG)

**EP LQ570 SML LRG** sets the spectrum analyzer to be compatible with an Epson LQ-570 compatible printer. Press **Set B&W Printer** then **EP LQ570 SML LRG** until LRG is underlined to set up the large screen printout. This will allow for one printout per page. The large screen printout format will not allow for printing of the menu keys. Press **Set B&W Printer** then **EP LQ570 SML LRG** until SML is underlined to set up the small screen printout. This will allow for two printouts per page.

Front-Panel Key Access: (CONFIG)

**EP MX80 SML LRG** sets the spectrum analyzer to be compatible with an Epson MX80 compatible printer. Press **Set B&W Printer** then **EP MX80 SML LRG** until LRG is underlined to set up the large screen printout. This will allow for one printout per page. The large screen printout format will not allow for printing of the menu keys. Press **Set B&W Printer** then **EP MX80 SML LRG** until SML is underlined to set up the small screen printout. This will allow for two printouts per page.

Front-Panel Key Access: (CONFIG)

**EXECUTE TITLE** executes a programming command displayed in the screen title area of the spectrum analyzer. The **Change Title** function can be used to print programming commands in the screen title area of the display. The commands can then be executed from the front panel of the spectrum analyzer, without an external computer, by pressing the **EXECUTE TITLE** softkey.
Front-Panel Key Access: (CAL)

**EXIT** exits the EDIT FLATNESS softkey menu. This is a service calibration function and is designed for service use only.
Front-Panel Key Access: (CAL)

**Exit Catalog** returns the spectrum analyzer to the state it was in before the current catalog function was invoked. It clears the catalog display and returns to a normal spectrum analyzer display.
Front-Panel Key Access: (RECALL) or (SAVE)

**EXIT SHOW** removes the screen annotation left after pressing **SHOW OPTIONS**.
Front-Panel Key Access: (CONFIG)

**EXIT UTILITY** *Option 105 only. Option 101 is recommended.*
exits the gate utility returning to the gate control menu. The spectrum analyzer is returned to normal operation. The state of the spectrum analyzer becomes the state of the window that was active when exiting the gate utility.
Front-Panel Key Access: (SWEEP)

**EXTERNAL** activates the trigger condition that allows the next sweep to start when an external voltage (connected to EXT TRIG INPUT on the rear panel) passes through approximately 1.5 volts. The external trigger signal must be a 0 V to +5 V TTL signal.
Front-Panel Key Access: (TRIG)

**EXTERNAL PREAMPG** adds a positive or negative preamplifier gain value, which is subtracted from the displayed signal. The EXTERNAL PREAMPG function is similar to the REF LVL OFFSET function; however, with the EXTERNAL PREAMPG function, the attenuation may be changed depending on the preamplifier gain entered. A preamplifier gain offset is used for measurements that require an external preamplifier or long cables. The offset is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the input of the preamplifier. The preamplifier gain offset is displayed at the top of the screen and is removed by entering zero. The preamplifier gain offset is entered using the numeric keypad. Press **CAL STORE** if you want the spectrum analyzer to use the current preamplifier gain offset when power is turned on. Preamplifier gain offset is set to zero when **DEFAULT CONFIG** is pressed. The preamplifier gain value is not affected by an instrument preset.
Front-Panel Key Access: (AMPLITUDE)

**FFT MARKERS** if the FFT mode is already active, pressing **FFT MARKERS** only activates the FFT markers. If the FFT mode is not active, then the FFT marker will be activated and the FFT annotation will be displayed but an FFT will not be performed. Pressing the **% AM ON OFF** key will give a valid value for the signal in trace B. Press **FFT OFF** to return the spectrum analyzer to normal operation.

An FFT trace can be saved and recalled. If a trace has been recalled, **FFT MARKERS** can be used to activate the markers so that the trace can be evaluated.

Front-Panel Key Access: (MEAS/USER)

**FFT Menu** accesses the menu of keys to initiate and evaluate a Fourier transform of the spectrum analyzer's displayed data. Activating other spectrum analyzer functions will automatically exit the FFT function or will corrupt the display. See Table 6-7.

**Table 6-7. Compatibility of FFT With Other Functions**

| Function | Compatibility Info |
|---|---|
| Catalog functions | corrupts the display |
| DLP Editor | corrupts the display |
| Marker Table | exits FFT |
| N dB Points measurement | exits FFT |
| Peak Table | exits FFT |
| Power Menu measurements | exits FFT |
| Show Options | corrupts the display |
| Time Gate functions | exits FFT |
| TOI measurement | exits FFT |
| Windows | exits FFT |

Front-Panel Key Access: (MEAS/USER)

**FFT OFF** exits the FFT mode and menus, returning the spectrum analyzer to normal operation.

Front-Panel Key Access: (MEAS/USER)

**FFT STOP FREQ** allows the user to enter the stop frequency for the desired FFT span. This sets the spectrum analyzer sweep time by the relationship:

FFT stop freq = 400 / (sweep time × 2)

**Note** When using the FFT stop frequency function, the knob and step key increments are not optimal for positioning the signal. To use the knob or step keys to position the signal, select sweep time as the active function.

Front-Panel Key Access: (MEAS/USER)

**FINE TUNE DAC** displays the output of the YTO fine-tune DAC, which is produced on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**FLAT** draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all frequencies between the two points. If the amplitude values of the two segments differ, the limit line "steps" to the frequency value of the second segment.
Front-Panel Key Access: (DISPLAY)

**Flatness Data** provides access to the softkeys used for viewing or editing the flatness-correction constants. This is a service calibration function and is for service use only.
Front-Panel Key Access: (CAL)

**FM COIL DRIVE** displays the output of the FM coil driver produced on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**FM GAIN** *Option 102 or 103 only.*
adjusts the FM deviation display. The center graticule represents zero deviation. The top graticule is the positive deviation set by FM GAIN. The bottom graticule is the negative deviation set by FM GAIN. The range for FM gain is from 10 kHz to 500 kHz. The default value is 100 kHz.
Front-Panel Key Access: (AUX CTRL) or (CAL)

**FM OFFSET** *Option 102, 103, or 301 only.*
adjusts the horizontal trace for center-screen with no modulation on the carrier. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**FM SPAN** displays the FM_SPAN signal from the span dividers on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**FORMAT CARD** *HP 8590L and HP 8592L must have Option 003.*
formats a card in logical interchange format (LIF). This is the same as **ERASE MEM CARD** . The memory card is formatted with the volume label "HP859X." Pressing **FORMAT CARD** causes a message to appear on the spectrum analyzer screen: `If you are sure, press key again to purge data.` Press **FORMAT CARD** again if you want to format the memory card. Pressing **FORMAT CARD** deletes data stored on the memory card.
Front-Panel Key Access: (CONFIG)

**FREE RUN** activates the trigger condition that allows the next sweep to start as soon as possible after the last sweep.
Front-Panel Key Access: (TRIG)

**FREQ DIAG** *All E-Series and L-Series spectrum analyzers except HP 8590L with Option 713.*
displays, in real-time, frequency diagnostic information for the LO section. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**FREQ DISC NORM OFF** *All E-Series and L-Series spectrum analyzers except HP 8590L with Option 713.*
indicates the status of the frequency discriminator as a function of LO span. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**FREQ OFFSET** allows the user to input a frequency offset value that is added to the frequency readout, to account for frequency conversions external to the spectrum analyzer. Offset entries are added to all frequency readouts including marker, start frequency, and stop frequency. Entering an offset does not affect the trace. Offsets are not added to the span. Frequency offsets are entered using the numeric keypad.

When a frequency offset is entered, its value is displayed on the bottom of the screen (as opposed to reference level offsets, which are displayed on the left side of the screen). To eliminate an offset, press **FREQ OFFSET** and 0 (ENTER). Pressing (PRESET) also sets the offset to zero.
Front-Panel Key Access: (FREQUENCY)

(FREQUENCY) activates the center-frequency or start-frequency function and accesses the menu that has the frequency functions. The center frequency or start frequency value appears below the graticule on the screen.

Although the spectrum analyzer allows entry of frequencies greater than the specified frequency range, using frequencies greater than the frequency span of the spectrum analyzer is not recommended.

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**Note** When changing both the center frequency and the span, change the frequency first since the span can be limited by the frequency value.

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**FULL SPAN**

changes the spectrum analyzer span to full span.

*For an HP 8592L, HP 8593E, HP 8595E, and HP 8596E only:* span can be limited if harmonic band lock ( **BND LOCK ON OFF** ) is set to ON.

**Full Span Frequency Range**

| Model | Frequency Range |
|---|---|
| HP 8590L | 9 kHz to 1.8 GHz |
| HP 8591E | 9 kHz to 1.8 GHz |
| HP 8592L | 2.75 GHz to 22 GHz * |
| HP 8593E | 2.75 GHz to 22 GHz * |
| HP 8594E | 9 kHz to 2.9 GHz |
| HP 8595E | 9 kHz to 6.5 GHz * |
| HP 8596E | 9 kHz to 12.8 GHz * |

* Harmonic band lock is set to OFF.

Front-Panel Key Access: (SPAN)

**Gate Control**

*Option 105 only. Option 101 is recommended.*
accesses the menu of gate control functions and the entrance to the gate utility menus. The gate can be controlled independently or from within the gate utility. The gate utility makes it easier to set up and manipulate the gate.

When the gate control functions are accessed under the **Gate Control** menu, outside of the gate utility, they do not interact with the gate utility. Values that are changed using these keys will not affect the gate utility settings and graphics unless the utility is entered with the new settings.
Front-Panel Key Access: (SWEEP)

**GATE CTL EDGE LVL**

*Option 105 only. Option 101 is recommended.*
determines if the gate is enabled on the edge of the trigger input or on a threshold level of the input signal. If the gate control is set to EDGE, the edge of the input signal triggers the timer for the gate delay. When the gate control is set to LVL, the gate follows the positive level of the signal connected to GATE TRIGGER INPUT.

When the gate control is set to level, the functions of gate delay and gate length no longer apply and therefore, the **GATE DELAY** , **GATE LENGTH** , and **EDGE POL POS NEG** softkeys are blanked. The gate utility does not allow level triggering. The gate will automatically be set to edge trigger on entry to the gate utility.
Front-Panel Key Access: (SWEEP)

**GATE DELAY**

*Option 105 only. Option 101 is recommended.*
sets the duration of the delay after an edge trigger before the gate switch closes. The gate delay can be set from 1 μs to 65.535 ms in 1 μs steps.

If the **GATE DELAY** softkey is accessed outside of the time gate utility, it turns off the gate markers but does not affect the gate utility settings. When the gate utility is entered, the current value of the gate delay will be used. The **GATE DELAY** softkey can be accessed from within the gate utility under the **Define Gate** menu.
Front-Panel Key Access: (SWEEP)

**GATE LENGTH**

*Option 105 only. Option 101 is recommended.*
sets the duration of the gate. The gate length can be set from 1 μs to 65.535 ms in 1 μs steps.

If the **GATE LENGTH** softkey is accessed outside of the time gate utility it turns off the gate markers but does not affect the gate utility settings. When the gate utility is entered, the current value of the gate length will be used. The **GATE LENGTH** softkey can be accessed from within the gate utility under the **Define Gate** menu.
Front-Panel Key Access: (SWEEP)

**GATE ON OFF**

*Option 105 only. Option 101 is recommended.*
turns on or off the gate for Option 105, the time-gated spectrum analyzer capability. The gate can be turned on outside, or from within, the gate utility. The gate utility makes it easier to set up and manipulate the gate.

If **GATE ON OFF** is accessed under the (SWEEP) menu it turns the gate on and off. If **GATE ON OFF** is accessed under the **Define Gate** softkey from within the gate utility, the gate can only be turned on when the frequency domain window is active. If the time domain window is made active the gate will be turned off. Gate manipulation with the gate turned on in the time domain window is difficult due to trace dropouts and triggering errors.
Front-Panel Key Access: (SWEEP)

**GATE UTILITY**

*Option 105 only. Option 101 is recommended.*
accesses the softkey functions used for Option 105, the time-gated spectrum analyzer capability. It creates related time domain and frequency domain windows to set up the time gate and make measurements. The center frequency and reference level must be set correctly before entering the gate utility. There must be a TTL signal at the GATE TRIGGER INPUT on the rear panel, and GATE OUTPUT must be connected to EXT TRIG INPUT. If no trigger is present an error message is displayed. Connect a trigger input or press instrument preset to exit the gate utility.

**Note** If the gate utility menus are exited by pressing one of the front panel keys they may be re-entered by pressing (SWEEP) twice.

Some spectrum analyzer functions are altered or are not available when the gate utility is active. See Table 6-8. From within the gate utility press **EXIT UTILITY** to return to normal spectrum analyzer operation. Press (SWEEP) twice, and **EXIT UTILITY** to return to the gate utility and then exit it properly.

**Table 6-8. Commands Altered/Not Available within the Gate Utility**

| Command | Description of Change |
|---|---|
| % AM | measurement function is not available |
| Adjacent Channel Power | measurement function is not available |
| Calibration | no calibration functions can be accessed |
| Channel Power | measurement function is not available |
| FFT | measurement function is not available |
| N dB Points | measurement function is not available |
| Occupied Bandwidth | measurement function is not available |
| Peak Zoom | routine is not available |
| Res BW | turns off resolution BW coupling to pulse width |
| Span | must be zero in the time domain window |
| Sweep time | turns off sweep time coupling to PRI |
| TOI | measurement function is not available |
| Video BW | turns off video BW coupling to gate length |

Front-Panel Key Access: (SWEEP)

**GHIJKL** accesses the softkey menu used for selecting screen title or prefix characters G through L.
Front-Panel Key Access: (CAL), (CONFIG), (DISPLAY), (RECALL), or (SAVE)

**GND REF DETECTOR** displays the output of the analog-ground reference produced on the A16 Processor/Video assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**GRAT ON OFF** turns the screen graticule on and off. This is helpful when alternative graphics are drawn on the screen through a remote controller and during plotting, when a graticule is not required.
Front-Panel Key Access: (DISPLAY)

**GRPH MKR ON OFF** turns the graph marker ON or OFF. This softkey is available when ACPGRAPH is ON (for ACP or ACP extended measurements), or when PWRGRAPH is ON (for channel power measurements). For the ACPGRAPH, the delta frequency, ACP ratio, and channel power are displayed at the marker position. For the channel power graph, the frequency and channel power are displayed at the marker position.
Front-Panel Access Key: (MEAS/USER)

**(HOLD)** *HP 8590L and HP 8592L only.*
deactivates the active function and blanks the active function text from the display. No data can be accidentally entered using the knob, step keys, or keypad. Activating another function will turn off the hold function. The **HOLD** softkey can also be accessed by pressing the (DISPLAY) key.

**HOLD** deactivates the active function and blanks the active function text from the display. No data can be accidentally entered using the knob, step keys, or keypad. Activating another function will turn off the hold function.
Front-Panel Key Access: (DISPLAY)

**HP B&W PRINTER** *Option 021, 023, or 024 only.*
selects a black and white printer. Use this function if you have a black and white HP printer, or if you are using a color printer, but want to have a black and white print. Pressing **DEFAULT CONFIG** selects the **HP B&W PRINTER** softkey. Start printing by pressing **COPY DEV PRNT PLT** (PRNT) and (COPY).
Front-Panel Key Access: (CONFIG)

**IDNUM** is used when the instrument is powered on the first time. It inputs the spectrum analyzer model number and option information. This is a service calibration function and is for service use only. Refer to the service guide for more information.
Front-Panel Key Access: (CAL)

**INIT FLT** is used when the instrument is powered on the first time. It sets the defaults for spectrum analyzer flatness including the start and stop frequencies and the step size. All of the correction values are set to zero. This is a service calibration function and is for service use only. Refer to the service guide for more information.
Front-Panel Key Access: (CAL)

**INPUT Z 50Ω 75Ω** adjusts the voltage readout by 1.76 dB to correct for the difference between voltage and power measurements in a 75Ω system versus a 50Ω system. The impedance you select is for computational purposes only, since the actual impedance of 50Ω (75Ω for Option 001) is set by internal hardware. The preset value can be changed by using a service function. Select the computational input impedance by pressing **INPUT Z 50Ω 75Ω** or by entering 75 or 50 using the numeric keypad. For example, when making measurements in a 75Ω system, an analyzer with either a 75Ω input impedance (Option 001) or a 50Ω input impedance, using a 75Ω to 50Ω matching device, the **INPUT Z** should be set to 75Ω
Front-Panel Key Access: (AMPLITUDE)

**INTERNAL CARD** *Requires Option 003 for an HP 8590L or HP 8592L.*
selects between spectrum analyzer memory and the memory card for the save and recall functions.
Front-Panel Key Access: (RECALL) or (SAVE)

**INTERNAL → STATE** recalls the saved spectrum analyzer state from the selected state register. Recalling a state from the spectrum analyzer memory displays the time and date when the state data was stored. To recall a state, press **INTERNAL → STATE** and use the numeric keypad to enter a state register number (valid state register numbers are 1 through 9). State register 9 contains a previous state; state register 0 contains the current state. If windows are being used, the instrument state can only be recalled into the active window.
Front-Panel Key Access: (RECALL)

**Internal → Trace** accesses a softkey menu that allows you to either select the trace in which the trace data is to be recalled (trace A, trace B, or trace C), recall the current limit-line tables, or recall amplitude correction factors. When recalling a trace, select the trace in which the trace data is to be recalled, enter the trace register number, and press (ENTER). If windows are being used, only the trace of the active window can be recalled.

When recalling limit-line tables or amplitude correction factors, press **LIMIT LINES** or **AMP COR** respectively, enter the trace register number, and press (ENTER). Valid trace register numbers are 0 through the maximum register number. The maximum register number is the number displayed after MAX REG # = during a save or recall operation. If a screen title is present, it is recalled with the trace data (but not with the limit-line table or the amplitude-correction factors). If the screen title does not exceed 34 characters, the time and date when the data was stored will also be displayed. INVALID SAVEREG is displayed if data has not been stored in the trace register.
Front-Panel Key Access: (RECALL)

**LAST SPAN** changes the spectrum analyzer's frequency span to the previous span setting.
Front-Panel Key Access: (SPAN)

**Limit Lines** accesses the limit-line menus.
Front-Panel Key Access: (DISPLAY)

**LIMIT LINES** When accessed by (SAVE), pressing **LIMIT LINES** stores the current limit-line tables in spectrum analyzer memory or on the memory card. When accessed by (RECALL), pressing **LIMIT LINES** recalls limit-line tables from spectrum analyzer memory or the memory card. See "To Save a Limit-Line Table or Amplitude Correction Factors" or "To Recall Limit-Line Tables or Amplitude Correction Factors" in Chapter 5 for more information.
Front-Panel Key Access: (RECALL) or (SAVE)

**LIMITS FIX REL** allows you to choose fixed or relative type of limit lines. The fixed (FIX) type uses the current limit line as a reference with fixed frequency and amplitude values. The relative (REL) setting causes the current limit-line value to be relative to the displayed center frequency and reference-level amplitude values. When limit lines are specified with time, rather than frequency, the REL setting only affects the amplitude values. The current amplitude values will be relative to the displayed reference-level amplitude, but the time values will always start at the left edge of the graticule.

As an example, assume you have a frequency limit line. If the limit line is specified as fixed, entering a limit-line segment with a frequency coordinate of 300 MHz displays the limit-line segment at 300 MHz. If the same limit-line table is specified as relative, it is displayed relative to the spectrum analyzer's center frequency and reference level. If the center frequency is at 1.2 GHz, a relative limit-line segment with a frequency coordinate of 300 MHz will display the limit-line segment at 1.5 GHz. If the amplitude component of the relative limit-line segment is −10 dB, then −10 dB is added to the reference level value to obtain the amplitude of the given component (reference level offset included).

RELATIVE is displayed in the limit-line table when the limit-line type is relative; FIXED is displayed when limit-line type is fixed.

A limit line entered as fixed may be changed to relative, and one entered as relative may be changed to fixed. When changing between fixed and relative limit-lines, the frequency and amplitude values in the limit-line table change so that the limit line remains in the same position for the current frequency and amplitude settings of the spectrum analyzer. If a time and amplitude limit line is used, the amplitude values change but the time values remain the same.
Front-Panel Key Access: (DISPLAY)

**LIMITS FRQ TIME** selects whether limit lines will be entered using frequency or sweep time to define the segments. Limit lines can be created by the user to test trace data. They can be specified as a table of limit-line segments of amplitude versus frequency, or of amplitude versus time. Time values are evaluated with respect to the spectrum analyzer sweep time. A time value of zero corresponds to the start of the sweep, which is the left edge of the graticule.

Switching the limit line definition between frequency and time will erase the current limit line table. The message `If you are sure, press key again to purge data` will appear. Press **LIMITS FRQ TIME** again to purge the limit line table and switch between frequency and time.
Front-Panel Key Access: (DISPLAY)

**LINE** activates the trigger condition that allows the next sweep to be synchronized with the next cycle of the line voltage.
Front-Panel Key Access: (TRIG)

**LMT DISP Y N AUTO** displays any portion of the limit lines that are currently within the spectrum analyzer's display boundary. If Y (yes) is underlined the limit lines are displayed. If N (no) is underlined they are not displayed. If AUTO is underlined, the display of the limit lines is dependent on LMT TEST. The limit lines will be displayed while the limit test function is turned on, otherwise they will be turned off.

Limit lines cannot be displayed while using the analog+ display mode. Limit testing can be done but the limit lines will not be displayed.
Front-Panel Key Access: (DISPLAY)

**LMT TEST ON OFF** turns the limit-line testing and (if **LMT DISP AUTO** is selected) turns the display of the limit lines on and off. When limit-line testing is enabled, every measurement sweep of trace A is compared to the limit lines. If trace A is at or within the bounds of the limit lines, `LIMIT PASS` is displayed. If trace A is out of the limit-line boundaries, `LIMIT FAIL` is displayed.
Front-Panel Key Access: (DISPLAY)

**LOAD FILE** loads a file from the memory card into spectrum analyzer memory. When the memory card is selected, pressing any of the catalog softkeys (**CATALOG ALL**, **CATALOG STATES**, **CATALOG TRACES**, **CATALOG PREFIX**, **CATALOG DLP**, **CATALOG AMP COR**, **CATALOG LMT LINE**), or **CATALOG DISPLAY** accesses **LOAD FILE**. When cataloging spectrum analyzer memory using **CATALOG REGISTER**, press **LOAD FILE** to recall the contents of a state or trace register into spectrum analyzer memory. To use the LOAD FILE function, use the step keys to view sections of the directory, use the knob to select a file then press **LOAD FILE**. Trace data is loaded into trace B. See the softkey descriptions for **CATALOG CARD** and **CATALOG REGISTER**.

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**Note** Use of the **LOAD FILE** softkey is not recommended for recalling limit-line tables or amplitude-correction factors stored in spectrum analyzer memory.

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Front-Panel Key Access: (RECALL) or (SAVE)

**(LOCAL)**
Pressing CONFIG (LOCAL) after the spectrum analyzer has been placed in the remote mode places the spectrum analyzer in the local mode and enables front-panel control. During remote operation, "R" appears in the lower-right corner of the screen indicating remote and talk. A "T" or "L" may appear during remote operation, indicating talk or listen. Pressing the CONFIG key removes the "R" symbol in the lower-right corner.
Front-Panel Key Access: CONFIG

**MAIN COIL DR**
displays the output produced by the main-coil driver on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: CAL

**Main Menu**
*Option 105 only. Option 101 is recommended.*
returns to the main gate utility menu from within the gate utility. Pressing **Main Menu** accesses the **Define Time**, **Define Gate**, **Define Coupling**, **UPDATE TIMEFREQ**, and **EXIT UTILITY** softkeys.
Front-Panel Key Access: SWEEP

**MAIN SPAN**
displays the main-coil-span signal, MC_SPAN, from the span dividers on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: CAL

**MAN QP AT MKR**
*Option 103 only.*
performs a subset of the routine executed by pressing **AUTO QP AT MKR** and then displays a menu of quasi-peak softkeys. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: AUX CTRL

**MAN TRK ADJUST**
*Option 010 or 011 only.*
allows the user to adjust the frequency of the tracking-generator oscillator manually using the step keys or knob. The tracking adjust is tuned to maximize the amplitude of the trace.

Tracking error occurs when the output frequency of the tracking generator is not exactly matched to the input frequency of the spectrum analyzer. The resulting mixing product from the spectrum analyzer input mixer is not at the center of the IF bandwidth. Any tracking errors may be compensated for through manual adjustments of the tracking generator's oscillator, or through an automatic tracking routine, which is initiated by pressing **TRACKING PEAK**.
Front-Panel Key Access: AUX CTRL

**MARKER # ON OFF**
turns the selected marker on or off. One of the four markers must first be selected by the **SELECT 1 2 3 4** key, otherwise marker 1, or the last selected marker, will be turned on or off. When a new marker is turned on by pressing **MARKER # ON OFF**, the **MK TRACE AUTO ABC** function always switches to AUTO and the marker is put on the trace that is selected by the AUTO mode.
Front-Panel Key Access: MKR

**MARKER Δ** activates a second marker at the position of the first marker. (If no marker is present, two markers appear at the center of the display.) The amplitude and frequency of the first marker is fixed, and the second marker is under your control. Annotation in the active function block and in the upper-right corner of the screen indicates the frequency and amplitude differences between the two markers. The display mode must not be changed between log and linear while using a delta marker.

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**Note** If there are already four markers when **MARKER Δ** is pressed, a nonactive marker disappears, the active marker becomes a reference marker, and the delta marker becomes the active marker.

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Front-Panel Key Access: (MKR) or (PEAK SEARCH)

**MARKER Δ→SPAN** sets the start and stop frequencies to the values of the delta markers. The start and stop frequencies will not be set if the delta marker is off.
Front-Panel Key Access: (MKR→)

**MARKER→ AUTO FFT** functions exactly like the **CONTINUS FFT** softkey, if the spectrum analyzer is already in zero span. If the spectrum analyzer is not in zero span it activates a marker which must be placed on the signal that will have an FFT performed on it and **MARKER→ AUTO FFT** must be pressed again. The resolution bandwidth setting must be wide enough to include the displayed modulation signals. Refer to Chapter 4 "Measuring Amplitude Modulation Using the Fast Fourier Transform" for more information.

Press **FFT OFF** to return the spectrum analyzer to normal operation. The spectrum analyzer state prior to pressing **MARKER→ AUTO FFT** can be recalled from register 8.
Front-Panel Key Access: (MEAS/USER)

**MARKER →CF** changes the spectrum analyzer settings so that the frequency at the marker becomes the center frequency.
Front-Panel Key Access: (MKR→) or (PEAK SEARCH)

**MARKER →CF STEP** changes the center-frequency step size to match the value of the active marker. Press (FREQUENCY) then **CF STEP AUTO MAN** to view the step size. If marker delta is active, the step size will be set to the frequency difference between the markers.
Front-Panel Key Access: (MKR→)

**MARKER→ FFT STOP** changes the FFT stop frequency to whatever the current value of the FFT marker frequency is, within the limitations of the available sweep times. This puts the marker on the right side of the graticule.
Front-Panel Key Access: (MEAS/USER)

**MARKER→ MID SCRN** changes the frequency at the middle of the FFT display to whatever the current value of the FFT marker frequency is, within the limitations of the available sweep times. This puts the marker in the middle of the graticule.

When using the FFT function the **MARKER→ MID SCRN** softkey replaces the **MARKER → CF** softkey in the (PEAK SEARCH) and (MKR→) menus.
Front-Panel Key Access: (MEAS/USER), (MKR→), or (PEAK SEARCH)

**MARKER→ MINIMUM** moves the active marker to the minimum detected amplitude value.
Front-Panel Key Access: (MKR→)

**MARKER →PK-PK** finds and displays the frequency and amplitude differences between the highest and lowest trace points. Pressing **MARKER →PK-PK** performs the routine similar to pressing the following keys: (PEAK SEARCH), **MARKER Δ**, and **MARKER→ MINIMUM**.
Front-Panel Key Access: (MKR→)

**MARKER →REF LVL** changes the spectrum analyzer settings so that the amplitude at the active marker becomes the reference level.
Front-Panel Key Access: (MKR→)

**MARKER →START** changes the start frequency so that it is equal to the frequency of the active marker. This moves the active marker to the left edge of the display.
Front-Panel Key Access: (MKR→)

**MARKER →STOP** changes the stop frequency so that it is equal to the frequency of the active marker. This moves the active marker to the right edge of the display.
Front-Panel Key Access: (MKR→)

**MARKER ALL OFF** turns off all of the markers, including markers used for marker track and demodulation (demodulation is only available with Option 102 or 103). Marker annotation is also removed.
Front-Panel Key Access: (MKR)

**MARKER AMPTD** keeps the active marker at the requested amplitude on the screen. Once activated, the marker remains at the amplitude selected by the step keys, knob, or numeric keypad, even if the signal frequency is changed. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected units terminator menu. The marker will be placed on the signal furthest left at that amplitude. If no signal exists at that amplitude, it will be placed above the highest signal amplitude (or below the lowest trace element if it is below all trace elements). When marker delta is active in addition to marker amplitude, the behavior of the active marker is useful for measuring signal bandwidths. For example, place a marker 20 dB below the peak of a signal, press **MARKER Δ**, **MARKER AMPTD**. The marker readout shows the 20 dB bandwidth.
Front-Panel Key Access: (MKR)

**MARKER NORM PK** *For Option 103 only.*
provides a function similar to a normal marker when making quasi-peak measurements. When NORM is selected, the marker can be moved anywhere on the trace; when PK is selected, the marker is placed on the highest on-screen signal peak after each sweep.
Front-Panel Key Access: (AUX CTRL)

**MARKER NORMAL** activates a single frequency marker at the center frequency on the active trace if an on-screen marker is not already displayed. If there is an on-screen marker before the MARKER NORMAL function is enabled, a frequency marker is enabled at the position of the first marker. Use the data controls to position the marker. Annotation in the active function block and in the upper-right corner indicates the frequency and amplitude of the marker. The marker stays on the trace at the horizontal screen position where it was left unless **MK TRACK ON OFF**, **MARKER AMPTD**, or a "marker to" softkey function (such as **MARKER →CF**, **MARKER →REF LVL**, **MARKER →CF STEP**, **MARKER Δ →SPAN**, or **MARKER→ MINIMUM**) is selected.
Pressing **MARKER NORMAL** turns off the marker-delta function.
Front-Panel Key Access: (MKR)

**MARKER ON** *Option 105 only. Option 101 is recommended.*
activates a marker in the gate utility. The **MARKER ON** key is accessed from within the pulse parameter entry menus in the gate utility. If the reference edge parameter is being entered **MARKER ON** turns on a trigger marker. For pulse width and pulse repetition interval entry, it turns on a delta marker. The delta marker will be activated at the defined reference edge, if one is available. Otherwise, it will activate at mid screen.
Front-Panel Key Access: (SWEEP)

**MAX HOLD A** maintains the maximum level for each trace point of trace A. Updates each trace point if a new maximum level is detected in successive sweeps.
Front-Panel Key Access: (TRACE)

**MAX HOLD B** maintains the maximum level for each trace point of trace B. Updates each trace point if a new maximum level is detected in successive sweeps.
Front-Panel Key Access: (TRACE)

**MAX MXR LVL** lets you change the maximum input mixer level in 10 dB steps from −10 dBm to −100 dBm. The mixer level is equal to the reference level minus the attenuator setting. As the reference level changes, the input attenuator setting is changed to keep the power levels less than the selected level at the input mixer. Pressing (PRESET) resets the maximum input mixer level to −10 dBm.
Front-Panel Key Access: (AMPLITUDE)

**MEAS OFF** turns off the measurement functions under the **Power Menu** softkey and restores the spectrum analyzer to the state prior to initiating the power measurement. If another front-panel key is pressed, exiting the power menus, press the (MEAS/USER) key twice to return to the power menu.
Front-Panel Key Access: (MEAS/USER)

**MEAS/USER** switches between the User Menu and the menu containing **N dB PTS ON OFF**, **% AM ON OFF**, **TOI ON OFF**, **Power Menu**, and **FFT Menu**. If no keys have been defined in the user menu, **No User Menu** is displayed. See the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for more information about defining keys in the user menu.

**MEM LOCKED** indicates that the save lock function is on. It replaces the **ERASE STATEALL** and **ERASE TRACEALL** softkeys under the CONFIG key, and it replaces **STATE → INTERNAL** and **TRACE → INTERNAL** under the SAVE key when **SAV LOCK ON OFF** is ON. Pressing **SAV LOCK ON OFF** returns the menu to its unlocked state.
Front-Panel Key Access: SAVE or CONFIG

**MIN HOLD C** maintains the minimum level for each trace point of trace C. Updates each trace point if a new minimum level is detected in successive sweeps.
Front-Panel Key Access: TRACE

**MIXER BIAS DAC** *HP 8592L, HP 8593E, HP 8595E, or HP 8596E only.*
displays the output of the mixer-bias DAC from the first-converter driver on the A7 Analog Interface assembly. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: CAL

**MK COUNT ON OFF** *All E-Series and L-Series spectrum analyzers except HP 8590L with Option 713.*
turns on the marker counter when ON is underlined. If no marker is active before **MK COUNT ON OFF** is pressed, a marker is activated at center screen. Press **MK COUNT ON OFF** (so that OFF is underlined), to turn the marker counter off. Press **CNT RES AUTO MAN** to change the marker counter resolution to an uncoupled value.

An (*) may appear in the upper right of the display along with the message `Marker Count`. The ratio of the resolution bandwidth to span must be greater than 0.01 for the marker count function to work properly. `Reduce Span` appears on screen if the bandwidth to span ratio is less than 0.01. If Option 130, narrow resolution bandwidth, is not installed, the marker count function is limited to resolution bandwidths ≥300 Hz. `Widen RES BW` indicates that the resolution bandwidth must be increased. The function will count the largest signal is a 300 Hz bandwidth even if a narrower bandwidth setting is used.
Front-Panel Key Access: MKR FCTN

**MK NOISE ON OFF** reads out the average noise level, referenced to a 1 Hz noise power bandwidth, at the marker position. If no marker is present, a marker appears at the center of the screen. The root-mean-square noise level, normalized to a 1 Hz noise power bandwidth, is read out. The sample detector is activated.
Front-Panel Key Access: MKR FCTN

**MK PAUSE ON OFF** stops the spectrum analyzer sweep at the marker position for the duration of the dwell time. The dwell time can be set from 2 milliseconds to 100 seconds.
Front-Panel Key Access: MKR FCTN

**MK READ F T I P** selects the marker readout to be displayed in signal frequency, sweep time, the inverse of the sweep time, or the period which is the inverse of the frequency. When the instrument is in zero span the frequency type readout cannot be selected.
Front-Panel Key Access: (MKR)

**MK TABLE ON OFF** provides a list of the four available markers which is updated at the end of each sweep or when a marker is used. The marker data can be displayed in different formats. It can be in absolute or delta frequency and amplitude formats. There is also a delta display line format, which can be accessed using the **TABLE ΔDL NRM** softkey.

The marker table is not saved with the (SAVE) and (RECALL) keys.
Front-Panel Key Access: (MKR FCTN)

**MK TRACE AUTO ABC** assigns a marker to a trace. Pressing **MK TRACE AUTO ABC** will activate a marker on trace A if there are no markers turned on. If a marker is currently active, press **MK TRACE AUTO ABC** until A, B, or C are underlined. The active marker will be moved to the selected trace.

Selecting the AUTO mode will move the marker to the trace that is automatically selected. The selection order is to first look for a trace in the clear-write mode, in the order of trace A, then trace B, then trace C. If no traces are currently being written, it will select a trace in the view-store mode, again in the order of trace A, B, then C.
Front-Panel Key Access: (MKR)

**MK TRACK ON OFF** moves the signal that is nearest to the active marker to the center of the screen and keeps the signal there. MKR-TRK or CNTR-TRK appears in the upper-right corner of the display. An (*) may appear in the upper-right corner of the display while the spectrum analyzer is verifying that it has the correct signal.

Pressing **MK TRACK ON OFF**, (PRESET), **MARKER NORMAL**, or **MARKER ALL OFF** turns off the marker-track function.

When marker track is on and the span is reduced, an automatic zoom is performed: the span is reduced in steps so that the signal remains at the center of the screen. If the span is zero, marker track cannot be activated.
Front-Panel Key Access: (MKR FCTN)

(MKR) accesses the marker control softkeys which select the type and number of markers and turn them on and off. Markers are diamond-shaped characters that identify points of traces and allow the traces to be manipulated and controlled on the screen. During manual operation, four markers may appear on the display simultaneously; only one can be controlled at a time. The marker that is controlled is called the "active" marker. Pressing (MKR) activates the **MARKER NORMAL** softkey.

(MKR→) (read "marker to") accesses the softkeys used for the transfer of marker information directly into other functions.

**MKR FCTN** accesses the marker function softkeys. These softkeys can be used to access the marker table and to turn on marker functions for tracking the signal and counting its frequency. Noise markers and the marker pause function are also accessed under **MKR FCTN**.

**MNOPQR** accesses the softkey menu for selecting screen title or prefix characters M through R.
Front-Panel Key Access: **CAL**, **CONFIG**, **DISPLAY**, **RECALL**, or **SAVE**

**MODE** changes the softkey menus for the spectrum-analyzer mode and other modes of operation when **SPECTRUM ANALYZER** (located under **PRESET**) and **PRESET SPECTRUM** are selected, respectively. Other modes are available using the downloadable measurement personalities. The HP 85711A cable television measurements personality, the HP 85712D EMI diagnostics measurements personality, and the HP 85713A digital radio measurements personality are examples of some of these modes. Others are described in Chapter 8 "Options and Accessories." Consult the documentation accompanying each personality for information about these other modes of operation.

**N dB PTS ON OFF** automatically places two markers at points N dB from the highest point on the highest displayed signal, and determines the frequency difference between the two markers. N dB is the active function and the value of N is set by the user. The measurement defaults to 3 dB when it is first turned on. The measurement runs continuously re-executing at the end of each sweep.

No other signal can appear on the display within N dB of the highest signal. The measured signal cannot have more than one peak that is greater than or equal to N dB. A signal must be greater than the peak excursion above the threshold to be identified. The setting for peak excursion may be increased from the 6 dB default value so that noise will not be identified as signals. Increasing the value too much may cause a smaller signal to be missed or misinterpreted as part of a larger signal. The amplitude scale may be either linear or logarithmic.
Front-Panel Key Access: **MEAS/USER**

**NEW EDIT** *For Options 021, 024, and 024 only. Refer to the HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide for more information.*
starts the DLP editor function, clearing the DLP editor memory to create a new item in the spectrum analyzer's 2500 byte DLP editor memory. The item will not be in the spectrum analyzer's user memory until it is processed by the **SAVE EDIT** softkey. The DLP editor memory buffer remains intact when the instrument is preset and when it is powered off.
Front-Panel Key Access: **RECALL** or **SAVE**

**NEXT** *HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only.*
switches the active window between the two displayed windows, if the windows display mode has been turned on. The active window is marked by solid lines.

If the zoom function has been used to expand an active window to the full screen, the **NEXT** key still switches the active window between the two windows. The windows remain zoomed (full screen) so the inactive window is not displayed as the active window is switched.

**NEXT PEAK** places the marker on the next highest peak. The signal peak must exceed the threshold value. (Also see the **PEAK EXCURSN** and **THRESHLD ON OFF** softkey descriptions.)
Front-Panel Key Access: (PEAK SEARCH)

**NEXT PK LEFT** moves the marker to the next peak to the left of the current marker. The signal peak must exceed the threshold value. If there is no peak to the left, the marker will not move. (Also see the **PEAK EXCURSN** and **THRESHLD ON OFF** softkey descriptions.)
Front-Panel Key Access: (PEAK SEARCH)

**NEXT PK RIGHT** moves the marker to the next peak to the right of the current marker. The signal peak must exceed the threshold value. If there is no peak to the right, the marker will not move. (Also see the **PEAK EXCURSN** and **THRESHLD ON OFF** softkey descriptions.)
Front-Panel Key Access: (PEAK SEARCH)

**No User Menu** is displayed if key number 1 has not been defined by the user. Key number 1 can be defined by remote programming commands (KEYCMD or KEYDEF).
Front-Panel Key Access: (MEAS/USER)

**NORMLIZE ON OFF** subtracts trace B from trace A and adds the result to the display line. The result is displayed in trace A. The trace data is normalized with respect to the display line even if the value of the display line is changed. This function is executed on all subsequent sweeps until it is turned off. A minus sign (−) appears between the trace A status and the trace B status in the screen annotation while the function is active. To turn off the normalize function, press **NORMLIZE ON OFF** so that OFF is underlined.

The normalize function is useful for applying correction data to a trace. For example, store a measurement sweep of the response of a system in trace B. Trace A can be used to measure the response of the system after a device is added. Set **NORMLIZE ON OFF** to ON to subtract the system response from the response of the device under test, to characterize the response of a device under test.
Front-Panel Key Access: (TRACE)

**NORMLIZE POSITION** displays the display line and makes the display line function active. The trace data is normalized with respect to the display line even if the value of the display line is changed.
Front-Panel Key Access: (TRACE)

**NTSC** *Options 101 and 102, or Option 301 only.*
allows you to trigger on the NTSC video format. Pressing **NTSC** alters the TV line number that the spectrum analyzer triggers on internally; the line number displayed when **TV LINE #** is pressed does not change. Pressing **NTSC** changes the video modulation to negative; set **TV SYNC NEG POS** so that POS is underlined if positive video modulation is required.
Front-Panel Key Access: (TRIG)

**OCC BW % POWER** allows the user to enter the percent of the power desired when using the occupied bandwidth measurement under the **Power Menu** softkey. When the power measurements are first accessed the initial value for percent power is 99 percent. Once the value is changed, the new value will be saved through an instrument preset or power-on. If the occupied bandwidth measurement is active and the percent power is changed, another sweep is taken and measured.
Front-Panel Key Access: (MEAS/USER)

**OCCUPIED BANDWDTH** integrates the power of the displayed spectrum and puts markers at the frequencies containing a selected percent of the power. The measurement defaults to 99% of the occupied bandwidth power. The power-bandwidth routine first computes the combined power of all signal responses contained in the trace. For 99% occupied power bandwidth, it then puts markers at the frequencies at which 0.5% of the power lies to the right of the right marker and to the left of the left marker. Thus 99% of the power lies between the markers. The difference of the marker frequencies is the 99% power bandwidth and is the value displayed.

The **OCC BW % POWER** softkey can be used to change the measured power value from 1% to 99.99% of the total displayed power. The occupied bandwidth function also indicates the value of the measured power in the occupied bandwidth, and the difference between the spectrum analyzer's center frequency and the center frequency of the occupied bandwidth. The measurement can be made on a single sweep or to continuously update at the end of each sweep. The center frequency, reference level, and channel spacing must be set by the user. Press **PARAM AUTO MAN** so that AUTO is underlined and other spectrum analyzer settings will be set automatically set to make a valid measurement. Set **PARAM AUTO MAN** to (MAN) to manually control all settings. The measurement function stops and the spectrum analyzer is returned to its prior state when other functions are activated.
Front-Panel Key Access: (MEAS/USER)

WINDOWS (ON) *HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E only.*
activates the windows display mode and accesses the menu of window zone functions. The windows display function splits the screen into two separate displays. Only one of these displays is active at a time. The currently active window will have a solid line around the graticule rather than a broken line. The WINDOWS (NEXT) key will switch the active display between the upper and lower windows. The instrument state of the active window can be changed without affecting the state of the inactive window. The complete annotation is not displayed for each window because of space limitations.

When the windows display mode is first turned on, the top window will contain an inactive copy of the previous full display. The lower window will be active and will display a subset of the frequency span of the upper window. The displayed span, or zone, of the lower window will be indicated on the upper window by two vertical lines called zone markers. The zone can be moved and changed using the zone keys which are accessed by pressing the

WINDOWS (ON) key. Changing the span or center frequency of the lower window will change the corresponding zone markers on the upper window.

Most functions can be used from within the windows display mode. Some functions, like editing limit lines and showing the options, require a full-sized display. They will temporarily exit the windows display format. When the function is finished the instrument will return to a windows display. Other functions will permanently exit the windows display and it will be necessary to restart the windows display mode by pressing WINDOWS (ON). See Table 6-9.

Limit lines can be displayed and tested within the windows display mode. Viewing and testing must be turned on independently in each window. The current limit lines will be common to both windows.

(SAVE) and (RECALL) do not save the windows display mode. If the windows display mode is being used, the save state function saves the state of the currently active window. The recall state function recalls the stored state into the currently active window. See the **DISPLAY → CARD** and **CARD →DISPLAY** softkeys for information about saving the display.

**Table 6-9. Functions Which Exit The Windows Display Format**

| Function | Description |
|---|---|
| % AM | measures percent amplitude modulation |
| Adjacent Channel Power | measures adjacent channel power |
| Calibration Functions | self-calibration routines |
| Channel Power | measures channel power |
| Confidence Test | built-in self test routine |
| Dispose User Memory | deletes user's items from analyzer memory |
| FFT | initiates FFT on zero span input |
| Gate Utility | accesses time gate functionality |
| Instrument Preset | returns analyzer to preset state |
| Marker Table | lists all of the active markers |
| N dB Points | measures N dB bandwidth |
| Occupied Bandwidth | measures occupied bandwidth |
| Peak Table | lists displayed signal peaks |
| Peak Zoom | initiates the peak zoom routine |
| TOI | makes a third-order intercept measurement |

**PAINTJET PRINTER**

*Option 021, 023, or 024 only.*
selects a color print (for use with an HP PaintJet printer only). The traces are displayed in orange (trace A), blue (trace B), and red (trace C). The graticule, screen annotation, and user information are displayed in black.
Front-Panel Key Access: (CONFIG)

**PAL**

*Options 101 and 102, or Option 301 only.*
allows you to trigger on the PAL video format. Pressing **PAL** alters the TV line number that the spectrum analyzer triggers on internally; the line number displayed when **TV LINE #** is pressed does not change. Pressing **PAL** changes the video modulation to negative; set **TV SYNC NEG POS** so that POS is underlined if positive video modulation is required.
Front-Panel Key Access: (TRIG)

**PAL-M** *Options 101 and 102, or Option 301 only.*
allows you to trigger on the PAL-M video format. **PAL-M** alters the TV line number the spectrum analyzer triggers on internally; the line number displayed by **TV LINE #** does not change. **PAL-M** changes the video modulation to negative; use **TV SYNC NEG POS** (POS) if positive video modulation is required.
Front-Panel Key Access: (TRIG)

**PARAM AUTO MAN** lets the user choose between automatically or manually setting the parameters used for the measurement functions under the **Power Menu** softkey. Parameters such as span, resolution bandwidth, video bandwidth, center frequency step size, detector mode, and sweep time are coupled so that they are automatically updated. With AUTO underlined when channel bandwidth or channel spacing are changed, the coupled parameters will be updated and another sweep will be taken and measured. If MAN is underlined the user must set all of the parameters correctly.
Front-Panel Key Access: (MEAS/USER)

**PEAK EXCURSN** sets the minimum amplitude variation of signals that the marker can identify as a peak. If a value of 10 dB is selected, the marker moves only to peaks that rise and fall more than 10 dB above the threshold line (or the noise floor of the display). Pressing (PRESET) or turning on power resets the excursion to 6 dB, and the threshold to 70 dB below the reference level.

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**Note** When a peak has a lump on its skirt that is the peak-excursion value above the threshold, the lump is considered a peak in its own right only if it has a peak excursion drop on both sides. Two peaks that are so close that only a valley divides them are not differentiated if the valley is not the peak-excursion value deep.

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When the peak excursion value is less than 6 dB, the marker-peaking functions may not recognize signals less than 6 dB above the noise floor. To correct this, when measuring signals near the noise floor, the excursion value can be reduced even further. To prevent the marker from identifying noise as signals, reduce the noise floor variance to a value less than the peak-excursion value by reducing the video bandwidth or by using video averaging.
Front-Panel Key Access: (PEAK SEARCH)

**Peak Menu** accesses the same softkeys that are available when (PEAK SEARCH) is pressed (see the key description for (PEAK SEARCH) below). Pressing **Peak Menu** instead of (PEAK SEARCH) allows you to use the peak-search functions without initiating a new peak search.
Front-Panel Key Access: (MKR→)

(PEAK SEARCH) automatically places a marker on the highest amplitude of a trace, displays the marker's amplitude and frequency. It also accesses the menus of marker peak functions including the peak table functions.

**PEAK ZOOM** finds the highest displayed signal and narrows the span to a value selected by the user. Pressing **PEAK ZOOM** the first time will make FINAL SPAN the active function so the user can input the destination span. The current FINAL SPAN value will be displayed. At that time the user can enter a span or press **PEAK ZOOM** again to use the displayed span.

The peak zoom function sets the reference level to the signal amplitude and sets the center frequency step size to the signal frequency. If the signal is in a microwave band, a preselector peak is executed.

For a signal to be found it must have a peak of at least 6 dB. If no signal is found, `Signal not found` will be displayed. (The routine will ignore the spectrum analyzer's local oscillator feedthrough signal which is at 0 Hz.)

Front-Panel Key Access: (SPAN)

**PK MODE <>DL NRM** select which peaks will be listed in the peak table to include all peaks, or to exclude the peaks that are either above or below the display line. See Table 6-10. The display line is activated if it was not currently being displayed.

**Table 6-10.**

| Selection | Peaks Listed |
|---|---|
| NRM | all peaks listed |
| >DL | peaks above display line listed |
| < DL | peaks below display line listed |

Front-Panel Key Access: (PEAK SEARCH)

**PK SORT FRQ AMP** switches the peak table sorting routine between listing the peaks in order by descending amplitude or by ascending frequency.
Front-Panel Key Access: (PEAK SEARCH)

**PK TABLE ON OFF** displays a list, of up to ten signal peaks, that is updated at the end of each sweep. The peaks can be sorted in order by descending amplitude or by ascending frequency. Peaks above or below the display line can be excluded from the table. The peak table function works with trace A only. The peak table is not saved with the (SAVE) and (RECALL) keys.
Front-Panel Key Access: (PEAK SEARCH)

**Plot Config** *Option 021, 023, or 024 only.*
accesses the menu used to address the plotter and to select plotter options. See the (COPY) key for more information.
Front-Panel Key Access: (CONFIG)

**PLOTTER ADDRESS** *Option 021 only.*
changes the HP-IB address of the plotter. The plotter address is set to 5 when **DEFAULT CONFIG** is pressed.
Front-Panel Key Access: (CONFIG)

**PLT _ _ LOC _ _** *Option 021, 023, or 024 only.*
selects the position of the plotter output. The highlighted portion of the softkey label indicates where the plot is to be output on the page. This softkey function appears only if two or four plots per page are selected when **PLTS/PG 1 2 4** is pressed.
Front-Panel Key Access: (CONFIG)

**PLT MENU ON OFF** *Option 021, 023, or 024 only.*
allows the softkey labels to be plotted along with the spectrum analyzer display. This function operates when the (COPY) key is used in a plot configuration. The **PLT MENU ON OFF** function is set to OFF when **DEFAULT CONFIG** is pressed.
Front-Panel Key Access: (CONFIG)

**PLTS/PG 1 2 4** *Option 021, 023, or 024 only.*
allows you to plot a full-page, half-page, or quarter-page output. Selecting two plots per page requires a plotter that has the rotate command (RO). The plotter will be set to a full-page output when **DEFAULT CONFIG** is pressed.
Front-Panel Key Access: (CONFIG)

**PLT->LJT ON OFF** *Option 021, 023, or 024 only.*
allows you to plot a full-page, half-page, or quarter-page output to an HP LaserJet printer. This softkey can be accessed by pressing (CONFIG), then **Plot Config**.
Front-Panel Key Access: (CONFIG)

**POINT** specifies a limit value for one coordinate point, so that a POINT segment specifies a limit value for a single frequency or time. For an upper limit line, a POINT segment is indicated by a line drawn vertically from the coordinate point to a point off the top of screen. For a lower limit line, a POINT segment is indicated by a line drawn vertically from the coordinate point to a point off the bottom of screen. The POINT segment type is generally used as the last segment in the limit-line table. However, if the last segment in the table is not of the POINT segment type, an implicit point is automatically added at the right-hand side of the screen. If a visible POINT segment at the right-hand edge of the display is not desired, add an explicit last-point segment to the limit-line table that is higher in frequency than the stop frequency.
Front-Panel Key Access: (DISPLAY)

**Power Menu**
accesses functions which make transmitter power measurements. The measurements are designed for analog radio or continuous carrier digital radio signals.

If another front-panel key is pressed, exiting the power menus, press the (MEAS/USER) key twice to return to the last power menu that was being used.
Front-Panel Key Access: (MEAS/USER)

**POWER ON IP LAST**
determines the state of the spectrum analyzer when the spectrum analyzer is powered on. If the POWER ON function is set to IP, the state of the spectrum analyzer is the same as it is after (PRESET) is pressed, when the spectrum analyzer is powered on. If the POWER ON function is set to LAST, then the state that the spectrum analyzer was left in when it was powered off is recalled.

The setting (IP or LAST) of the POWER ON function is not changed by pressing (PRESET). Use the **POWER ON IP LAST** softkey function to change the setting of the spectrum analyzer state which is recalled at power on. Limit lines are not recalled when the spectrum analyzer is powered up.

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**Note** If you have a downloadable program or "personality" installed in spectrum analyzer memory, the following changes apply to the operation of the POWER ON function: When using a downloadable program or personality, the last state of the personality is not recalled. We recommend that if you are using a downloadable program or personality, you set **POWER ON IP LAST** to IP. If **POWER ON IP LAST** is set to LAST, you must press (PRESET) whenever you power on the spectrum analyzer.

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Front-Panel Key Access: (CONFIG)

**PRESEL DAC**
*HP 8592L, HP 8593E, HP 8595E, or HP 8596E only.*
peaks the YTF preselector by allowing the user to manually adjust the YTF fine-tune DAC. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**PRESEL DEFAULT**
*HP 8592L, HP 8593E, HP 8595E, and HP 8596E only.*
enables default preselector data for bands 1 through 4, to allow maximum frequency response without peaking the preselector. The CAL YTF routine should be performed before pressing **PRESEL DEFAULT**.
Front-Panel Key Access: (AMPLITUDE)

**PRESEL PEAK**
*HP 8592L, HP 8593E, HP 8595E, or HP 8596E only.*
optimally centers the preselector on a given signal for the most accurate measurement of amplitude. The maximum response found for the frequency at the marker determines the future adjustment values that will be provided to the preselector.
Front-Panel Key Access: (AMPLITUDE)

(PRESET) provides a convenient starting point for making most measurements. Pressing (PRESET) displays softkeys used for accessing the operating modes available for your spectrum analyzer. See Table 6-12 and Table 6-11 for the conditions established by pressing (PRESET).

The instrument preset function performs a processor test, but does not affect CAL data. Pressing (PRESET) clears both the input and output buffers, but does not clear trace B. The amplitude values of trace C are set to the reference level. Amplitude-correction factors are turned off. Limit-line testing is turned off, but the limit-line tables remain in spectrum analyzer memory. The status byte is set to 0. Instrument preset affects all operating modes. (See the key description for (MODE) for more information about other operating modes.) Pressing (PRESET) erases all "on time" functions—ONCYCLE, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME, and TRMATH. These are remote programming commands. See the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for more information.

**Note** Turning the spectrum analyzer on performs an instrument preset. Turning on the spectrum analyzer also fetches CAL data; completes a processor test; clears trace B, trace C, and both the input and output buffers; turns off amplitude correction factors; turns off limit-line testing; and sets the status byte to 0. The last state of the spectrum analyzer (before it was switched off) is recalled, unless IP has been set by the POWER ON function.

**Table 6-11. Model Specific Preset Conditions**

| Model | Center Frequency | Span | Start Frequency | Stop Frequency | Sweep Time |
|---|---|---|---|---|---|
| HP 8590L | 900 MHz | 1.8 GHz | 0 Hz | 1.8 GHz | 20 ms (auto-coupled) |
| HP 8591E | 900 MHz | 1.8 GHz | 0 Hz | 1.8 GHz | 20 ms (auto-coupled) |
| HP 8592L | 12.38 GHz | 19.25 GHz | 2.75 GHz | 22 GHz | 385 ms, full span (auto-coupled) |
| HP 8593E | 12.38 GHz | 19.25 GHz | 2.75 GHz | 22 GHz | 385 ms, full span (auto-coupled) |
| HP 8594E | 1.450 GHz | 2.9 GHz | 0 Hz | 2.9 GHz | 58 ms (auto-coupled) |
| HP 8595E | 3.25 GHz | 6.5 GHz | 0 Hz | 6.5 GHz | 130 ms (auto-coupled) |
| HP 8596E | 6.4 GHz | 12.8 GHz | 0 Hz | 12.8 GHz | 256 ms (auto-coupled) |

## Table 6-12. Common Preset Conditions

| | |
|---|---|
| A − B → A | off |
| Amplitude correction factors | off |
| Amplitude units | default values |
| Annotation and graticule display | on |
| Attenuation | 10 dB (auto-coupled) |
| Center frequency | Refer to Table 6-11. |
| CF step size | 10% of span |
| Coupled functions | all set to AUTO |
| Coupling * | AC |
| Mass storage device (card or internal) | INTERNAL |
| Detector | positive peak |
| Display line level | 2.5 graticule divisions below reference level, display off |
| Frequency offset | 0 Hz |
| Limit-line testing | off |
| LIMIHI and LIMILO | cleared |
| Log scale | 10 dB/division |
| Marker counter † | off |
| Marker counter resolution † | auto-coupled |
| Markers | off |
| Mixer level | −10 dBm |
| Operating mode | spectrum analyzer |
| Preselector peak ‡ | reset |
| Reference level | 0 dBm in power-on units |
| Reference level offset | 0 dB |
| Reference level position | top (8th) graticule |
| Resolution bandwidth | 3 MHz (auto-coupled) |
| Span | Refer to Table 6-11. |
| SRQ mask | octal 50 |
| Start Frequency | Refer to Table 6-11. |
| Stop Frequency | Refer to Table 6-11. |
| State registers 1—8 | unaffected |
| Sweep | continuous |
| Threshold level | one graticule above baseline, display off |
| Title | cleared |
| Trace A | clear-write |
| Trace B | store-blank |
| Trace C | store-blank, at reference level |
| Trace registers | unaffected |
| Trigger | free run |
| VBW/RBW ratio | 0.3 |
| Video averaging | off |
| Video bandwidth | 1 MHz (auto-coupled) |

* HP 8594E, HP 8595E, or HP 8596E only.
† All E-Series and L-Series spectrum analyzers except HP 8590L with Option 713.
‡ HP 8592L, HP 8593E, HP 8595E, or HP 8596E only.

**PRESET SPECTRUM** allows the spectrum-analyzer mode only to be preset. Table 6-13 lists the conditions affected by the PRESET SPECTRUM function. Other operating modes will not be affected. See the description of the (MODE) key.

In addition, pressing **PRESET SPECTRUM** erases user-generated graphics and blanks the active-function block that is on the spectrum analyzer screen.

Pressing **PRESET SPECTRUM** disposes of ONEOS, ONSWP, and TRMATH. These are remote programming commands; see the *HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide* for more information.
Front-Panel Key Access: (MODE) or (PRESET)
(continued on next page)

**Table 6-13. Preset Spectrum Conditions for All Models**

| | |
|---|---|
| A − B → A | off |
| Analog+ display mode | off |
| Annotation and graticule | on |
| Attenuation | coupled |
| Center frequency | Refer to Table 6-11. |
| Center frequency step size | 10% of span |
| Coupled functions | all set to AUTO |
| Coupling * | AC |
| Detector | positive peak |
| Display line | off |
| Frequency offset | 0 Hz |
| Harmonic lock † | off |
| Limit-line testing | off |
| Scale | log 10 dB/div |
| Marker counter ‡ | off |
| Marker counter resolution ‡ | 2 kHz (auto-coupled) |
| Markers | off |
| Measure | SA (spectrum analyzer) |
| On end-of-sweep command (ONEOS) | cleared |
| On-sweep command (ONSWP) | cleared |
| Reference level | 0 dBm in power-on units |
| Reference level offset | 0 dB |
| Reference level position | top (8th) graticule |
| Resolution bandwidth | 3 MHz (coupled) |
| Span | Refer to Table 6-11. |
| Start frequency | Refer to Table 6-11. |
| Stop frequency | Refer to Table 6-11. |
| State registers 1—8 | unaffected |
| Sweep | continuous |
| Sweep time | Refer to Table 6-11. (coupled) |
| Threshold | off |
| Trace A | clear-write |
| Trace B | store-blank |
| Trace C | store-blank |
| Trace math command (TRMATH) | cleared |
| Trace registers | unaffected |
| Trigger | free |
| Video averaging | off |
| Video bandwidth | 1 MHz (coupled) |
| Video bandwidth to resolution bandwidth ratio | 0.3 |

* HP 8594E, HP 8595E, or HP 8596E only.
† HP 8592L, HP 8593E, HP 8595E, or HP 8596E only.
‡ All E-Series and L-Series spectrum analyzers except HP 8590L with Option 713.

**Print Config**

*Option 021, 023, or 024 only.*
accesses the softkey functions that are used to address the printer, select a black and white print or a color print (a color print requires an HP PaintJet printer), and reset the printer. See the (COPY) key for more information.
Front-Panel Key Access: (CONFIG)

**PRINTER ADDRESS**

*Option 021 only.*
allows you to change the HP-IB address of the printer. The printer address is set to 1 by pressing **DEFAULT CONFIG**.
Front-Panel Key Access: (CONFIG)

**PRINTER SETUP**

*Option 021, 023, or 024 only.*
resets the printer, sets the printer to 60 lines per page, and skips line perforations. This function enables you to obtain up to three printouts per page. The printer paper should be at the top of the form before using this function. The PRINTER SETUP function may not work with printers that are not recommended (see Chapter 9 for recommended printers).
Front-Panel Key Access: (CONFIG)

**PRT MENU ON OFF**

*Option 021, 023, or 024 only.*
allows the softkey labels to be printed along with the spectrum analyzer display. This function operates when the (COPY) key is used in a print configuration. The PRT MENU function is set to ON when **DEFAULT CONFIG** is pressed.
Front-Panel Key Access: (CONFIG)

**Pulse Param**

*Option 105 only. Option 101 is recommended.*
accesses the gate utility menus for entering the pulse parameters: reference edge, pulse width, and pulse repetition interval. If pulse parameters have previously been entered, pressing **Pulse Param** causes a list of the current values to be displayed.
Front-Panel Key Access: (SWEEP)

**PURGE AMP COR**

clears the current amplitude-correction factors table. Pressing **PURGE AMP COR** displays the message: `If you are sure, press key again to purge data.` Pressing **PURGE AMP COR** a second time clears the amplitude-correction data. Press **SAVE AMP COR** to save amplitude-correction factors, and then press **PURGE AMP COR** to clear the current amplitude-correction factors table.
Front-Panel Key Access: (CAL)

**PURGE LIMITS**

clears the current limit-line table from spectrum analyzer memory. Pressing **PURGE LIMITS** displays the message: `If you are sure, press key again to purge data.` Press **PURGE LIMITS** again if you wish to clear the current limit-line table. Press **SAVE LIMIT** to save the current limit-line table, and then press **PURGE LIMITS** to clear the current limit-line table.
Front-Panel Key Access: (DISPLAY)

**PWRGRAPH ON OFF**

turns the channel power graph ON or OFF. With the PWRGRAPH ON, the channel powergraph is calculated and displayed and the numeric results are not displayed. The value of the channel power is displayed at the selected marker frequency. This graph function is used after doing a channel power measurement with the **CHANNEL POWER** softkey.
Front-Panel Key Access: (MEAS/USER)

**PWR SWP ON OFF** *HP 8590L and HP 8591E with Option 010 or 011. HP 8593E, HP 8594E, HP 8595E, and HP 8596E with Option 010.*
activates (ON) or deactivates (OFF) the power-sweep function, which sweeps the output power of the tracking generator over the selected power-sweep range. The value of the power-sweep range is displayed in the active-function block when **PWR SWP ON OFF** is turned on. The available power-sweep range is a function of the source attenuator setting: For power sweeps, press **SRC ATN MAN AUTO** until (MAN) is underlined so the spectrum analyzer source attenuator is manually set (decoupled). For a given source attenuation setting, the maximum specified power-sweep range is given by the following:

*Power Sweep Range for the HP 8590L and HP 8591E* is (−15 dBm minus the source attenuation setting) to (0 dBM minus the source attenuation setting). For example, if the source attenuation setting is 20 dB, the maximum power sweep range is from −35 dBm (−15 dBm − 20 dB) to −20 dBm (0 dBm − 20 dB). The starting power level is the source power setting. The ending power level is the sum of the source power setting plus the source power sweep setting. Source power sweep may be set as high as 20 dB, but performance is specified only up to 15 dB.

*Power Sweep Range for the HP 8593E, HP 8594E, HP 8595E, and HP 8596E* is also related to the source attenuation setting. See Table 6-14.

**Table 6-14. HP 8593E, HP 8594E, HP 8595E, and HP 8596E**

| Attenuator Setting | Power Sweep Range |
|---|---|
| 0 dB | −1 to −10 |
| 8 dB | −10.1 to −18 |
| 16 dB | −18.1 to −26 |
| 24 dB | −26.1 to −34 |
| 32 dB | −34.1 to −42 |
| 40 dB | −42.1 to −50 |
| 48 dB | −50.1 to −58 |
| 56 dB | −58.1 to −66 |

The output power of the tracking generator is swept according to the sweep rate of the spectrum analyzer. The output power is always swept from the source power setting to a higher power setting (negative source power sweep values are not allowed). Refer to the calibration guide for your instrument for more information regarding source power and source attenuation relationships.

Power-sweep measurements are particularly useful in making gain compression measurements or output power versus frequency measurements.
Front-Panel Key Access: (AUX CTRL)

**QP X10 ON OFF**

*Option 103 only.*
amplifies the video signal ten times (20 dB) in order to make an accurate measurement of a low quasi-peak signal. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: (AUX CTRL)

**QP DET ON OFF**

*Option 103 only.*
turns the quasi-peak detector on and off. This is a service diagnostic function and is for service use only. See either the service documentation or the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: (AUX CTRL) or (CAL)

**QP GAIN ON OFF**

*Option 103 only.*
amplifies the video signal ten times (20 dB). This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**QPD OFFSET**

*Option 103 only.*
sets the offset of the quasi-peak detector. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**QPD RST ON OFF**

*Option 103 only.*
discharges and resets the quasi-peak detector. This is a service diagnostic function and is for service use only.
Front-Panel Key Access: (CAL)

**Quasi Peak**

*Option 103 only.*
accesses the menu of quasi-peak softkey functions and, if there is not an on-screen marker, places a marker on the highest on-screen signal. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: (AUX CTRL)

**(RECALL)**

accesses softkey menus that allow you to recall data from the memory card or spectrum analyzer memory. When INTERNAL is selected, states, traces, limit-line tables, amplitude-correction factors can be recalled from spectrum analyzer memory. When CARD is selected, states, traces, limit-line tables, and amplitude-correction factors, display images, and downloadable programs can be recalled from the memory card. Option 003 is required to use a memory card with the HP 8590L or HP 8592L.

In addition, pressing (RECALL) accesses the cataloging functions used to catalog the saved data that is in spectrum analyzer memory or on the memory card. It also accesses the DLP editor utility.

**RECALL AMP COR** recalls an amplitude-correction factors table from the current mass-storage device (spectrum analyzer memory or memory card). To verify the current mass storage device, press **RECALL AMP COR** . If MAX REG # appears on the spectrum analyzer display, the current mass storage device is spectrum analyzer memory. If PREFIX= is displayed, the memory card is the mass storage device. Press (SAVE) or (RECALL), then **INTERNAL CARD** to change the current mass storage device. To recall an amplitude-correction factors table, enter the register number that the table was previously saved under, then press (ENTER). When recalling an amplitude-correction factors table from the memory card, it may be necessary to change the current prefix to the prefix with which the table was stored. Press **Change Prefix** to change the current prefix. When saved in spectrum analyzer memory, the register number is restricted to the range between 0 and the number x indicated by MAX REG# = x. The screen title is not recalled with the amplitude-correction factors table.
Front-Panel Key Access: (CAL)

**RECALL LIMIT** recalls limit-line tables from the current mass-storage device (spectrum analyzer memory or memory card). To verify the current mass-storage device, press **RECALL LIMIT** . If MAX REG # appears on the spectrum analyzer display, the current mass-storage device is spectrum analyzer memory. If PREFIX= is displayed, the memory card is the mass-storage device. Press (SAVE) or (RECALL), then **INTERNAL CARD** to change the current mass-storage device. To recall a limit line, enter the register number that the limit-line tables was saved under, then press (ENTER). When recalling a limit line from the memory card, it may be necessary to change the current prefix to the prefix with which the limit line was stored. Press **Change Prefix** to change the current prefix. When saved in spectrum analyzer memory, the register number is restricted to the range between 0 and the number x indicated by MAX REG# = x. The screen title is not recalled with the limit-line tables.
Front-Panel Key Access: (DISPLAY)

**REF LVL** allows the reference level to be changed. This function is activated when (AMPLITUDE) is pressed. The reference level is the amplitude power or voltage represented by the top graticule line on the screen. Changing the value of the reference level changes the absolute amplitude level (in dBm) of the top graticule line. Pressing any digit, 0 through 9, on the numeric keypad brings up the selected terminator menu.
Front-Panel Key Access: (AMPLITUDE)

**REF LVL OFFSET** adds an offset value to the displayed reference level. Offsets are entered by using the number/units keypad. Entering an offset does not affect the trace or the attenuation value. Reference-level offsets are used when gain or loss occurs between a device under test and the spectrum-analyzer input. Thus, the signal level measured by the spectrum analyzer is the level at the input of an external amplitude-conversion device. When an amplitude offset is entered, its value is displayed on the left side of the screen (as opposed to frequency offsets which are displayed at the bottom of the screen). To eliminate an offset, press **REF LVL OFFSET** , 0 (-dBm) or (+dBm). Pressing (PRESET) also sets the offset to zero. Reference-level offsets are entered using the numeric keypad. See also the **EXTERNAL PREAMPG** softkey description.
Front-Panel Key Access: (AMPLITUDE)

**RES BW AUTO MAN** changes the spectrum analyzer's 3 dB resolution bandwidth. As the resolution bandwidth is decreased, the sweep time is increased to maintain amplitude calibration. Resolution bandwidth is also related to span. As span is decreased, the resolution bandwidth is decreased. A "#" mark appears next to RES BW on the screen to indicate that it is not coupled. To recouple the resolution bandwidth, press **RES BW AUTO MAN** so that AUTO is underlined. The resolution bandwidth can be changed using the step keys, the knob, or the numeric keypad.
Front-Panel Key Access: (AUTO COUPLE) or (BW)

**RETURN** *Option 103 only.*
returns the spectrum analyzer to the settings that were present when **MAN QP AT MKR** was pressed, displays the quasi-peak amplitude value and the quasi-peak marker if **ACCEPT QP DATA** was pressed, and returns to the previous quasi-peak softkey menu. See the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E Option 103 supplement documentation for more information.
Front-Panel Key Access: (AUX CTRL)

**RPG TITLE** provides additional characters for the Change Title function. Pressing **RPG TITLE** provides lowercase letters, numbers, Greek letters, and punctuation symbols. When **RPG TITLE** is pressed, a character table appears on the screen. To select a character, turn the knob to position the cursor under the desired character and press the (ENTER) key. The step keys move the cursor between rows. When all characters have been entered, press WINDOWS (NEXT), or for an HP 8590L or HP 8592L, press (HOLD). All other spectrum analyzer functions are unaccessible until the (NEXT) or (HOLD) key is pressed.
Front-Panel Key Access: (CAL) or (DISPLAY)

**SAV LOCK ON OFF** locks all the current internal state and trace registers against further data storage, when ON is underlined. With the state and trace memory locked, the **STATE → INTRNL** and **Trace → Intrnl** softkey functions are no longer accessible; the **MEM LOCKED** softkey function is displayed instead. Pressing **DEFAULT CONFIG** or (PRESET) sets **SAV LOCK ON OFF** to OFF.

**Note**

When **SAV LOCK ON OFF** is set to ON, none of the state registers, (1-8), can be overwritten. The spectrum analyzer automatically updates state register nine with the last state.

**ERASE MEM ALL** ignores the state of the **SAV LOCK**. So, even if STATES and TRACES are locked, they will still be erased by **ERASE MEM ALL**.

Front-Panel Key Access: (SAVE)

**SAVE**

accesses softkey menus that allow you to store state data, trace data, limit-line tables, and amplitude-correction factors on a memory card or in spectrum analyzer memory. The SAVE function also allows you to save state data, trace data, limit-line tables, amplitude-correction factors, and program data on the memory card. In addition, pressing **SAVE** accesses the softkey menus used to catalog the saved data in spectrum analyzer memory or on the memory card.

To save to, or catalog from, spectrum analyzer memory press **INTERNAL CARD** so that INTERNAL is underlined. To save to, or catalog from, the memory card, press **INTERNAL CARD** so that CARD is underlined. The HP 8590L or HP 8592L must have Option 003 for memory card operation.

Saving state data saves the spectrum analyzer settings, but not the trace data. Saving trace data saves both the trace data and the state data. Display images and programs (also called downloadable programs or DLPs), can only be saved to or recalled from the memory card.

States and traces are saved in spectrum analyzer memory even if the instrument is turned off or **PRESET** is pressed. Eight spectrum analyzer-memory state registers and many trace registers are available for the user. The **Catalog Internal** softkey is used to access the catalog functions. It also accesses the DLP editor utility.

**SAVE AMP COR**

saves the current amplitude-correction factors table to the current mass-storage device (spectrum analyzer memory or memory card). To verify the current mass storage device, press **SAVE AMP COR**. If **MAX REG #** appears on the spectrum analyzer display, the current mass storage device is spectrum analyzer memory. If PREFIX= is displayed, the memory card is the mass storage device. Press **SAVE** or **RECALL**, then **INTERNAL CARD** to change the current mass storage device. Press **SAVE AMP COR**, enter a register number, then press **ENTER** to save the current amplitude-correction factors table in spectrum analyzer memory or on the memory card. When saved on the memory card, amplitude-correction factors tables are stored with "a_", the prefix, and the register number entered. When saved in spectrum analyzer memory, the register number is saved in a trace register. Trace register values are restricted to a range between 0 and the number x indicated by **MAX REG# = x**.
Front-Panel Key Access: **CAL**

**SAVE EDIT**

*For Options 021 and 023 only. Refer to the HP 8590 E-Series and L-Series Spectrum Analyzer, and HP 8591C Cable TV Analyzer, Programmer's Guide for more information.*
passes the text from the DLP editor memory through the parser to execute as spectrum analyzer commands. Pressing **SAVE EDIT** is similar to outputting the text to the spectrum analyzer from an external controller. If the text (commands) is a valid user-defined function, it passes through the parser and into the spectrum analyzer user memory. It will replace an existing user defined function of the same name.

The DLP editor memory buffer remains intact when the spectrum analyzer is preset or powered off so the text being edited will not be lost.
Front-Panel Key Access: **RECALL** or **SAVE**

**SAVE LIMIT**
saves the current limit-line tables in the current mass-storage device (spectrum analyzer memory or memory card). To verify the current mass-storage device, press **SAVE LIMIT**. If MAX REG # appears on the spectrum analyzer display, the current mass-storage device is spectrum analyzer memory. If PREFIX= is displayed, the memory card is the mass-storage device. Press (SAVE) or (RECALL), then **INTERNAL CARD** to change the current mass-storage device. Press **SAVE LIMIT**, enter a register number, then press (ENTER) to save the current limit-line table in spectrum analyzer memory or on the memory card. When saved on the memory card, limit-line tables are stored with "l_", the prefix, and the register number entered. When saved in spectrum analyzer memory, the register number is saved in a trace register. Trace-register values are restricted to a range between 0 and the number x indicated by MAX REG # = x.
Front-Panel Key Access: (DISPLAY)

**SCALE LOG LIN**
scales the vertical graticule divisions in logarithmic units when LOG is underlined. When the SCALE LOG LIN function is the active function, the logarithmic units per division can be changed. Values may range from 0.1 to 20 dB per division. When LIN is underlined, the vertical scale is in linear mode which has a range of 1 kW to 1 pW. The reference-level value is set to the top of the screen and the bottom graticule becomes zero volts. (Each division of the graticule is one-eighth of the reference level in volts.)

Pressing **SCALE LOG LIN** always sets the units specified for the current amplitude scale. Pressing (PRESET) or powering on the spectrum analyzer sets the default units.
Front-Panel Key Access: (AMPLITUDE)

**SECAM-L**
*Requires Option 301, or both Options 101 and 102.*
triggers on the SECAM-L video formats. Pressing **SECAM-L** alters the TV line number that the spectrum analyzer triggers on internally; the line number displayed when **TV LINE #** does not change. Pressing **SECAM-L** changes the video modulation to positive; set **TV SYNC NEG POS** to NEG if negative video modulation is required.
Front-Panel Key Access: (TRIG)

**SELECT 1 2 3 4**
selects one of the four possible markers. A marker can be turned on once it is selected. A marker that has already been turned on will become active when it is selected. If a marker has already been turned on and assigned to a specific trace it will become active on that trace and the **MK TRACE AUTO ABC** softkey will have the appropriate trace letter underlined.
Front-Panel Key Access: (MKR)

**SELECT AMPLITUD**
allows you to enter either the amplitude value for the displayed (upper or lower) limit-line segment or the amplitude value for the current amplitude-correction point. Enter the amplitude value for the selected frequency or time by using the data keys. Change an amplitude value by using the step keys or the knob. Press (BK SP) to correct errors.
Front-Panel Key Access: (CAL) or (DISPLAY)

**SELECT DLT AMPL**
allows you to enter the delta amplitude value. The middle amplitude value and the delta amplitude value create an upper and lower limit-line segment. Enter the delta amplitude value for the selected frequency or time by using the knob or data keys. Press (BK SP) to correct errors. The default value is 0.
Front-Panel Key Access: (DISPLAY)

**SELECT FREQ** allows you to enter the frequency value for a limit-line segment or for an amplitude-correction point. Enter the frequency value for the frequency by using the data keys. Change the frequency value by using the step keys or the knob. Press (BK SP) to correct errors.

A frequency coordinate must always be specified for either limit lines or amplitude-correction factors.

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**Note**

Limit-line data is sorted in frequency order in the limit-line table. The sorting occurs after you have entered the frequency and at least one amplitude value.

For amplitude-correction factors, only two entries with the same frequency are valid. Only the first and last points of a series with the same frequency values are used; the middle points are ignored.

Amplitude-correction data is sorted in the table by frequency. The sorting occurs immediately after you have entered the frequency value via the front-panel.

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Front-Panel Key Access: (CAL) or (DISPLAY)

**SELECT LWR AMPL** allows you to enter the amplitude value for the lower limit-line segment. Enter the amplitude value for the selected frequency or time by using the knob or data keys. Press (BK SP) to correct errors.
Front-Panel Key Access: (DISPLAY)

**SELECT MID AMPL** allows you to enter the middle amplitude value. The middle amplitude value and the delta amplitude value create upper and lower limit-line segments. Enter the amplitude value for the selected frequency or time by using the knob or data keys. Press (BK SP) to correct errors.
Front-Panel Key Access: (DISPLAY)

**SELECT POINT** allows you to create or edit an amplitude-correction factor data point. Enter the point number to be created or edited by using the data keys, then press (ENTER). Press (BK SP) to correct errors.
Front-Panel Key Access: (CAL)

**SELECT PREFIX** allows you to select an already existing prefix of a cataloged file and changes the current prefix to this selected prefix. This provides a convenient method for saving and recalling data to and from the memory card and for cataloging by the prefix. Use either the knob or step keys to select the file.
Front-Panel Key Access: (RECALL) or (SAVE)

**SELECT SEGMENT** allows you to create or edit a limit-line segment. Limit lines are created by entering frequency (or time) and amplitude values into a limit-line table. The frequency (or time) and amplitude values specify a coordinate point from which a limit-line segment is drawn. The coordinate point is the lowest frequency or time point of the line segment. Limit lines are constructed from left to right. To select a segment, press **SELECT SEGMENT** , enter the segment number you wish to specify, then press a units key.

Up to 20 segments can be specified per limit-line table.
Front-Panel Key Access: (DISPLAY)

**SELECT TIME** allows you to enter the time value for a limit-line segment. The time value is with respect to the spectrum analyzer's sweep time. A time value of zero is the start of the sweep, which is the left edge of the graticule. Enter the time value by using the data keys. Change the time value by using the step keys or the knob. Press (BK SP) to correct errors.

**Note** Limit-line data is sorted in time order in the limit-line table. The sorting occurs after you have entered the time and at least one amplitude value.

Front-Panel Key Access: (DISPLAY)

**SELECT TYPE** accesses the softkey menu used to select the limit-line type of line. Press **FLAT** to select a flat line, press **SLOPE** to select a sloped line, or press **POINT** to select a point.
Front-Panel Key Access: (DISPLAY)

**SELECT UPR AMPL** allows you to enter the amplitude value for the upper limit-line segment. Enter the amplitude value for the selected frequency or time by using the knob or data keys. Press (BK SP) to correct errors.
Front-Panel Key Access: (DISPLAY)

**Service Cal** accesses several service calibration functions. The service calibration functions are designed for service use only. More detailed descriptions of the service functions are available in the service documentation. Service documentation can be obtained by ordering Option 915 through your HP Sales and Service office. For a listing of all available service calibration functions, refer to "Service Functions" at the beginning of this chapter.
Front-Panel Key Access: (CAL)

**Service Diag** accesses several service diagnostic functions. The service diagnostic functions are designed for service use only. More detailed descriptions of the service diagnostic functions are available in the service documentation. Service documentation can be obtained by ordering Option 915 through your HP Sales and Service office. For a listing of all available service diagnostic functions, refer to "Service Functions" at the beginning of this chapter.
Front-Panel Key Access: (CAL)

**SET ATTN ERROR** sets the calibration attenuator-error factors (this is not the same as the input attenuator). This is a service calibration function and is for service use only.
Front-Panel Key Access: (CAL)

**Set B&W Printer** accesses the softkeys for setting up black and white HP and Epson compatible printers.
Front-Panel Key Access:(CONFIG)

**Set Colr Printer** accesses the softkey for setting up the HP PaintJet and DeskJet printers.
Front-Panel Key Access:(CONFIG)

**SET DATE** allows you to set the date of the real-time clock. Enter the date in the YYMMDD format using the number keypad and press (ENTER). Valid year (YY) values are 00 through 99. Valid month (MM) values are from 01 to 12, and valid day values are from 01 to 31.
Front-Panel Key Access: (CONFIG)

**SET TIME** allows you to set the time of the real-time clock. Enter the time in 24 hour, HHMMSS format, using the number keypad and pressing (ENTER). Valid hour (HH) values are from 00 to 23. Valid minute (MM) and second (SS) values are from 00 to 59.
Front-Panel Key Access: (CONFIG)

**Setup** accesses the menu used to set up parameters specific to the power measurements.

If another front-panel key is pressed, exiting the power menus, press the (MEAS/USER) key twice to return to the last power menu that was being used.
Front-Panel Key Access: (MEAS/USER)

**(SGL SWP)** changes the sweep control to single sweep if the spectrum analyzer is in the continuous sweep mode. It executes a sweep after the trigger condition is met.

**SHOW OPTIONS** displays the number and description of the options installed in your spectrum analyzer, the instrument model number of the spectrum analyzer, the last five digits of the spectrum analyzer's serial number, and the firmware revision. Pressing **SHOW OPTIONS** changes the softkey label to **EXIT SHOW**. Press **EXIT SHOW** to erase the SHOW OPTIONS function information.

Pressing **SHOW OPTIONS** displays the individual option numbers. It will not show combination options such as Option 301, instead both options 101 and 102 will be displayed.
Front-Panel Key Access: (CONFIG)

**SIGNAL ID** activates an FFT marker that must be put on a signal to verify that it is not being displayed at the wrong frequency due to aliasing. Once the marker is on the signal press **SIGNAL ID** again to initiate the signal identification function. The signal should move half of a division to the right for 2 seconds. A marker will be put at the frequency that the signal should move to. If the marker appears on the signal when it is shifted, then the frequency readout of the signal is correct. Sweep time limitations may alter or stop the function from executing.

If the marker or the signal is less than half of a division from the right side of the display before **SIGNAL ID** is pressed, then the routine may not function correctly and a warning message can be displayed.
Front-Panel Key Access: (MEAS/USER)

**SINGLE FFT** initializes the fast Fourier transform (FFT) function. If the spectrum analyzer is in single sweep mode, an FFT is performed on trace A without taking a new sweep. If the spectrum analyzer is in continuous sweep, it is put in single sweep, a sweep is taken, and the FFT is performed. If the spectrum analyzer is already in the FFT mode it is put in single sweep, a sweep is taken, and an FFT is performed. Pressing **SINGLE FFT** again or pressing (SGL SWP) will take another sweep and perform an FFT.

After using the FFT function, the display is in log mode. The markers are put in the FFT mode for use in evaluating the data. The signal being transformed is in trace A and the Fourier transform of the signal is in trace B. (Any information that was in trace B and C will be lost.) Press **FFT OFF** to return the spectrum analyzer to normal operation.

Refer to Chapter 4, "Measuring Amplitude Modulation Using the Fast Fourier Transform Function," for more information.
Front-Panel Key Access: (MEAS/USER)

**SINGLE MEAS** sets the functions in the **Power Menu** so that they make the measurement on a single sweep. After a power measurement is activated, pressing **SINGLE MEAS** or (SGL SWP) initiates a sweep and recalculates the measurement results.
Front-Panel Key Access: (MEAS/USER)

**SLOPE** draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all frequencies between the two points.
Front-Panel Key Access: (DISPLAY)

(SPAN) or **SPAN** activates the SPAN function and accesses the frequency-span functions. Pressing **SPAN** allows the user to change the frequency range symmetrically about the center frequency. The frequency-span readout describes the total displayed frequency range; to determine frequency span per horizontal graticule division, divide the frequency span by 10.
Front-Panel Key Access: (SPAN)

**SPAN ZOOM** finds the highest signal peak on-screen. If a marker is not already on the peak, it places a marker on it, turns on the marker-track function, and activates the span function. Pressing **SPAN ZOOM** performs the routine similar to pressing the following keys: (PEAK SEARCH), (MKR FCTN), **MK TRACK ON OFF** (ON), and (SPAN).
Front-Panel Key Access: (SPAN)

**SPEAKER ON OFF** *Option 102, 103, or 301 only.*
turns the internal speaker on and off. The volume from the speaker is controlled by the front-panel volume control knob and **FM GAIN** (when using FM demodulation). There is no output from the speaker unless demodulation is turned on. Pressing (PRESET) sets **SPEAKER ON OFF** to ON.
Front-Panel Key Access: (AUX CTRL)

**SPECTRUM ANALYZER** sets the spectrum analyzer to the spectrum analyzer operating mode and accesses the **PRESET SPECTRUM** softkey function.
Front-Panel Key Access: (MODE) or (PRESET)

**SOURCE** *Option 102, 103, or 301 only.*

**SWEEP** *Option 105 only. Option 101 is recommended.*

**TIMEDATE ON OFF** turns the display of the real-time clock on or off. Pressing **DEFAULT CONFIG** sets **TIMEDATE ON OFF** to ON.
Front-Panel Key Access: (CONFIG)

**TOI ON OFF** finds the third-order intercept of the two highest amplitude signals and the two associated distortion products. The effect of unequal test signal amplitude is compensated for. The measurement runs continuously, re-executing at the end of each sweep. The units for the displayed value can be selected by pressing **Amptd Units** softkey. The two test signals and the two associated distortion products must all be displayed for the measurement to function. The relative amplitudes and frequencies of the displayed signals must fit the TOI pattern. All of the signals must be greater than the peak excursion above the threshold.
Front-Panel Key Access: (MEAS/USER)

(TRACE) accesses the trace softkeys that allow you to store and manipulate trace information. Each trace is comprised of a series of data points that form a register where amplitude information is stored. The spectrum analyzer updates the information for any active trace with each sweep. If two traces are being written to, they are updated on alternating sweeps. (Also see "Screen Annotation" in Chapter 2.)

**TRACE A B C** selects the softkey menu used for trace A, trace B, or trace C functions. Press **TRACE A B C** until the letter of the desired trace is underlined.
Front-Panel Key Access: (TRACE)

**TRACE A** sets up trace A for recalling previously-saved trace data into trace A or saving trace data from trace A.
Front-Panel Key Access: (RECALL) or (SAVE)

**TRACE B** sets up trace B for recalling previously-saved trace data into trace B or saving trace data from trace B.
Front-Panel Key Access: (RECALL) or (SAVE)

**TRACE C** sets up trace C for recalling previously-saved trace data into trace C or saving trace data from trace C.
Front-Panel Key Access: (RECALL) or (SAVE)

**Trace → Card** begins the process used to save trace data, limit-line tables, or amplitude-correction factors on the memory card. Pressing **Trace → Card** accesses a softkey menu that allows you to select the trace to be saved (trace A, trace B, or trace C) and accesses the **LIMIT LINES** and **AMP COR** softkeys.

To save a trace, press **TRACE A**, **TRACE B**, or **TRACE C**, use the numeric keypad to enter a trace register number, and press (ENTER). To save limit-line tables or amplitude-correction factors, press **LIMIT LINES** or **AMP COR**, use the numeric keypad to enter a trace register number, and press (ENTER). If windows are being used, only the trace of the active window will be saved.

If you want the file name of the stored data to contain a prefix, press **Change Prefix** to enter a prefix before storing the data. If the trace data was stored using a prefix, the file name is t(prefix)_(register number). If no prefix was available, the data is stored under t_(register number). File names for limit-line tables and amplitude-correction factors are treated the same way as file names for trace data, except "l" or "a" is used instead of "t." If a screen title is present, it is saved with the trace data. The time and date that the data was stored is appended to the screen title.

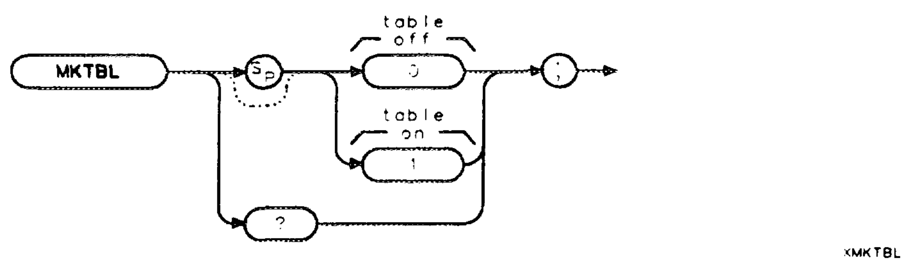
When comparing a trace displayed in view mode with a recalled trace, it is possible to over-write the displayed trace by recalling the trace data. This can happen because the instrument state is saved (and recalled) with the trace data.

For example, if you save trace A when it is in clear-write mode, place trace A in view mode, then recall the trace data into trace B, trace B will be placed in view mode, but the trace mode of trace A is changed to clear-write mode (since the trace mode of trace A was clear-write when it was saved). To avoid this problem, we change the trace mode of the traces to view or blank mode before saving the trace data.
Front-Panel Key Access: (SAVE)

# MKTBL
# Marker Table

Turns on or off the marker table.

## Syntax




Equivalent Softkey: **MK TABLE ON OFF** .
Preset State: 0 (marker table is off).
Related Commands: DL, MKDLMODE.

## Example

`OUTPUT 718;"MOV MKTBL,1;"` *Turns on the marker table.*

## Description

When the marker table is turned on, the spectrum analyzer screen displays two windows. The upper window displays the traces and the graticule, and the lower window displays the marker table. The marker table displays the following information about the on-screen markers: the trace (trace A, B, or C) on which the marker is located, the type of marker (frequency, time, inverse sweep time, or period), the frequency or time of the marker, and the amplitude of the marker. While the marker table is turned on, the marker table data is updated at the end of every sweep, or whenever a marker is moved. (MKTBL command uses the ONMKRU command to update the marker table information).

The marker table is displayed on the spectrum analyzer display only. To obtain the information that is displayed in the marker table remotely, you must use the following programming commands.

- Use MKACT to select a marker. Use the MKACTV command makes the selected marker the active function.
- Use MKA? to determine the amplitude of a marker.
- Use MKF? to determine the frequency or time of a marker.
- Use MKREAD? to determine the type of marker.
- Use MKTRACE? to determine which trace the marker is located on.

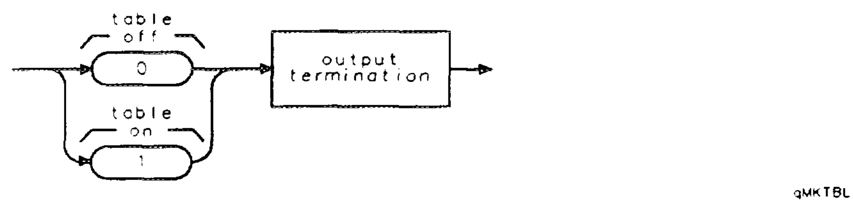
**Restrictions**
Turning on the marker table turns off following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW). Marker noise (MKNOISE) and marker counter (MKFC) are not available with the marker table.

**MKTBL Marker Table**

You can execute the MKTBL command two different ways. You can either execute the MKTBL command directly (for example, "MKTBL 1;") or use the MOV command to move the 1 or 0 into the MKTBL command (for example, "MOV MKTBL,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

You should turn off the marker table (set MKTBL to 0) when you are done with the marker table.

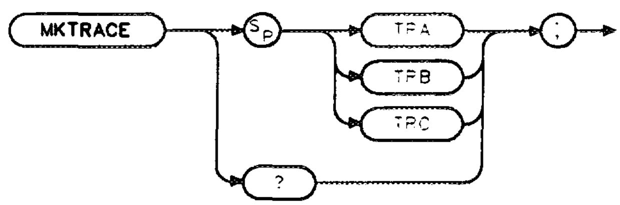
## Query Response



# MKTRACE
# Marker Trace

Moves the active marker to a corresponding position in trace A, trace B, or trace C.

## Syntax



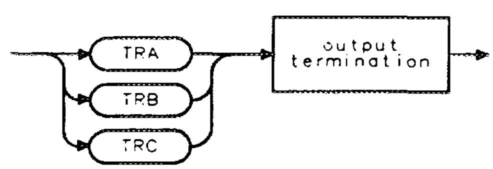

XMKTRACE

Equivalent Softkey: **MK TRACE AUTO ABC** .

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"MKMIN;"` | *Finds the lowest amplitude of trace.* |
| `30 OUTPUT 718;"MKTRACE TRB;"` | *Moves marker to corresponding position on trace B.* |
| `40 OUTPUT 718;"BLANK TRA;CLRW TRB;"` | *Blanks trace A and displays trace B.* |
| `50 END` | |

## Query Response

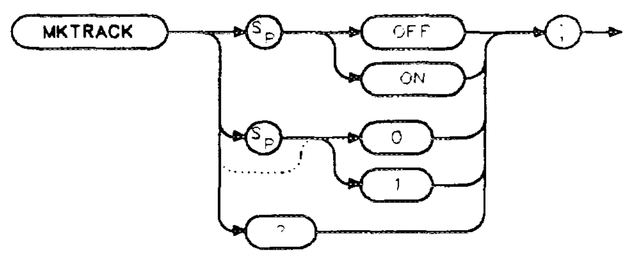



QMKTRACE

# MKTRACK
# Marker Track

Moves the signal on which the active marker is located, to the center of the spectrum analyzer display and keeps the signal peak at center screen.

## Syntax




XMKTRACK

Equivalent Softkey: **MK TRACK ON OFF** .

Related Commands: MKA, MKCF, MKF.

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

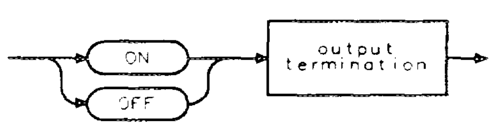
## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"CF 300MHZ;TS;"` | *Changes the center frequency.* |
| `OUTPUT 718;"MKTRACK ON;"` | *Activates the marker track.* |
| `OUTPUT 718;"SP 10MHZ;TS;"` | *Changes the span.* |
| `OUTPUT 718;"MKTRACK OFF;"` | *Turns off the marker track.* |

## Description

To keep a drifting signal at center screen, place the active marker on the desired signal before turning on MKTRACK.

## Query Response

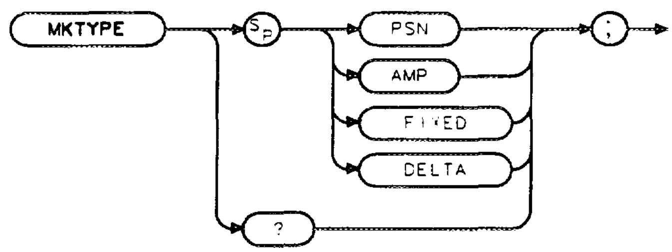



QQ2

# MKTYPE
# Marker Type

Changes the type of the current active marker.

## Syntax




XMKTYPE

Equivalent Softkey: The functions of MKTYPE AMP and **MARKER AMPTD** are equivalent.
Preset State: MKTYPE PSN.
Related Commands: MKA, MKBW.

## Example

`OUTPUT 718;"MKTYPE AMP;MKA -5;"` *Positions the marker at −5 dBm.*

## Description

The marker types are as follows:

**PSN** allows markers to be positioned according to the horizontal position on the display. The marker type is set to PSN after an instrument preset.

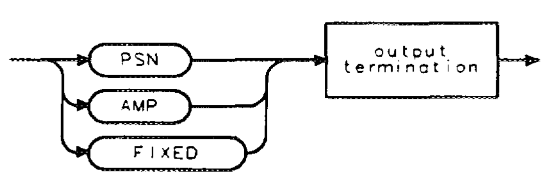
**AMP** allows markers to be positioned according to amplitude, as shown in the example. If two or more points on the trace are at the same amplitude, the marker is moved to the closest point on the trace with the correct amplitude. If no point on the trace is at the specified amplitude, the marker is placed at the specified amplitude and not on the trace.

**FIXED** allows a marker to be placed at any fixed point on the spectrum analyzer screen. The position of the marker cannot be changed unless another marker type is used.

**DELTA** allows the marker frequency to be positioned with respect to another marker.

Use "MKTYPE PSN" to return from using the AMP, FIXED, or DELTA types.

## Query Response

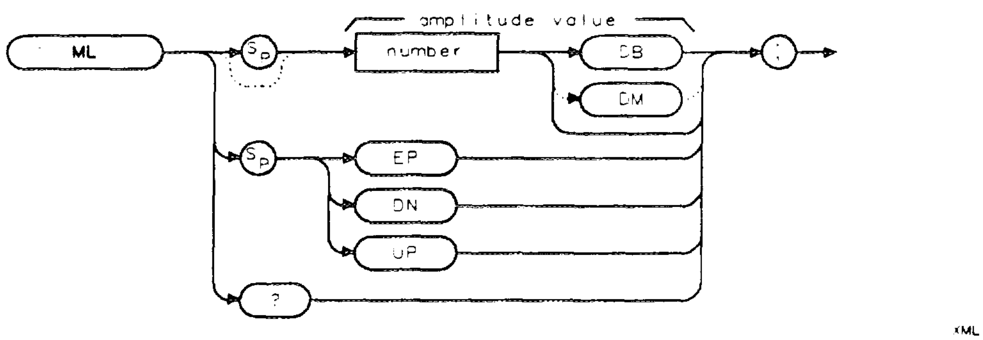



QMKTYPE

# ML
# Mixer Level

Specifies the maximum signal level that is applied to the input mixer for a signal that is equal to or below the reference level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | −10 to −60 dBm. |

Equivalent Softkey: **MAX MXR LEVEL** .
Preset State: −10 dBm.
Step Increment: by 10 dBm.
Related Commands: AT, ROFFSET.

## Example

`OUTPUT 718;"ML -40DM;"`

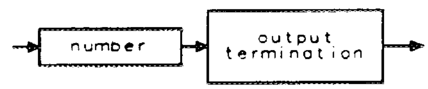
*As the reference level is changed, the coupled input attenuator is changed automatically. This limits the maximum signal at the mixer input to −40 dBm for signals less than or equal to the reference level.*

## Description

The ML command specifies the maximum signal level that is applied to the input mixer for a signal that is equal to or below the reference level.

The effective mixer level is equal to the reference level minus the input attenuator setting. When ML is activated, the effective mixer level can be set from −10 dBm to −60 dBm in 10 dB steps.

## Query Response

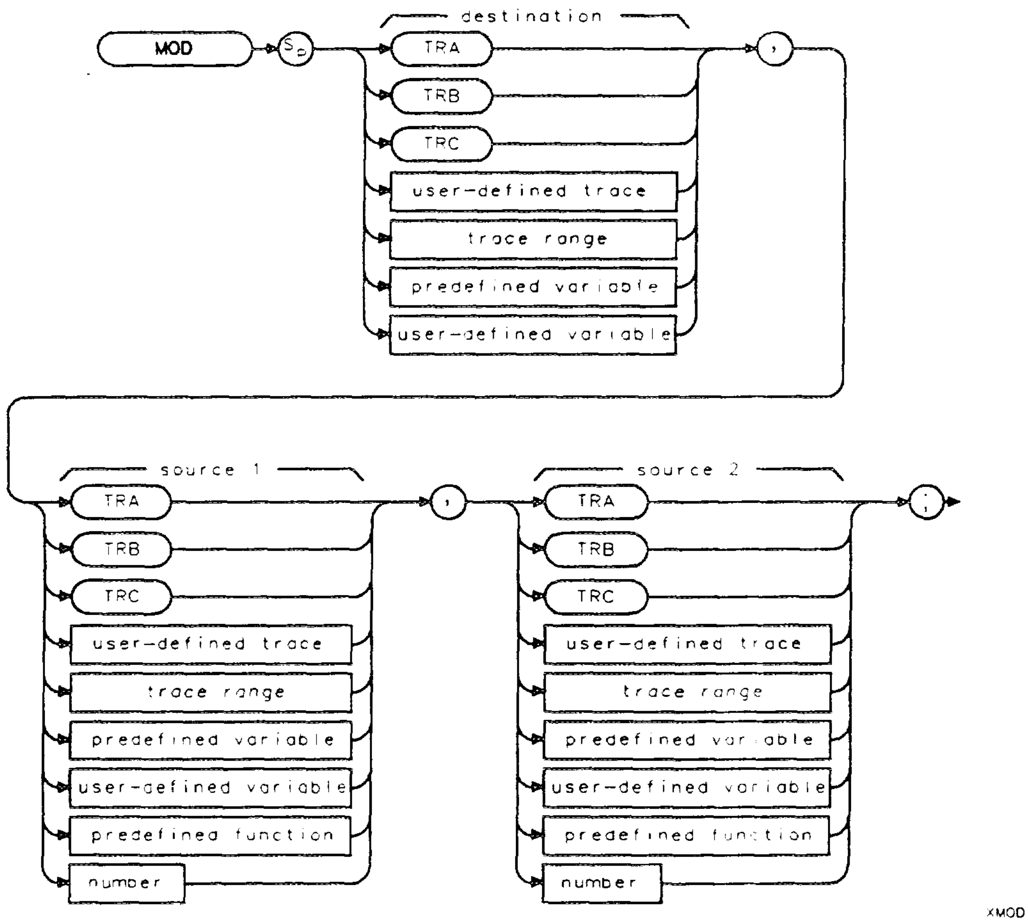



QQ1

# MOD
# Modulo

Stores the remainder from the division of source 1 by source 2 in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: DIV.

## Example

```
10 OUTPUT 718;"VARDEF S_ONE,15;"
20 OUTPUT 718;"VARDEF S_TWO,4;"
30 OUTPUT 718;"VARDEF D_EST,0;"
40 OUTPUT 718;"MOD D_EST,S_ONE,S_TWO;"
50 OUTPUT 718;"D_EST?;"
60 ENTER 718;Number

70 DISP Number
80 END
```

*Places 15 into S_ONE.*
*Places 4 into S_TWO.*
*D_EST holds the result.*

*Moves the result to the computer.*
*Puts the spectrum analyzer response in the computer variable, Number.*
*Displays a 3.*

## Description

If source 1 is a negative number and source 2 is a positive number, the MOD function returns a negative remainder. If both sources are negative, the MOD function returns a negative remainder.

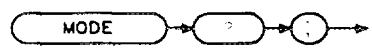
Integer values are used when a trace is the destination or one of the sources. If trace data is used as the source and the destination, the MOD function is done with 32-bit arithmetic using 16-bit integer data. If a user-defined variable or predefined variable is used as the source or destination, the MOD function is done in floating point format. If a real number is used as a source, but the destination is an integer value, the result is truncated. If a trace is used as a source, be sure the trace contains a complete sweep of measurement information before executing MOD.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MODE
# Mode

Returns a "0" if the mode of operation is spectrum analysis. A number other than "0" is returned if the operating mode is other than spectrum analysis.

## Syntax




XMODE

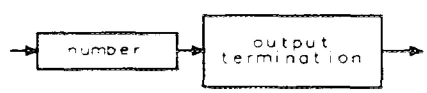
## Example

```
OUTPUT 718;"MODE?;"
```

## Description

All spectrum analyzers have the spectrum analyzer mode of operation. If a program (also called a downloadable program or personality) has been loaded into the spectrum analyzer's memory, and the spectrum analyzer is using the personality mode, the number that is returned by MODE may be modified.

## Query Response

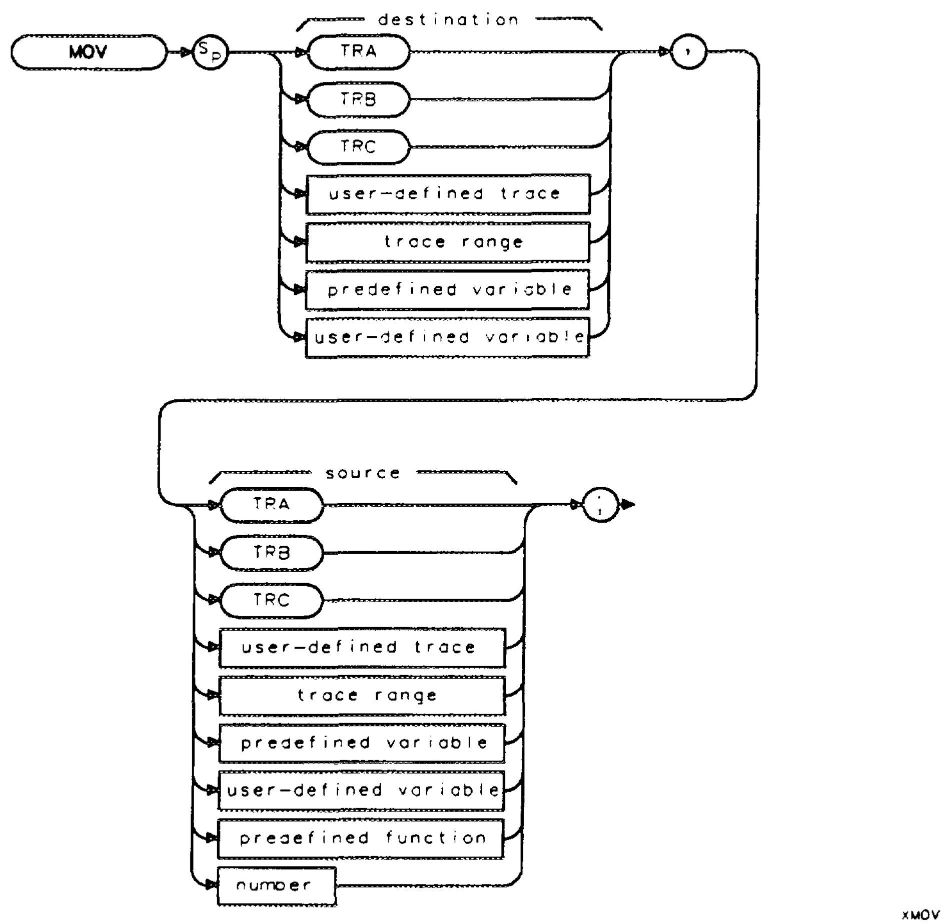



QO1

# MOV
# Move

Copies the source values into the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable.

## Example

| | |
|---|---|
| `10 CLEAR 718` | *Clears the HP-IB bus and spectrum analyzer.* |
| `20 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `30 OUTPUT 718;"FA 100MHZ;FB 1100MHZ;"` | *Sets up the measurement range.* |
| `40 OUTPUT 718;"TS;MKPK HI;"` | *Places a marker at the highest peak.* |
| `50 OUTPUT 718;"DL ON;"` | *Turns on display line.* |
| `60 OUTPUT 718;"MOV DL,MKA;"` | *Sets the display-line value equal to the marker amplitude by storing the value of the marker amplitude variable, MKA, in the display line variable, DL.* |
| `70 END` | |

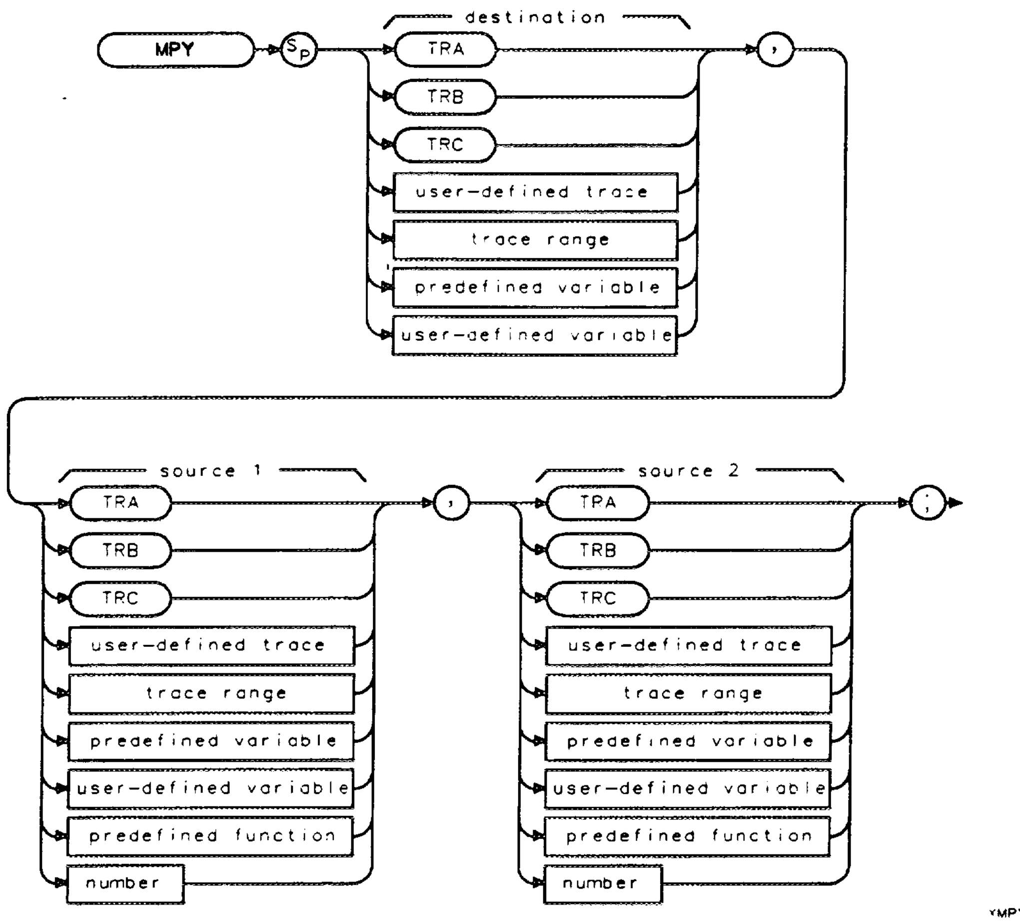
## Description

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MPY
# Multiply

Multiplies the sources, point by point, and places the results in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.

## Example

```
OUTPUT 718;"MPY CF,CF,2;"
```
*Doubles the center frequency.*

## Description

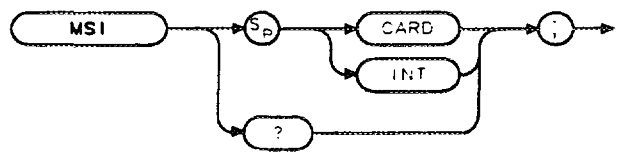
Traces, user-defined traces, and trace ranges are multiplied as 16-bit integers. Negative numbers are represented in two's complement format. Single variables and numbers are treated as floating point numbers and must be within the real number range as defined in Table 5-1.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MSI
# Mass Storage Is

Allows you to specify the current mass storage device as the spectrum analyzer memory or a memory card.

## Syntax




XMSI

Related Commands: CAT, SAVRCLN.

## Example

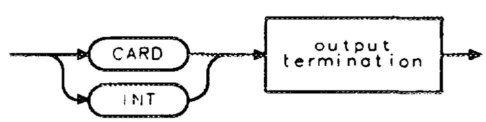
`OUTPUT 718;"MSI CARD;"` *Selects the memory card as the current mass storage device.*

## Description

If you specify INT, the current mass storage device is set to spectrum analyzer memory. If you specify CARD, the current mass storage device is set to the memory card. *For the HP 8590D or HP 8592D only:* Your spectrum analyzer must have Option 003 installed in it to select the memory card as the mass storage device.

If MSI is used as a predefined variable, it returns a "0" if the mass storage device is the spectrum analyzer memory and a "1" if it is the memory card.

## Query Response

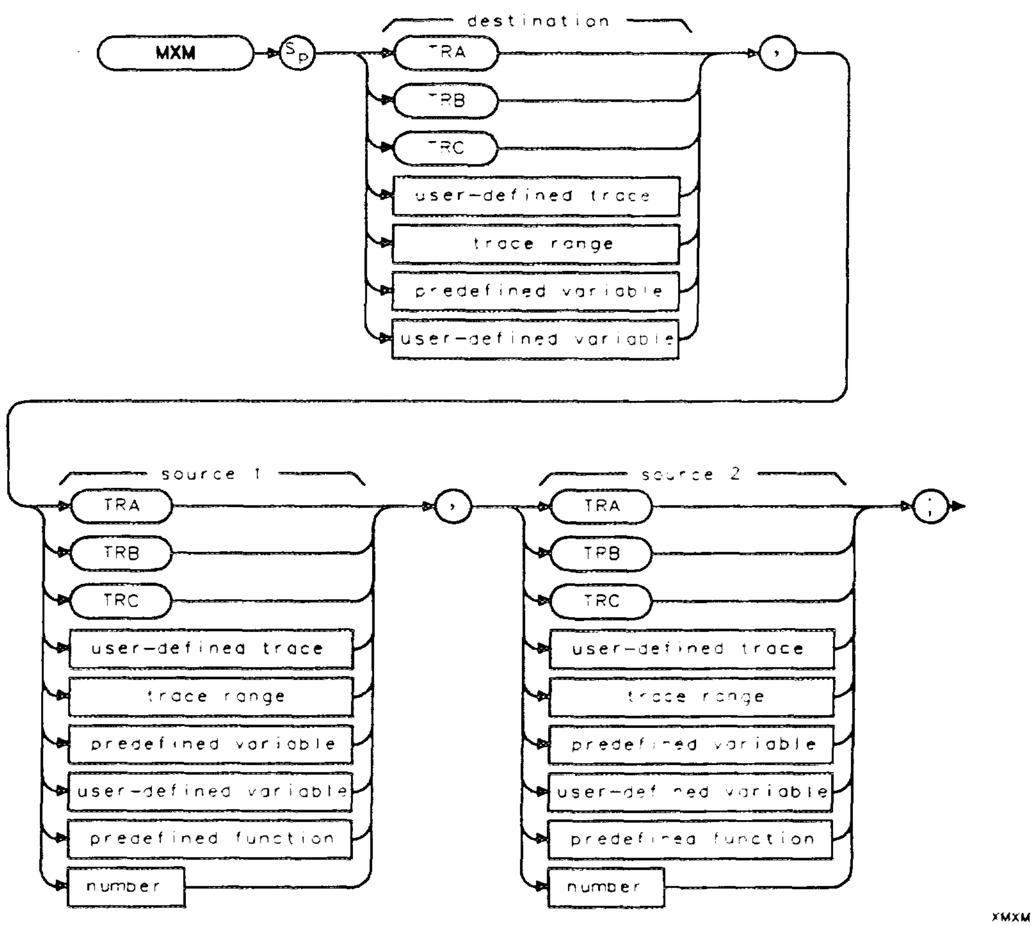



QMSI

# MXM
# Maximum

Compares source 1 and source 2, point by point, sending the greater value of each comparison to the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: MIN, PKPOS, TS.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"CF 300MHZ;SNGLS;"` | *Changes the center frequency and activate single-sweep mode.* |
| `30 OUTPUT 718;"TS;VIEW TRA;"` | *Updates trace. Displays and stores the results of trace A.* |
| `40 OUTPUT 718;"MXM TRB,TRA,4000;"` | *Moves elements of trace A that exceed 4000 trace data points (above center screen) to trace B.* |
| `50 OUTPUT 718;"BLANK TRA;VIEW TRB;"` | *Displays result.* |
| `60 END` | |

## Description

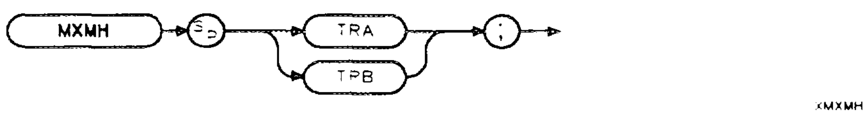
If one of the sources is a single value, it acts as a threshold; all values equal to or greater than the threshold pass to the destination.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MXMH
# Maximum Hold

Updates each trace element with the maximum level detected.

## Syntax




Equivalent Softkeys: **MAX HOLD A** and **MAX HOLD B**.
Related Commands: BLANK, CLRW, MINH, VAVG, VIEW.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"MXMH TRA;"
```

## Description

MXMH updates the specified trace (either trace A or trace B) with a new value from a detector only if the new value is larger than the previous trace data value.

# Programmer's Guide

## HP 8590 Series Spectrum Analyzer

HEWLETT PACKARD

HP Part No. 5960-6537 Microfiche Part No. 5960-6538
Printed in USA April 1992

## HP 8590 Series Spectrum Analyzer Documentation Description

In addition to the programmer's guide, the following guides are shipped with your spectrum analyzer:

The Calibration Guide for Your Spectrum Analyzer

- Tells you how to test your spectrum analyzer to determine if the spectrum analyzer meets its specifications.

*HP 8590 Series Spectrum Analyzer User's Guide*

- Tells you how to make measurements with your spectrum analyzer.
- Describes the spectrum analyzer features.
- Tells you what to do in case of a failure.

*HP 8590 Series Spectrum Analyzer Quick Reference Guide*

- Describes how to make a simple measurement with your spectrum analyzer.
- Briefly describes the spectrum analyzer functions.
- Lists all the programming commands.

### How to Order Guides

Each of the guides listed above can be ordered individually. To order, contact your local HP Sales and Service Office.

# How to Use This Guide

## Where to Start

- If you have not configured your spectrum analyzer in your computer system, first read Chapter 1, "Preparing for Use." This chapter tells you how to set up your computer and spectrum-analyzer system.
- If you are familiar with spectrum analyzer programming and wish to find the description of a programming command, turn to Chapter 5, "Programming Commands."
- If you are not familiar with spectrum analyzer programming:
  - Turn to Chapter 2, "Writing a Program." This chapter introduces spectrum analyzer programming by leading you through a simple spectrum analyzer measurement.
  - After you've successfully made your first measurement (or if you are experienced in remote operation of the spectrum analyzer), you can turn to Chapter 3, "Programming Topics," which demonstrates advanced programming techniques. Or, if you begin writing your own programs, turn to Chapter 5, "Programming Commands," for command descriptions.
  - If you want to learn how to write a downloadable program (DLP) or use the DLP editor, turn to Chapter 4, "Creating and Using Downloadable Programs."

## This guide uses the following conventions:

| | |
|---|---|
| (Front-Panel Key) | A boxed, uppercase name in this typeface represents a key physically located on the instrument. |
| **Softkey** | A boxed word written in this typeface indicates a "softkey," a key whose label is determined by the instrument's firmware. |
| `Screen Text` | Text printed in this typeface indicates text displayed on the spectrum analyzer screen. |

**Caution**

The CAUTION symbol denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a CAUTION symbol until the indicated conditions are fully understood and met.

## Spectrum Analyzers with Earlier Versions of Firmware

This guide documents programming commands that may not have been available with earlier versions of firmware. The following table lists the programming commands that have been added with a firmware revision.

**Spectrum Analyzer Commands Added with Firmware Revision**

| Command Mnemonic | Option Required | First Available with Firmware Revision |
|---|---|---|
| ACP | | 17.3.92 |
| ACPBW | | 17.3.92 |
| ACPCONTM | | 17.3.92 |
| ACPE | | 17.3.92 |
| ACPGRAPH | | 17.3.92 |
| ACPPAR | | 17.3.92 |
| ACPSNGLM | | 17.3.92 |
| ACPSP | | 17.3.92 |
| AMPCOR | | 03.01.90 |
| AMPLEN | | 17.3.92 |
| ANLGPLUS | 101 or 301 | 17.7.91 |
| BITF | | 17.3.92 |
| CHP | | 17.3.92 |
| CLRBOX | | 17.3.92 |
| COUPLE | | 10.10.90 |
| DA | | 17.3.92 |
| DOTDENS | 101 or 301 | 17.7.91 |
| DRAWBOX | | 17.3.92 |
| FFTAUTO | | 17.3.92 |
| FFTCLIP | | 17.3.92 |
| FFTCONTS | | 17.3.92 |
| FFTMKR | | 17.3.92 |
| FFTMM | | 17.3.92 |
| FFTMS | | 17.3.92 |
| FFTOFF | | 17.3.92 |
| FFTPCTAM | | 17.3.92 |
| FFTPCTAMR | | 17.3.92 |
| FFTSNGLS | | 17.3.92 |
| FFTSTAT | | 17.3.92 |
| FFTSTOP | | 17.3.92 |
| GATE | 105 | 10.10.90 |
| GATECTL | 105 | 10.10.90 |
| GC | 105 | 10.10.90 |
| GD | 105 | 10.10.90 |
| GDRVCLPAR | 105 | 17.3.92 |
| GDRVGDEL | 105 | 17.3.92 |
| GDRVGLEN | 105 | 17.3.92 |
| GDRVGT | 105 | 17.3.92 |
| GDRVGTIM | 105 | 17.3.92 |
| GDRVPRI | 105 | 17.3.92 |
| GDRVPWID | 105 | 17.3.92 |
| GDRVRBW | 105 | 17.3.92 |
| GDRVREFE | 105 | 17.3.92 |
| GDRVST | 105 | 17.3.92 |

## Spectrum Analyzer Commands Added with Firmware Revision (continued)

| Command Mnemonic | Option Required | First Available with Firmware Revision |
|---|---|---|
| GDRVSWAP | 105 | 17.3.92 |
| GDRVSWDE | 105 | 17.3.92 |
| GDRVSWP | 105 | 17.3.92 |
| GDRVUTIL | 105 | 17.3.92 |
| GDRVVBW | 105 | 17.3.92 |
| GL | 105 | 10.10.90 |
| GP | 105 | 10.10.90 |
| LIMIDEL | | 03.01.90 |
| LIMIDISP | | 17.3.92 |
| LIMIFAIL | | 03.01.90 |
| LIMIFT | | 17.3.92 |
| LIMISEGT | | 17.3.92 |
| LIMIHI | | 10.10.90 |
| LIMILINE | | 03.01.90 |
| LIMILO | | 10.10.90 |
| LIMIMIRROR | | 03.01.90 |
| LIMIMODE | | 03.01.90 |
| LIMIREL | | 03.01.90 |
| LIMISEG | | 03.01.90 |
| LIMISEGT | | 17.3.92 |
| LIMITEST | | 03.01.90 |
| LINFILL | | 17.3.92 |
| LSPAN | | 10.10.90 |
| MEANTH | | 10.10.90 |
| MEASOFF | | 17.3.92 |
| MEASURE | 010 or 011 | 03.01.90 |
| MERGE | | 17.3.92 |
| MKACTV | | 17.3.92 |
| MKDLMODE | | 17.3.92 |
| MKTBL | | 17.3.92 |
| NDB | | 17.3.92 |
| NDBPNT | | 17.3.92 |
| NDBPNTR | | 17.3.92 |
| NRL | | 03.01.90 |
| OBW | | 17.3.92 |
| OBWPCT | | 17.3.92 |
| ONMKRU | | 17.3.92 |
| PCTAM | | 17.3.92 |
| PCTAMR | | 17.3.92 |
| PKDLMODE | | 17.3.92 |
| PKRES | | 17.3.92 |
| PKSORT | | 17.3.92 |
| PKTBL | | 17.3.92 |
| PKZMOK | | 17.3.92 |
| PKZOOM | | 17.3.92 |
| POWERON | | 03.01.90 |
| PREAMPG | | 10.10.90 |
| PWRUPTIME | | 17.3.92 |
| RESETRL | | 03.01.90 |

## Spectrum Analyzer Commands Added with Firmware Revision (continued)

| Command Mnemonic | Option Required | First Available with Firmware Revision |
|---|---|---|
| RLPOS | | 03.01.90 |
| SEGDEL | | 03.01.90 |
| SENTER | | 03.01.90 |
| SENTERT | | 17.3.92 |
| SRCALC | 010 or 011 | 03.01.90 |
| SRCAT | 010 or 011 | 03.01.90 |
| SRCNORM | 010 or 011 | 03.01.90 |
| SRCPOFS | 010 or 011 | 03.01.90 |
| SRCPSTP | 010 or 011 | 03.01.90 |
| SRCPSWP | 010 or 011 | 03.01.90 |
| SRCPWR | 010 or 011 | 03.01.90 |
| SRCTK | 010 or 011 | 03.01.90 |
| SRCTKPK | 010 or 011 | 03.01.90 |
| SWPCPL | 010 or 011 | 03.01.90 |
| SYNCMODE | | 17.3.92 |
| TOI | | 17.3.92 |
| TOIR | | 17.3.92 |
| TVSTND | 101 and 102 (301) | 03.01.90 |
| WAIT | | 10.10.90 |
| WINNEXT | | 17.3.92 |
| ZMKCNTR | | 17.3.92 |
| ZMKSPAN | | 17.3.92 |
| ZMKPKNR | | 17.3.92 |
| ZMKPKNL | | 17.3.92 |

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# Preparing for Use

## What You'll Learn in This Chapter

This chapter tells you how to connect a computer to your spectrum analyzer via the Hewlett-Packard Interface Bus (HP-IB) or the RS-232 Interface and how to connect a printer or a plotter. The remainder of the chapter covers procedures to follow if a problem is encountered.

### Connecting Your Spectrum Analyzer to a Computer

The spectrum analyzer works with many popular computers. However, the steps required to connect your spectrum analyzer to a specific computer depend on the computer you are using. Before turning to the interconnection instructions for your computer, please read the following general information.

### Configuring Your Computer System

Every computer system has a specific configuration. Your system configuration might include a printer, external disk drive, or plotter. Whenever you add another piece of equipment (for example, your spectrum analyzer), you may need to reconfigure your computer system so that the computer knows where and how to send information to the newly added device.

Some computers do not require configuring when a spectrum analyzer is connected; others require a simple modification. The most common modification is changing the configuration information stored on the computer's operating system disk. A few computers require the insertion of an add-on board, or "card." Refer to your computer documentation if your system needs these modifications.

All of the test programs for HP-IB and RS-232 interfaces are written using the BASIC language of the computer under consideration. If you have never entered or run a BASIC program, refer to your computer documentation.

### Connecting the Computer to the Spectrum Analyzer

#### For the HP-IB Interface

Refer to Appendix B for a detailed description of the HP-IB interface.

Appendix B contains instructions for connecting the spectrum analyzer's HP-IB interface to either an HP 9000 Series 200, or a Series 300 computer, or to an HP Vectra PC equipped with an HP 82300B BASIC Language Processor. If your computer is not listed, but it supports an HP-IB interface, there is a good possibility that it can be connected to the spectrum analyzer. Consult your computer documentation to determine how to connect external devices on the bus.

### For the RS-232 Interface

Refer to Appendix C for a detailed description of the RS-232 interface.

Appendix C contains instructions for connecting the spectrum analyzer's RS-232 interface to an HP Vectra PC or IBM PC/AT or compatible computers. If your computer is not listed, but it supports a standard RS-232 interface, there is a good possibility that the spectrum analyzer may be connected to the computer. Consult your computer documentation to determine how to connect external devices to your computer's RS-232 connector.

There are two types of RS-232 devices: data terminal equipment (DTE) and data communication equipment (DCE). Types of DTE devices include display terminals. DCE equipment includes modems and, generally, other computer RS-232 devices. The spectrum analyzer RS-232 port is the DTE-type. Connections from the computer (DCE) to the spectrum analyzer (DTE) are shown in Appendix C.

## The Test Program

To test the system configuration, a simple test program is provided for each computer listed. After you have connected your computer and spectrum analyzer, you should enter and run the test program on your computer to make sure the computer is sending instructions to the spectrum analyzer through the interface cable. If the interface is working and the program is entered correctly, a statement is displayed on the computer screen.

**Note**

The listed computer and spectrum analyzer equipment includes the minimum components necessary to establish communication between your spectrum analyzer and computer. If you are using application software, check with your software supplier for specific computer hardware and memory requirements.

**Note**

Using an interface cable other than the one listed with your computer's interconnection instructions may prevent proper communication between the spectrum analyzer and computer.

Pressing (CONFIG) removes the spectrum analyzer from remote mode and enables front-panel control.

## HP-IB Connections for the HP 9000 Series 200 Technical Computers

### Equipment

- HP 9816, 9826, or 9836 Series 200 technical computer.
- HP 8590 Series spectrum analyzer with Option 021.
- HP 10833 (or equivalent) HP-IB cable.

### Interconnection Instructions

Connect the spectrum analyzer to the computer using the HP-IB cable. Figure 1-1 shows an HP 9836 computer connected to the spectrum analyzer.

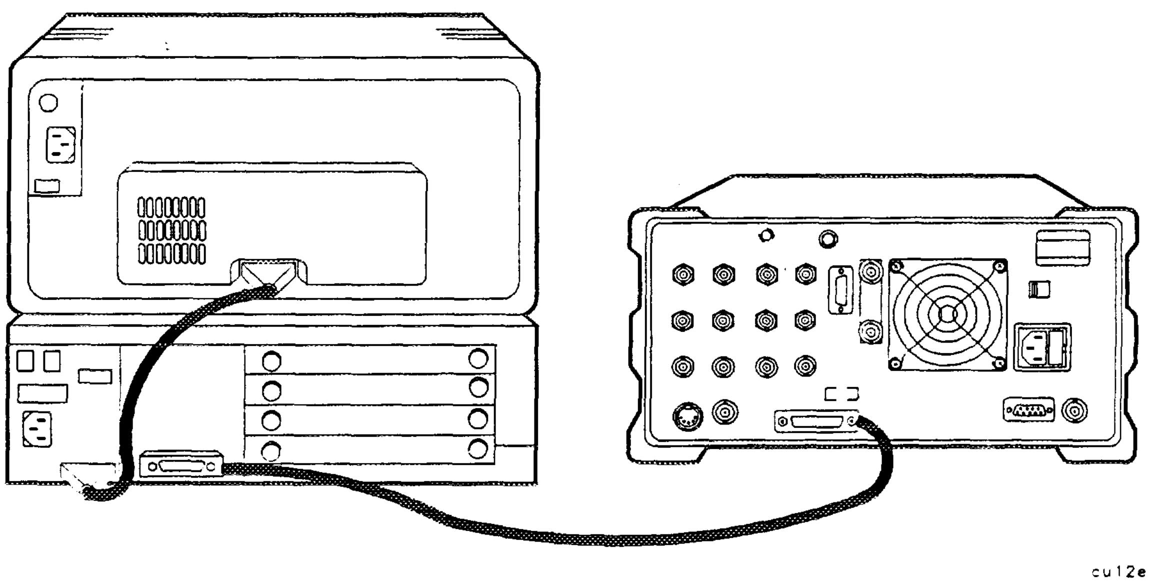



**Figure 1-1. Connecting the HP 9000 Series 200 Computer to the Spectrum Analyzer**

### Test Program

To test the connection between the computer and the spectrum analyzer, turn on your spectrum analyzer and follow the instructions below.

1. Your HP 9000 Series 200 computer may have either a soft-loaded or built-in language system. If your language system is built-in, remove any disks from the drives and turn on the computer.
2. If your language is soft-loaded, install the BASIC language disk into the proper drive. Turn the computer power on. After a few seconds, the `BASIC READY` message appears; the computer is now ready for use.

   For further information on loading BASIC on your system, consult your BASIC manual.
3. Check the HP-IB address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**. The usual address for the spectrum analyzer is 18. If necessary, reset

the address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, 18, (Hz) (or enter the appropriate address).

4. Enter the following program, then press (RUN) on the computer. If you need help entering and running the program, refer to your computer and software documentation.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 PRINTER IS 1
20 Analyzer=718
30 CLEAR Analyzer
40 OUTPUT Analyzer;"IP;SNGLS;"
50 OUTPUT Analyzer;"CF 300MZ;TS;"
60 OUTPUT Analyzer;"CF?;"
70 ENTER Analyzer;A
80 PRINT "CENTER FREQUENCY = ";A;"Hz";
90 END
```

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep.

The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## HP-IB Connections for the HP 9000 Series 300 Technical Computers

### Equipment

- HP 98580A, 98581A, 98582A, or 98583A Series 300 technical computer.
- HP 8590 Series spectrum analyzer with Option 021.
- HP 10833 (or equivalent) HP-IB cable.

### Interconnection Instructions

Connect the spectrum analyzer to the computer using the HP-IB cable as shown in Figure 1-2.

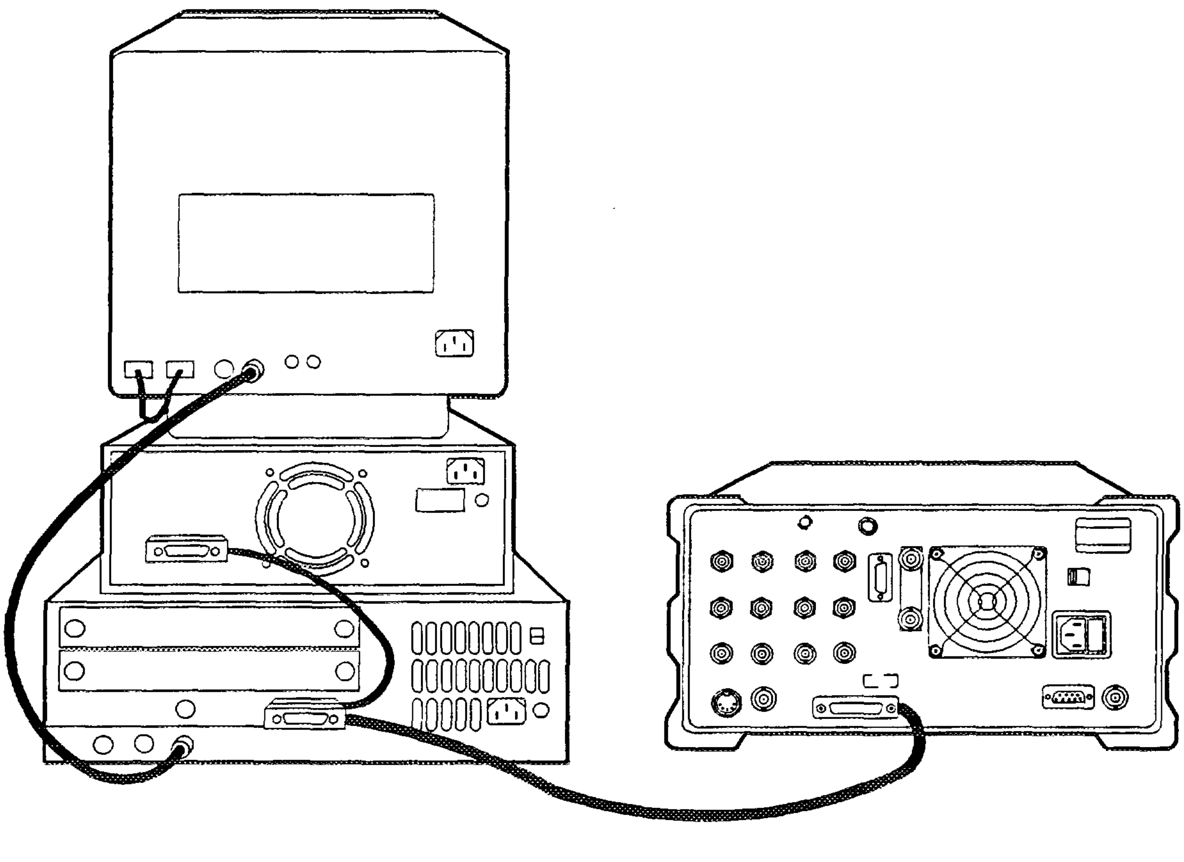



**Figure 1-2. Connecting the HP 9000 Series 300 Computer to the Spectrum Analyzer**

## Test Program

To test the connection between the computer and the spectrum analyzer, turn on your spectrum analyzer and follow the instructions below.

1. Your HP 9000 Series 300 computer may have either a soft-loaded or built-in language system. If your language system is built-in, remove any disks from the drives and turn on the computer.
2. If your language is soft-loaded, install the BASIC language disk into the proper drive. Turn the computer power on. After a few seconds, the `BASIC READY` message appears; the computer is now ready for use.

   For further information on loading BASIC on your system, consult your BASIC manual.
3. Check the HP-IB address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**. The usual address for the spectrum analyzer is 18. If necessary, reset the address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, 18, (Hz) (or enter the appropriate address).
4. Enter the following program, then press (RUN) on the computer. If you need help entering and running the program, refer to your computer and software documentation.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 PRINTER IS 1
20 Analyzer=718
30 CLEAR Analyzer
40 OUTPUT Analyzer;"IP;SNGLS;"
50 OUTPUT Analyzer;"CF 300MZ;TS;"
60 OUTPUT Analyzer;"CF?;"
70 ENTER Analyzer;A
80 PRINT "CENTER FREQUENCY = ";A;"Hz";
90 END
```

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep.

The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

# HP-IB Connections for the HP Vectra Personal Computer

## Equipment

- HP Vectra personal computer, with option HP 82300B, the HP BASIC Language Processor.
- HP 8590 Series spectrum analyzer with Option 021.
- HP 10833 (or equivalent) HP-IB cable.

## Interconnection Instructions

Connect the spectrum analyzer to the computer using the HP-IB cable as shown in Figure 1-3.

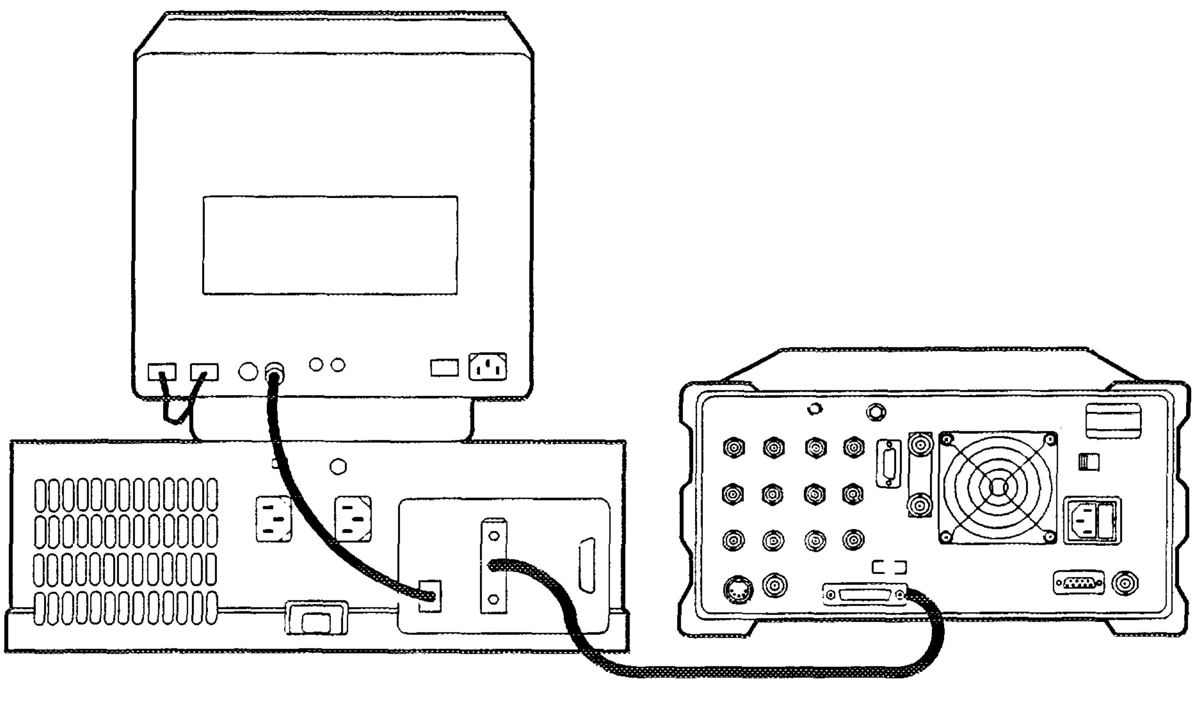



**Figure 1-3. Connecting the HP Vectra Personal Computer to the Spectrum Analyzer**

## Test Program

To test the connection between the computer and the spectrum analyzer, turn on your spectrum analyzer and follow the instructions below.

1. Refer to the HP 82300 Language Processor documentation to install the language processor board in your computer and load the BASIC programming language into your computer.
2. Check the HP-IB address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**. The usual address for the spectrum analyzer is 18. If necessary, reset the address of the spectrum analyzer: press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**, 18 (Hz) (or enter the appropriate address).

3. Enter the following program, then press (F10) on the computer. If you need help entering and running the program, refer to your computer and software documentation.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 PRINTER IS 1
20 Analyzer=718
30 CLEAR Analyzer
40 OUTPUT Analyzer;"IP;SNGLS;"
50 OUTPUT Analyzer;"CF 300MZ;TS;"
60 OUTPUT Analyzer;"CF?;"
70 ENTER Analyzer;A
80 PRINT "CENTER FREQUENCY = ";A;"Hz";
90 END
```

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep. The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## RS-232 Connections for the HP Vectra Personal Computer

### Equipment

- HP Vectra personal computer with RS-232 interface that has an 9-pin female port.
- HP 8590 Series spectrum analyzer with Option 023.
- HP 24542G RS-232 cable.

### Interconnection Instructions

1. Connect the spectrum analyzer to the computer using the RS-232 cable as shown in Figure 1-4.

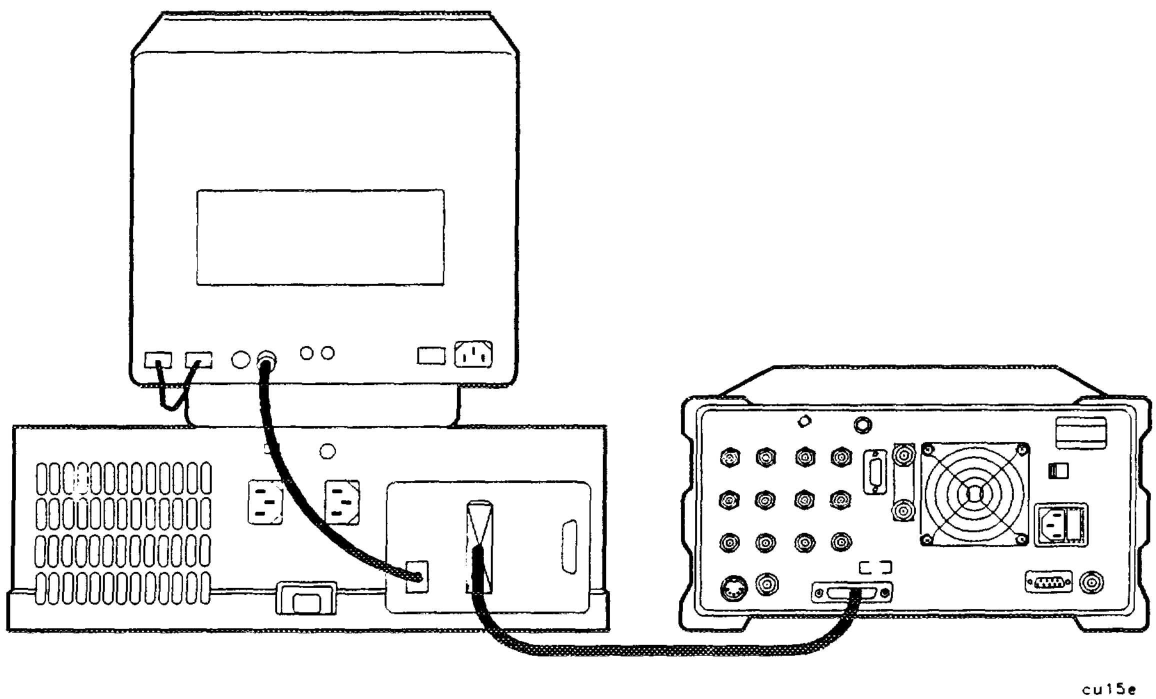



**Figure 1-4. Connecting the HP Vectra Personal Computer to the Spectrum Analyzer**

2. Turn on the spectrum analyzer and the computer.

### Test Program

The program shown below works with the following computers:

- HP Vectra PC using a version of BASIC (HP 45952A) for the Vectra PC. The MS BASIC Interpreter (HP 35190A) is compatible with the version of BASIC for the Vectra PC.
- IBM PC/AT and compatible computers using BASICA (version 2.0 or later) or GW BASIC.

To test the interconnection, first load the BASIC language for your computer and specify a communications buffer of 4096 bytes. Use the following command:

```
BASICA/C:4096
```

Set the spectrum analyzer baud rate to 1200, to match the baud rate set up for the computer port in the test program. In line 20, the "1200" indicates 1200 baud for the computer port.

Press the following keys to set the baud rate: (CONFIG), **More 1 of 3**, **BAUD RATE**, 1200, (Hz).

Enter the following test program. The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 'File = TESTPGM
20 OPEN "COM1:1200,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;"
50 PRINT #1,"CF 300MZ;TS;"
60 PRINT #1,"CF?;"
70 INPUT #1,CENTER
80 PRINT,"CENTER FREQ = ";CENTER;"Hz"
90 END
```

When you have entered the program, type:

```
SAVE "TESTPGM"
```

When you are ready to run the program, turn on the spectrum analyzer and run your program.

The program tells the spectrum analyzer to perform an instrument preset and enter single sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep. The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

# RS-232 Connections for the IBM PC/AT and Compatible Computers

## Equipment

- IBM PC/AT or compatible with RS-232 interface.
- HP 8590 Series spectrum analyzer with Option 023.
- HP 13242G RS-232 cable (DCE-DCE), 7 pins used (refer to Appendix C for wiring of this cable).

## Interconnection Instructions

1. Connect the spectrum analyzer to the computer with the RS-232 cable. (See Figure 1-5.) The spectrum analyzer uses a female RS-232 connector; the IBM PC/AT computer usually uses a male RS-232 connector. Some compatibles use a female RS-232 connector.

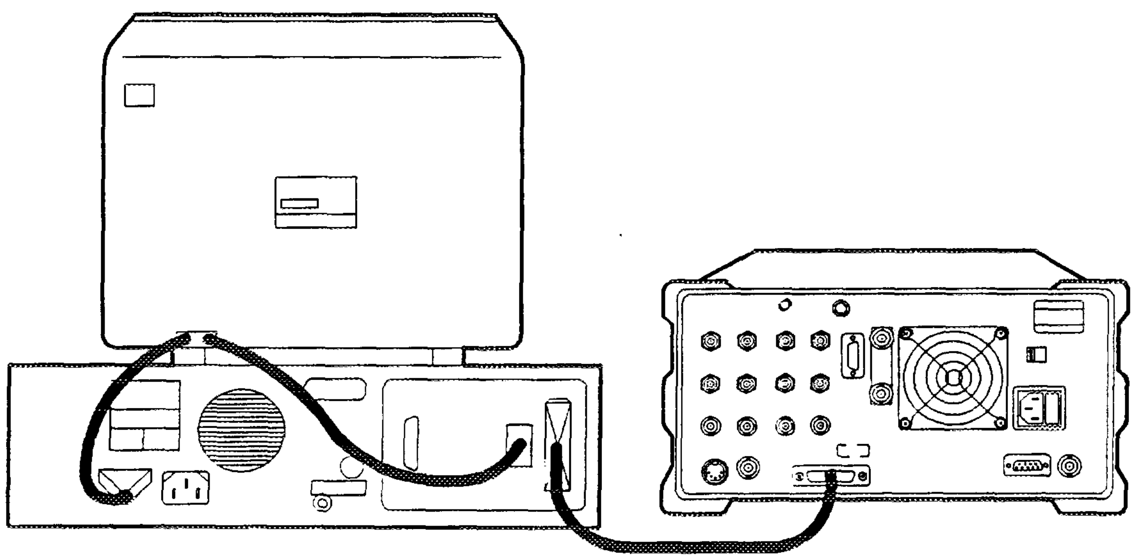



**Figure 1-5. Connecting an IBM PC/AT Compatible Computer to the Spectrum Analyzer**

2. Turn on the spectrum analyzer and the computer.

## Test Program

The program shown below is written to work with BASICA (version 2.0 or later) or GW BASIC.

To test the interconnection, first load the BASIC language for your computer and specify a communications buffer of 4096 bytes. Use the following command:

```
BASICA/C:4096
```

Set the spectrum analyzer baud rate to 1200, to match the baud rate set up for the computer port in the test program. In line 20, the "1200" indicates 1200 baud for the computer port. To set the baud rate to 1200:

1. Press (CONFIG), **More 1 of 3**.
2. Press the **BAUD RATE** softkey.
3. Press these keys: 1200 (Hz).

Enter the following test program.

The program shows that the computer is able to send instructions to, and read information from, the spectrum analyzer.

```
10 'File = TESTPGM
20 OPEN "COM1:1200,N,8,1" AS #1
30 PRINT #1,"IP;"
40 PRINT #1,"SNGLS;"
50 PRINT #1,"CF 300MZ;TS;"
60 PRINT #1,"CF?;"
70 INPUT #1,CENTER
80 PRINT,"CENTER FREQ = ";CENTER;"Hz"
90 END
```

When you have entered the program, type:

```
SAVE "TESTPGM"
```

When you are ready to run the program, turn on the spectrum analyzer and run your program.

The program tells the spectrum analyzer to perform an instrument preset and enter single-sweep mode. Next, the program sets the center frequency to 300 MHz and takes a sweep. The program then queries the center frequency value and tells the computer to display `CENTER FREQUENCY = 3.0E+8 Hz`.

If the computer does not display the center frequency, refer to "If There is a Problem" at the end of this chapter.

## Printing or Plotting

You may wish to obtain a permanent record of data displayed on the spectrum analyzer screen. This can be done using the (COPY) key of the spectrum analyzer, and a printer or plotter.

**Note** The HP 7470A plotter does not support 2 plots per page. If you use an HP 7470A plotter with an HP 8590 Series spectrum analyzer, you can select one plot per page or four plots per page, but not 2 plots per page.

### Printer with an HP-IB Interface

#### Equipment

- HP 8590 Series spectrum analyzer with Option 021.
- HP 2225 ThinkJet printer or HP 3630A PaintJet color printer.
- HP 10833 (or equivalent) HP-IB cable.

### Interconnection and Printing Instructions

1. Turn off the printer and the spectrum analyzer.
2. Connect the printer to the spectrum analyzer using the HP-IB cable.

**Note** Because HP-IB cables can be connected together, more than one instrument can communicate on the HP-IB. This means that both a printer and a plotter can be connected to the spectrum analyzer (using two HP-IB cables). Each device must have its own HP-IB address.

**Note** Because the spectrum analyzer cannot print or plot with two controllers (the computer and the spectrum analyzer) connected, the computer must be disconnected from the HP-IB.

3. Turn on the spectrum analyzer and printer.
4. On the spectrum analyzer, press (CONFIG), **Print Config**.
5. The printer usually resides at the first device address. To enter address 1 for the printer, press **PRINTER ADDRESS**, 1, (Hz).
6. If the spectrum analyzer is connected to an HP PaintJet printer and you want a color printout, press **PAINTJET PRINTER** (so that the **PAINTJET PRINTER** softkey label is underlined). If the spectrum analyzer is connected to an HP PaintJet printer and you want a black and white printout, press **B&W PRINTER** (so that the **B&W PRINTER** softkey label is underlined).
7. If you want the softkey labels to be printed with the spectrum analyzer display printout, press **PRT MENU ON OFF** so that ON is underlined.
8. Press **Previous Menu**, **COPY DEV PRNT PLT** (PRNT should be underlined), then (COPY).

## Plotter with an HP-IB Interface

### Equipment

- HP 8590 Series spectrum analyzer with Option 021.
- HP 7440A ColorPro plotter.
- HP 10833 (or equivalent) HP-IB cable.

## Interconnection and Plotting Instructions

1. Turn off the plotter and the spectrum analyzer.
2. Connect the plotter to the spectrum analyzer using the HP-IB cable.

**Note** Because HP-IB cables can be connected together, more than one instrument can communicate on the HP-IB. This means that both a printer and a plotter can be connected to the spectrum analyzer (using two HP-IB cables). Each device must have its own HP-IB address.

**Note** Because the spectrum analyzer cannot print or plot with two controllers (the computer and the spectrum analyzer) connected, the computer must be disconnected from the HP-IB.

3. Turn on the spectrum analyzer and the plotter.
4. On the spectrum analyzer, press (CONFIG), **Plot Config**.
5. The plotter usually resides at the fifth device address. To set the plotter address, press PLOTTER ADDRESS , 5, (Hz), to enter the address 5 for the plotter.
6. With PLTS/PG 1 2 4 , you can choose a full-page, half-page, or quarter-page plot. Press PLTS/PG 1 2 4 to underline the number of plots per page desired.
7. If two or four plots per page are chosen, a function is displayed that allows you to select the location on the paper of the plotter output. If two plots per page are selected, then the PLT □LOC _ _ function is displayed. If four plots per page are selected, then the PLT □ _LOC _ _ is displayed. Press the softkey until the rectangular marker is in the desired section of the softkey label. The upper and lower sections of the softkey label graphically represent where the plotter output will be located.

**Note** For a multi-pen plotter, the pens of the plotter draw the different components of the screen as follows:

| Pen Number | Description |
|---|---|
| 1 | Draws the annotation and graticule. |
| 2 | Draws trace A. |
| 3 | Draws trace B. |
| 4 | Draws trace C and the display line. |
| 5 | Draws user-generated graphics and the lower-limit line. |
| 6 | Draws the upper-limit line. |

8. Press `Previous Menu`, `COPY DEV PRNT PLT` (PLT should be underlined), then (COPY).

**Note** Once the address of the printer and plotter have been entered, the spectrum analyzer remembers these addresses even though the power is turned off. There is no need to reenter them when the spectrum analyzer is turned off and on.

## Printer with an RS-232 Interface

### Equipment

- HP 8590 Series spectrum analyzer with Option 023.
- HP 2225 ThinkJet printer with an RS-232 interface, or HP 3630A PaintJet color printer with an RS-232 interface.

**Note** Refer to Appendix C of this manual for the appropriate RS-232 cable connectors.

## Interconnection and Printing Instructions

1. Turn off the spectrum analyzer and the printer.

**Note** The RS-232 interface allows only one device (either the printer or the plotter) to be connected to the spectrum analyzer.

2. Connect the printer using an RS-232 cable.
3. Turn on the spectrum analyzer and printer.
4. Press (CONFIG), `More 1 of 3`.

5. To set the baud rate to 9600 baud, press **BAUD RATE**, 9600, (Hz). To set the baud rate to 1200 baud, press: **BAUD RATE**, 1200, (Hz).

**Note**

Some of the programs in this manual utilize 1200 baud. If your system uses the RS-232 handshake lines, you can use 9600 baud for all of the programs.

6. Press (CONFIG), **Print Config**.
7. If the spectrum analyzer is connected to an HP PaintJet printer and you want a color printout, press **PAINTJET PRINTER** (so that the PAINTJET PRINTER softkey label is underlined). If the spectrum analyzer is connected to an HP PaintJet printer and you want a black and white printout, press **B&W PRINTER** (so that the B&W PRINTER softkey label is underlined).
8. If you want the softkey labels to be printed with the spectrum analyzer display print out, press **PRT MENU ON OFF** so that ON is underlined.
9. Press **Previous Menu**, **COPY DEV PRNT PLT** (PRNT should be underlined), then (COPY).

## Plotter with an RS-232 Interface

### Equipment

- HP 8590 Series spectrum analyzer with Option 023.
- HP 7440A ColorPro plotter with an RS-232 interface.

**Note**

Refer to Appendix C of this manual for the appropriate RS-232 cable connectors.

## Interconnection and Plotting Instructions

1. Turn off the spectrum analyzer.

**Note**

The RS-232 interface allows only one device (either the printer or the plotter) to be connected to the spectrum analyzer.

2. Connect the plotter using an RS-232 cable.
3. Turn on the spectrum analyzer and the plotter.
4. Press (CONFIG), **More 1 of 3**.
5. To set the baud rate to 9600 baud, press **BAUD RATE**, 9600, (Hz). To set the baud rate to 1200 baud, press: **BAUD RATE**, 1200, (Hz).

**Note**

Some of the programs in this manual utilize 1200 baud. If your system uses the RS-232 handshake lines, you can use 9600 baud for all of the programs.

6. Press (CONFIG), **Plot Config**. You can choose a full-page, half-page, or quarter-page plot with the **PLTS/PG 1 2 4** softkey. Press **PLTS/PG 1 2 4** to underline the number of plots per page desired.
7. If two or four plots per page are chosen, a function is displayed that allows you to select the location on the paper of the plotter output. If two plots per page are selected, then the **PLT [ ] LOC _ _** function is displayed. If four plots per page are selected, then the **PLT □ _LOC _ _** is displayed. Press the softkey until the rectangular marker is in the desired section of softkey label. The upper and lower sections of the softkey label graphically represent where the plotter output will be located.

**Note**

For a multi-pen plotter, the pens of the plotter draw the different components of the screen as follows:

| Pen Number | Description |
|---|---|
| 1 | Draws the annotation and graticule. |
| 2 | Draws trace A. |
| 3 | Draws trace B. |
| 4 | Draws trace C and the display line. |
| 5 | Draws user-generated graphics and the lower-limit line. |
| 6 | Draws the upper-limit line. |

8. Press **Previous Menu**, **COPY DEV PRNT PLT** (so that PLT is underlined), then (COPY).

## Printing after Plotting or Plotting after Printing

Pressing (COPY) without changing **COPY DEV PRNT PLT** produces the function last entered (a print or a plot).

- To print after doing a plot, press (CONFIG), **COPY DEV PRNT PLT** (so that PRNT is underlined), then (COPY).
- To plot after printing, press (CONFIG), **COPY DEV PRNT PLT** (so that PLT is underlined), and (COPY).

## If There is a Problem

This section offers suggestions to help get your computer and spectrum analyzer working as a system. The test programs provided in this chapter let you know if the connection between the computer and the spectrum analyzer interconnection is working properly.

If the test program does not run, try the following suggestions:

1. You may need to modify the program syntax to work with your computer. Refer to your BASIC manual for correct syntax.
2. The program must be executed correctly. Refer to your computer manual for information about program execution.
3. Check your program for errors.

If the test program runs on the computer, but the spectrum analyzer does not respond, try the following suggestions:

1. Make sure the spectrum analyzer is turned on. If the spectrum analyzer has power, the green indicator light above the line switch is on.
2. Make sure the interface cable is connected securely. Check the interface cable for defects. Make sure the correct cable is used.
3. If you are using an HP-IB interface, the spectrum analyzer must be set to the correct address setting. Press (CONFIG), **More 1 of 3**, **ANALYZER ADDRESS**.
4. If you are using the RS-232 interface, check the spectrum analyzer baud rate. Refer to Appendix C for information about setting the baud rate on the spectrum analyzer.
5. If a program in user memory is suspected of causing problems, use (CONFIG), **More 1 of 3**, **DISPOSE USER MEM**, **DISPOSE USER MEM**. (**DISPOSE USER MEM** requires a double key press.) **DISPOSE USER MEM** erases all user programs, variables, personalities (which are usually in the form of downloadable programs), and user-defined traces that are in spectrum analyzer memory.
6. If you wish to reset the spectrum analyzer configuration to the state it was in when it was originally shipped from the factory, use **DEFAULT CONFIG**. To access **DEFAULT CONFIG**, press (CONFIG), **More 1 of 3**, **DEFAULT CONFIG**, **DEFAULT CONFIG**. (**DEFAULT CONFIG** requires a double key press.)

If you suspect your computer is causing the problems, check it by running a program that you know works. If your system still has problems, contact your HP salesperson. Your salesperson will either be able to help solve the problem or refer you to someone who can.

# 2

# Writing a Program

## What You'll Learn in This Chapter

This chapter introduces spectrum analyzer programming. The first section of this chapter, "Writing Your First Program," helps you write your first spectrum analyzer program and introduces programming fundamentals. The second section, "Getting Information from the Spectrum Analyzer," shows how to get data out of the spectrum analyzer. A summary at the end of this chapter reviews the programming guidelines introduced.

If the computer is not connected to the spectrum analyzer, follow the instructions in Chapter 1, "Preparing for Use."

A general knowledge of the BASIC programming language and the spectrum analyzer is recommended before reading this chapter. Refer to your software documentation manuals for more information about BASIC. For reference, Chapter 5 of this manual provides spectrum analyzer commands in alphabetical order.

**Note**

All programming examples in this chapter for the HP-IB interface are written in HP BASIC 4.0, using an HP 9000 Series 200 computer. For the RS-232 interface, examples are written in GW BASIC, using an HP Vectra personal computer or compatible controller.

## Writing Your First Program

When the spectrum analyzer has been connected to a computer via HP-IB or RS-232 interface, the computer can be used to send instructions to the spectrum analyzer. These instructions tell the spectrum analyzer such things as frequency span, resolution bandwidth, and sweep mode. If a properly selected sequence of instructions is sent to the spectrum analyzer, a measurement is made. Sequences of coded instructions are called programs.

### Composing the Program

Most spectrum analyzer programs contain several common statements, or "commands," that address the spectrum analyzer, preset it, and select its sweep mode. As an example, we will write a short program that executes only these common commands.

The following programs are for the HP-IB and the RS-232 interfaces. Note the quotation marks that contain spectrum analyzer commands in each line. Also note the semicolons at the end of each line, inserted at the end of each set of spectrum analyzer commands within the quotation marks. Using semicolons makes programs easier to read, prevents command misinterpretation, and is recommended by IEEE Standard 728.

**Note**

In commands where quotation marks occur, the computer recognizes data as character data and not BASIC programming language commands.

### Program Example for the HP-IB Interface

```
05  !File:  "IBPROG1"
10 Analyzer=718
20 CLEAR Analyzer
30 OUTPUT Analyzer;"IP;"
40 OUTPUT Analyzer;"SNGLS;TS;"
50 LOCAL 7
60 END
```

Line 10 of our program assigns a variable called "Analyzer" to our spectrum analyzer at address 718. This instruction is followed by the HP BASIC CLEAR command, which resets the spectrum analyzer on the HP-IB. With these two program lines, we have set up a clear communication path between the computer and the spectrum analyzer.

Line 30 introduces the instrument preset (IP) command, which corresponds to the (PRESET) key on the spectrum analyzer. The IP command sets all of the analog parameters of the spectrum analyzer to known values and provides a good starting point for every measurement.

**Note**

All softkey functions on the spectrum analyzer have corresponding programming commands. As you continue programming, you will learn the command names that correspond to the front-panel keys and softkeys.

Line 40 activates the single-sweep mode. Most remotely controlled measurements require control of the sweep. Once SNGLS has activated the single-sweep mode, take sweep (TS) starts and completes one full sweep. TS maintains absolute control over the sweep, which is necessary for accurate computer data transfer and reduced program execution time.

Before we end the program, we return the spectrum analyzer to front-panel control with line 50, `LOCAL 7`. The LOCAL command corresponds to the (CONFIG) (LOCAL) key on the front panel of the spectrum analyzer. (`LOCAL 7` commands everything on the bus to go to local mode.)

## Description

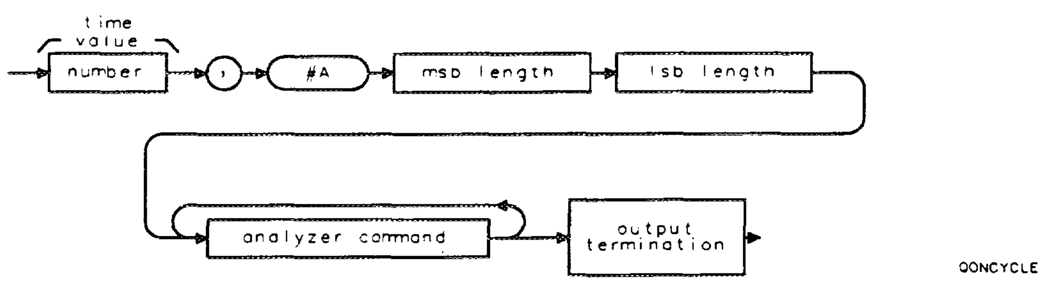
The ONCYCLE command performs the list of spectrum analyzer commands

periodically. In contrast, the ONDELAY command performs the list of spectrum analyzer commands once after the elapsed time interval. After the ONCYCLE function has been created, the first execution of the spectrum analyzer commands does not occur until the time value has elapsed.

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONCYCLE definition:** IP clears the ONCYCLE definition. You can use the DISPOSE command to clear the ONCYCLE definition also.

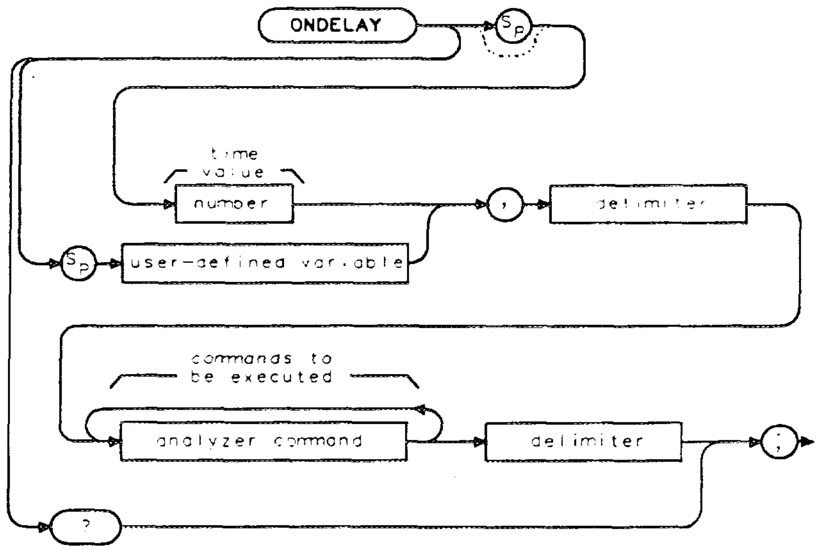
## Query Response



# ONDELAY
# On Delay

Executes the list of analyzer commands after the time value has elapsed.

## Syntax




XONDELAY

| Item | Description/Default | Range |
|---|---|---|
| Number | A valid number. | 0 to 2,147,483 seconds |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command. | |

Related Commands: CAT, DISPOSE, ERASE, IP, ONCYCLE, ONEOS, ONMKR, ONSRQ, ONSWP, ONTIME.

## Example

OUTPUT 718;"ONDELAY 000030,!CF 1.2GHZ;!;" *Changes the center frequency after 30 seconds.*

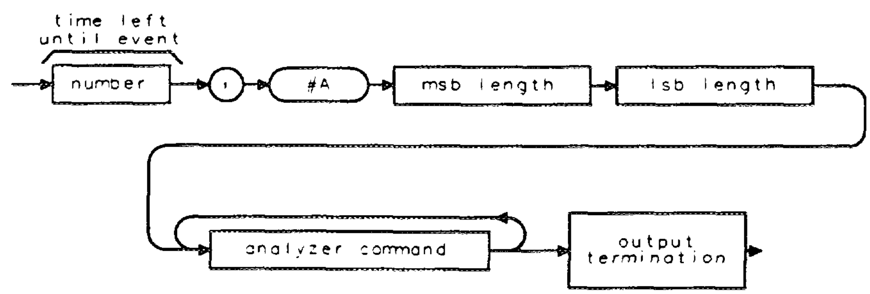
## Description

The ONDELAY command performs the list of spectrum analyzer commands once after the elapsed time interval; the ONCYCLE command performs the list of spectrum analyzer commands periodically.

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONDELAY definition:** IP clears the ONDELAY definition. You can use the DISPOSE command to clear the ONDELAY definition also.

## Query Response

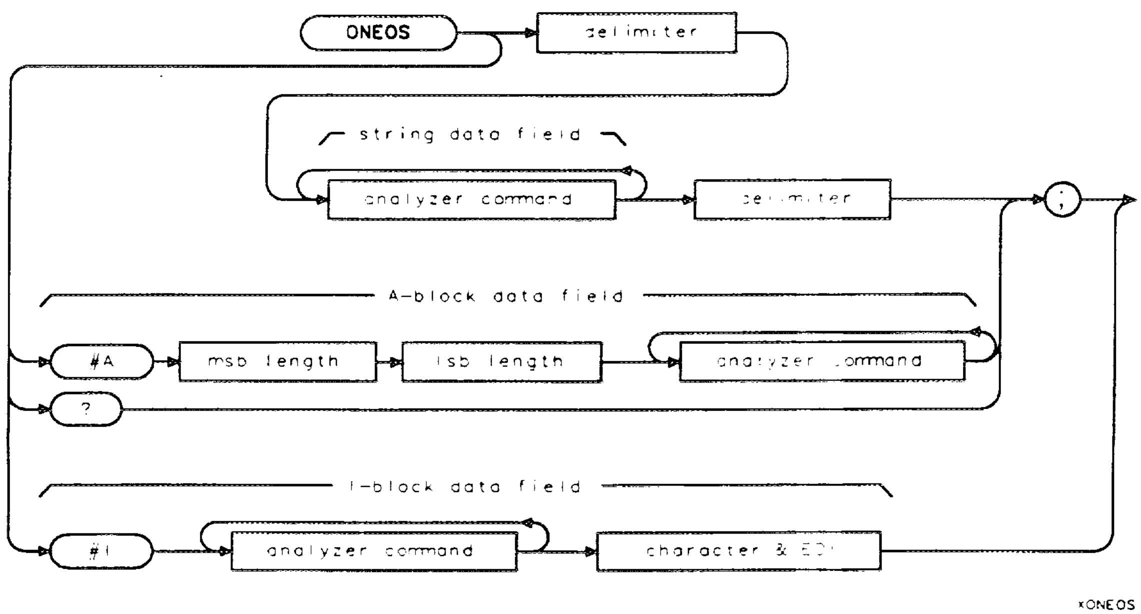



QONDELAY

# ONEOS
# On End of Sweep

Executes the contents of the data field after the end of the sweep.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command except TS. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Character & EOI | Any valid character and END. | |

Related Commands: CAT, DISPOSE, ERASE, IP, ONSWP.

## Example

`OUTPUT 718;"ONEOS!CF 100MHZ;!"` *Center frequency is changed at the end of the sweep.*

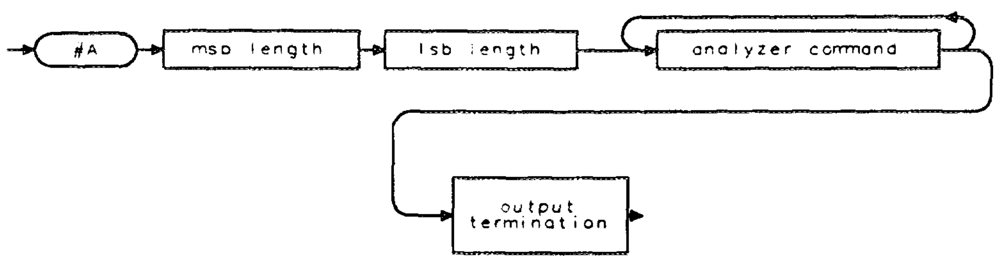
## Description

**Restrictions:** The list of analyzer commands should not include a take sweep (TS). Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

The #A, msb length, LSB length, and character data form a A-block data field. The A-block data field is used when the length of the character data is known. The #I, character data, and EOI (END) form and I-block data field. The I-block data field is used when the length of the character data is unknown. The I-block data field is available for HP-IB interface only.

**Clearing the ONEOS definition:** IP clears the ONEOS definition. You can use the DISPOSE command to clear the ONEOS definition also.

## Query Response

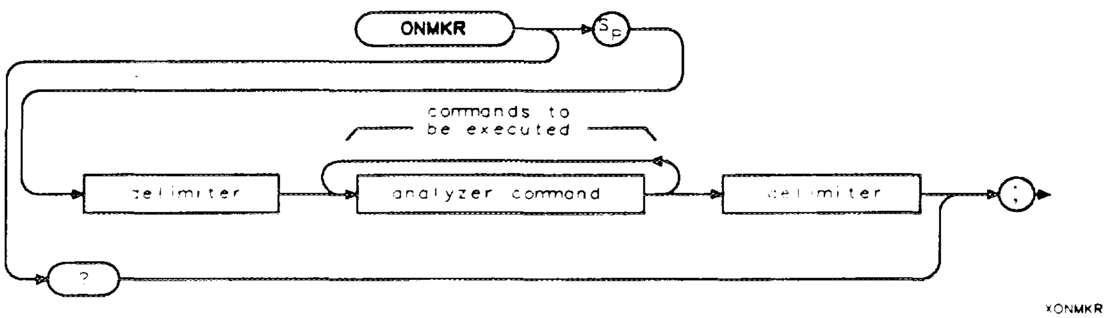



QONEOS

# ONMKR
# On Marker

Performs the list of spectrum analyzer commands when the sweep reaches the marker position.

## Syntax




<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any spectrum analyzer command.</td><td></td></tr>
</table>

Related Commands: CAT, DISPOSE, ERASE, IP, ONCYCLE, ONDELAY, ONEOS, ONSRQ, ONSWP, ONTIME.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"ONMKR !PU,PA 100,100;TEXT@CONNECT CAL
OUT TO INPUT@;!;"
```

*The text is displayed on the spectrum analyzer screen when the sweep reaches the marker position.*

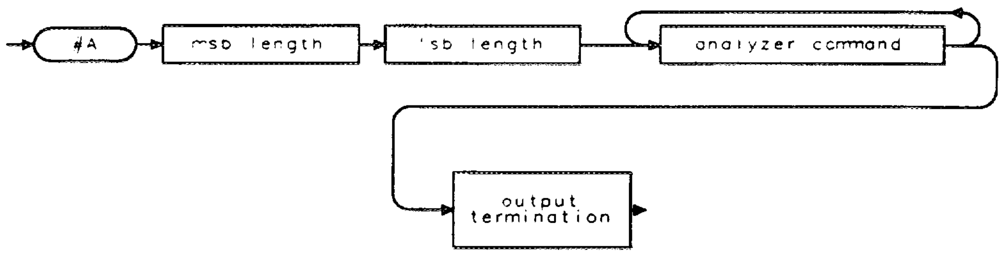
## Description

The ONMKR command performs the list of spectrum analyzer commands when the sweep reaches the marker. The sweep resumes after the list of spectrum analyzer commands is executed, provided the list of spectrum analyzer commands does not halt execution.

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONMKR definition:** IP clears the ONMKR definition. You can use the DISPOSE command to clear the ONMKR definition also.

## Query Response

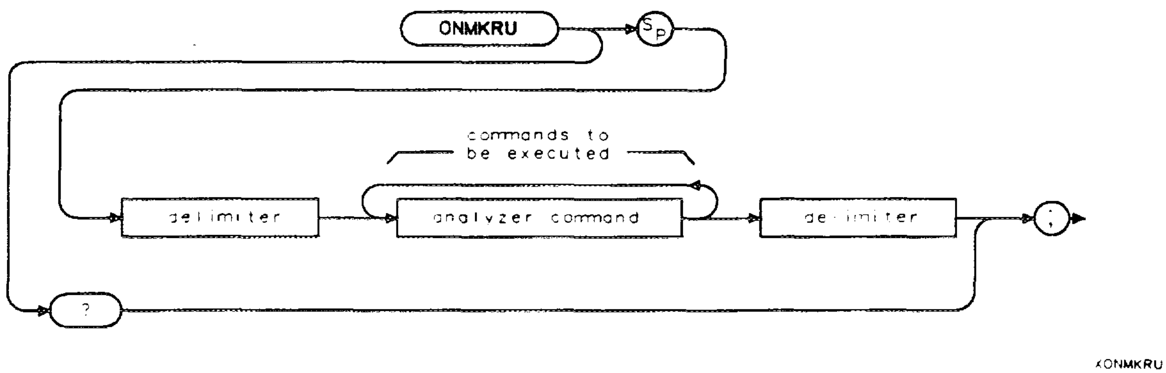



QONMKR

# ONMKRU
# On Marker Update

Executes the list of spectrum analyzer commands whenever the value or the units of the active marker are changed.

## Syntax




Related Commands: DISPOSE, IP.

## Example

The following example uses ONMKRU to display the marker's amplitude in watts.

| | | |
|---|---|---|
| 150 | ASSIGN @Sa TO 718 | *Assigns the IO path to spectrum analyzer.* |
| 160 | ! | |
| 170 | OUTPUT @Sa;"VARDEF T_EMP,0;"; | *Defines a variable called T_EMP.* |
| 180 | ! | |
| 190 | OUTPUT @Sa;"ONMKRU$"; | *Starts the ONMKRU definition.* |
| 200 |   OUTPUT @Sa;"EXP T_EMP,MA,10;" | *Changes the marker's amplitude value to milliwatts and places it in T_EMP.* |
| 210 |   OUTPUT @Sa;"MPY T_EMP,T_EMP,1000;"; | *Changes the value of T_EMP to μwatts.* |
| 220 |   OUTPUT @Sa;"MOV DA,0;"; | *Changes the display address to 0 to reset the display list.* |
| 230 |   OUTPUT @Sa;"PUPA10,101;"; | *Positions the pen.* |
| 240 |   OUTPUT @Sa;"TEXT^Power:^;"; | *Displays a label for the results.* |
| 250 |   OUTPUT @Sa;"DSPLY T_EMP,9.4;"; | *Displays the results.* |
| 260 |   OUTPUT @Sa;"TEXT^ uW^;"; | *Displays the units.* |
| 270 | OUTPUT @Sa;"$;"; | *Ends the ONMKRU definition.* |
| 280 | ! | |
| 290 | OUTPUT @Sa;"CF300MZ;" | *Sets the center frequency to the calibration signal.* |
| 300 | OUTPUT @Sa;"SP1MZ;" | *Changes the span to 1 MHz.* |
| 310 | OUTPUT @Sa;"RL -20DM;" | *Sets the reference level.* |
| 320 | OUTPUT @Sa;"RB30KZ;" | *Sets the resolution bandwidth.* |
| 330 | OUTPUT @Sa;"SNGLS;TS;" | *Takes a sweep.* |
| 340 | OUTPUT @Sa;"MKN;" | *Activates a normal marker.* |
| 350 | ! | |

```
360    END
```

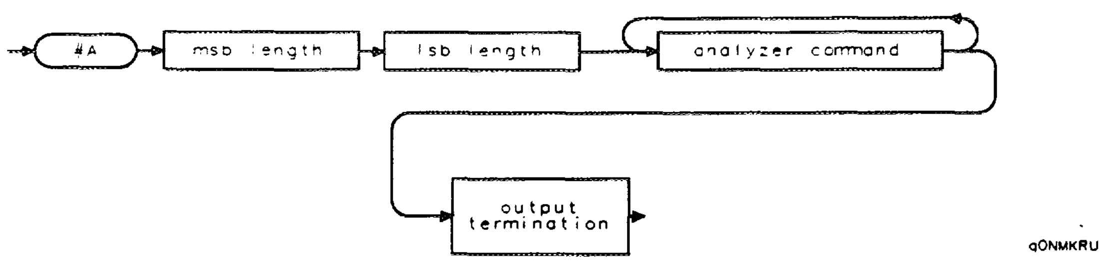
## Description

ONMKRU executes the specified user-defined function whenever the value or units of a marker are changed. While ONMKR executes the function when the marker is encountered, ONMKRU executes the function at the end of the sweep (when the marker data is updated), when the marker is moved, or if the units are changed with AUNITS. Executing any of the marker commands (for example, MKA, MKF, or MKNOISE) also executes the function.

**Restrictions:** The user-defined function should not include a take sweep (TS).

**Clearing the ONMKRU definition:** IP clears the ONMKRU definition. You can use the DISPOSE command to clear the ONMKRU definition also.

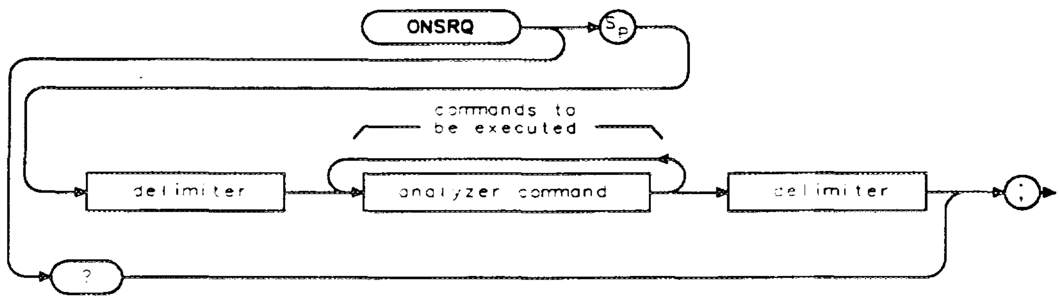
## Query Response



# ONSRQ
# On Service Request

Executes the list of analyzer commands whenever a service request occurs.

## Syntax




ONSRQ

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>` | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any spectrum analyzer command.</td><td></td></tr>
</table>

Related Commands: CAT, DISPOSE, ERASE, IP, ONDELAY, ONEOS, ONMKR, ONSWP, ONTIME, SRQ.

## Example

```
OUTPUT 718;"ONSRQ !PU;PA 100,100;TEXT @SRQ OCCURRED@;!;"
```

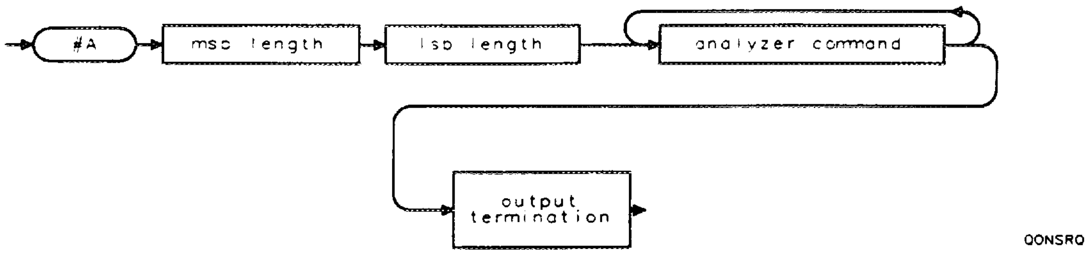
*"SRQ OCCURRED" is displayed on the spectrum analyzer screen if an SRQ is encountered.*

## Description

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONSRQ definition:** IP clears the ONSRQ definition. You can use the DISPOSE command to clear the ONSRQ definition also.

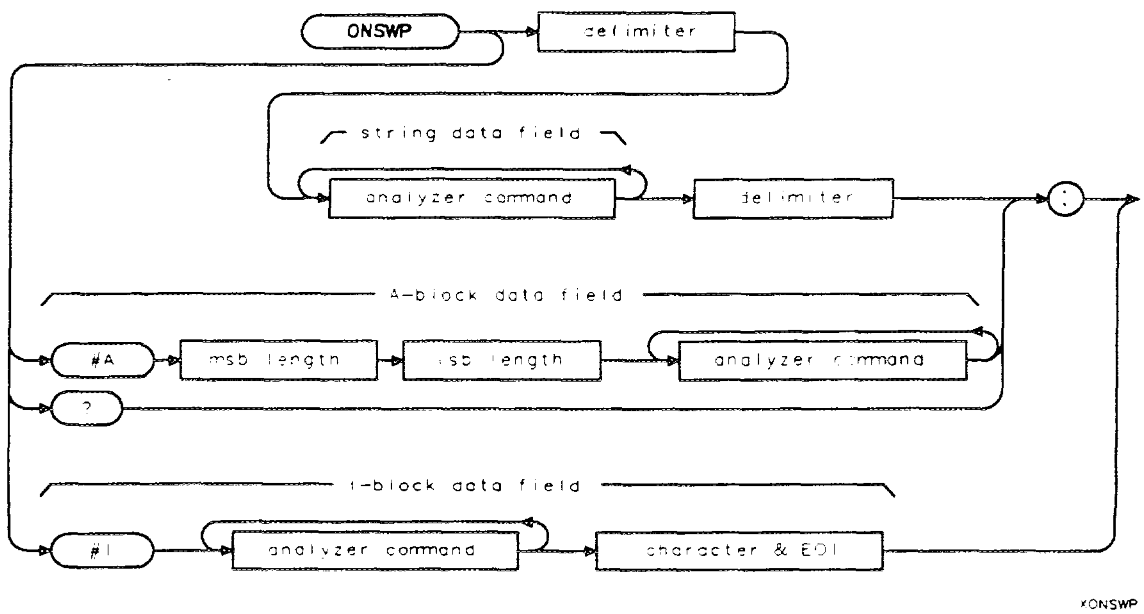
## Query Response



# ONSWP
# On Sweep

Executes the list of spectrum analyzer commands at the beginning of the sweep.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command except TS. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Character & EOI | Any valid character and END. | |

Related Commands: CAT, DISPOSE, ERASE, IP, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP.

## Example

`OUTPUT 718;"ONSWP!CF 100MHZ;!"` *The center frequency is changed to 100 MHz at the beginning of the sweep.*

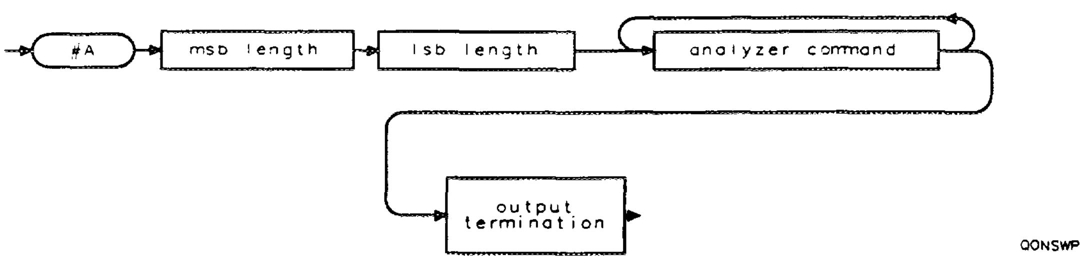
## Description

The list of analyzer commands should not include a take sweep (TS). Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

The #A, msb length, lsb length, and character data form an A-block data field. The A-block data field is used when the length of the character data is known. To use the A-block data format, #A must precede the msb length and lsb length. The msb length and lsb length represent the length of the character data. The #I, character data, and EOI (END) form an I-block data field. The I-block data field is used when the length of the character data is unknown. The I-block data field is available for the HP-IB interface only.

**Clearing the ONSWP definition:** IP clears the ONSWP definition. You can use the DISPOSE command to clear the ONSWP definition also.

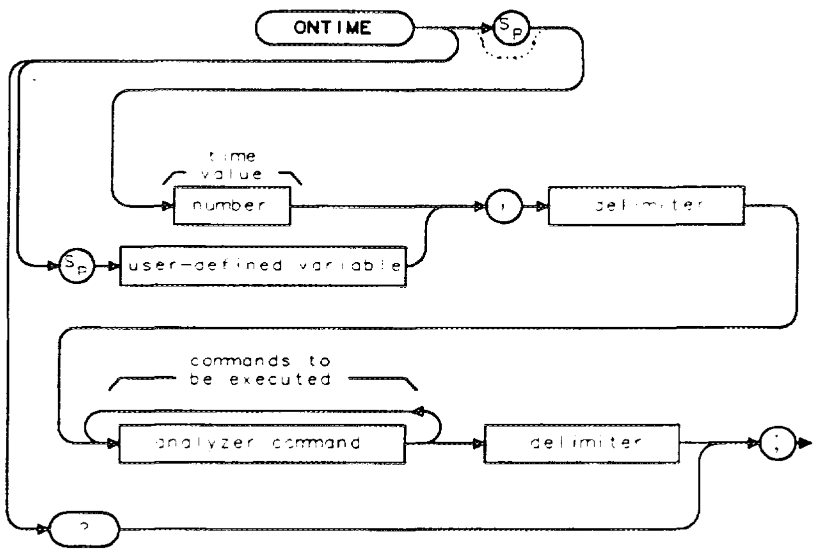
## Query Response



# ONTIME
# On Time

Executes the list of spectrum analyzer commands at the specified time.

## Syntax




XONTIME

| Item | Description/Default | Range |
|---|---|---|
| Number | A valid number in the YYMMDDHHMMSS (24 hour) format. | A valid year, month, day, and time. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Analyzer command | Any spectrum analyzer command. | |

Related Commands: DISPOSE, ERASE, IP, ONDELAY, ONEOS, ONMKR, ONSWP, ONSRQ.

## Example

`OUTPUT 718;"ONTIME 890212080000,!CF 600MHZ;!;"` *Changes the center frequency on 12 February 1989, at 8 AM.*

`OUTPUT 718;"ONTIME 080000,!CF 600MHZ;!;"` *If the YYMMDD is omitted from the time value parameter, the command list is executed at the next occurrence of the time value given.*

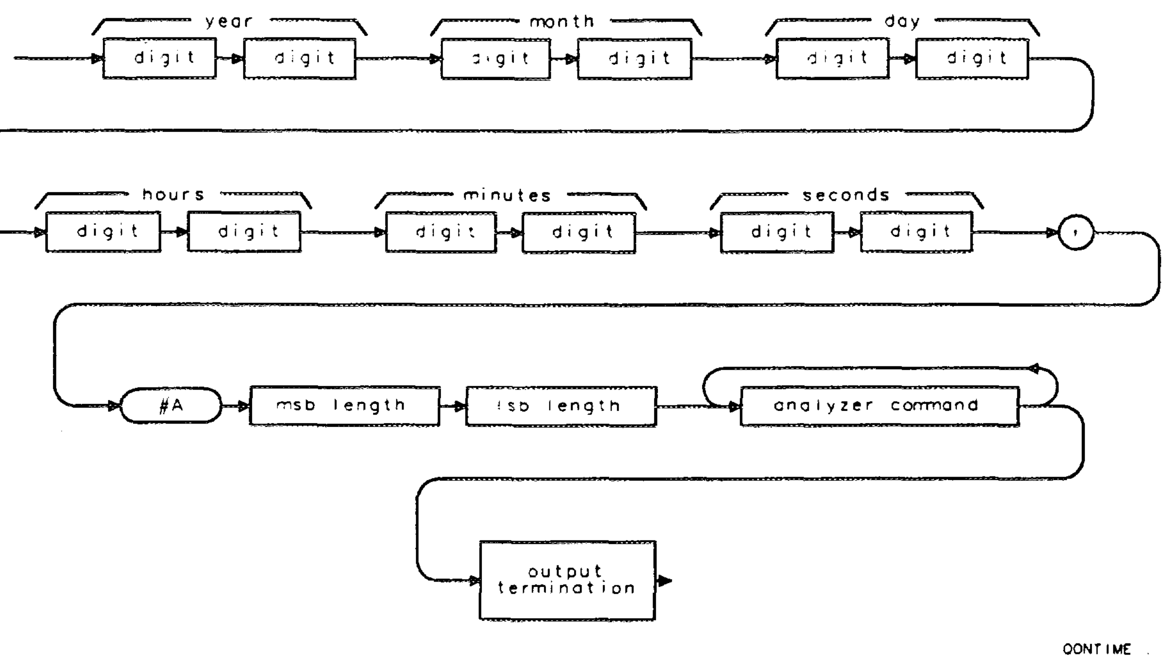
`OUTPUT 718;"ONTIME 890212150000,!CF 600MHZ;!;"` *Changes the center frequency on 12 February 1989, at 3 PM.*

## Description

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Clearing the ONTIME definition:** IP clears the ONTIME definition. You can use the DISPOSE command to clear the ONTIME definition also.

## Query Response



# OP
# Output Parameter

Returns parameter values P1 and P2, which represent the $x$ and $y$ coordinates of the lower-left and upper-right spectrum analyzer display.

## Syntax


XOP

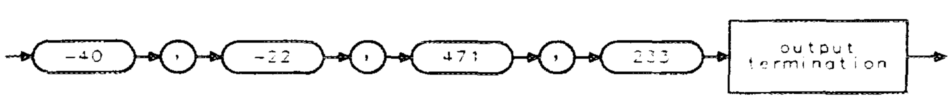
## Example

| | |
|---|---|
| `10 DIM A$[20]` | *Allocates memory space for result.* |
| `30 OUTPUT 718;"OP?;"` | *Gets the lower-left and the upper-right coordinates of the spectrum analyzer display.* |
| `40 ENTER 718;A$` | *Moves result to the computer.* |
| `50 DISP A$` | *Displays the result.* |
| `60 END` | |

## Description

The values returned represent $x$ and $y$ screen coordinates of the spectrum analyzer display. The screen coordinates designate the total on-screen area. The values returned are the minimum $x$ coordinate, the minimum $y$ coordinate, the maximum $x$ coordinate, and the maximum $y$ coordinate.

## Query Response

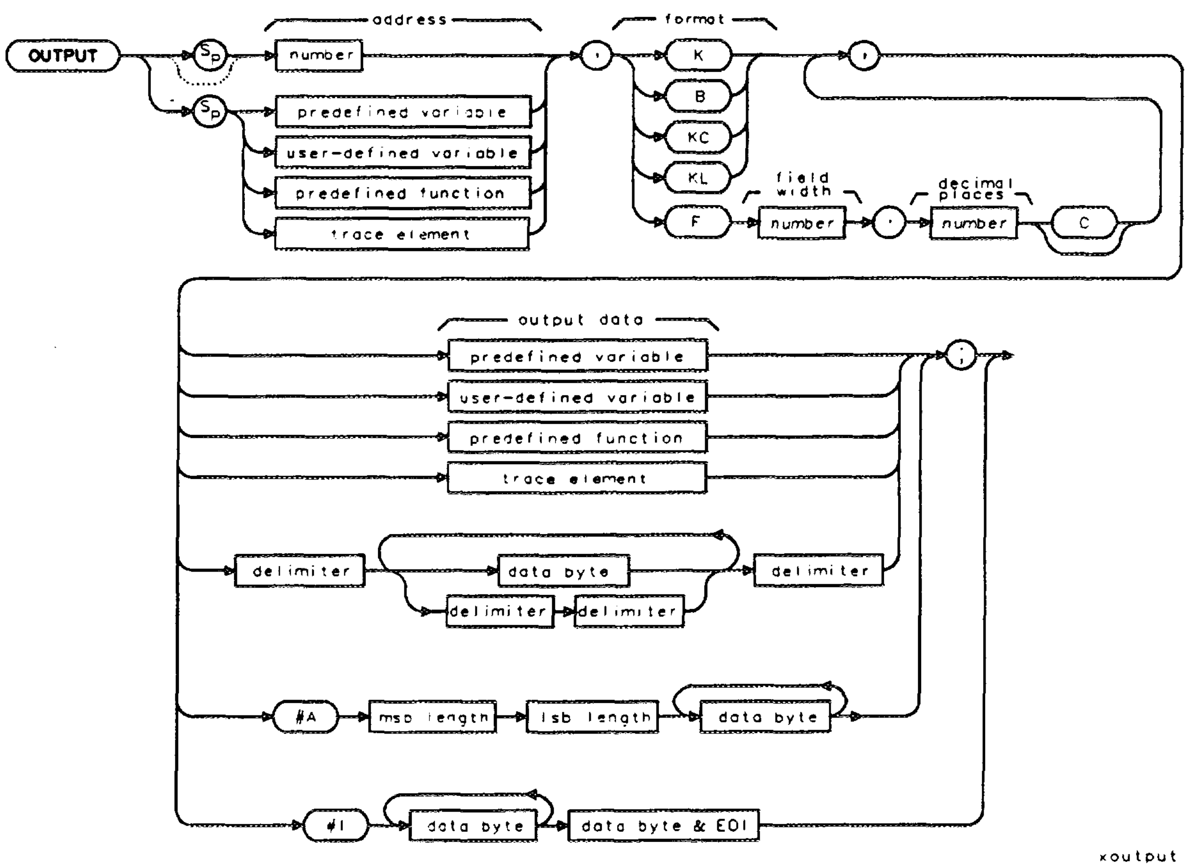



QOP

# OUTPUT
# Output to HP-IB

Allows the spectrum analyzer to send data to other devices on the HP-IB.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | An integer number. | 0 to 30. |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Data byte | 8-bit byte containing numeric or character data. | |
| Data byte & EOI | 8-bit byte containing numeric or character data followed by END. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.

Related Commands: ENTER, RELHPIB.

## Example

This example assumes that the plotter is at address 5 and the spectrum analyzer is at address 18. (The program is only valid for HP 9000 Series 200 and 300 computers.)

The following example uses the spectrum analyzer to send the ASCII code for OP; (output parameter) to the plotter. The ENTER command is then used to receive the coordinates from the plotter. Program lines 110 to 140 display the coordinates on the spectrum analyzer screen. Softkey 1 is programmed to display the plotter coordinates. Softkey 1 can be accessed by pressing [MEAS/USER], **User Menus** .

**Note** Disconnect the computer before pressing softkey 1 or execute ABORT 7, LOCAL 7 from the computer. The execute the P_OP function, the spectrum analyzer must be the only controller on the HP-IB.

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF P_ONEX,1,VARDEF P_ONEY,1;"` | *Declares the variables used to hold the plotter coordinates.* |
| `20 OUTPUT 718;"VARDEF P_TWOX,1;VARDEF P_TWOY,1;"` | *Declares the variables used to hold the plotter coordinates.* |
| `30 OUTPUT 718;"FUNCDEF P_OP,@";` | *Defines a function called P_OP.* |
| `40 OUTPUT 718;"OUTPUT 5,B,79;";` | *Sends ASCII code for "O".* |
| `50 OUTPUT 718;"OUTPUT 5,B,80;";` | *Sends ASCII code for "P".* |
| `60 OUTPUT 718;"OUTPUT 5,B,59;";` | *Sends ASCII code for ";".* |
| `70 OUTPUT 718;"ENTER 5,K,P_ONEX;";` | *Gets plotter coordinates from plotter.* |
| `80 OUTPUT 718;"ENTER 5,K,P_ONEY;";` | *Gets Y coordinate from plotter.* |
| `90 OUTPUT 718;"ENTER 5,K,P_TWOX;";` | *Gets X coordinate from plotter.* |
| `100 OUTPUT 718;"ENTER 5,K,P_TWOY;";` | *Gets Y coordinate from plotter.* |
| `110 OUTPUT 718;"PU;PA 200,190;DSPLY P_ONEX,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `120 OUTPUT 718;"PU;PA 200,180;DSPLY P_ONEY,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `130 OUTPUT 718;"PU;PA 200,170;DSPLY P_TWOX,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `140 OUTPUT 718;"PU;PA 200,160;DSPLY P_TWOY,10.2;";` | *Displays coordinate on spectrum analyzer screen.* |
| `150 OUTPUT 718;"RELHPIB;";` | *Releases spectrum analyzer control of the HP-IB.* |
| `160 OUTPUT 718;"@;"` | *Marks the end of the function, P_OP.* |
| `170 OUTPUT 718;"KEYDEF 1,P_OP,!DSP OP;!;"` | *Assigns the P_OP function to softkey 1.* |
| `180 END` | |

## Description

Use OUTPUT to send data or instructions to an HP-IB device using the following output formats.

**K** Outputs in free-field ASCII format with no terminator.

**B** Outputs in a free-field format with no terminator, but in a single 8-bit bytes.

**KC** Outputs in free-field ASCII with a carriage return and line feed terminator.

**KL** Outputs in free-field ASCII with a line feed and an EOI terminator.

**F** Outputs an ASCII number with the field width and decimal places specified. For example, a number displayed as 13.3 has a field width of 13 and a decimal place of three. If a "C" follows the ASCII number, a carriage return and line feed will terminate the output.

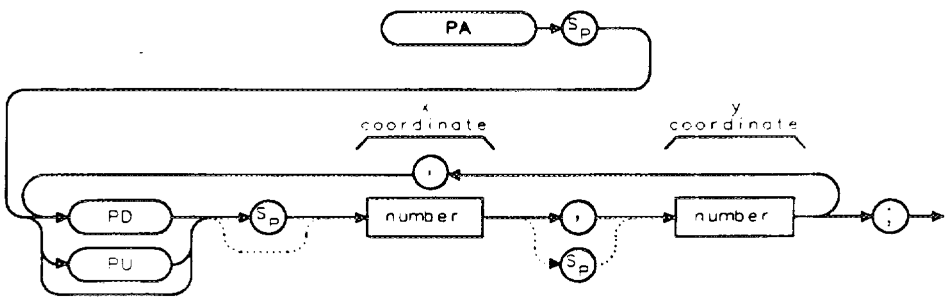
Because HP-IB allows only one controller on the HP-IB, OUTPUT must be synchronized with a controller operation or else incorporated into user-defined functions that are executed with softkeys when the spectrum analyzer is under manual control. If another controller is detected on the HP-IB, the OUTPUT function is aborted.

Execute RELHPIB (RELEASE HP-IB) to discontinue spectrum analyzer control of HP-IB.

# PA
# Plot Absolute

Moves the pen to a vector location on the spectrum analyzer screen relative to the reference coordinates (0,0) in display units.

## Syntax



XPA

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | Within screen or graticule coordinates. |

Related Commands: CLRDSP, DSPLY, TEXT, PD, PLOT, PR, PRINT, PU.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;BLANK TRA;"` | *Initializes the spectrum analyzer and blanks trace A.* |
| `OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Clears the spectrum analyzer screen.* |
| `OUTPUT 718;"PU;"` | *Pen up.* |
| `OUTPUT 718;"PA 100,100;PD 100,150;"` | *PU and PA commands prevent an initial vector from being drawn before the pen is positioned at (100, 100). PD draws a vector to (100, 150).* |
| `OUTPUT 718;"150,150,150,100,100,100;"` | *Draws the last three sides of the rectangle.* |

## Description

The vector is drawn on the screen if the pen-down (PD) command is in effect. If the pen-up (PU) command is in effect, the vector does not appear on the screen.

Display units are the scaling units of the spectrum analyzer display for on screen graphics commands such as PA or PR. One display unit is the distance between two points along an the $x$ or $y$ axis. For the HP 8590 Series spectrum analyzer, there are a maximum of 511 display units (−40 to 471) along the $x$ axis and 255 display units (−22 to 233) along the $y$ axis. See Figure 5-1.

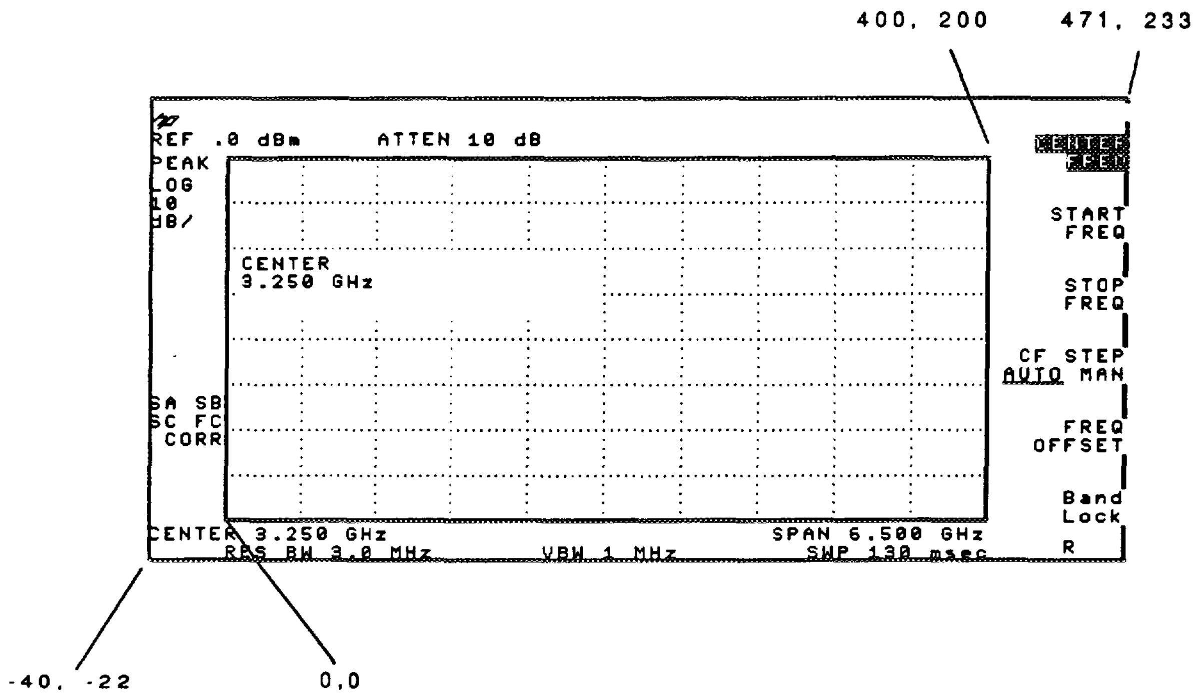



**Figure 5-1. Display Units**

The coordinates of the lower left screen corner of the screen are −40,−22 and the upper right screen corner of the screen are 471,233. For the graticule area, the coordinates of the lower left corner of the graticule are 0,0 and the coordinates of the upper right graticule area are 400,200. For example, you could execute "PU;PA 0,0;PD;PA 0,200,400,200,400,0,0,0;" to draw a box around the graticule area.

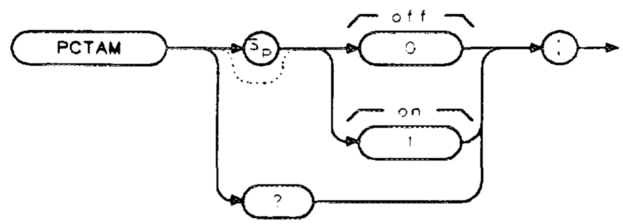
Because PA is an active function, executing PA causes the active function area on the spectrum analyzer screen to blank. To prevent the text following PA from being written in the active function area, execute hold (HD) after PA.

PU should be executed before the first PA command, and PA should be executed before executing TEXT, PD, or DSPLY commands.

# PCTAM
# Percent AM

Turns on or off the percent AM measurement.

## Syntax




xPCTAM

Equivalent Softkey: `% AM ON OFF`.
Related Commands: MKPX, PCTAMR, TH.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV PCTAM,1;"` | *Turns on the percent AM measurement.* |
| `OUTPUT 718;"PCTAMR?;"` | *Queries PCTAMR. PCTAMR contains the results of the percent AM measurement.* |
| `ENTER 718;Percent` | *Stores the value of PCTAMR in the variable Percent.* |
| `PRINT "Percent AM is ",Percent` | *Prints the results.* |
| `OUTPUT 718;"MOV PCTAM,0;"` | *Turns off the percent AM measurement.* |

## Description

Setting PCTAM to 0 turns off the percent AM function. Setting PCTAM to 1 turns on the percent AM function. When the percent AM function is turned on, the spectrum analyzer finds the signal with the highest amplitude, and then finds two signals (with lower amplitudes) on either side of the highest signal. The highest on-screen signal is assumed to be the carrier, and the adjacent signals are assumed to be the sidebands. The amplitude levels of all three signals are measured, and the percent AM is calculated using the carrier level and the sideband with the higher amplitude level. Percent AM is calculated as follows:

$$Percent\ AM = 200 \times \frac{Level_{Carrier}}{Level_{Sideband}}$$

The percent AM measurement is repeated at the end of every sweep (PCTAM uses the ONEOS command) until you turn off the percent AM measurement. You must query PCTAMR to determine the percent AM.

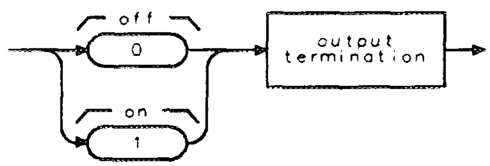
PCTAM can perform the percent AM measurement only if there are three on-screen signals that have the characteristics of a carrier with two sidebands. Also, to be considered a signal, the levels of the carrier and sideband signals must be greater than the peak excursion above the threshold. If there are not three signals that fit the characteristics of a carrier with two sidebands, the value of PCTAMR will be −100.

You can execute the PCTAM command two different ways. You can either execute the PCTAM command directly (for example, "`PCTAM 1;`") or use the MOV command to move the 1 or 0 into the PCTAM command (for example, "MOV PCTAM,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

**Restrictions**
Turning on the PCTAM function turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW).

You should turn off the percent AM measurement (set PCTAM to 0) when you are done with the percent AM measurement.

## Query Response




QPCTAM

# PCTAMR
# Percent AM Response

Returns the percent AM measured by the percent AM measurement (PCTAM).

## Syntax


XPCTAMR

Related Commands: MKPX, PCTAM, TH.

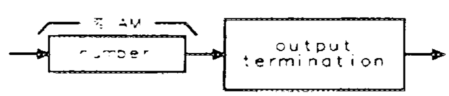
## Example

| | |
|---|---|
| `OUTPUT 718;"MOV PCTAM,1;"` | *Turns on the percent AM measurement.* |
| `OUTPUT 718;"PCTAMR?;"` | *Queries PCTAMR. PCTAMR contains the results of the percent AM measurement.* |
| `ENTER 718;Percent` | *Stores the value of PCTAMR in the variable Percent.* |
| `PRINT "Percent AM is ",Percent` | *Prints the results.* |
| `OUTPUT 718;"MOV PCTAM,0;"` | *Turns off the percent AM measurement.* |

## Description

PCTAMR returns a −100 if the PCTAM function has not been turned on, or if the on-screen signal is not valid or is not present. PCTAM can perform the percent AM measurement only if there are three on-screen signals that have the characteristics of a carrier and two sidebands. Also, to be considered a signal, the levels of the carrier and sideband signals must be greater than the peak excursion above the threshold.

## Query Response




QPCTAMR

# PD
# Pen Down

Instructs the spectrum analyzer to plot vectors on the spectrum analyzer screen until a PU command is received.

## Syntax


XPD

Related Commands: DSPLY, PA, PLOT, PR, PU, TEXT.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;BLANK TRA;"` | *Initializes the spectrum analyzer and blanks trace A.* |
| `OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Clears the spectrum analyzer screen.* |
| `OUTPUT 718;"PU;"` | *Pen up.* |
| `OUTPUT 718;"PA 100,100;PD 100,150;"` | *PU and PA commands prevent an initial vector from being drawn before the pen is positioned at (100, 100). PD draws a vector to (100, 150).* |
| `OUTPUT 718;"150,150,150,100,100,100;"` | *Draws the last three sides of the rectangle.* |

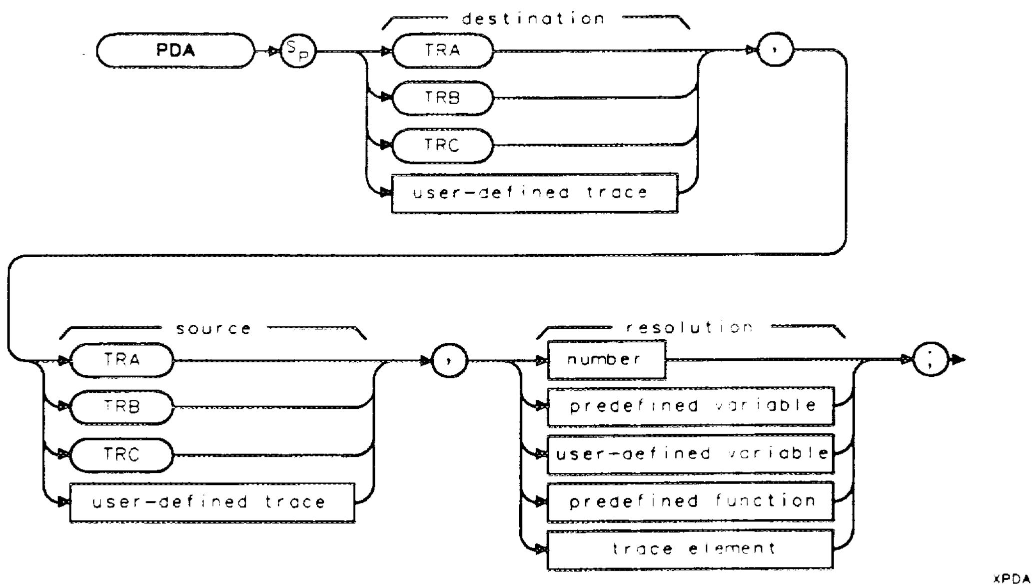
## Description

The command PD is used to enable drawing of all vectors specified by the commands PA (plot absolute), or PR (plot relative). It remains in effect until a PU command is received. PD does not need to be executed before using the TEXT or DSPLY commands.

# PDA
# Probability Distribution of Amplitude

Sums the probability distribution of amplitude in the destination trace with the amplitude distribution function of the source trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: PDF, RMS, STDEV.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer and activates the single-sweep mode.* |
| `OUTPUT 718;"VB 10KHZ;HD;TS;"` | *Changes video bandwidth, updates trace.* |
| `OUTPUT 718;"MOV TRB,0;"` | *Replaces trace B data with all zeros.* |
| `OUTPUT 718;"PDA TRB,TRA,1;"` | *Determines the distribution of trace A and sums results into trace B.* |
| `OUTPUT 718;"MPY TRB,TRB,5;"` | *Multiplies values in trace B by 5 to make the results more visible.* |

```
OUTPUT 718;"VIEW TRB;"
```
*Displays the result.*

## Description

The PDA command takes the data in the source trace on a point-by-point basis. Each amplitude value is divided by 100 times resolution value, and the result of the division is rounded to an integer. If the result falls within the range of the buckets of the destination trace, the content of the corresponding destination trace element is increased by one. For example, to show the distribution of amplitudes on a trace with values ranging from 0 to 8000, a resolution value of 1 dB would result in 81 buckets ((8000/(1 × 100))+ 1). Amplitude values ranging from 0 to 99 would go to bucket 1, values from 100 to 199 would go into bucket 2, and so forth. Finally, values from 7900 to 7999 would go to bucket 400. An amplitude value of 8000 would fall into bucket 81.

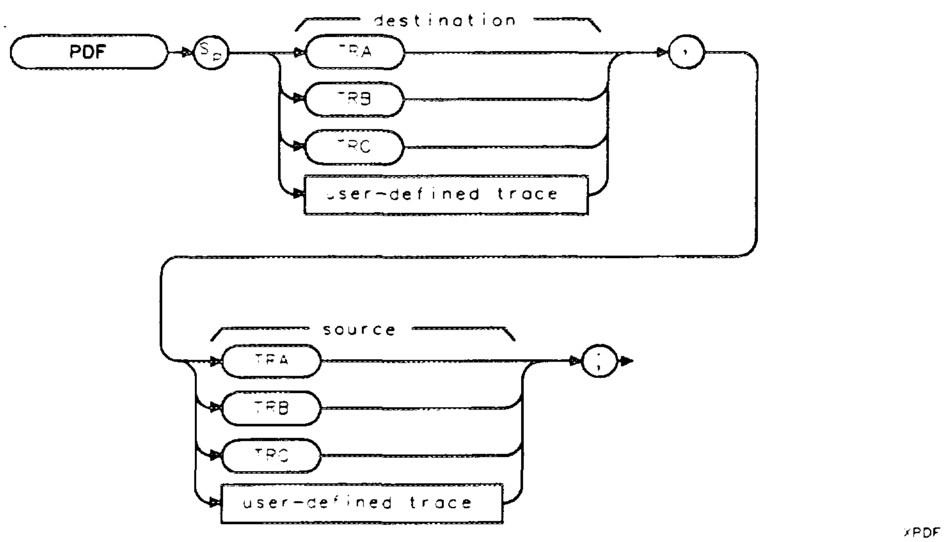
Due to the summing nature of the PDA command, the destination trace should always be initialized to all zeros.

The PDA function is similar to the probability density function in statistics. The probability density function has the $y$-axis as the probability of an occurrence, where the PDA function of the HP 8590 Series spectrum analyzer has the number of occurrences as its $y$-axis. The PDA could be converted to a probability density function by dividing, in an external controller, the value of each bucket by the total number of source elements. Note that performing the divide inside the spectrum analyzer would not be appropriate because the result is less than 1, which would be truncated to 0.

# PDF
# Probability Distribution of Frequency

Increments an element of the destination trace whenever the corresponding element of the source trace exceeds a threshold. This is useful for constructing a frequency probability density function.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |

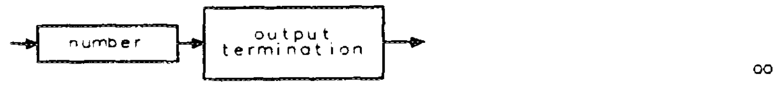
Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: PDA, TH.

## Example

This example finds the portions of the frequency band where no signals above −50 dBm are observed in an hour time frame.

| | |
|---|---|
| `10 OUTPUT 718;"IP;";` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SP 100MZ;CF 300MZ;"` | *Changes the span and center frequency.* |
| `30 OUTPUT 718;"TH -50 DM;TS;"` | *Activates the threshold level, take a sweep.* |
| `40 OUTPUT 718;"VIEW TRB;CLRW TRA;MOV TRB,0;"` | *Sets trace B to zeros.* |
| `50 OUTPUT 718;"ST?;"` | *Gets the sweep time.* |
| `60 ENTER 718;Sweep_time` | *Returns the sweep time to the controller.* |
| `70 Swp_retrace = Sweep_time+.1` | *Calculates the total sweep time, including the retrace time.* |
| `80 Num_sweeps = 3600/Swp_retrace` | *Calculates the number of sweeps in one hour.* |

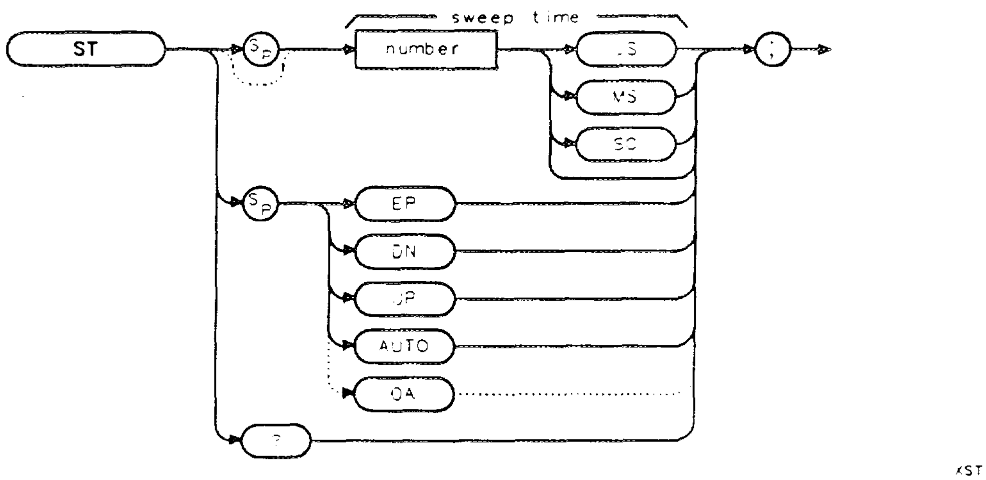
## Query Response



# ST
# Sweep Time

Specifies the time in which the spectrum analyzer sweeps the displayed frequency range.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | Within the sweep time range of the spectrum analyzer. |

Equivalent Softkey: **SWP TIME AUTO MAN**.
Sweep Time Range in Zero Span: 15 ms to 100s.
Sweep Time Range in Zero Span, Option 101 only: 20 μs to 100s.
Sweep Time Range in Non-zero Span: 20 ms to 100 s.
Step Increment: 2, 3, 5, 7.5, 10, 15 sequence.
Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: AUTO, CONTS, HNLOCK, HNUNLK, RB, SNGLS, SP, SRCPSWP, TS.

## Example

`OUTPUT 718;"ST 100MS;"` *Sets the sweep time to 100 milliseconds.*

## Description

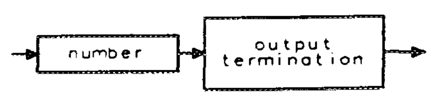
When used as a predefined variable, ST returns the sweep time as a real number in seconds.

| | |
|---|---|
| `40 ENTER 718 USING "K";Mk_freq` | *Puts the spectrum analyzer response in the computer variable, Mk_freq.* |
| `50 OUTPUT 718;"MKA?;"` | *Returns the amplitude of the marker.* |
| `60 ENTER 718 USING "K";Mk_amp` | *Puts the spectrum analyzer response in the computer variable, Mk_amp.* |
| `70 OUTPUT 718;"SS ";Mk_freq;"HZ"` | *Changes the step size to the marker frequency.* |
| `80 OUTPUT 718;"CF UP;TS;MKPK HI;MKA?;"` | *Increases the center frequency, takes sweep, puts the marker on the highest peak and returns the amplitude of the marker.* |
| `90 ENTER 718;Mk_ampl` | *Puts the spectrum analyzer response in the computer variable, Mk_ampl.* |
| `100 PRINT "THE FUNDAMENTAL IS ";Mk_amp-Mk_ampl` | *Outputs the result.* |
| `110 PRINT "dB ABOVE THE SECOND HARMONIC"` | |
| `120 END` | |

## Description

The AUTO parameter removes SS as an active function but does not have an effect on its value.

## Query Response

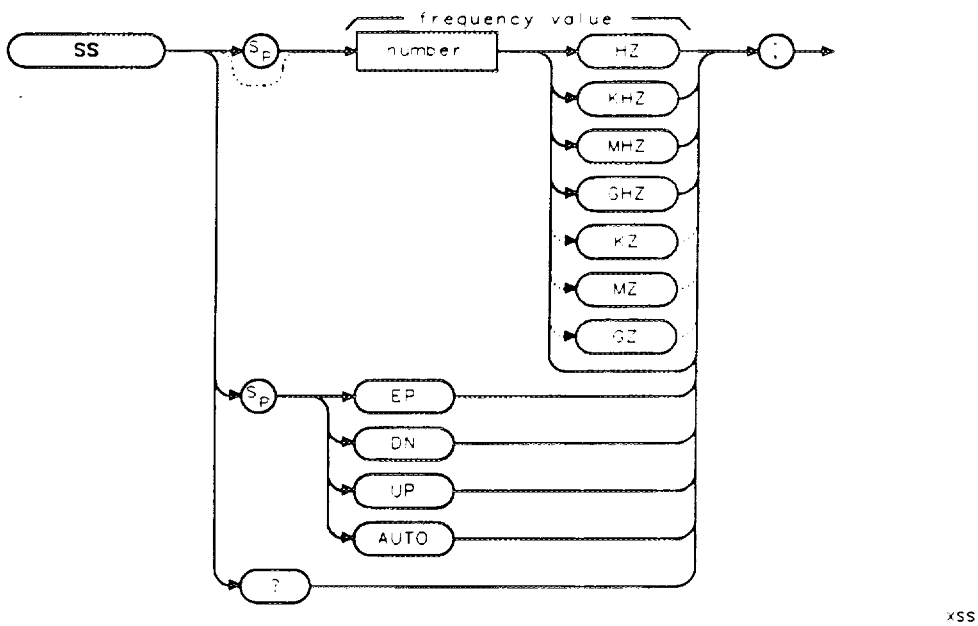



QQ1

# SS
# Center Frequency Step Size

Specifies center frequency step size.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency range of the spectrum analyzer. |

Equivalent Softkey: **CF STEP AUTO MAN**.
Preset State: 100 MHz.
Step Increment: 1, 2, 5, 10 sequence.
Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: AUTO, CF, FOFFSET, SP.

## Example

| | |
|---|---|
| `10 CLEAR 718` | *Clears the HP-IB.* |
| `20 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes the spectrum analyzer, activates single-sweep mode, changes the center frequency, span, takes sweep.* |
| `30 OUTPUT 718;"MKPK HI;MKRL;TS;MKF?;"` | *Finds the highest peak, changes the reference level to the marker, takes sweep, returns the frequency of the marker.* |

**SRQ Force Service Request**

## Interface Differences

As implemented on the HP-IB interface, an spectrum analyzer service request asserts the SRQ control line on the HP-IB.

On the RS-232 interface, the spectrum analyzer does not have a way of signaling the interrupt condition to a controller. In this case, the controller must operate in a polled mode if it requires interrupt information (see "Polled Mode of Operation" below for a discussion of the polled mode).

**Interrupt-Related Commands Common to All Interfaces:**

- CLS Clear status byte, without read.
- RQS Request mask.
- SRQ Force service request.
- STB Read then clear status byte.

The HP-IB interface supports interface commands to read the status byte.

On HP-IB in HP 9000 Series 200 or 300 BASIC, the statement SPOLL (Device_address) can be used to read the status byte.

## Polled Mode of Operation

The polled mode of operation is probably most applicable to an RS-232 interface user. Because there is no interrupt signal to the RS-232 controller, the user must periodically ask the spectrum analyzer, via the "STB?" command, for the contents of its status register. For example, the RS-232 controller could periodically check for the hardware-broken condition by executing the "STB?" command and reading the results.

**Table 5-9. Spectrum Analyzer Status Byte**

| Bit Number | Decimal Equivalent | Spectrum Analyzer State | Description |
|---|---|---|---|
| 5 | 32 | Set when an illegal command is present. | SRQ 140 appears on the spectrum analyzer screen. |
| 4 | 16 | Set when any command is completed. | It is triggered by EOI at the end of a command string or the completion of a print or plot. |
| 3 | 8 | Indicates hardware broken condition. | SRQ 110 appears on the spectrum analyzer screen. |
| 2 | 4 | Indicates end of sweep. | SRQ 104 appears on the spectrum analyzer screen. If you send any RQS value that contains mask value 4, another sweep will be taken. |
| 1 | 2 | Indicates a units key was pressed. | SRQ 102 appears on the spectrum analyzer screen. If you activate the units key bit, it will remain active until you activate "EE" and press a units key. (See "EE.") |

Bit numbers **0** (LSB), **6**, and **7** are not used.

The spectrum analyzer screen numbers 102, 104, and 110 are the octal values corresponding to the status register values; that is, SRQ 102 = bit 6 = octal 100 and bit 2 = octal 2 are both true.

Generally, you must set the bit mask using the RQS command. However, the "hardware broken" and "illegal remote command" conditions are automatically enabled after presetting or sending the IP command. Pressing (PRESET) or sending the IP command, then, produces the same interrupt bit mask as sending "RQS 40;" (decimal 40 is the sum of the assigned values of these two interrupt bits, 32 = bit 5 and 8 = bit 3).

For most conditions, the RQS mask bit stays set until the next instrument preset (IP), or RQS command is executed. The only condition to which this does not apply is the Units Key Pressed bit. When this bit (bit 1) is set in the RQS mask, a Units Key Pressed interrupt occurs if EE (enable entry mode) is executed and a front-panel units key such as Hz, kHz, MHz, or GHz is pressed.

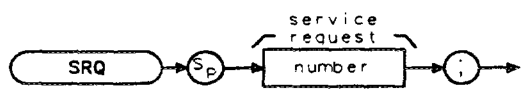
When a units key is pressed, the interrupt occurs and the Units Key Pressed bit in the RQS mask is reset. To reenable the Units Key Pressed interrupt, you must send a new RQS mask. See "RQS" for detailed information.

As mentioned, you can simulate a service request condition. Choose the desired interrupt conditions from the RQS command table (see "RQS"), and sum their assigned values. Use the RQS command with this value to set the bit mask. By setting the corresponding bits in the SRQ command and sending the SRQ command to the spectrum analyzer, the desired interrupt occurs. This allows the user to verify proper operation of software routines designed to handle infrequent or unlikely interrupts.

# SRQ
# Force Service Request

The SRQ command is used by an external controller to simulate interrupts from the spectrum analyzer.

## Syntax




XSRQ

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 2 to 126. |

Related Commands: CLS, EE, RQS, STB.

## Example

`OUTPUT 718;"RQS 8;SRQ 8;"` *Sets bit mask for a hardware broken service request, generates a hardware broken interrupt.*

**Note**

A program can respond to the interrupt in the same way it would under a true service request condition.

## Description

The service request condition is also displayed on the spectrum analyzer screen with the annotation `SRQ XXX`, where XXX is a three-digit octal number.

The conditions that can generate a service request are as follows:

32 = Illegal command
16 = Command complete
8 = Hardware broken
4 = End of sweep
2 = Units key pressed

A service request is generated only if the proper request mask bit has been set (see "RQS"), and either the condition itself or the Force Service Request is sent. To set the request mask, choose the desired interrupt conditions and sum their assigned values. Executing the RQS command with this value sets the bit mask. After setting the bit mask, only the chosen conditions can produce an interrupt.

Each bit in the status byte is defined as shown in the following table.

# SRCTKPK
# Source Tracking Peak

Automatically adjusts the tracking of source output with spectrum-analyzer sweep.

## Syntax


XSRCTKPK

Option Required: Option 010 or 011.
Equivalent Softkey: **TRACKING PEAK**.
Related Commands: Commands that change bandwidth, such as RB, VB, ST, and commands that change frequency, such as SP, CF, FA, FB, SP, FS, SRCTK.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

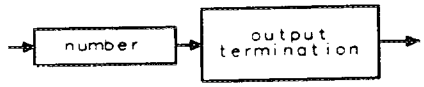
| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Activates the stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DB;"` | *Turns on the power at the source output to its current setting.* |
| `OUTPUT 718;"SP 1MHZ;"` | *Sets measurement range.* |
| `OUTPUT 718;"RB 1KHZ;"` | |
| `OUTPUT 718;"TS;"` | *Takes sweep.* |
| `OUTPUT 718;"SRCTKPK;"` | *Automatically adjusts the tracking.* |

## Description

The SRCTKPK command adjusts the tracking of the tracking-generator source output automatically to maximize responses for measurements made with resolution bandwidths less than 300 kHz.

SRCTKPK maximizes the amplitude of the displayed active trace.

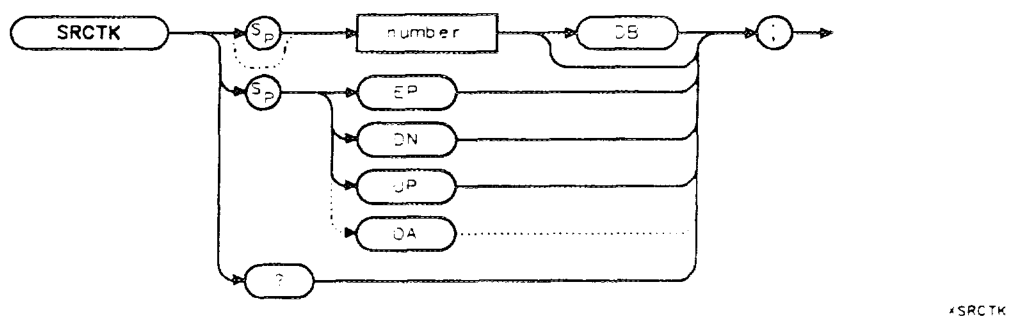
## Query Response



# SRCTK
# Source Tracking

Adjusts the tracking of the source output with the spectrum analyzer sweep.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 0 to 16,383. |

Option Required: Option 010 or 011.
Equivalent Softkey: **MAN TRK ADJUST**.
Step Increment: 1.
Related Commands: Commands that change bandwidth, such as RB, VB, ST, and commands that change frequency, such as SP, CF, FA, FB, SP, FS, SRCTKPK.

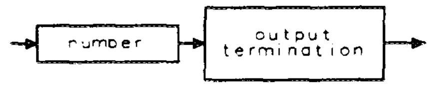
## Example

| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Activates the stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -20DB;"` | *Turns on the power at the source output.* |
| `OUTPUT 718;"SP 1MHZ;"` | *Sets measurement range.* |
| `OUTPUT 718;"RB 1KHZ;"` | |
| `OUTPUT 718;"TS;"` | *Takes sweep.* |
| `OUTPUT 718;"SRCTK EP;"` | *Allows entry of from front-panel keys to adjust tracking.* |

## Description

The SRCTK command adjusts the tracking of the tracking-generator output relative to the center frequency of the spectrum-analyzer. SRCTK is used typically for bandwidths less than 300 kHz. Bandwidths greater than 300 kHz do not require tracking adjustment. Use SRCTK to improve amplitude accuracy and maximize signal response. Use SRCTKPK to adjust tracking automatically. See "SRCTKPK."

## Query Response

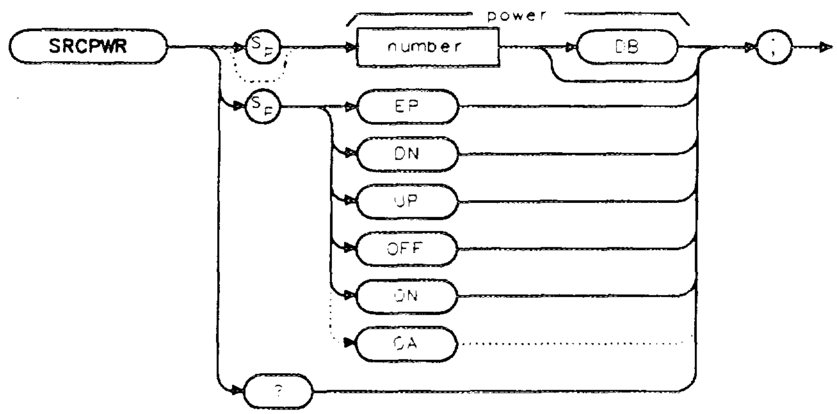



001

# SRCPWR
# Source Power

Selects the source power level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is the current amplitude unit. | Actual range is hardware dependent. |

Option Required: Option 010 or 011.
Equivalent Softkey: SRC PWR ON OFF .
Step Increment: Set by SRCPSTP.
Related Commands: SRCAT, SRCPSTP, SRCPSWP.
Preset State: −10 dBm.

## Example

Use SRCPWR to turn on the source and adjust its power level.

```
OUTPUT 718;"SRCPWR -20DB;"     Changes power level to -20 dBm.
OUTPUT 718;"AUNITS DBMV;"      Changes the current amplitude unit.
OUTPUT 718;"SRCPWR 37;"        The source power is now 37 dBmV.
```

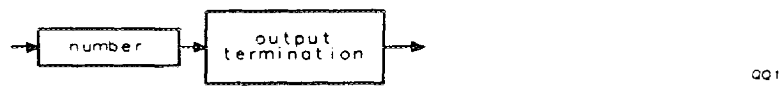
## Description

The SRCPWR command turns the source off or on and sets the power level of the source. The source is turned on automatically whenever its value is specified with SRCPWR. Also see "SRCPSTP."

**Note** Power is swept from low to high.

The minimum sweep time is limited to 20 ms when performing a source power sweep, even if the spectrum analyzer has an Option 101 installed in it.

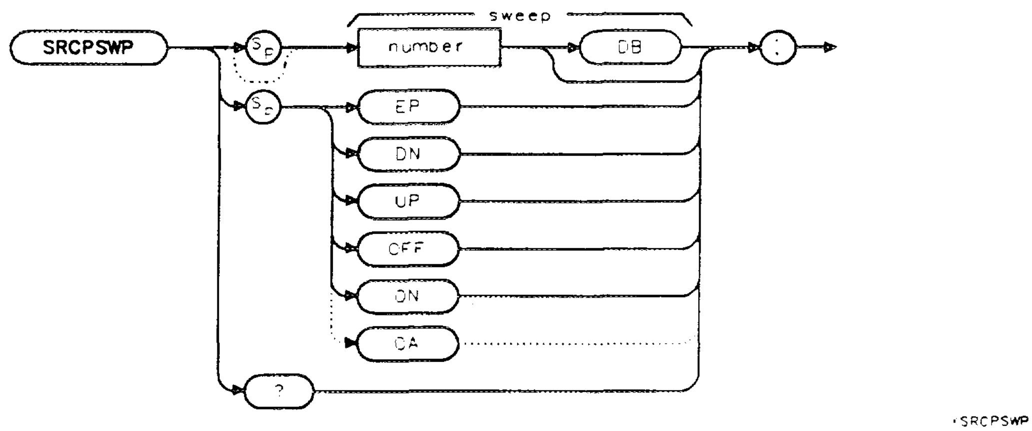
## Query Response



# SRCPSWP
# Source Power Sweep

Selects the sweep range of the source output.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | |

Option Required: Option 010 or 011.
Equivalent Softkey: **PWR SWP ON OFF**.
Step Increment: Determined by SRCPSTP.
Related Commands: SRCPSWP, SRCPOFS, SRCPSTP.
Preset State: SRCPSWP OFF.

## Example

Use SRCPSWP to sweep the power level of the source output.

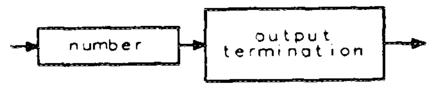
| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Activates stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DB;"` | *Sets power level of source output to −10 dBm.* |
| `OUTPUT 718;"SP 0;"` | *Sets span to 0 Hz.* |
| `OUTPUT 718;"SRCPSWP 10DB;"` | *Sweeps source output from −10 dBm to 0 dBm.* |

## Description

The SRCPSWP command works in conjunction with the SRCPWR (source power) command to sweep the amplitude level of the source output. The SRCPWR setting determines the amplitude level at the beginning of the sweep. The SRCPSWP command determines the change in amplitude level of the sweep.

For example, if SRCPWR and SRCPSWP are set to −15 dBm and 4 dB respectively, the source sweeps from −15 dBm to −11 dBm.

## Query Response

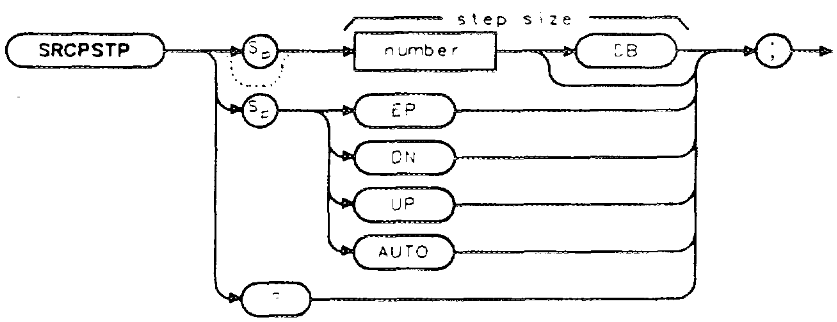



QQ1

# SRCPSTP
# Source Power-Level Step Size

Selects the source-power step size.

## Syntax




SRCPSTP

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | |

Option Required: Option 010 or 011.
Equivalent Softkey: **SRC PWR STP SIZE**.
Step Increment: 0.1 dB.
Related Commands: SRCPWR, SRCPOFS, SRCPSWP.
Preset State: SRCPSTP AUTO (one major vertical scale division).

## Example

Select incremental changes of power effected by "SRCPWR UP;", "SRCPWR DN;" commands, or the step keys.

```
OUTPUT 718;"MEASURE SR;"       Activates stimulus-response mode.
OUTPUT 718;"SRCPWR -10DB;"     Turns on the source output.
OUTPUT 718;"SRCPSTP .3DB;"     Sets power-level step size to 0.3 dB.
OUTPUT 718;"SRCPWR UP;"        Increases the power level.
```

## Description

The SRCPSTP command selects the step size for the following source commands:

- Power offset (SRCPOFS).
- Power sweep (SRCPSWP).
- Power (SRCPWR).

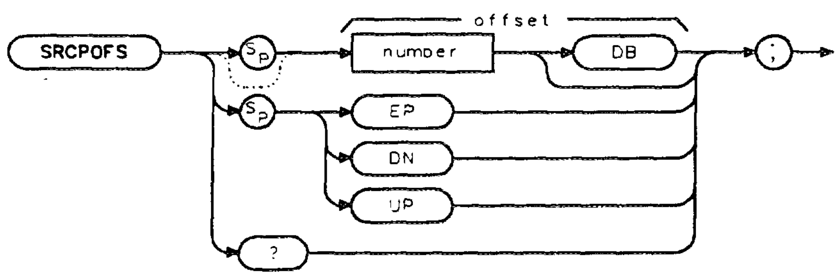
Use SRCPSTP to set the step size to a specific value.

"SRCPSTP AUTO;" sets the step size to one vertical scale division.

# SRCPOFS
# Source Power Offset

Offsets the source power level readout.

## Syntax




XSRCPOFS

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | |

Option Required: Option 010 or 011.
Equivalent Softkey: **SRC PWR OFFSET** .
Related Commands: SRCPWR, SRCPSWP.
Step Increment: Determined by SRCPSTP.
Preset State: 0 dB.

## Example

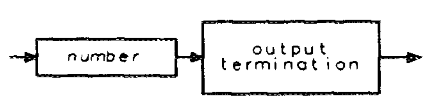
Use SRCPOFS to offset the power-level readout for the tracking-generator source.

| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Sets spectrum analyzer to stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DB;"` | *Turns on source output.* |
| `OUTPUT 718;"SRCPOFS 13DB;"` | *Offsets power-level readout for source by 13 dB.* |

## Description

The SRCPOFS command offsets the displayed power of the built-in tracking generator. This function may be used to take into account system losses (for example, cable loss) or gains (for example, preamplifier gain) reflecting the actual power delivered to the device under test.

## Query Response



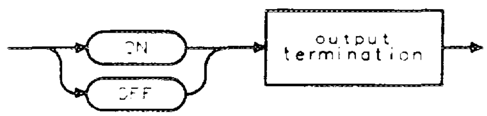

QQ1

## Description

The SRCNORM command subtracts trace B from trace A, point by point, adds the display line value to the difference, and sends the difference to trace A. The SRCNORM function remains in effect until it is turned off by executing "SRCNORM OFF;".

A common use of trace subtraction is to normalize one trace with respect to another. For example, traces are frequently subtracted to normalize the spectrum analyzer response when a tracking generator is used. In such applications, amplitude units in dBm should be subtracted. To accomplish this, the display line should be set to 0 dBm using DL as shown in the example. Also see example 2 and 3 in "AMB" for comparison.

## Query Response

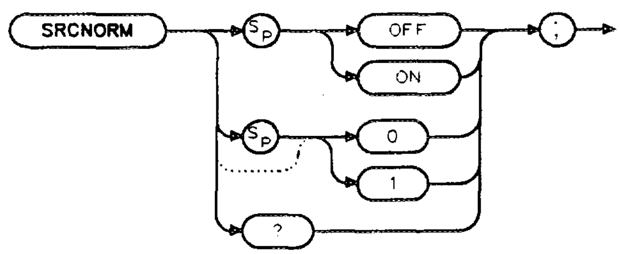



002

# SRCNORM
# Source Normalization

Subtracts trace B from trace A, adds the display line value to the difference, and sends the result to trace A during every sweep of the spectrum analyzer.

## Syntax




XSRCNORM

Equivalent Softkey: **NORMLIZE ON OFF**.
Preset State: SRCNORM OFF.
Related Commands: AMB, CONTS, CLRW, DL, MXMH, SNGLS, TS, VAVG, VIEW.

## Example

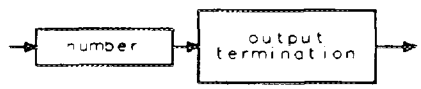
| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;RL 20DB;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 OUTPUT 718;"MOV TRA,5000;"` | *Sets trace A to 5000 measurement units, which is equal to −10 dBm.* |
| `30 OUTPUT 718;"VIEW TRA;"` | |
| `40 OUTPUT 718;"MOV TRB,4000;"` | *Sets trace B to 4000 measurement units, which is equal to −20 dBm.* |
| `50 OUTPUT 718;"VIEW TRB;"` | |
| `60 OUTPUT 718;"DL 0DM;"` | *Sets display line to 0 dBm, which is at 6000 measurement units.* |
| `70 OUTPUT 718;"SRCNORM ON;"` | *Performs trace A − trace B + display line. The result is 5000 − 4000 + 6000 = 7000 or 10 dBm. Note that this has resulted in a subtraction of amplitude in dBm, −10 dBm −(−20 dBm) = 10 dBm.* |
| `80 OUTPUT 718;"BLANK TRB;VIEW TRA;"` | |
| `90 END` | |

## Description

The SRCAT command attenuates the output level of the source. Use SRCAT to attenuate the power level of the source manually, from 0 to 60 dB in 10 dB steps for an HP 8591E, from 0 to 56 dB in 8 dB steps for an HP 8593E, HP 8594E, HP 8595E, or HP 8596E.

"SRCAT AUTO;" automatically adjusts the attenuator to yield the source amplitude level specified by the SRCPWR command.

## Query Response

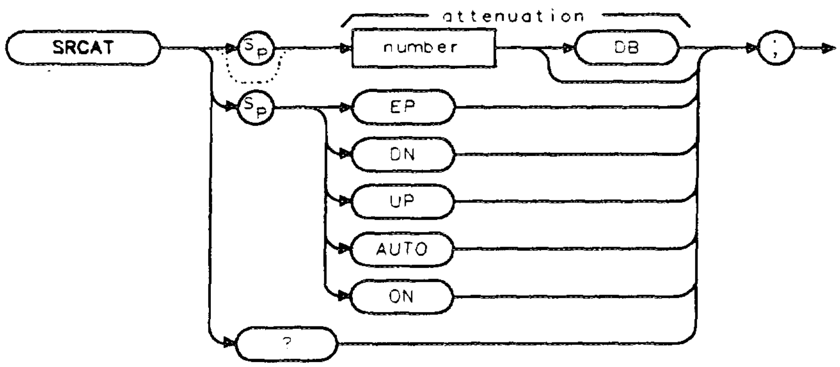



001

## SRCAT
## Source Attenuator

Attenuates the source output level.

### Syntax




XSRCAT

| Item | Description/Default | Range |
|---|---|---|
| Number (HP 8591E only) | Any real or integer number, specified in multiples of 10 dB. | 0 to 60 dB. |
| Number (HP 8593E, HP 8594E, HP 8595E, or HP 8596E only) | Any real or integer number, specified in multiples of 8 dB. | 0 to 56 dB. |

Equivalent Softkey: **SRC ATN MAN AUTO** .

Option Required: Option 010 or 011 installed in an HP 8591E. Option 010 installed in an HP 8593E, HP 8594E, HP 8595E, or HP 8596E.

Coupling: Coupled to power level of the source output (SRCPWR) when set to auto (SRCAT AUTO).

Related Commands: SRCPSTP.

Preset State: SRCAT AUTO.

### Example

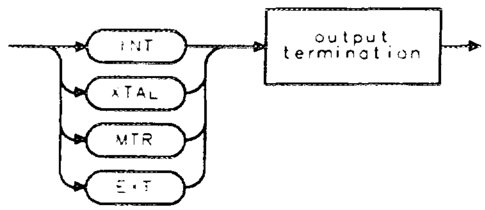
The following example uses the SRCAT command to attenuate the source output. This value specified for SRCAT (20 dB) applies to an HP 8591E only.

| | |
|---|---|
| `OUTPUT 718;"SRCAT AUTO;"` | *Activates source-attenuation coupling.* |
| `OUTPUT 718;"SRCPWR -20DB;"` | *Activates source output.* |
| `OUTPUT 718;"SRCAT 20DB;"` | *Sets attenuator to 20 dB. This decouples the attenuator from the source power-level setting.* |

When used as a predefined variable, SRCALC returns a number from 0 to 2. The value that is returned by SRCALC depends on the SRCALC parameter, as shown in the following table.

| Parameter setting | Value returned |
|---|---|
| INT | 0 |
| XTAL or EXT | 1 |
| MTR | 2 |

## Query Response

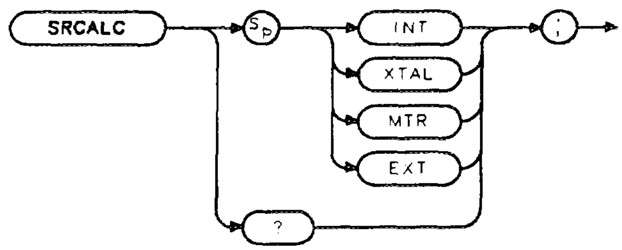



QSRCALC

# SRCALC
# Source Leveling Control

Selects internal or external leveling for use with the built-in tracking generator.

## Syntax




XSRCALC

Option Required: Option 010 or 011.
Preset State: SRCALC INT.
Related Commands: CF, FA, FB, FS, HNLOCK, SP.

## Example

```
OUTPUT 718;"SRCALC XTAL;"
```

## Description

**For the HP 8590D or HP 8591E:** Option 010 or 011 for the HP 8590D and HP 8591E provide internal (INT), crystal (XTAL), and meter (MTR) leveling.

- SRCALC INT activates internal leveling.
- SRCALC XTAL activates external leveling. The external leveling input (EXT ALC INPUT) is located on the rear panel of the spectrum analyzer. Positive- or negative-polarity detectors are supported. External leveling increases the amplitude accuracy by improving the effective source match.
- SRCALC MTR narrows loop bandwidth so Hewlett-Packard power meters can be used for external leveling.

*For the HP 8590D and HP 8591E only:* The functions of SRCALC and **ALC MTR INT XTAL** are identical.

**For the HP 8593E, HP 8594E, HP 8595E, or HP 8596E:** Option 010 for the HP 8593E, HP 8594E, HP 8595E, or HP 8596E provide internal (INT) and external (EXT) leveling.

- SRCALC INT activates internal leveling.
- SRCALC EXT is for external leveling. The external leveling input (EXT ALC INPUT) is located on the rear panel of the spectrum analyzer. Only negative-polarity detectors are supported. External leveling increases the amplitude accuracy by improving the effective source match.

*For the HP 8593E, HP 8594E, HP 8595E, and HP 8596E only:* The functions of SRCALC and **ALC INT EXT** are identical.

## Example

`OUTPUT 718;"SQR SP,1E8;"` *Changes the span to 10 kHz.*

## Description

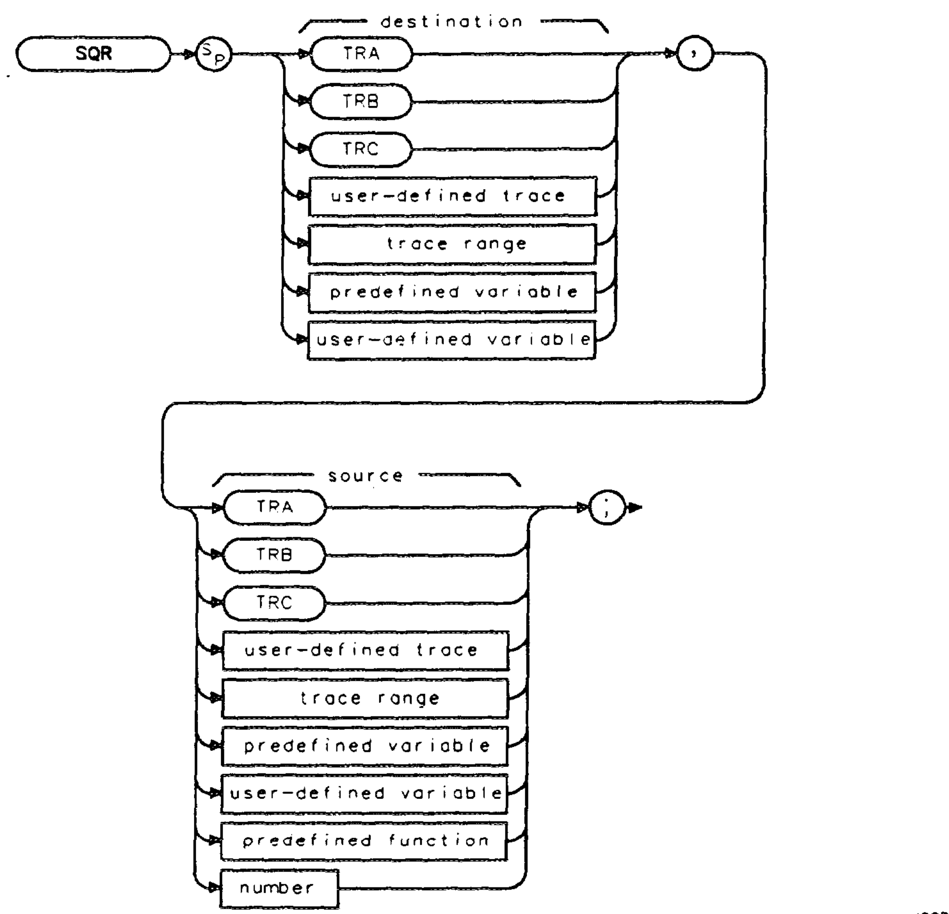
If the source is negative, the square root of the absolute value will be returned.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# SQR
# Square Root

Places the square root of the source into the destination.

## Syntax



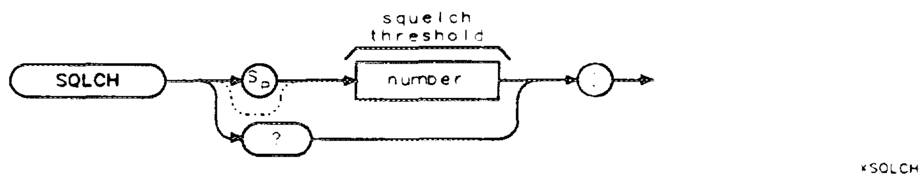

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: PDA, PDF, STDEV.

# SQLCH
# Squelch

Sets the squelch threshold by setting the squelch level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 0 to 100. |

Equivalent Softkey: **SQUELCH** .
Option Required: Option 102, 103, or 301.
Preset Value: 0.
Related Commands: DEMOD, FMGAIN, SPEAKER.

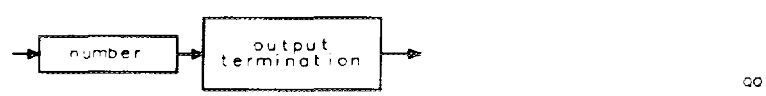
## Example

```
OUTPUT 718;"SQLCH 100;"
```

## Description

SQLCH mutes weak signals and passes strong signals.

## Query Response



SPZOOM
# Span Zoom

Places a marker on the highest on-screen signal (if an on-screen marker is not present), turns on the signal track function, and activates the span function.

## Syntax


XSPZOOM

Equivalent Softkey: **SPAN ZOOM** .

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

```
OUTPUT 718;"IP;CF 300MZ;TS;"
OUTPUT 718;"SPZOOM;"
```

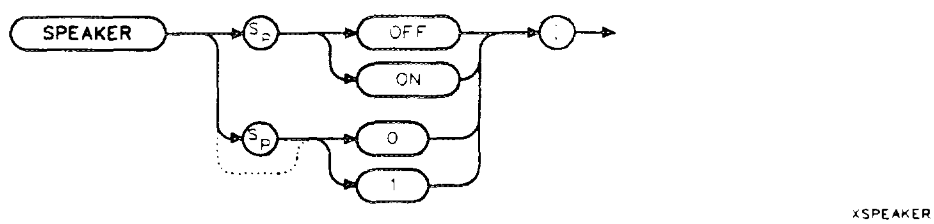
## Description

If a marker is present before SPZOOM is executed, SPZOOM turns on the signal track function and activates the span function.

# SPEAKER
# Speaker

Turns on or off the internal speaker.

## Syntax




Option Required: Option 102, Option 103, or Option 301.
Preset State: SPEAKER ON.
Related Commands: DEMOD, FMGAIN, SQLCH.

## Example

```
OUTPUT 718;"SPEAKER OFF;"
```

## Description

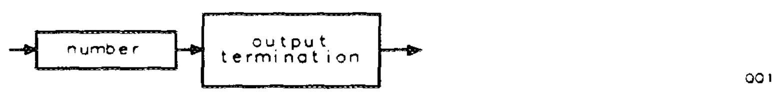
The frequency span readout refers to the displayed frequency range. Dividing the readout by 10 yields the frequency span per division.

If resolution and video bandwidths are coupled to the span width, the bandwidths change with the span width to provide a predetermined level of resolution and noise averaging. Likewise, the sweep time changes to maintain a calibrated display, if coupled. All of these functions are normally coupled, unless RB, VB, or ST have been executed.

Because span is affected by frequency, change the frequency before changing span (see "HNLOCK"). For the HP 8592D and HP 8593E, the span can be set to include band 0 and band 1 except in single-sweep mode.

Specifying 0 Hz enables zero-span mode, which configures the spectrum analyzer as a fixed-tuned receiver.

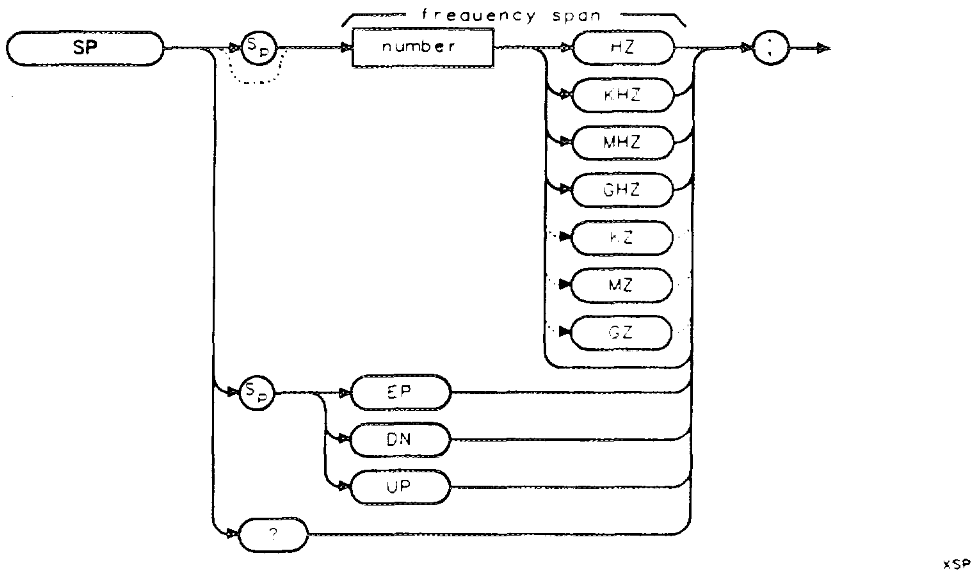
## Query Response



# SP
# Span

Changes the total displayed frequency range symmetrically about the center frequency.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Frequency span of the spectrum analyzer. |

Equivalent Softkey: **SPAN**.

Step Increment: 1, 2, 5, 10 sequence (up to the stop frequency of the spectrum analyzer).
Related Commands: CF, FA, FB, FOFFSET, FS, HNLOCK, HNUNLK, RB, ST, VB.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;SP 20MHZ;"` | *Initializes spectrum analyzer, changes frequency span.* |
| `OUTPUT 718;"SP?;"` | *Gets the span value from the spectrum analyzer.* |
| `ENTER 718;Span` | *Puts the spectrum analyzer response in the computer variable, Span.* |
| `PRINT Span` | *Displays the span value.* |

# SNGLS
# Single Sweep

Sets the spectrum analyzer to single-sweep mode.

## Syntax


XSNGLS

Equivalent Keys: (SGL SWP) or **SWEEP CONT SGL** (SGL is underlined).
Related Commands: CLRW, CONTS, TM, TS.

## Example

```
OUTPUT 718;"SNGLS;"
```

## Description

Each time TS (take sweep) is sent, one sweep is initiated, as long as the trigger and data entry conditions are met.

*For the HP 8592D or the HP 8593E only:* The frequency span that can be viewed with a single-sweep is bounded by the instrument range only; therefore, band 0 can be included in a multiband sweep in single sweep mode. This allows a 0 GHz to 22 GHz span with an HP 8592D or HP 8593E (also see "TS").

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep mode, takes a sweep.* |
| `30 OUTPUT 718;"VIEW TRA;"` | *Stores results of trace A.* |
| `40 OUTPUT 718;"SMOOTH TRA,10;"` | *Smooths trace A.* |
| `50 OUTPUT 718;"VIEW TRA;"` | *Displays the result.* |
| `60 END` | |

## Description

Each point value is replaced with the average of the values (in measurement units) of the given number of points centered on it. Increasing the number of points increases smoothing at the cost of decreasing resolution. If the number of points is an even number, then the number of points is increased by one. If the number of points is larger than the size of SOURCE, then the size of SOURCE is used (unless size of SOURCE is even, in which case the size of SOURCE minus one is used). Smoothing decreases at the endpoints.

The purpose of this function is to perform a spatial video averaging as compared to the temporal version supplied by the video-average (VAVG) command. The functions of SMOOTH and VAVG are not interchangeable however. Unlike VAVG, SMOOTH averages values that occur before and after the data point in time. This can cause some display irregularities at the start and stop frequencies. Use low values for the SMOOTH parameter to avoid signal distortion.

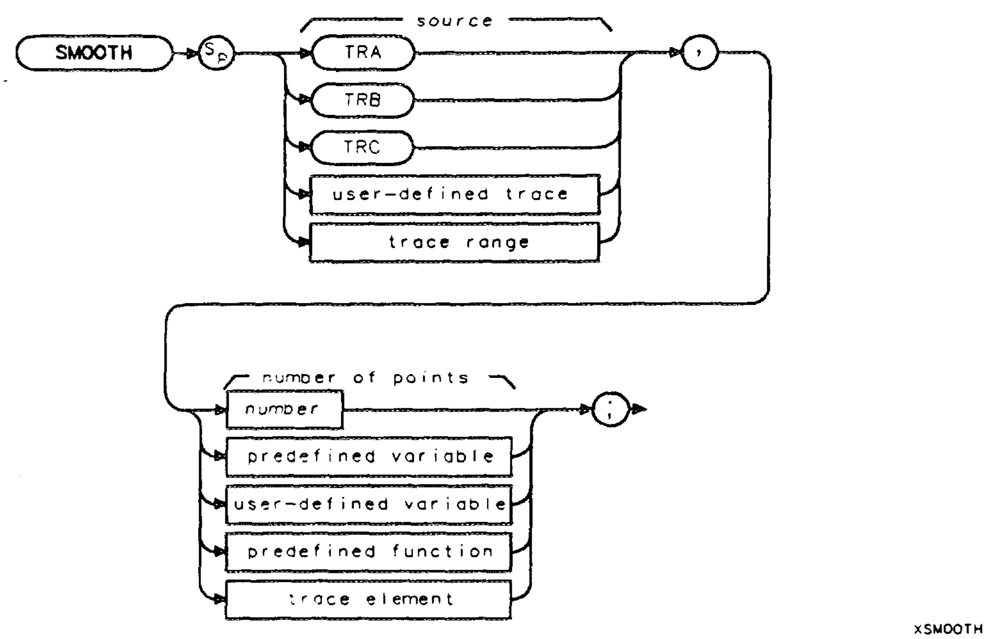
By replacing the value of each point in a trace with the average of the values of a number of points centered about that point, any rapid variations in video noise or signals are smoothed into more gradual variations. It thereby performs a function similar to reducing the video bandwidth without the corresponding changes in sweep time. As such, it does result in a reduction of frequency resolution. Also, signal peaks are reduced with large smoothing values, and this can cause the amplitude to appear to be low.

This command requires user memory for its execution. Memory is not permanently allocated, so the largest amount of memory is available for the functions that are used in a particular application. When the command is complete, memory is returned to the free user memory.

# SMOOTH
# Smooth Trace

Smooths the trace according to the number of points specified for the running average.

## Syntax



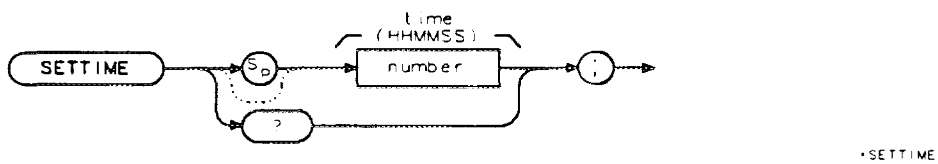

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: SNGLS, TS, VAVG.

# SETTIME
# Set Time

Allows you to set the time of the real-time clock of the spectrum analyzer.

## Syntax



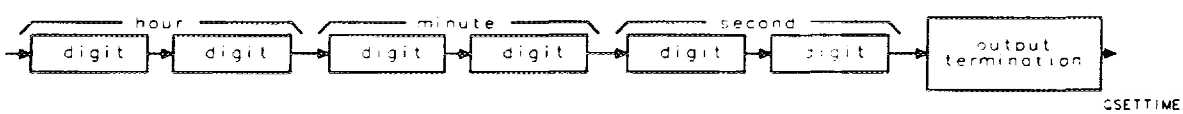

| Item | Description/Default | Range |
|---|---|---|
| Number | A number in the HHMMSS (24 hour) format. | 0 to 235959. |

Equivalent Softkey: **SET TIME** .
Related Commands: SETDATE, TIMEDATE, TIMEDSP.

## Example

`OUTPUT 718;"SETTIME 135501;"` *Sets the time to 1:55:01* P.M.

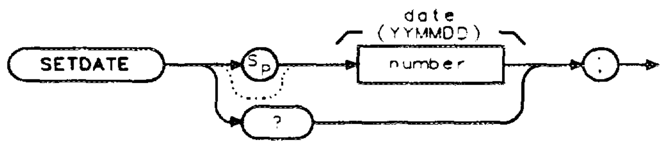
## Query Response



# SETDATE
# Set Date

Allows you to set the date of the real-time clock of the spectrum analyzer.

## Syntax




XSETDATE

| Item | Description/Default | Range |
|---|---|---|
| Number | A number in the YYMMDD format. | Valid year, month, and day. |

Equivalent Softkey: SET DATE .
Related Commands: SETTIME, TIMEDATE, TIMEDSP.

## Example

`OUTPUT 718;"SETDATE 890212;"` *Sets the date to February 12, 1989.*

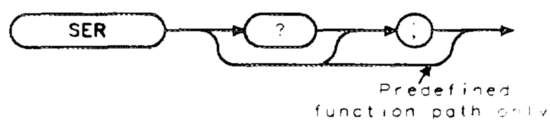
## Query Response


QSETDATE

# SER
# Serial Number

Returns the serial number suffix of the spectrum analyzer.

## Syntax




XSER

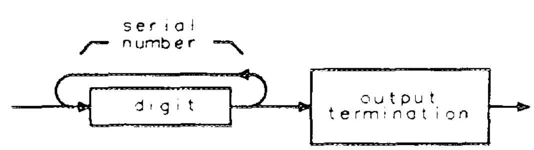
Related Commands: ID, REV.

## Example

| | |
|---|---|
| `DIM Serial$[24]` | *Reserves memory space for a string.* |
| `OUTPUT 718;"SER;"` | *Gets the serial number from the spectrum analyzer.* |
| `ENTER 718;Serial$` | *Puts the spectrum analyzer response in the computer variable.* |
| `DISP Serial$` | *Displays the serial number on the computer screen.* |

## Query Response

The last five digits of the serial number are returned.




QSER

**SENTERT Segment Entry for Sweep Time Limit Lines**

**Note** If the current limit line table contains lines based on frequency (as opposed to a limit line based on the sweep time), executing SENTERT will clear the current frequency limit line table.

The three segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all sweep times between the two points. If the amplitude values of the two segments differ, the limit-line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all sweep times between the two points.
- POINT specifies a limit value for the coordinate point, and no other sweep time points, so that a POINT segment specifies a limit value for a single sweep time. For an upper limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the top of screen. For a lower limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the bottom of screen. The POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is automatically used. If a visible POINT segment at the right-hand edge of the display is not desired, add an explicit last point segment to the limit-line table that is higher in sweep time than the current sweep time of the spectrum analyzer.

Segments are sorted as they are entered according to starting sweep time. A maximum of 20 segments can be defined using SENTERT.

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. For amplitude, the default unit is dBm. For sweep time, the default unit is seconds. | The range for the amplitude varies with ROFFSET. The range for the sweep time is the sweep time range of the spectrum analyzer. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Related Commands: LIMIMODE, LIMIREL, LIMISEGT, SEGDEL, SENTER.

## Example 1

This example enters limit-line values into the upper and lower limit-line tables.

| | |
|---|---|
| `OUTPUT 718;"RL -10DB;"` | *Sets the reference level to −10 dB.* |
| `OUTPUT 718;"LIMIDEL;"` | *Erases any the current limit line table.* |
| `OUTPUT 718;"LIMIFT TIME;"` | *Sets the limit lines to be based on sweep time.* |
| `OUTPUT 718;"LIMIMODE UPLOW;LIMIREL ON;"` | *Specifies the upper and lower limit-line table as relative.* |
| `OUTPUT 718;"SENTERT 10MS,-10DB,-50DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTERT 0MS,-15DB,-60DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"LIMITEST ON;TS;"` | *Turns on the limit-line testing.* |

## Example 2

| | |
|---|---|
| `OUTPUT 718;"LIMIFT TIME;"` | *Sets the limit lines to be based on sweep time.* |
| `OUTPUT 718;"LIMIMODE DELTA;LIMIREL OFF;"` | *Specifies the mid and delta table format and fixed type.* |
| `OUTPUT 718;"SENTERT 10MS,-20DB,10DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTERT 0MS,-30DB,20DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"LIMITEST ON;TS"` | *Turns on the limit-line testing.* |

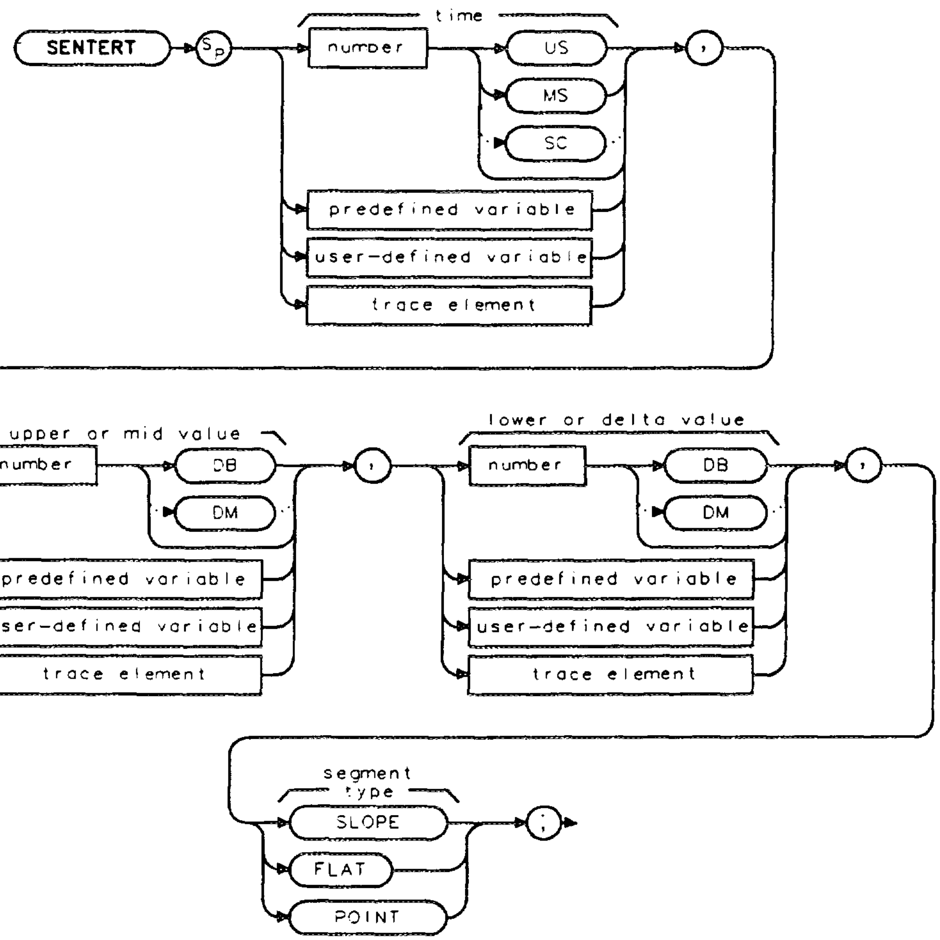
## Description

Each limit-line segment is specified with a starting sweep time, an upper or median amplitude value, a lower or delta amplitude value, and a segment type. The segment type defines how the line segment is to extend from its starting point to the next segment.

# SENTERT
# Segment Entry for Sweep Time Limit Lines

Enters the limit-line data in either the upper and lower limit-line table or the mid and delta table for limit lines based on sweep time.

## Syntax




XSENTERT

top of screen. For a lower limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the bottom of screen. The POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is automatically used. If a visible POINT segment at the right-hand edge of the display is not desired, add an explicit last point segment to the limit-line table that is higher in frequency than the stop frequency.

Segments are sorted as they are entered according to starting frequency. A maximum of 20 segments can be defined using SENTER. When the type is omitted, the last type given (or SLOPE if no previous type has been given) is used.

**SENTER Segment Entry for Frequency Limit Lines**

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | Varies with FOFFSET and ROFFSET. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Related Commands: LIMIMODE, LIMIREL, LIMISEG, SEGDEL, SENTERT.

## Example 1

This example enters limit-line values into the upper and lower limit-line tables.

| | |
|---|---|
| `OUTPUT 718;"LIMIFT FREQ;"` | *Sets the limit lines to be based on frequency.* |
| `OUTPUT 718;"LIMIMODE UPLOW;LIMIREL OFF;"` | *Specifies the upper and lower limit-line table as fixed.* |
| `OUTPUT 718;"SENTER 300MHZ,-10DB,-50DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTER 350MHZ,-15DB,-60DB,FLAT;"` | *Enters in values for a segment.* |

## Example 2

| | |
|---|---|
| `OUTPUT 718;"LIMIFT FREQ;"` | *Sets the limit lines to be based on frequency.* |
| `OUTPUT 718;"LIMIMODE DELTA;LIMIREL OFF;"` | *Specifies the mid and delta table format and fixed type.* |
| `OUTPUT 718;"SENTER 300MHZ,-20DB,10DB,FLAT;"` | *Enters in values for a segment.* |
| `OUTPUT 718;"SENTER 350MHZ,-30DB,20DB,FLAT;"` | *Enters in values for a segment.* |

## Description

Each limit-line segment is specified with a starting frequency, an upper or median amplitude value, a lower or delta amplitude value, and a segment type. The segment type defines how the line segment is to extend from its starting point to the next segment.

**Note** If the current limit line table contains lines based on sweep time (as opposed to a limit line based on the frequency), executing SENTER will clear the current sweep time limit line table.

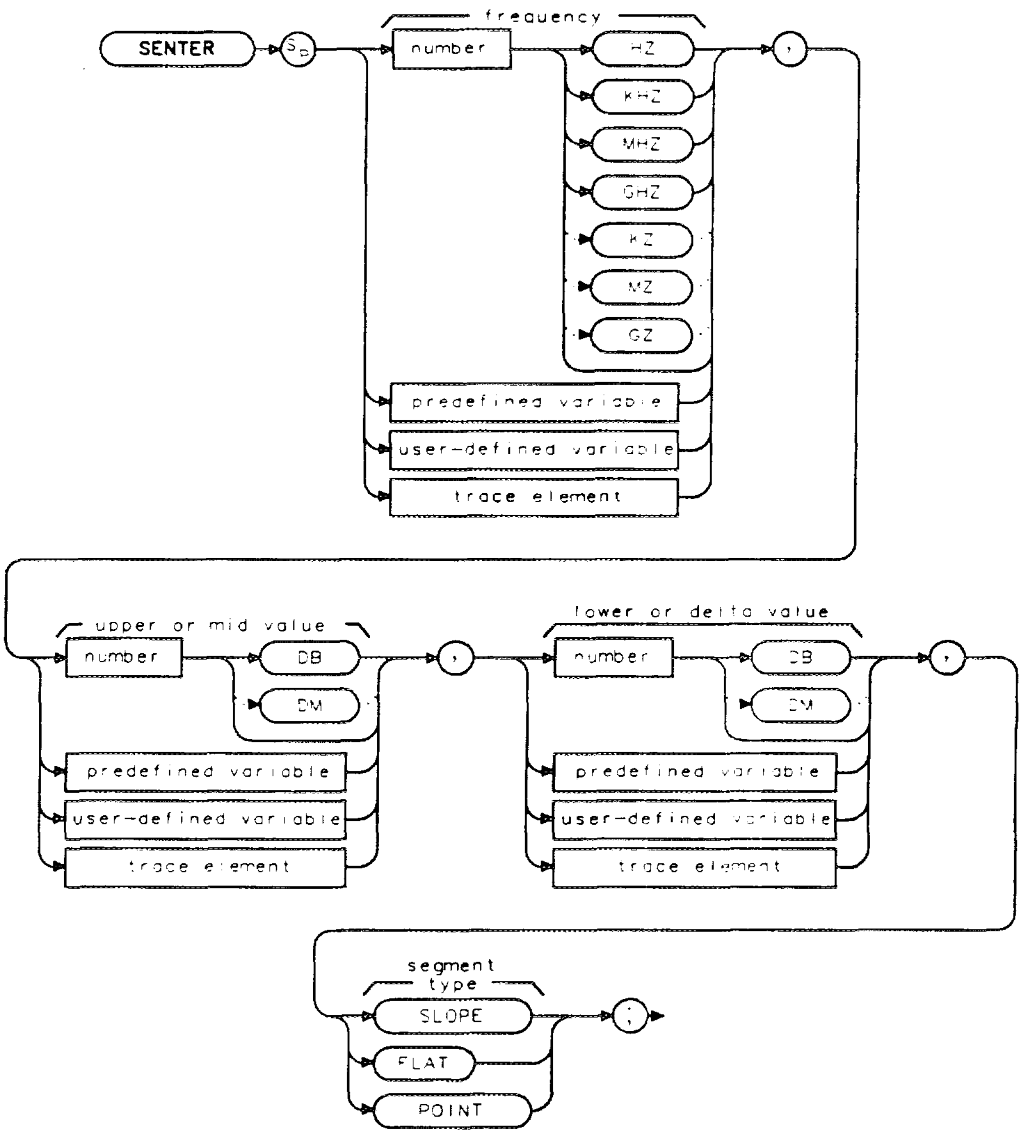
The three segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all frequencies between the two points. If the amplitude values of the two segments differ, the limit-line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all frequencies between the two points.
- POINT specifies a limit value for the coordinate point, and no other frequency points, so that a POINT segment specifies a limit value for a single frequency. For an upper limit-line, a POINT segment is indicated by a line drawn from the coordinate point, vertically off the

# SENTER
# Segment Entry for Frequency Limit Lines

Enters the limit-line data in the upper and lower limit-line table or the mid and delta table for limit lines based on frequency.

## Syntax




XSENTER

**SEGDEL Segment Delete**

| | |
|---|---|
| `50 OUTPUT 718;"LIMISEG 300MHZ,-70DB,FLAT;"` | *Enters a segment into the lower limit-line table.* |
| `60 OUTPUT 718;"LIMIMODE UPLOW;"` | *Specifies both the upper and lower limit-line tables.* |
| `70 OUTPUT 718;"SEGDEL 1;"` | *Deletes the segment from the upper and lower limit-line tables.* |
| `80 END` | |

## Description

The result of SEGDEL depends on the setting of the LIMIMODE command as shown in the following table.

| LIMIMODE Setting | Result of SEGDEL |
|---|---|
| LIMIMODE UPPER | Deletes specified segment from the upper limit-line table. |
| LIMIMODE LOWER | Deletes specified segment from the lower limit-line table. |
| LIMIMODE UPLOW | Deletes specified segment from the upper and lower limit-line table. |
| LIMIMODE DELTA | Deletes specified segment from the mid and delta limit-line table. |

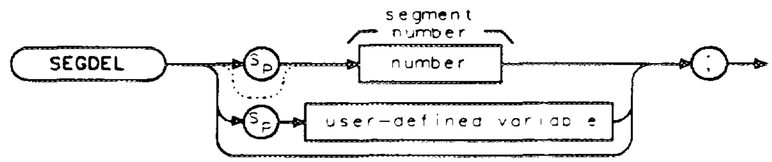
You may want to query LIMIMODE before using SEGDEL if you are unsure of the LIMIMODE setting.

To determine the number of each segment, you can use the softkeys accessed by **Edit Limit** to display the limit-line table. (Limit-line entries are sorted according to frequency or time.)

# SEGDEL
# Segment Delete

Deletes the specified segment from the limit-line tables.

## Syntax




XSEGDEL

Related Commands: LIMIMODE, LIMISEG, LIMISEGT, SENTER, SENTERT.

## Example

### Example 1

This example uses LIMIMODE for entering segments into the upper limit-line table, then entering a segment into the lower limit-line table (upper and lower limit lines are treated as separate tables). Line 60 demonstrates the effect of deleting a segment when the upper and lower limit-line tables are treated separately.

| | |
|---|---|
| 10 OUTPUT 718;"LIMIDEL;" | *Deletes the current limit-line table, sets the table type to fixed.* |
| 20 OUTPUT 718;"LIMIMODE UPPER;" | *Specifies the upper limit-line table.* |
| 25 OUTPUT 718;"LIMIFT FREQ;" | *Limit lines to be based on frequency.* |
| 30 OUTPUT 718;"LIMISEG 300MHZ,-30DB,FLAT;" | *Enters a segment into the upper limit-line table.* |
| 40 OUTPUT 718;"LIMIMODE LOWER;" | *Specifies the lower limit-line table.* |
| 50 OUTPUT 718;"LIMISEG 300MHZ,-70DB,FLAT;" | *Enters a segment into the lower limit-line table.* |
| 60 OUTPUT 718;"SEGDEL 1;" | *Deletes the segment from the lower limit-line table.* |
| 70 END | |

### Example 2

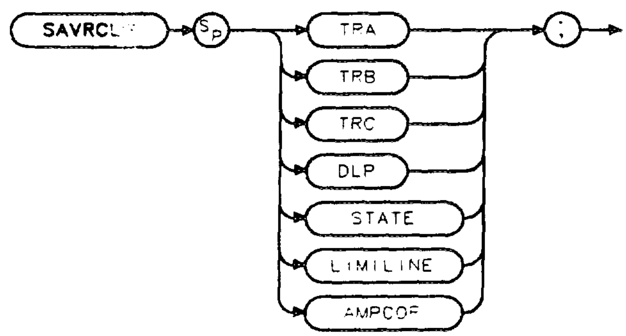
With the addition of line 60, the upper and lower limit-line tables are no longer treated as separate tables, but as one table. The segment is deleted from the upper and lower limit-line tables (for the given frequency).

| | |
|---|---|
| 10 OUTPUT 718;"LIMIDEL;" | *Deletes the current limit-line table.* |
| 20 OUTPUT 718;"LIMIMODE UPPER;" | *Specifies the upper limit-line table.* |
| 25 OUTPUT 718;"LIMIFT FREQ;" | *Limit lines to be based on frequency.* |
| 30 OUTPUT 718;"LIMISEG 300MHZ,-30DB,FLAT;" | *Enters segment into the upper limit-line table.* |
| 40 OUTPUT 718;"LIMIMODE LOWER;" | *Specifies the lower limit-line table.* |

# SAVRCLW
# Save or Recall Data

Specifies the data to be transferred: trace A, trace B, trace C, program, amplitude correction factors, limit line, or state.

## Syntax




XSAVRCLW

Related Commands: MSI, PREFX, RCLS, RCLT, SAVES, SAVET, SAVRCLF, SAVRCLN.

## Example

This example allows the current spectrum analyzer state to be saved on a RAM card.

| | |
|---|---|
| `OUTPUT 718;"SAVRCLF SAVE;"` | *Specifies a save operation.* |
| `OUTPUT 718;"SAVRCLW STATE;"` | *Specifies the source as the current spectrum analyzer state.* |
| `OUTPUT 718;"MSI CARD;"` | *Specifies the card as the mass storage device.* |
| `OUTPUT 718;"PREFX %FRED%;"` | *Specifies the prefix to store the state data under.* |
| `OUTPUT 718;"SAVRCLN 34;"` | *Appends the register number 34 to the prefix and initiates the data transfer.* |

The RAM card now has a file called sFRED_34 that contains the instrument state.

## Description

SAVRCLW is used to save or recall data in spectrum analyzer memory or on a RAM card. See "SAVRCLN" for the sequence of commands to initiate a data transfer.

The SAVRCLW parameters correspond to the type of data transferred as shown in the following table.

| Parameter | Type of Data Transferred |
|---|---|
| TRA | Trace A. |
| TRB | Trace B. |
| TRC | Trace C. |
| DLP | Downloadable programs. |
| STATE | Instrument state. |
| LIMILINE | Limit lines. |
| AMPCOR | Amplitude correction factors. |

3. Specify a RAM card or spectrum analyzer memory as the mass storage device with MSI.
4. When saving to or recalling from a RAM card, specify the prefix to be used with PREFX. The prefix is ignored when saving or recalling from spectrum analyzer memory.
5. Enter the number to append to the prefix and initiate the data transfer with SAVRCLN.

When saving trace data, amplitude correction factors, or limit-line tables in spectrum analyzer memory, specify a number within the trace register number range (0 to TRCMEM − 1). When saving state data in spectrum analyzer memory, specify a number within the state number range (1 to 8).

When saving data on a RAM card, the number plus the number of characters in the prefix must not exceed eight characters.

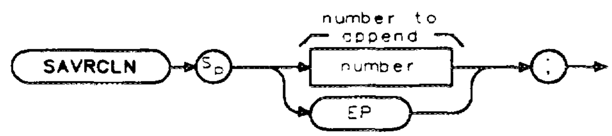
**Note**

With the memory card reader, the spectrum analyzer can read from either a RAM (random-access memory) card or a ROM (read-only memory card). To write to a memory card, the memory card must be a RAM card. The spectrum analyzer cannot write to a ROM card.

# SAVRCLN
# Save or Recall Number

Specifies the number to append to the prefix for a save or recall operation, and initiates the transfer of data.

## Syntax




XSAVRCLN

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | Dependent on mass storage device. |

Related Commands: MSI, PREFX, RCLS, SAVES, SAVRCLF, SAVRCLW.

## Example

This example allows trace A to be saved on a RAM card.

| | |
|---|---|
| `OUTPUT 718;"SAVRCLF SAVE;"` | *Specifies a save operation.* |
| `OUTPUT 718;"SAVRCLW TRA;"` | *Specifies the source as trace A.* |
| `OUTPUT 718;"MSI CARD;"` | *Specifies the card as the mass storage device.* |
| `OUTPUT 718;"PREFX %FRED%;"` | *Specifies the prefix to store the trace data under.* |
| `OUTPUT 718;"PU;PA 0,160;TEXT%ENTER TEST NUMBER%;"` | *Prompts the user for the number to append to the prefix.* |
| `OUTPUT 718;"SAVRCLN EP;"` | *After the user enters the number, the number is appended to the prefix and the data transfer is initiated.* |

## Description

SAVRCLN is used to save or recall data from spectrum analyzer memory or from a RAM card. SAVRCLN is useful if you want to write a program that allows the spectrum analyzer operator to save data in spectrum analyzer memory or on a RAM card. The SAVRCLN command uses the SAVRCLF flag information, SAVRCLW information, prefix, and mass storage device when transferring data.

Because the SAVRCLN command initiates the transfer of data, it should be the last command specified in the sequence to save or recall data.

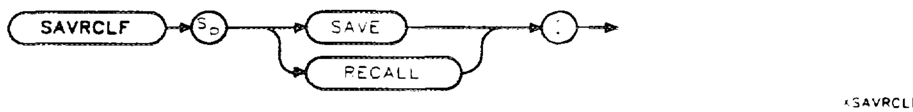
The sequence to save or recall data is as follows:

1. Specify either a save or recall operation with SAVRCLF.
2. Indicate the type of data to be saved or recalled using SAVRCLW.

# SAVRCLF
# Save or Recall Flag

Indicates a save or recall operation.

## Syntax



Related Commands: MSI, PREFX, RCLS, RCLT, SAVES, SAVET, SAVRCLN, SAVRCLW.

## Example

This example allows trace A to be saved on a RAM card.

| | |
|---|---|
| `OUTPUT 718;"SAVRCLF SAVE;"` | *Specifies a save operation.* |
| `OUTPUT 718;"SAVRCLW TRA;"` | *Specifies the source as trace A.* |
| `OUTPUT 718;"MSI CARD;"` | *Specifies the card as the mass storage device.* |
| `OUTPUT 718;"PREFX %FRED%;"` | *Specifies the prefix to store the trace data under.* |
| `OUTPUT 718;"PU;PA 0,160;TEXT%ENTER TEST NUMBER%;"` | *Prompts the user for the number to append to the prefix.* |
| `OUTPUT 718;"SAVRCLN EP;"` | *After the user enters the number, the number is to appended to the prefix and the data transfer is initiated.* |

The RAM card now contains a file called tFRED_(register number).

**SAVET Save Trace**

## Description

The trace data is saved in the specified register if the state registers have not been locked by PSTATE ON (see "SAVES"). Use AMPCOR to save amplitude correction factors, LIMILINE to save limit-line tables.

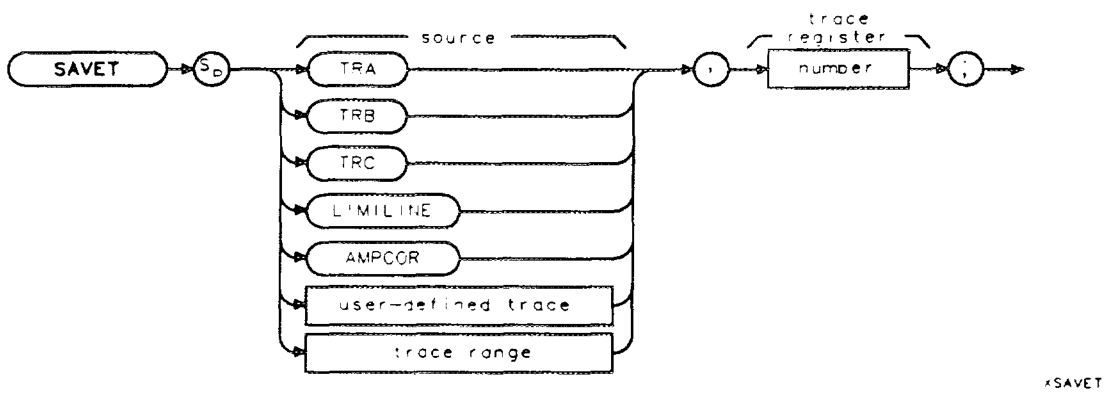
**Note** The TS and VIEW commands should be executed prior to saving trace data.

The SAVET command saves trace data, amplitude correction factors, or limit-line tables in spectrum analyzer memory. See "STOR" or "SAVRCLN" to save data on a RAM card.

# SAVET
# Save Trace

Saves the selected trace data and state information, amplitude correction factors, or limit-line tables in spectrum analyzer memory.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command with a length of 401 elements. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 0 to TRCMEM − 1. |

Equivalent Softkey: **Trace -> Intrnl** .

Prerequisite Commands: TRDEF when using a user-defined trace.

Related Commands: CAT, CLRW, PSTATE, RCLT, SNGLS, TS, VIEW.

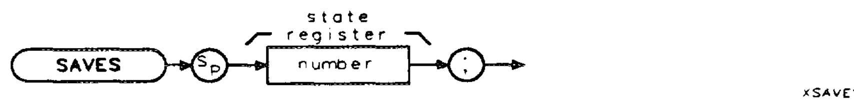
## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes spectrum analyzer, changes the center frequency and span.* |
| `OUTPUT 718;"VIEW TRA;SAVET TRA,1;"` | *Puts trace A in the view mode, saves spectrum analyzer state and trace A data in register 1.* |
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"RCLT TRA,1;VIEW TRA;"` | *Recalls spectrum analyzer state, trace data.* |

# SAVES
# Save State

Saves the currently displayed instrument state in spectrum analyzer memory.

## Syntax




| Item | Description/Default | Range |
| --- | --- | --- |
| Number | Any valid integer. | 1 to 8. |

Equivalent Softkey: **STATE -> INTRNL**.
Related Commands: OL, PSTATE, RCLS, SAVET, STOR.

## Example

| | |
| --- | --- |
| `OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;"` | *Initializes spectrum analyzer, changes center frequency, span.* |
| `OUTPUT 718;"SAVES 1;"` | *Saves spectrum analyzer state in register 1.* |

## Description

The state data is saved in the specified state register if the state registers have not been locked by the PSTATE command.

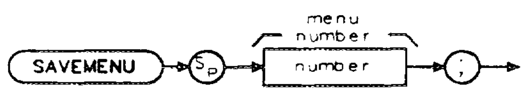
Only state registers 1 through 8 are available for saving the instrument state. State register nine contains the previous state data, state register zero contains the current state.

**Note** The SAVES command saves state data in spectrum analyzer memory. See "STOR" or "SAVRCLN" to save state data on a RAM card.

# SAVEMENU
# Save Menu

Saves menu 1 under the specified menu number.

## Syntax




XSAVEMENU

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 1, 101 to 200. |

## Example

```
OUTPUT 718;"MENU 1;"           Displays menu 1.
OUTPUT 718;"SAVEMENU 101;"     Copies the key functions from menu 1 into menu 101.
OUTPUT 718;"KEYCLR;"           Erases the key functions of menu 1.
PAUSE
OUTPUT 718;"MENU 101;"         Displays menu 101.
```

## Description

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 is can be accessed by pressing (MEAS/USER), **User Menus** .

Menus 101 through 200 as well as menu 1 can be accessed using the MENU command. See "MENU" for more information about accessing softkeys and menus.

**RQS Service Request Mask**

**0** (LSB), **6**, and **7** are not used.

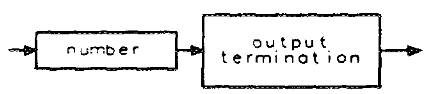
The spectrum analyzer screen numbers 102, 104, and 110 are the octal values corresponding to the status register values; that is, SRQ 102 = bit 6 = octal 100 and bit 2 = octal 2 are both true.

A service request is generated only if the proper request mask bit has been set, and either the condition itself or the Force Service Request (see "SRQ") is sent. To set the request mask, choose the desired interrupt conditions and sum their assigned values. Executing the RQS command with this value sets the bit mask. After setting the bit mask, only the chosen conditions can produce an interrupt. Generally, you must set the bit mask using the RQS command. However, the "hardware broken" and "illegal remote command" conditions are automatically enabled after presetting or sending the IP command. Pressing (PRESET) or sending the IP command, then, produces the same interrupt bit mask as sending "RQS 40;" (decimal 40 is the sum of the assigned values of these two interrupt bits, 32 = Bit 5 and 8 = Bit 3).

For most conditions, the RQS mask bit stays set until the next IP or RQS command is executed. The only condition in which this does not apply is the Units Key Pressed bit. When this bit (bit 1) is set in the RQS mask, a Units Key Pressed interrupt occurs if EE (enable entry mode) is executed and a front-panel units key such as Hz, kHz, MHz, or GHz is pressed.

When a units key is pressed, the interrupt occurs and the Units Key Pressed bit in the RQS mask is reset. To reenable the Units Key Pressed interrupt, you must send a new RQS mask.

## Query Response

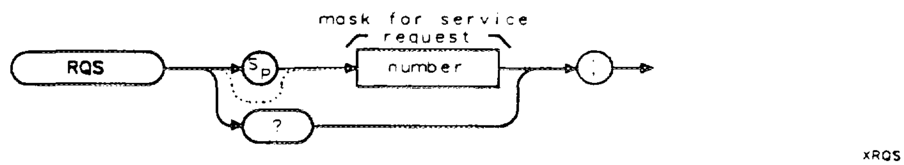



QQ1

# RQS
# Service Request Mask

Sets a bit mask for service requests (see "SRQ").

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | 0 to 62. |

Related Commands: SRQ, STB.

## Example

`OUTPUT 718;"RQS 12;"` *Sends a mask bit for hardware broken and end of sweep.*

## Description

Assignment of values for the mask is as follows:

32 = Illegal command (bit 5)
16 = Command complete (bit 4)
8 = Hardware broken (bit 3)
4 = End of sweep (bit 2)
2 = Units key pressed (bit 1)

As shown in the example, a mask with hardware broken and end of sweep is equal to 12 (8 + 4). The mask also disables command complete and illegal command interrupts.

To activate all conditions in the mask, the mask value is equal to 62 (32 + 16 + 8 + 4 + 2). To set the service request mask for all conditions, execute `OUTPUT 718;"RQS 62;"`.

Each bit in the status byte is defined as follows:

**1** Indicates that the units key was pressed. `SRQ 102` appears on the spectrum analyzer screen. If you activate the units key bit, it will remain active until you activate "EE" and press a units key. (See "EE.")

**2** Indicates end of sweep. `SRQ 104` appears on the spectrum analyzer screen. If you send any RQS value that contains mask value 4, another sweep will be taken.

**3** Indicates broken hardware. `SRQ 110` appears on the spectrum analyzer screen.

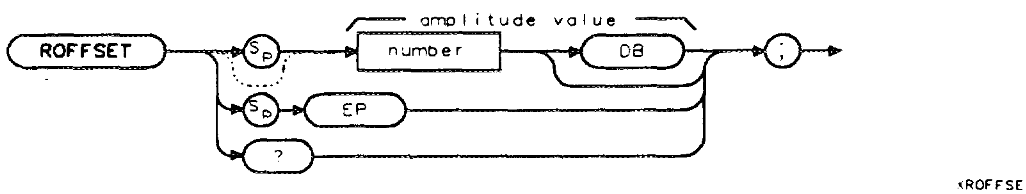
**4** Indicates completion of a command. It is triggered by EOI at the end of a command string or the completion of a print or plot.

**5** Indicates an illegal spectrum analyzer command was used. `SRQ 140` appears on the spectrum analyzer screen.

# ROFFSET
# Reference Level Offset

Offsets all amplitude readouts without affecting the trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dB. | −200 dB to +200 dB. |

Equivalent Softkey: REF LVL OFFSET .
Preset State: 0 dB.
Related Commands: AT, RL.

## Example

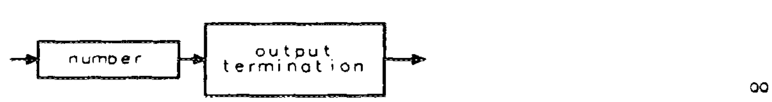
| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"RL -20DB;" | *Changes the reference level.* |
| 30 OUTPUT 718;"ROFFSET -10;" | *Changes spectrum analyzer reference offset value.* |
| 40 OUTPUT 718;"RL?;" | *Gets the reference value from spectrum analyzer.* |
| 50 ENTER 718;Ref | *Puts the spectrum analyzer response in the computer variable, Ref.* |
| 60 DISP "THE NEW REFERENCE LEVEL IS ",Ref | *Displays −30 as the new reference level.* |
| 70 END | |

## Description

Once activated, the ROFFSET command displays the amplitude offset in the active function block. And, as long as the offset is in effect, the offset is displayed on the left side of the screen.

Entering ROFFSET 0 or presetting the spectrum analyzer eliminates an amplitude offset.

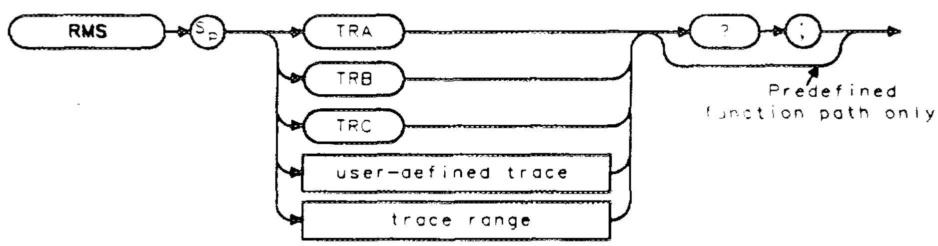
## Query Response



# RMS
# Root Mean Square Value

Returns the root mean square value of the trace in measurement units.

## Syntax




XRMS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, PDA, PDF, STDEV, VARIANCE.

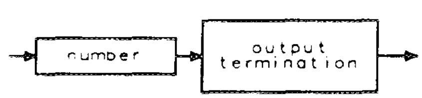
## Example

```
OUTPUT 718;"IP;SNGLS;TS;"
OUTPUT 718;"RMS TRA?;"
ENTER 718;Number
DISP Number
```

## Description

Trace data, user-defined trace data, and trace range data are treated as 16-bit integers.

## Query Response

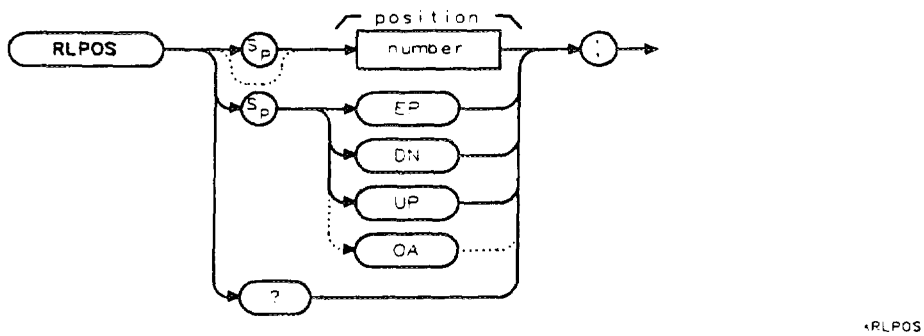



QQ1

# RLPOS
# Reference-Level Position

Selects the position of the reference level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 0 to 8. |

Step Increment: 1.
Related Commands: IP, MEASURE, NRL, RL.
Preset State: RLPOS 8.

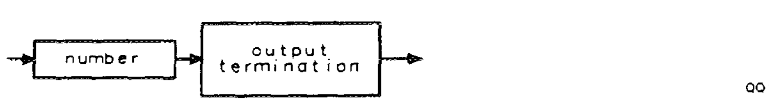
## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"MEASURE NRM;"` | *Changes the measurement mode to normalized.* |
| `OUTPUT 718;"AMBPL ON;"` | *Activates trace normalization.* |
| `OUTPUT 718;"RLPOS 7;"` | *Positions the reference level at the seventh major graticule division.* |

## Description

The RLPOS command changes the position of the reference level during log display mode. The top and bottom graticule lines correspond to 8 and 0, respectively. RLPOS must be used with MEASURE NRM or MEASURE SR, and AMBPL ON or AMB ON. Arrows appear on the left and right side of the screen graticule when the reference level position is changed.

## Query Response



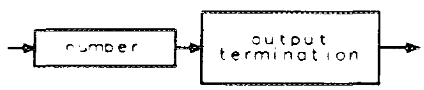
## Description

The reference level and input attenuator are coupled to prevent gain compression. Signals with peaks at or below the reference level are not affected by gain compression.

**Caution** Signal levels above +30 dBm will damage the spectrum analyzer.

RL may affect the attenuation value.

## Query Response

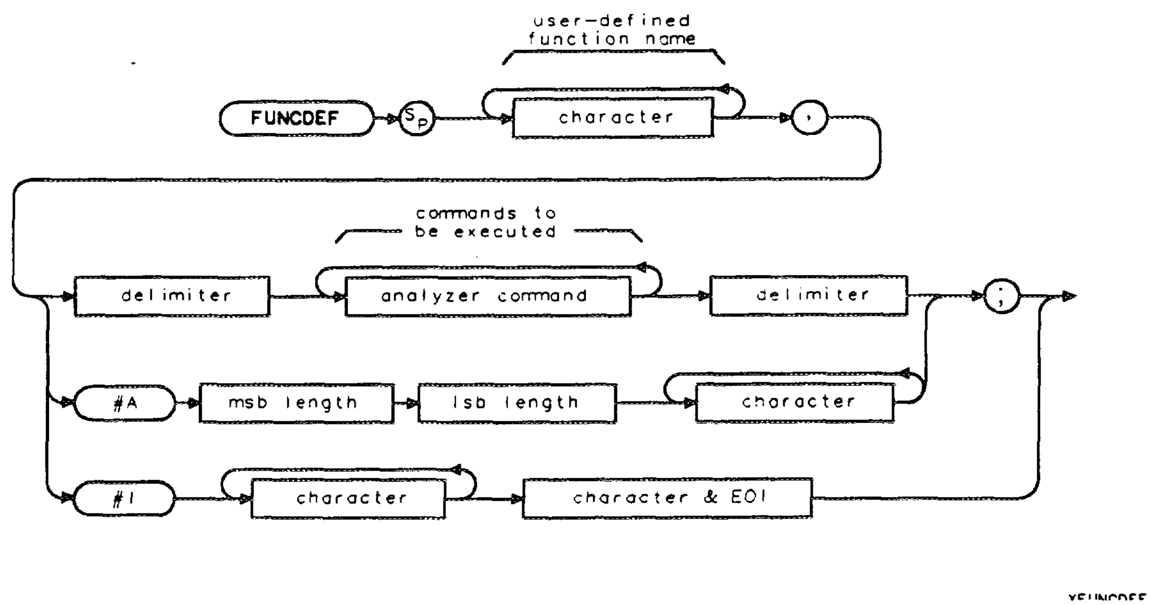



001

# FUNCDEF
# Define Function

Defines a routine consisting of spectrum analyzer commands, assigns the routine a label, and stores the routine and its label in the user memory.

## Syntax




<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Character (function name)</td><td>Any valid character.</td><td>2 to 11 characters long, A through Z and the underscore (the underscore should be used as the second character of the label).</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any valid spectrum analyzer command.</td><td></td></tr>
<tr><td>Msb length</td><td>Most significant byte of a two-byte word that describes the number of bytes transmitted.</td><td></td></tr>
<tr><td>Lsb length</td><td>Least significant byte of a two-byte word that describes the number of bytes transmitted.</td><td></td></tr>
<tr><td>Character (data)</td><td>Any valid character.</td><td></td></tr>
<tr><td>Character & EOI</td><td>Any valid character and END.</td><td></td></tr>
</table>

Restriction: User-defined function name cannot be a reserved word (see Table 5-2).
Related Commands: ABORT, DISPOSE, KEYDEF, RETURN.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"VARDEF H_SPAN,0;"` | *Defines user-defined variable with an initial value of 0.* |
| `30 OUTPUT 718;"FUNCDEF S_HIFT,@";` | *Creates user-defined function, called S_HIFT. Shift divides the span by two and adds the results to the center frequency. The "@" delimits the definition.* |
| `40 OUTPUT 718;"DIV H_SPAN,SP,2;";` | *Puts half of span value into H_SPAN.* |
| `50 OUTPUT 718;"ADD CF,CF,H_SPAN;";` | *Adds H_SPAN to CF.* |
| `60 OUTPUT 718;"@;"` | *Marks the end of the FUNCDEF declaration.* |
| `70 OUTPUT 718;"KEYDEF 1,S_HIFT,%SHIFT_UP%;"` | *Assigns the function S_HIFT to the user-defined softkey, called SHIFT_UP.* |
| `80 OUTPUT 718;"CF 300MHZ;"` | *Displays the calibrator signal.* |
| `90 OUTPUT 718;"SP 1MHZ;";` | |
| `100 LOCAL 718` | *Returns control to local mode.* |
| `110 END` | |

The semicolons at the end of lines 30, 40, and 50 in the example suppress BASIC's carriage return and line feed. Adding the semicolons at the end of the lines of a FUNCDEF declaration saves memory (because the carriage returns and line feeds are suppressed).

## Description

The FUNCDEF command can be used to create a user-defined function (also called a DLP). To use the FUNCDEF command, you must specify the function label and the list of commands it executes. Once a user-defined function is created, it is stored in spectrum analyzer memory. The user-defined function can be executed by invoking the function name within the definition of a user-defined softkey, another user-defined function, or a computer program. To delete the function from spectrum analyzer memory, use the DISPOSE command. (See Chapter 4 for more information about creating and using a DLP).

The ABORT, IF/THEN/ELSE/ENDIF, REPEAT/UNTIL, or RETURN commands are useful commands for altering the user-defined function's operation.

The following are general rules and limitations of FUNCDEF:

- Do not use existing function names or secondary keywords (reserved words) as labels for user-defined functions. See Table 5-2 for a list of reserved words.
- Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.
- The maximum number of nested FUNCDEF declarations is 40. (Nested FUNCDEF declarations is when one FUNCDEF calls another FUNCDEF.) See the programming example for the ABORT command for an example of nesting FUNCDEF declarations.
- Some programming commands cannot be used within a DLP. The commands that cannot used within a DLP are as follows:

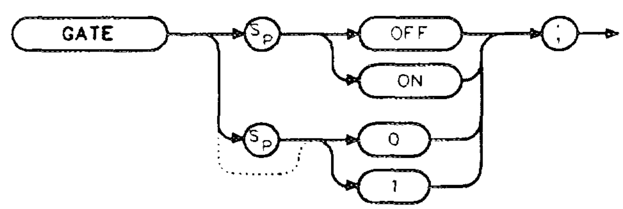
| Command | Description | Comments |
|---|---|---|
| DISP | The BASIC command for displaying a variable | Use the DSPLY command. See "Creating and Executing a DLP" in Chapter 4 for more information about displaying a variable. |
| ENTER | The BASIC command statement | |
| EP | The spectrum analyzer's enter parameter command. | Use the ACTDEF command instead. |
| PLOT | The spectrum analyzer's command for plotting the display. | Use the GETPLOT command instead. |
| PRINT | The spectrum analyzer's command for printing the display. | Use the GETPRNT command instead. |

- Avoid using the POWERON LAST, SAVE STATE, and RECALL STATE programming commands within the function. These commands save and recall a state that, within a user-defined function, may only partially recall the saved state.
- Define all variables and user-defined traces at the beginning of the program, do not define the variables or user-defined traces within a user-defined function. See "Creating and Executing a DLP" in Chapter 4 for more information.

# GATE
# Gate

Turns on or off the time-gating.

## Syntax




xGATE

Equivalent Softkey: **GATE ON OFF**.
Option Required: Option 105.
Preset State: GATE OFF.
Related Commands: GATECTL, GD, GDRVUTIL, GL, GP.

## Example

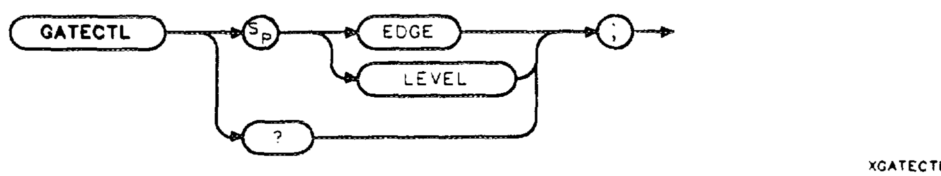
Connect the HI SWEEP IN/OUT connector to the GATE TRIGGER INPUT. Connect the CAL OUT to the spectrum analyzer input.

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"IP;"` | *Performs an instrument preset.* |
| 20 | `OUTPUT 718;"CF 300MHZ;SP 0HZ;ST 200MS;"` | *Sets the center frequency, span, and sweep time.* |
| 30 | `OUTPUT 718;"GD 66MS;GL 66MS;"` | *Sets the gate delay and gate length.* |
| 40 | `OUTPUT 718;"GATECTL EDGE;"` | *Sets the gate triggering for the edge of the trigger input signal.* |
| 50 | `OUTPUT 718;"GP POS;"` | *Triggers on the positive edge of the trigger input signal.* |
| 60 | `OUTPUT 718;"GATE ON;"` | *Turns on the gating.* |
| 70 | `END` | |

# GATECTL
# Gate Control

Selects between the edge and the level mode for Option 105, the time-gated spectrum analysis capability.

## Syntax




Equivalent Softkey: **GATE CTL EDGE LVL** .

Option Required: Option 105.

Preset State: GATECTL EDGE.

Related Commands: GATE, GD, GL, GP.

## Example

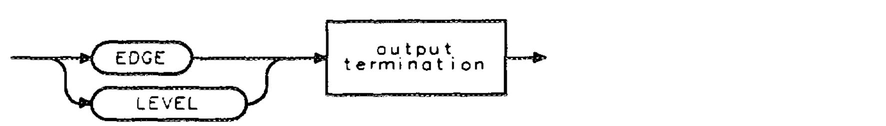
```
OUTPUT 718;"GATECTL LEVEL;"
```

## Description

In the edge mode, a trigger input starts the delay timer that triggers the gate timer. The gate polarity (GP), gate delay time (GD), and gate time length (GL) are operational in the edge mode, but not in the level mode. In the level mode, the gate follows the trigger input level.

When used as a predefined variable, GATECTL returns a "0" if GATECTL has been set to EDGE, a "1" if GATECTL has been set to LEVEL.

## Query Response



# GC
# Gate Preset

Presets Option 105, the time-gated spectrum analysis capability.

## Syntax


xGC

Option Required: Option 105.
Related Commands: GATE, GATECTL, GD, GL, GP.

## Example

```
OUTPUT 718;"GC;"
```

## Description

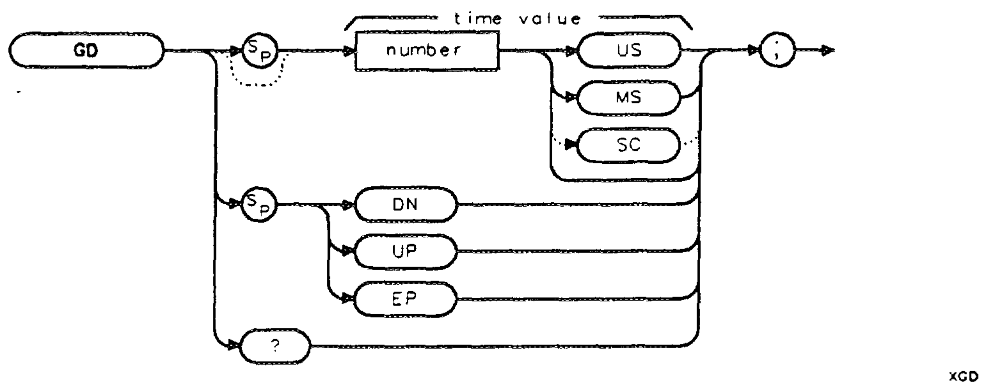
The GC command sets the following time-gated spectrum analysis functions:

- GATE to OFF.
- GATECTL to EDGE.
- GP to POS.
- The gate delay (GD) and gate length (GL) time values are set to 1 μs.

# GD
# Gate Delay

Sets the delay time from when the gate trigger occurs to when the gate opens.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 $\mu$s to 65.5 ms |

Equivalent Softkey: **GATE DELAY**.
Option Required: Option 105.
Preset State: 1 $\mu$s.
Related Commands: GATE, GATECTL, GC, GL.

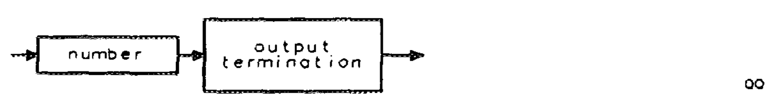
## Example

```
OUTPUT 718;"GD 1US;"
```

## Description

GD applies only if GATECTL is set to EDGE.

## Query Response



# GDRVCLPAR
## Clear Pulse Parameters

Clears the pulse parameters (pulse width, pulse repetition interval, and reference edge) for a time-gate measurement by setting the pulse parameters to 0.

### Syntax


XGDRVCLPAR

Equivalent Softkey: **CLEAR PARAM** .
Option Required: Option 105. Option 101 is recommended.
Related Commands: GDRVPWID, GDRVPRI, GDRVREFE, GDRVST, GDRVVBW, GDRVRBW.

### Example

`OUTPUT 718;"GDRVCLPAR;"` *Clears all the pulse parameters.*

### Description

GDRVPWID, GDRVPRI, GDRVREFE are the programming commands that can be used to set the pulse width, pulse repetition interval, and reference edge, respectively.

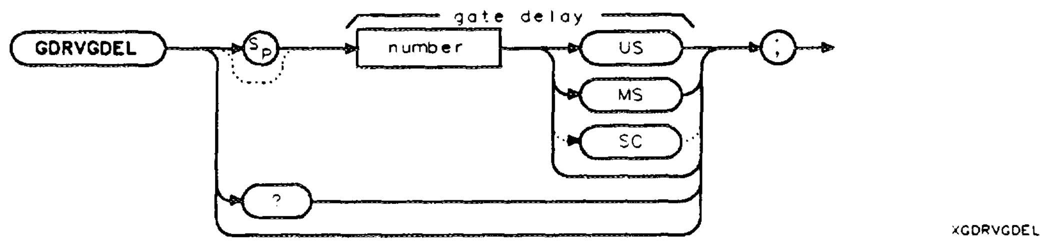
GDRVCLPAR also turns off the resolution bandwidth to pulse width coupling, video bandwidth to gate length coupling, and sweeptime to pulse repetition interval coupling.

The GDRVCLPAR command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

# GDRVGDEL
# Gate Delay for the Frequency Window

For the frequency window only, GDRVGDEL sets the time delay from when the gate trigger occurs to when the gate is opened.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 $\mu$s to 65 ms. |

Equivalent Softkey: GDRVGDEL is equivalent to **GATE DELAY** when using the gate utility (**GATE UTILITY**) functions.
Option Required: Option 105. Option 101 is recommended.
Preset Value: 1 $\mu$s
Related Commands: GDRVUTIL, GDRVGLEN, GD, GL.

## Example

`OUTPUT 718;"MOV GDRVGDEL,1US;"` *Sets the gate marker delay to 1 $\mu$s.*

## Description

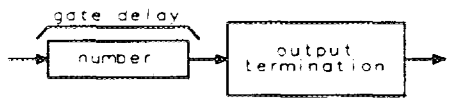
If the frequency window is currently the active window, GDRVGDEL updates the gate position markers and the position of the gate. If the time window is currently active, only the gate position markers are updated.

You can execute the GDRVGDEL command two different ways. You can either execute the GDRVGDEL command directly (for example, `"GDRVGDEL 1MS;"`) or use the MOV command to move the value for the time delay into the GDRVGDEL command (for example, `"MOV GDRVGDEL,1MS;"`). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVGDEL command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

GDRVGDEL? returns the last value entered for GDRVGDEL. To determine the current gate delay, query the gate delay (GD) command.

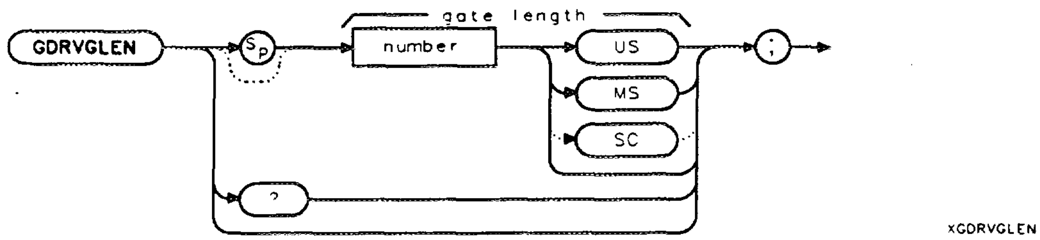



QGDRVGDEL

# GDRVGLEN
# Gate Length for the Frequency and Time Windows

Adjusts the gate length in both the time and frequency windows.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 $\mu$s to 65 ms. |

Equivalent Softkey: GDRVGLEN is equivalent to **GATE LENGTH** when using the gate utility (**GATE UTILITY**) functions.
Option Required: Option 105. Option 101 is recommended.
Preset Value: 1 $\mu$s.
Related Commands: GDRVUTIL, GDRVGDEL, GD, GL.

## Example

`OUTPUT 718;"MOV GDRVGLEN,1US;"` *Sets the gate marker to a length of 1 $\mu$s.*

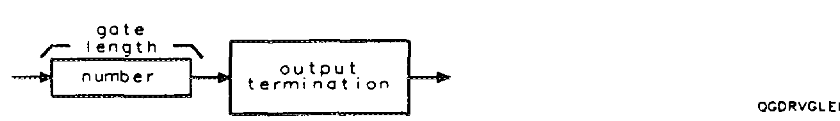
## Description

You can execute the GDRVGLEN command two different ways. You can either execute the GDRVGLEN command directly (for example, "`GDRVGLEN 1MS;`") or use the MOV command to move the value for the gate length delay into the GDRVGLEN command (for example, "`MOV GDRVGLEN,1MS;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVGLEN command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

## Query Response

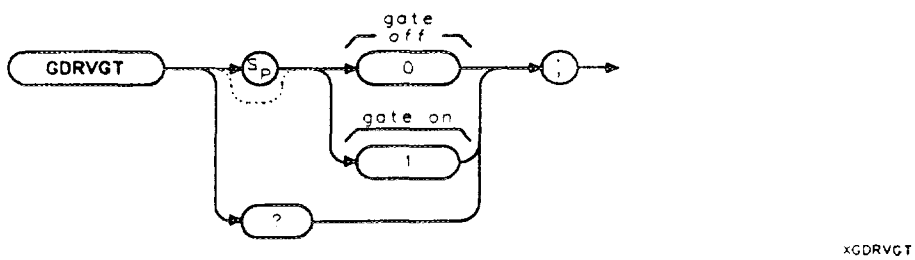
GDRVGLEN? returns the last value entered for GDRVGLEN. To determine the current gate time length, query the gate length (GL) command.



# GDRVGT
# Window Gate Control

*Turns on or off the gate in the frequency window.*

## Syntax




Equivalent Softkey: GDRVGT is equivalent to **GATE ON OFF** when using the gate utility (**GATE UTILITY**) functions.
Option Required: Option 105. Option 101 is recommended.
Related Commands: GDRVUTIL, GATE.

## Example

`OUTPUT 718;"MOV GDRVGT,1;"` *Turns on the gate in the frequency window.*

## Description

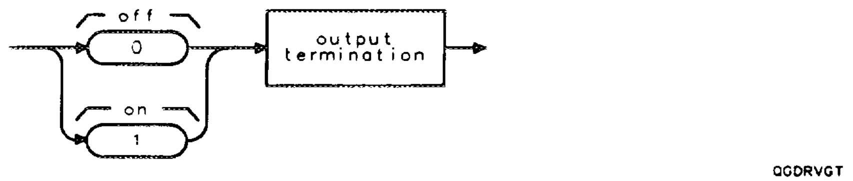
Before executing GDRVGT, you should do the following:

1. Ensure there is a trigger pulse connected to the GATE TRIGGER INPUT connector on the rear panel of spectrum analyzer. The gate utility functions do not work if there is not a trigger input.
2. Ensure that the GATE OUTPUT connector and the EXT TRIG INPUT connector are connected together.

If the time window is the active window, turning on the gate with GDRVGT makes the frequency window the active window. The GDRVGT command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the `COMMAND ERROR:` message and an SRQ 140.

You can execute the GDRVGT command two different ways. You can either execute the GDRVGT command directly (for example, "`GDRVGT 1;`") or use the MOV command to move the 1 or 0 into the GDRVGT command (for example, "`MOV GDRVGT,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

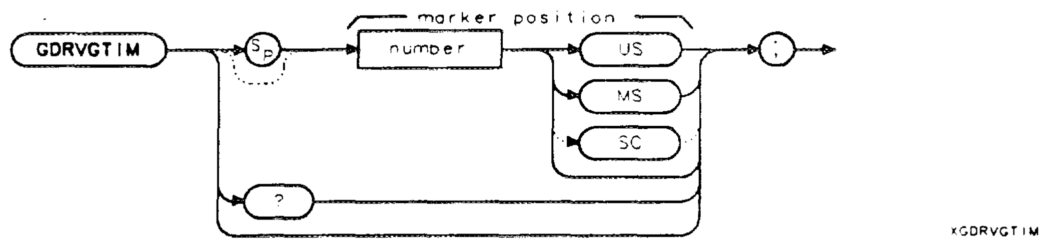
## Query Response



# GDRVGTIM
## Gate Trigger to Marker Position for Time Window

Activates the gate trigger marker, and then places it at the given value in the time window. The trigger marker readout shows the time between the gate trigger edge and the current marker position.

### Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 0 to the sum of the sweep time and sweep delay (GDRVSWDE). |

Equivalent Softkey: GDRVGTIM is similar to **TRIG MKR ON OFF**.
Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVUTIL.

### Example

`OUTPUT 718;"MOV GDRVGTIM,10MS;"` *Places the gate trigger marker 10 ms after the start of the sweep.*

### Description

If the frequency window is the active window, executing GDRVGTIM makes the time window the active window.

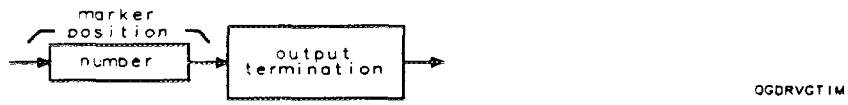
Once you enter a value into GDRVGTIM, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVGTIM.

You can execute the GDRVGTIM command two different ways. You can either execute the GDRVGTIM command directly (for example, "GDRVGTIM 1MS;") or use the MOV command to move the value for the time delay into the GDRVGTIM command (for example, "MOV GDRVGTIM,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVGTIM command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

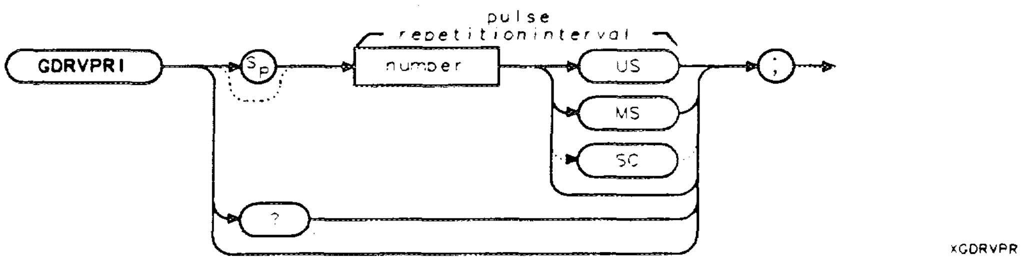
GDRVGTIM? returns the last value entered for GDRVGTIM. If you want the current value for the gate trigger marker, make the marker active with MKACTV, and then use MKF?.



# GDRVPRI
# Pulse Repetition Interval

Enters the specified value as the pulse repetition interval.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | Range is from the sweep delay (GDRVSWDE) to the sweep time plus the sweep delay. |

GDRVPRI is equivalent to **ENTER PRI** .

Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVCLPAR, GDRVST.

## Example

`OUTPUT 718;"MOV GDRVPRI,1MS;"` *Sets the pulse repetition interval to 1 ms.*

## Description

When the pulse repetition interval is entered, the approximate gate trigger position will be indicated on screen by either a "↑"for a positive trigger, or a "↓" for a negative trigger. Unlike **ENTER PRI** , GDRVPRI does not make the marker function active or display the **Pulse Param** softkeys.

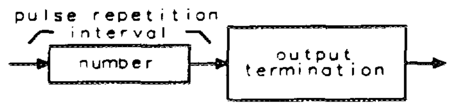
Once you enter a value into GDRVPRI, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVPRI.

You can execute the GDRVPRI command two different ways. You can either execute the GDRVPRI command directly (for example, "GDRVPRI 1MS;") or use the MOV command to move the value for the time delay into the GDRVPRI command (for example, "MOV GDRVPRI,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVPRI command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVPRI returns the current value for the pulse repetition interval.

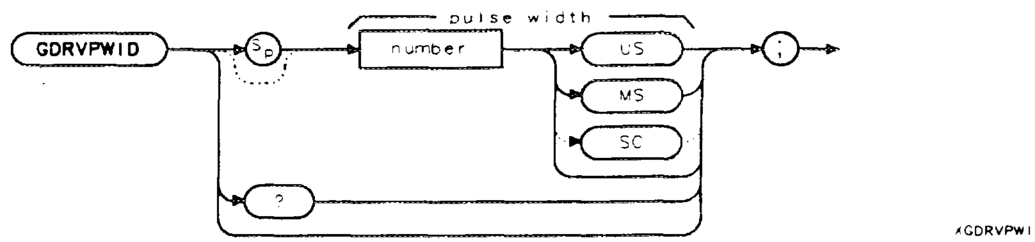



QGDRVPRI

# GDRVPWID
# Pulse Width

Enters the specified value as the pulse width.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is $\mu$s. | Range is from the sweep delay (GDRVSWDE) plus the sweep time to the sweep delay. |

Equivalent Softkey: **ENTER WIDTH** .
Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVCLPAR, GDRVRBW.

## Example

`OUTPUT 718;"MOV GDRVPWID,1MS;"` *Sets the pulse width to 1 ms.*

## Description

Unlike **ENTER WIDTH** , GDRVPWID does not make the marker function active or display the **Pulse Param** softkeys.

Once you enter a value into GDRVPWID, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVPWID.

You can execute the GDRVPWID command two different ways. You can either execute the GDRVPWID command directly (for example, "GDRVPWID 1MS;") or use the MOV command to move the value for the pulse width into the GDRVPWID command (for example, "MOV GDRVPWID,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVPWID command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

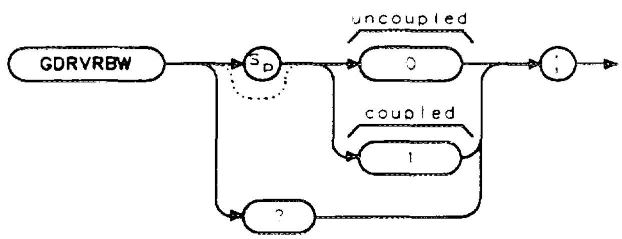
GDRVPWID returns the current value for the pulse width.


QGDRVPWID

# GDRVRBW
## Couple Resolution Bandwidth to Pulse Width

Couples or uncouples the resolution bandwidth to the specified pulse width.

### Syntax




XGDRVRBW

Equivalent Softkey: CPL RBW ON OFF .

Option Required: Option 105. Option 101 is recommended.
Preset Value: Uncoupled.
Related Commands: GDRVPWID, GDRVVBW, GDRVST.

### Example

`OUTPUT 718;"MOV GDRVRBW,1;"` *Couples the resolution bandwidth to the pulse width.*

### Description

Before coupling the resolution bandwidth to the pulse width, you should enter the pulse width into GDRVPWID. Coupling the resolution bandwidth to the pulse width updates the trace display in the active window. If the resolution bandwidth and the pulse width are uncoupled, the setting of the resolution bandwidth does not change.

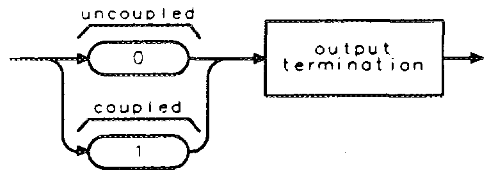
The resolution bandwidth is at least three times $\frac{1}{PulseWidth}$ when coupled. The resolution bandwidth is updated to the coupled value when the window is next active.

You can execute the GDRVRBW command two different ways. You can either execute the GDRVRBW command directly (for example, "GDRVRBW 1;") or use the MOV command to move the 1 or 0 into the GDRVRBW command (for example, "MOV GDRVRBW,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVRBW command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVRBW returns a "1" if the resolution bandwidth is coupled to the pulse width, or a "0" if it is not coupled.

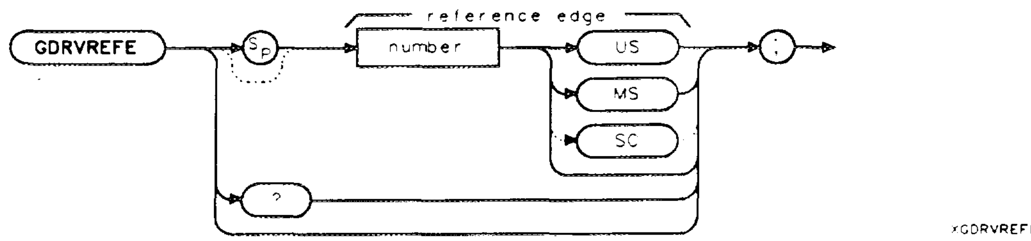



QGDRVRBW

# GDRVREFE
# Enter Reference Edge

Allows you to enter the position (in time) for a reference edge.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is $\mu$s. | Range is from the sweep delay (GDRVSWDE) plus the sweep time to the sweep delay. |

Equivalent Softkey: **ENTER REF EDGE** .

Option Required: Option 105. Option 101 is recommended.
Initial Value: 0 s.
Related Commands: GDRVUTIL.

## Example

```
OUTPUT 718;"MOV GDRVREFE,1MS;"
```

## Description

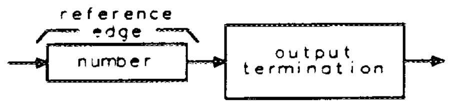
Unlike **ENTER REF EDGE** , GDRVREFE does not make the marker function active or display the **ENTER REF EDGE** softkeys.

Once you enter a value into GDRVREFE, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVREFE.

You can execute the GDRVREFE command two different ways. You can either execute the GDRVREFE command directly (for example, "GDRVREFE 1MS;") or use the MOV command to move the value into the GDRVREFE command (for example, "MOV GDRVREFE,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVREFE command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

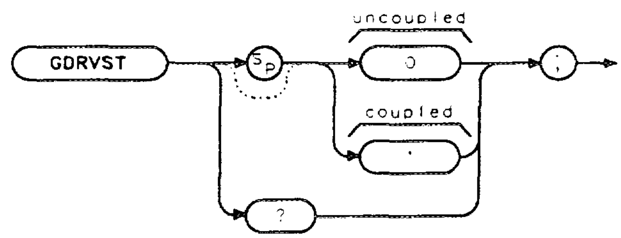



QGDRVREFE

# GDRVST
## Couple Sweep Time to Pulse Repetition Interval

Couples or uncouples the sweep time to the pulse repetition interval.

### Syntax




XGDRVST

Equivalent Softkey: **CPL SWP ON OFF** .

Option Required: Option 105. Option 101 is recommended.
Preset Value: Uncoupled.
Related Commands: GDRVPRI.

### Example

`OUTPUT 718;"MOV GDRVST,1;"` *Couples the sweep time to the pulse repetition interval.*

### Description

Before coupling the sweep time to the pulse repetition interval, you should enter the pulse repetition interval into GDRVPRI. Coupling the sweep time to the pulse repetition interval updates the trace display in the active window. If the sweep time and the pulse repetition interval are uncoupled, the setting of the sweep time does not change.

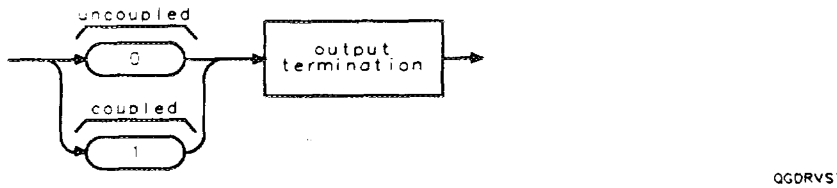
The sweep time is 401 times the pulse repetition interval when coupled. The sweep time is updated to the coupled value when the window is next active.

You can execute the GDRVST command two different ways. You can either execute the GDRVST command directly (for example, "GDRVST 1;") or use the MOV command to move the 1 or 0 into the GDRVST command (for example, "MOV GDRVST,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVST command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVST returns a "1" if the sweep time is coupled to the pulse repetition interval, or a "0" if it is not coupled.



# GDRVSWAP
## Update the Time or Frequency Window

Makes the window (either the time or frequency window) that is currently not the active window, the active window.

### Syntax


XGDRVSWAP

Equivalent Softkey: GDRVSWAP is equivalent to **UPDATE TIMEFREQ** , or pressing (NEXT).
Option Required: Option 105. Option 101 is recommended.
Related Commands: GDRVUTIL.

### Example

```
OUTPUT 718;"GDRVSWAP;"
```

### Description

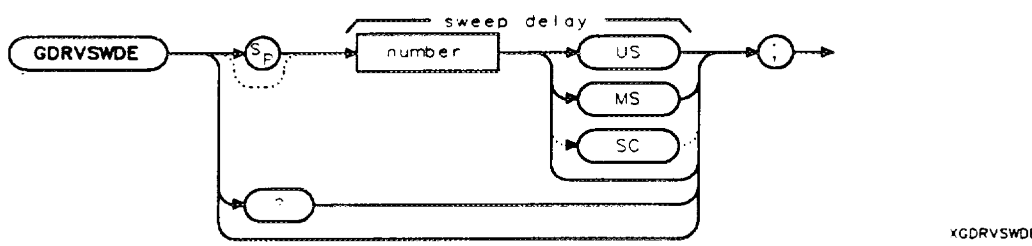
Whenever the window is made active, the trace and gate position are updated. GDRVSWAP also couples the resolution bandwidth, video bandwidth, and sweep time to the current pulse width and pulse repetition interval values, if the pulse values have been entered and coupling is active. (See "GDRVRBW," "GDRVVBW," and "GDRVST" for more information about coupling resolution bandwidth, video bandwidth, and sweep time to the current pulse width and pulse repetition interval.)

The GDRVSWAP command is a gate utility function (see "GDRVUTIL" command for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

# GDRVSWDE
# Delay Sweep for Time Window

Allows you to specify the delay from the edge of the gate trigger until the sweep is started in the time window.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is second. | 1 μs to 65 ms. |

Equivalent Softkey: **SWEEP DELAY** .
Option Required: Option 105. Option 101 is recommended.
Initial Value: 1 μs.
Related Commands: GDRVUTIL, GD.

## Example

`OUTPUT 718;"MOV GDRVSWDE,1US;"` *Sets the time delay to 1 μs.*

## Description

When using GDRVSWDE, the gate zone markers shown in the time window are updated to the value of GDRVSWDE.

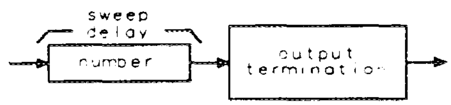
Once you enter a value into GDRVSWDE, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVSWDE.

You can execute the GDRVSWDE command two different ways. You can either execute the GDRVSWDE command directly (for example, "`GDRVSWDE 1MS;`") or use the MOV command to move the value for the time delay into the GDRVSWDE command (for example, "`MOV GDRVSWDE,1MS;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVSWDE command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the **COMMAND ERROR:** message and an SRQ 140.

## Query Response

GDRVSWDE? returns the last value entered into GDRVSWDE. To determine the current value of the sweep time delay, query the gate delay (GD) command.

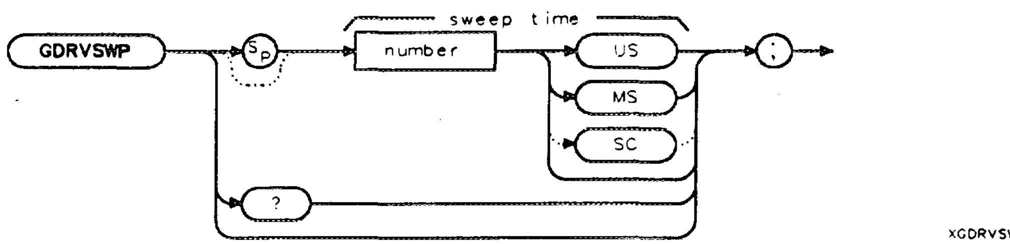



QGDRVSWDE

# GDRVSWP
# Sweep Time for the Time Window

Specifies the sweep time for the time domain window of the gate utility.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is second. | 0 to 65 ms. |

Option Required: Option 105. Option 101 is recommended.
Initial Value: 0.
Related Commands: GDRVUTIL, ST.

## Example

`OUTPUT 718;"MOV GDRVSWP,1MS;"` *Sets the time delay to 1 ms.*

## Description

The positions of the gate markers and the gate trigger markers are updated to the new value of the sweep time.

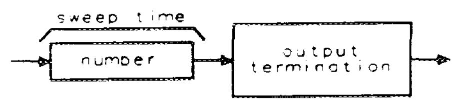
Once you enter a value into GDRVSWP, that value is retained until you change it, or execute DISPOSE ALL. Pressing (PRESET) or turning the spectrum analyzer off does not change the value of GDRVSWP.

You can execute the GDRVSWP command two different ways. You can either execute the GDRVSWP command directly (for example, "GDRVSWP 1MS;") or use the MOV command to move the value for the sweep time into the GDRVSWP command (for example, "MOV GDRVSWP,1MS;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVSWP command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVSWP? returns the last value entered into GDRVSWP. To determine the current value of the sweep time in the time window, query the sweep time (ST).

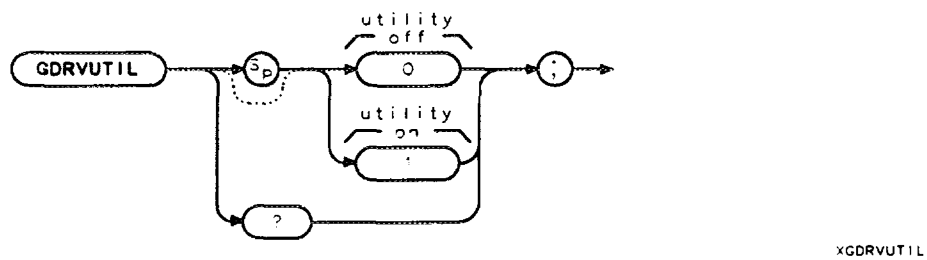



QGDRVSWP

# GDRVUTIL
# Gate Utility

Turns on or off the gate utility.

## Syntax




Equivalent Softkey: **GATE UTILITY**.

Option Required: Option 105. Option 101 is recommended.

## Example

`OUTPUT 718;"MOV GDRVUTIL,1;"` *Turns on the gate utility.*

## Description

When the gate utility is turned on, the spectrum analyzer screen displays two windows. The upper window displays the input signal in the time domain, and the lower window displays the input signal in the frequency domain. If the spectrum analyzer is in zero span when the gate utility is turned on, the frequency span of the lower window will be set to a nonzero frequency span.

Before executing GDRVUTIL, you should do the following:

1. Ensure there is a trigger pulse connected to the GATE TRIGGER INPUT connector on the rear panel of spectrum analyzer. The gate utility functions do not work if there is not a trigger input.
2. Ensure that the GATE OUTPUT connector and the EXT TRIG INPUT connector are connected together.
3. Set the center frequency of the analyzer to the signal's center frequency.
4. Set the reference level of the analyzer so that the signal's peak is within the first graticule.

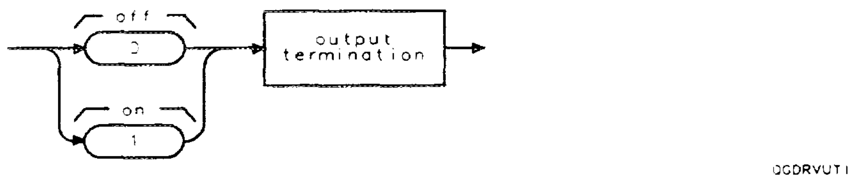
The spectrum analyzer cannot turn on the gate utility if the spectrum analyzer is not properly triggered. Once the gate utility has been turned on, you can use the commands that begin with "GDRV" to make the time-gate measurement. Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

**Restrictions**

Executing GDRVUTIL exits the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), or power menu measurements (ACP, ACPE, CHP, and OBW).

You should turn off the gate utility (set GDRVUTIL to 0) when you are done with the gate utilities.

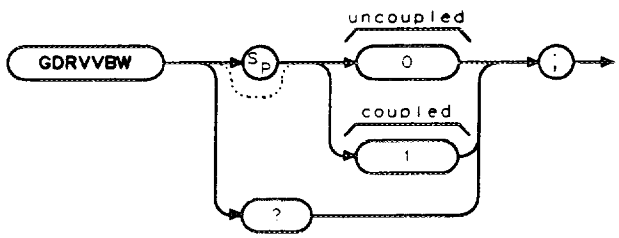
## Query Response



# GDRVVBW
# Couple Video Bandwidth to Gate Length

Couples or uncouples the video bandwidth to the gate length.

## Syntax




XGDRVVBW

Equivalent Softkey: **CPL VBW ON OFF**.
Option Required: Option 105. Option 101 is recommended.
Preset Value: Uncoupled.
Related Commands: GDRVGLEN.

## Example

`OUTPUT 718;"MOV GDRVVBW,1;"` *Couples the video bandwidth to the gate length.*

## Description

Before coupling the video bandwidth to the gate length, you should enter the gate length into GDRVGLEN. Coupling the video bandwidth to the gate length updates the trace display in the active window. If the video bandwidth and the gate length is uncoupled, the setting of the video bandwidth does not change.

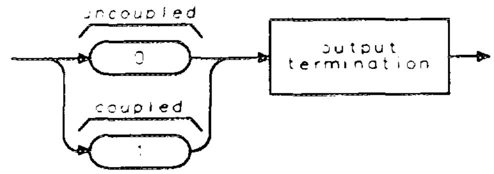
The video bandwidth is at least equal to the inverse of the gate length when coupled. The video bandwidth is updated to the coupled value when the window is next active.

You can execute the GDRVVBW command two different ways. You can either execute the GDRVVBW command directly (for example, "GDRVVBW 1;") or use the MOV command to move the 1 or 0 into the GDRVVBW command (for example, "MOV GDRVVBW,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

The GDRVVBW command is a gate utility function (see "GDRVUTIL" for more information about the gate utility functions). Executing a gate utility command without Option 105 installed in the spectrum analyzer generates the COMMAND ERROR: message and an SRQ 140.

## Query Response

GDRVVBW returns a "1" if the resolution bandwidth is coupled to the pulse width, or a "0" if it is not coupled.

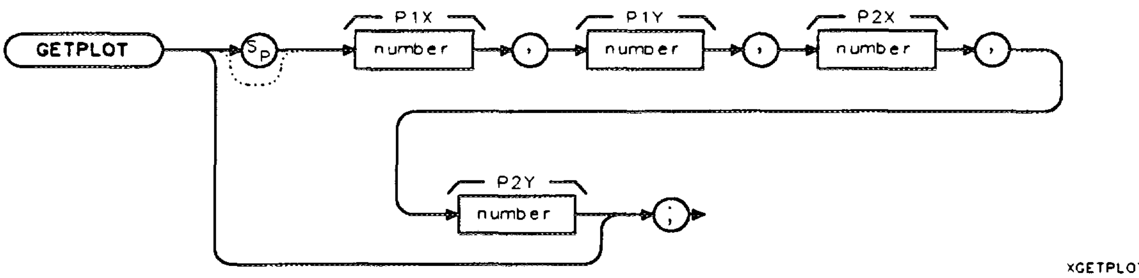



QGDRVVBW

# GETPLOT
## Get Plot

Initiates output of the spectrum analyzer display to a plotter. GETPLOT is meant to be used within a downloadable program.

### Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Number within the plotter coordinates. |

Related Commands: FUNCDEF, GETPRNT, SNGLS, TS.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

### Example for the HP-IB Interface

This example illustrates how you can use a softkey to plot the spectrum analyzer display, and then have the plotter perform a page feed. (Not all plotters support the page feed command, however.) This example assumes that the plotter is at address 5 and the spectrum analyzer is at address 18. (This example is only valid for HP 9000 series 200 and 300 computers.)

| | |
|---|---|
| `OUTPUT 718;"FUNCDEF P_LOT,%";` | *Creates a user-defined function called P_LOT.* |
| `OUTPUT 718;"GETPLOT;";` | *P_LOT performs the GETPLOT command to plot the spectrum analyzer screen.* |
| `OUTPUT 718;"OUTPUT 5,B,80;";` | *P_LOT then sends the ASCII code for "P" to the plotter.* |
| `OUTPUT 718;"OUTPUT 5,B,71;";` | *P_LOT then sends the ASCII code for "G" to the plotter.* |
| `OUTPUT 718;"OUTPUT 5,B,59;";` | *P_LOT then sends the ASCII code for a semicolon to the plotter.* |
| `OUTPUT 718;"%;"` | *Ends the FUNCDEF declaration.* |
| `OUTPUT 718;"KEYDEF 1,P_LOT,%PLOT PG|FEED  %;"` | *Assigns P_LOT to softkey number 1. Softkey number 1 can be accessed by pressing* (MEAS/USER), **User Menus**. |
| `LOCAL 718` | |

## Description

The GETPLOT command transfers the trace data, graticule, and annotation of the spectrum analyzer screen to a plotter via the spectrum analyzer interface (softkey labels excluded). The data is transferred in ASCII, HPGL format.

Before executing the downloadable program that contains GETPLOT, you should do one of the following:

- Disconnect the computer from the spectrum analyzer.

  Or,

- Send the following BASIC commands:

  ```
  ABORT 7
  LOCAL 7
  ```

  ABORT 7 instructs the computer to release control of the HP-IB, and LOCAL 7 allows you to control the spectrum analyzer from the front panel.

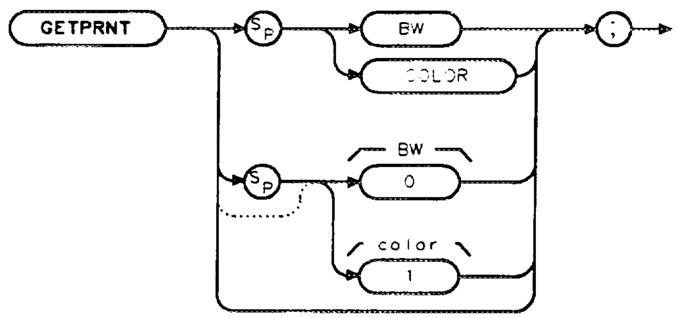
When using the PLOT command, the scaling points (P1x, P1y; P2x, P2y) can be specified. These scaling points specify the (x,y) coordinates, which determine the size of the plot. (P1x,P1y) refers to the lower-left plotter coordinates. (P2x,P2y) refers to the upper-right plotter coordinates.

**Note** The HP 7470A plotter does not support 2 plots per page. If you use an HP 7470A plotter with an HP 8590 Series spectrum analyzer, you can select one plot per page or four plots per page but not 2 plots per page.

# GETPRNT
# Get Print

Initiates output of the spectrum analyzer display to a printer. GETPRNT is meant to be used within a downloadable program.

## Syntax




Related Commands: FUNCDEF, GETPLOT.

## Example for the HP-IB Interface

This example illustrates how you can use a softkey to print the spectrum analyzer display, and then have the printer perform a page feed. This example assumes that the printer is at address 1 and the spectrum analyzer is at address 18. (This example is only valid for HP 9000 series 200 and 300 computers.)

| | |
|---|---|
| `OUTPUT 718;"FUNCDEF P_RINT,%";` | *Creates a user-defined function called P_RINT.* |
| `OUTPUT 718;"GETPRNT;";` | *P_RINT performs the GETPRNT command to print the spectrum analyzer screen.* |
| `OUTPUT 718;"OUTPUT 1,B,10;";` | *P_RINT then sends the ASCII code for a carriage return to the printer.* |
| `OUTPUT 718;"OUTPUT 1,B,13;";` | *P_RINT then sends the ASCII code for a line feed to the printer.* |
| `OUTPUT 718;"OUTPUT 1,B,12;";` | *P_RINT then sends the ASCII code for a form feed to the printer.* |
| `OUTPUT 718;"%;"` | *Ends the FUNCDEF declaration.* |
| `OUTPUT 718;"KEYDEF 2,P_RINT,%PRINT|FRM FEED%;"` | *Assigns P_RINT to softkey number 2. Softkey number 2 can be accessed by pressing* (MEAS/USER), **User Menus**. |
| `LOCAL 718` | *Allows you to control the spectrum analyzer from the front panel.* |

## Description

The data is output in HP raster graphics format. Executing "GETPRNT;", "GETPRNT 0;", or "GETPRNT BW;" produces a monochrome printout. Executing "GETPRNT 1;" and "GETPRNT COLOR;" produces a "color format" output for an HP PaintJet printer. Execute "MENU 0;" before printing to blank the softkeys.

Before executing the downloadable program that contains GETPRNT, you should do one of the following:

- Disconnect the computer from the spectrum analyzer.

  Or,

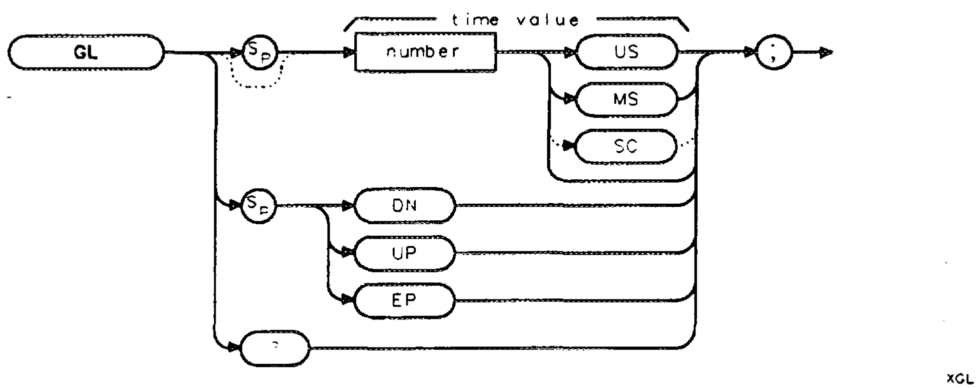
- Send the following BASIC commands:
  ```
  ABORT 7
  LOCAL 7
  ```

  ABORT 7 instructs the computer to release control of the HP-IB, and LOCAL 7 allows you to control the spectrum analyzer from the front panel.

# GL
# Gate Length

Sets the length of time the gate is open.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is seconds. | 1 $\mu$s to 65.5 ms |

Equivalent Softkey: **GATE LENGTH**.
Option Required: Option 105.
Preset State: 1 ms.
Related Commands: GATE, GATECTL, GC, GD.

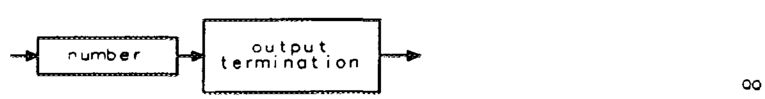
## Example

```
OUTPUT 718;"GL 1US;"
```

## Description

GL applies only if GATECTL is set to EDGE.

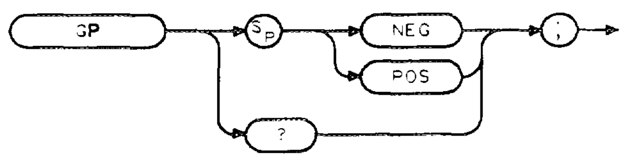
## Query Response



# GP
# Gate Polarity

Sets the polarity (positive or negative) for the gate trigger.

## Syntax




XGP

Equivalent Softkey: **EDGE POL POS NEG** .
Option Required: Option 105.
Preset State: GP POS.
Related Commands: GATE, GATECTL, GD, GL.

## Example

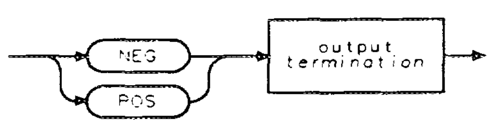
```
OUTPUT 718;"GP POS;"
```

## Description

GP applies only if GATECTL is set to EDGE.

When used as a predefined variable, GP returns a "0" if GP has been set to NEG, a "1" if GP has been set to POS.

## Query Response

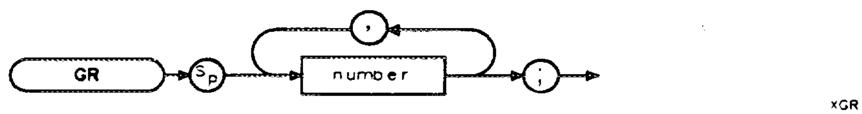



QGP

# GR
# Graph

Graphs the given $y$ coordinate while incrementing the $x$ coordinate by 1.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | −22 to 233. |

Related Commands: CLRDSP, DA.

## Example

This example graphs a diagonal line on the spectrum analyzer display.

```
OUTPUT 718;"BLANK TRA;"
OUTPUT 718;"PU;PA 0,0;GR;"  Positions the pen.
FOR I = 0 TO 400            I represents the Y value in graticule coordinates.
OUTPUT 718;I DIV 2          Graphs the Y values, incrementing the X value by 1.
NEXT I
```

## Description

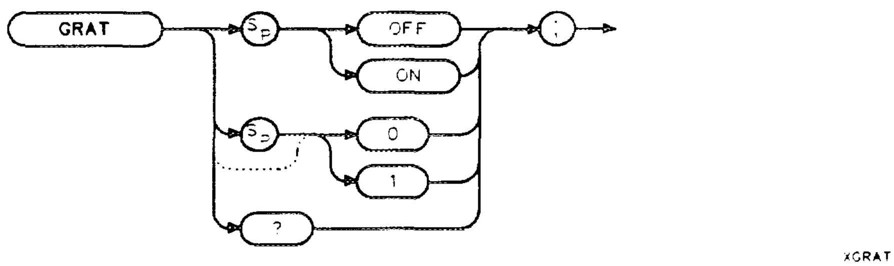
The GR command plots a graph at the amplitude point indicated by the next $y$ coordinate. The $y$ coordinates are specified in display units, with −22 at the bottom of the spectrum analyzer display and 233 at the top of the spectrum analyzer display. See "PA" for more information about display units. The $x$ coordinate is always incremented by 1; it cannot be decremented.

The GR command also places the graph in the display list. See "DA" for more information about the display list.

# GRAT
# Graticule

Turns on or off the graticule.

## Syntax




Equivalent Softkey: **GRAT ON OFF**.

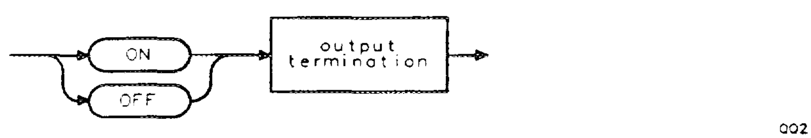
Preset State: GRAT ON.

Related Commands: ANNOT.

## Example

| | |
|---|---|
| `OUTPUT 718;"GRAT OFF;"` | *Turns off the graticule.* |
| `OUTPUT 718;"GRAT?;"` | *Queries graticule status.* |
| `ENTER 718;Grat$` | *Gets response from the spectrum analyzer.* |
| `DISP Grat$` | *Displays OFF on the computer screen.* |

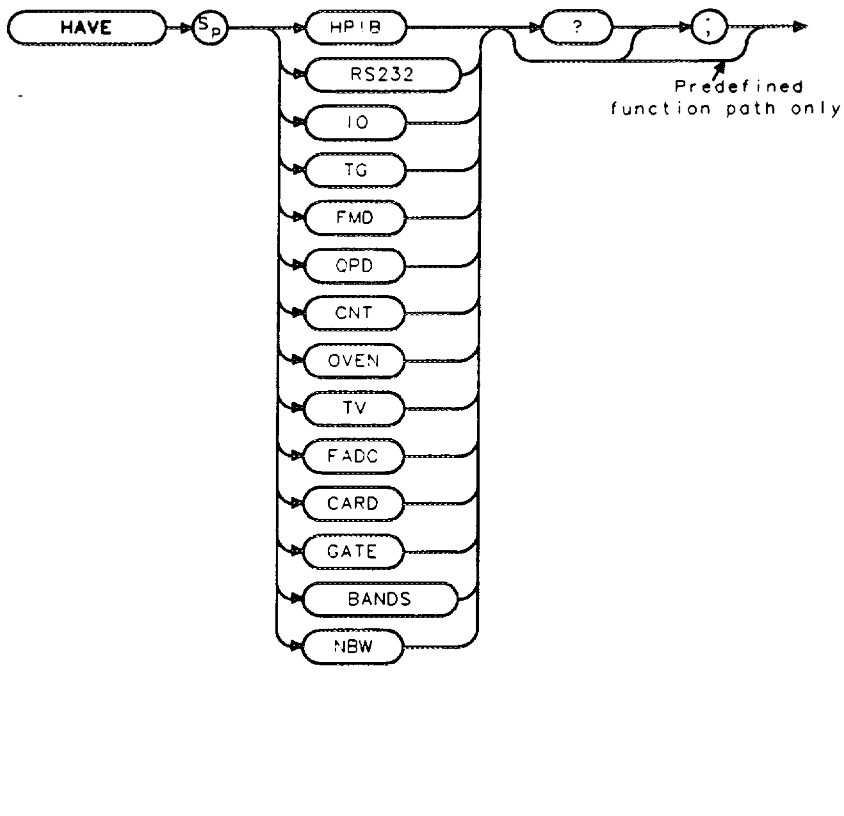
## Query Response



# HAVE
# Have

Returns a "0" if the specified option or device is *not* installed.

## Syntax




## Example

```
OUTPUT 718;"HAVE HPIB;"   Queries whether Option 021 is installed.
ENTER 718;A               Receives response from spectrum analyzer.
DISP A                    Displays response.
```

## Description

The parameters are:

| | |
|---|---|
| HPIB | HP-IB interface, Option 021. |
| RS232 | RS-232 interface, Option 023. |
| IO | Either the HP-IB interface (Option 021) or RS-232 interface (Option 023). |
| TG | Tracking generator, Option 010 or 011. |
| FMD | FM demodulator, Option 102, 103, or 301. |
| QPD | Quasi-peak detector, Option 103. |

**HAVE Have**

| | |
|---|---|
| CNT | Counter-lock. (The frequency counter is standard for an HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E; it is available as Option 013 for an HP 8590D.) |
| OVEN | Precision frequency reference, Option 004. |
| TV | TV synch trigger, Option 102 or 301. If the TV synch trigger option is installed in the spectrum analyzer and in use, "HAVE TV?;" returns a "2." |
| FADC | Fast ADC, Option 101 or 301. |
| CARD | Memory card reader. (The memory card reader is Option 003 for the HP 8590D or HP 8592D. The memory card reader is standard for the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E.) |
| GATE | Time-gated spectrum analyzer capability, Option 105. |
| BANDS | Returns the number of frequency bands that the spectrum analyzer has. See the following description. |
| NBW | Narrow bandwidths, Option 130. |

BANDS returns the number of frequency bands that the spectrum analyzer has, as shown in the following table.

| Model Number | Value HAVE BANDS Returns |
|---|---|
| HP 8590D, HP 8591E, or HP 8594E | 1 |
| HP 8595E | 2 |
| HP 8592D or HP 8593E | 5 |
| HP 8596E | 3 |

"HAVE CARD;" returns additional information about the memory card. By checking the bit status of the byte returned from "HAVE CARD;", you can determine the information shown in the following table.

| Bit Position | Bit Status = 0 | Bit Status = 1 |
|---|---|---|
| 0 | Memory card reader is not installed. | Memory card reader is installed. |
| 1 | Memory card is write protected. | Memory card is not write protected. |
| 2 | Memory card is a random access card (RAM). | Memory card is a read only memory card (ROM). |
| 3 | Memory card not inserted into memory card reader. | Memory card is inserted into memory card reader. |

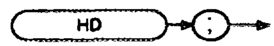
You can use the BIT or BITF command to determine the status of the bits. For example,

```
OUTPUT 718;"VARDEF R_ESULT,0;"             Stores the bit status in R_ESULT.
OUTPUT 718;"BIT R_ESULT,HAVE CARD,3;"      Checks the status of bit 3.
OUTPUT 718;"R_ESULT?;"                     Gets the result.
ENTER 718;A
DISP A                                     Displays the bit status of bit 3.
```

# HD
# Hold Data Entry

Disables data entry via the spectrum analyzer numeric keypad, knob, or step keys. The active function readout is blanked, and any active function is deactivated.

## Syntax




XHD

Equivalent Key: HOLD (for the HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E) or (HOLD) (for the HP 8590D or HP 8592D).
Related Commands: Any active function. See the description below for a list of the active functions.

## Example

| | |
|---|---|
| `OUTPUT 718;"HD;"` | *Disables the active function and clears the active function block area on the spectrum analyzer screen.* |
| `OUTPUT 718;"CF 600MHZ;HD;700MHZ;"` | *This will leave the center frequency at 600 MHz, because HD deactivates any current function.* |

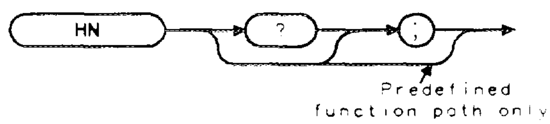
## Description

The active functions are ACPBW, ACPSP, AT, BAUDRATE, CF, COUPLE, CRTHPOS, CRTVPOS, DA, DL, DOTDENS, FA, FB, FFTSTOP, FMGAIN, FOFFSET, GATECTL, GD, GL, GP, INZ, LG, MKA, MKD, MKFC, MKFCR, MKN, MKPAUSE, MKPX, ML, MODE, NDB, NRL, PREAMPG, RB, RCLS, ROFFSET, RL, RLPOS, SAVES, SAVRCLN, SETDATE, SETTIME, SP, SQLCH, SRCAT, SRCPOFS, SRCPSTP, SRCPSWP, SRCPWR, SRCTK, SS, ST, TH, TIMEDATE, TVLINE, VAVG, VB, VBR, ZMKSPAN, ZMKCNTR and user-defined active function specified by the ACTDEF command.

# HN
# Harmonic Number

Returns the harmonic number of the current harmonic band in which the spectrum analyzer is tuning.

## Syntax




XHN

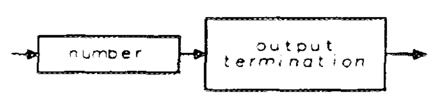
Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.
Related Commands: FS, HNLOCK, HNUNLK.

## Example

| | |
|---|---|
| `OUTPUT 718;"HN?;"` | *Queries harmonic band of spectrum analyzer.* |
| `ENTER 718;Number` | *Gets response from the spectrum analyzer.* |
| `DISP Number` | *Displays the result on computer screen.* |

## Query Response

The HN command returns the number of the harmonic band, if the spectrum analyzer is sweeping single-band. A "−1" is returned if the spectrum analyzer is sweeping multiband.

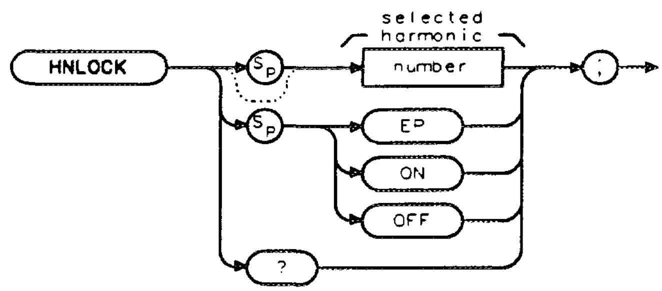



001

# HNLOCK
# Harmonic Number Lock

Forces the spectrum analyzer to use only the selected harmonic band.

## Syntax




XHNLOCK

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 0 to 4 (for HP 8592D, HP 8593E, or HP 8596E), 0 to 3 (HP 8596E only), 0 to 1 (for HP 8595E). |

Equivalent Softkey: The HNLOCK command and the softkeys under the **Band Lock** menu are identical.
Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.
Preset State: HNLOCK OFF.
Related Commands: CF, FA, FB, FOFFSET, HN, HNUNLK, SNGLS, SP.

## Example

```
INPUT "SELECT THE DESIRED FREQUENCY BAND",Harm    Gets harmonic band from user.
OUTPUT 718;"HNLOCK ";Harm;";"                     Locks harmonic band.
```

## Description

HNLOCK ON locks onto the harmonic band that is appropriate for the current center frequency, lowering the span, if necessary, due to the limits of the harmonic band.

HNLOCK <number>, where <number> is an integer, locks onto harmonic band <number> and automatically selects the settings shown in the following table.

| Remote Commands | Equivalent Softkey | Frequency Settings | |
|---|---|---|---|
| HNLOCK 0 | BAND 0 | Center frequency 1.450 GHz | Span 2.900 GHz |
| HNLOCK 1 | BAND 1 | Center frequency 4.638 GHz | Span 3.600 GHz |
| HNLOCK 2 | BAND 2 | Center frequency 9.400 GHz | Span 6.800 GHz |
| HNLOCK 3 | BAND 3 | Center frequency 15.90 GHz | Span 7.000 GHz |
| HNLOCK 4 | BAND 4 | Center frequency 20.55 GHz | Span 2.900 GHz |

**HNLOCK Harmonic Number Lock**

Once HNLOCK is set, only frequencies and spans that fall within the frequency band of the current harmonic may be entered. The span is reduced automatically to accommodate a center frequency specified near the end of the band range.

---

**Note**

Before changing the frequency range to another harmonic, unlock the band with the harmonic unlock command, "HNLOCK OFF;" or "HNUNLK;".

---

## BAND LOCK ON (HNLOCK ON)

### Start Frequency

If a start frequency is entered that is outside of the current band boundaries, it will be set to the nearest band edge instead. If a start frequency that is greater than the current stop frequency is entered, the (possibly modified) start frequency is used for both the start and the stop frequency; therefore, the span will be set to zero. If the start and stop frequencies specify too large a span, they will be modified. (Also see "FA.")

### Stop Frequency

If a stop frequency is entered that is outside of the current band boundaries, it will be set to the nearest band edge instead. If a stop frequency that is less than the current start frequency is entered, the (possibly modified) stop frequency will be used for both the start and stop frequency; therefore, the span will be set to zero. (Also see "FB.")

### Center Frequency

The span will be modified if necessary to get the center frequency specified without crossing the band edges. (Also see "CF.")

### Span

The span will be limited as necessary to keep the start and stop frequencies within the band edges without changing the center frequency. The maximum span allowed is 2.943 GHz in band 0, 3.600 GHz in band 1, 6.957 GHz in band 2, and 7 GHz in higher bands. (Also see "SP.")

## BAND LOCK OFF (HNLOCK OFF)

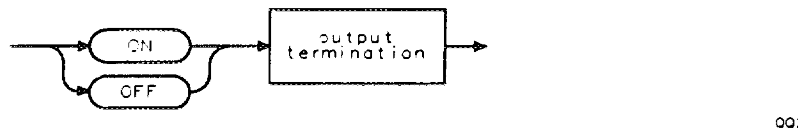
The start and stop frequencies are bounded by the range of the instrument.

The frequency not specified will be bounded by the following scheme:

Continuous Sweep Mode: If the specified frequency is in band 0, the values will be contained by the bounds of band 0. If the value is in the harmonic band range, the values will be bounded by the top of the instrument range and the lower end of band 1. (Also see "CONTS.")

Single Sweep Mode: The values are bounded by the instrument range only; therefore, band 0 can be included in a multiband sweep in single mode. (Also see "SNGLS.")

## Query Response



# HNUNLK
## Unlock Harmonic Number

*Unlocks the harmonic band.*

### Syntax


XHNUNLK

Equivalent Softkey: HNUNLK is equivalent to HNLOCK OFF and **BND LOCK ON OFF** (OFF is underlined).
Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.
Related Commands: CF, FA, FB, FOFFSET, FS, HN, HNLOCK, SP.

### Example

```
OUTPUT 718;"HNUNLK;"
```

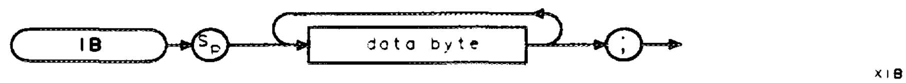
### Description

The HNUNLK command allows you to select frequencies and spans outside the range of a single harmonic band.

# IB
# Input B

Provides a method for putting values into trace B. The spectrum analyzer expects 401 two-byte integers. The data values can represent the range of integer numbers.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Data byte | 8-bit byte containing numeric or character data. | |

## Example

| | |
|---|---|
| `10 ASSIGN @Sa TO 718;FORMAT ON` | |
| `20 ASSIGN @Sa_bin TO 718;FORMAT OFF` | |
| `30 INTEGER Binary(1:401)` | *Dimensions an array called "Binary."* |
| `40 OUTPUT @Sa;"CF 300MZ;CLRW TRB;BLANK TRA;SP 10MZ;SNGLS;TS;"` | *Takes a measurement sweep.* |
| `50 OUTPUT @Sa;"TDF B;MDS W;TB;"` | *Outputs trace B (in binary) to computer.* |
| `60 ENTER @Sa_bin;Binary(*)` | *Stores trace data in array.* |
| `70 OUTPUT @Sa;"CF 100MZ;RB 30KZ;SP 1MZ;TS;"` | *Changes the spectrum analyzer settings.* |
| `80 DISP "PRESS CONTINUE WHEN READY"` | |
| `90 PAUSE` | |
| `100 OUTPUT @Sa;"IB";` | *Prepares spectrum analyzer to receive trace B data stored in array.* |
| `110 OUTPUT @Sa_bin;Binary(*)` | *Sends trace B data to spectrum analyzer.* |
| `120 OUTPUT 718;"VIEW TRB;"` | |
| `130 END` | |

## Description

The IB command sends trace B data as binary data only; IB is independent of the measurement data size (MDS) command. The IB command expects 802 data bytes (401 data points, two bytes each).

# ID
# Identify

Returns the spectrum analyzer model number to the controller (for example, "HP8593E").

## Syntax

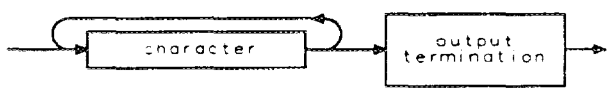

XID

Equivalent Softkey: SHOW OPTIONS .
Related Commands: REV, SER.

## Example

| | |
|---|---|
| 10 ALLOCATE A$[50] | *Allocates string to hold model number.* |
| 20 OUTPUT 718;"ID;" | *Gets model number.* |
| 30 ENTER 718;A$ | *Transfers number to computer.* |
| 40 DISP A$ | *Displays model number.* |
| 50 END | |

## Query Response

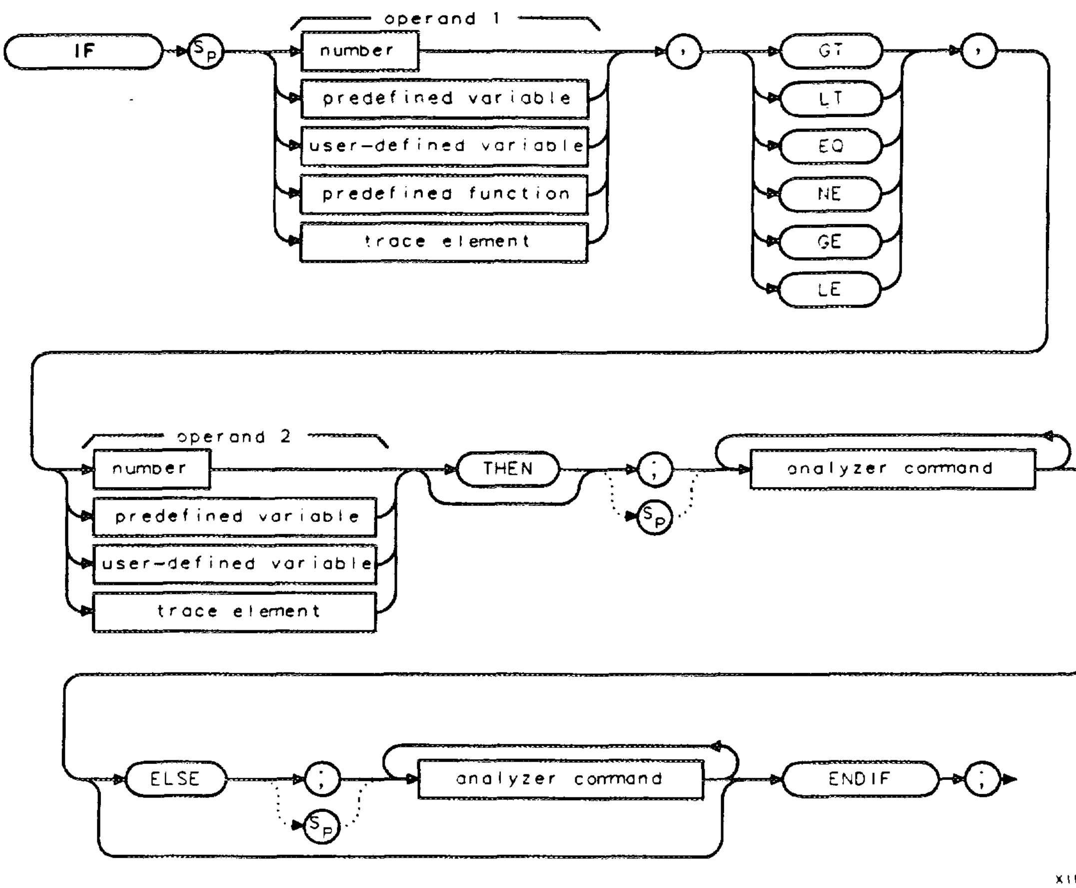



QID

# IF THEN ELSE ENDIF
# If Then Else Endif

The IF/THEN/ELSE/ENDIF commands form a decision and branching construct.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Real number range. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Analyzer command | Any spectrum analyzer command. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: REPEAT/UNTIL.

## Example

The following example uses the IF/THEN/ELSE/ENDIF command to pick a center frequency.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"TH -35DM;"` | *Sets threshold level.* |
| `30 OUTPUT 718;"TS;MKPK HI;MA;"` | *Finds highest peak.* |
| `40 OUTPUT 718;"IF MA,GT,TH THEN;"` | *Compares peak to threshold.* |
| `50   OUTPUT 718;"CF 20MHZ;"` | *Changes center frequency to 20 MHz if peak amplitude is greater than the threshold.* |
| `60 OUTPUT 718;"ELSE;"` | *This line is executed if peak is less than or* |
| `70   OUTPUT 718;"CF 100MHZ;TS;MKPK HI;"` | *equal to the threshold level.* |
| `80 OUTPUT 718;"ENDIF;"` | *End of IF/THEN/ELSE/ENDIF.* |
| `90 END` | |

The example below does not include the ELSE portion of the IF/THEN/ELSE/ENDIF command. This example lowers any signal positioned above the spectrum analyzer screen.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;MKPK HI;MA;"` | *Finds peak of trace.* |
| `30 OUTPUT 718;"IF MA,GT,RL THEN;"` | *Compares peak amplitude and reference level.* |
| `40   OUTPUT 718;"MKRL;"` | *Performs line 40 if the marker amplitude is greater than the reference level.* |
| `50 OUTPUT 718;"ENDIF;"` | *Ends IF/THEN/ENDIF structure.* |
| `60 END` | |

## Description

The IF portion compares operands 1 and 2 with the operators shown in the following table.

| Operator | Description |
|---|---|
| GT | Greater than. |
| LT | Less than. |
| EQ | Equal to. |
| NE | Not equal to. |
| GE | Greater than or equal to. |
| LE | Less than or equal to. |

If the condition is true, the command list following the IF statement is executed and commands between ELSE and ENDIF are skipped. If the condition is false, the commands after the ELSE statement are executed. If there is no ELSE statement, program execution resumes after the ENDIF statement.

The "equal to" (EQ) operator is not recommended if value 1 or value 2 represents a real number. When checking for equality with real numbers, the difference between the numbers is useful. For example:

| | |
|---|---|
| `OUTPUT 718;"SUB T_EST,V_ARA,V_ARB;"` | *Places the difference of V_ARA and V_ARB into T_EST. V_ARA, V_ARB, and T_EST are user-defined variables.* |
| `OUTPUT 718;"ABS T_EST,T_EST;"` | *Finds the absolute value of T_EST.* |

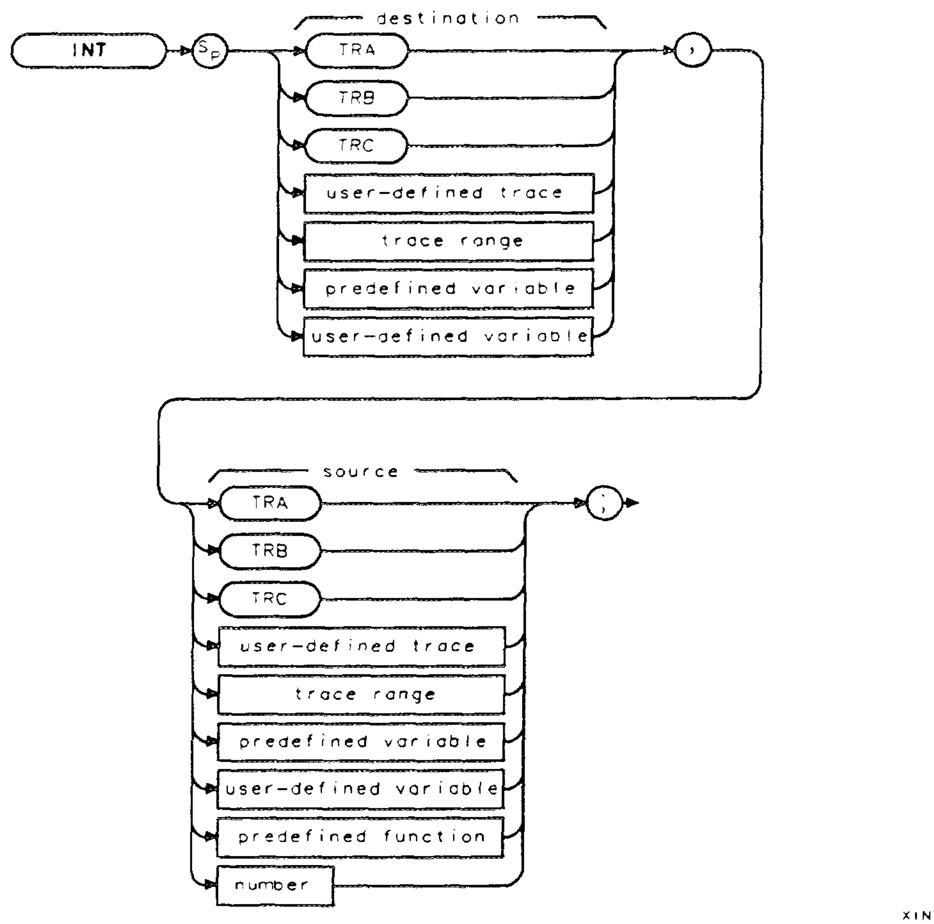
```
OUTPUT 718;"IF T_EST,LT,.01 THEN;"    Does a comparison.
OUTPUT 718;"CF UP;"
OUTPUT 718;"ENDIF;"
```

When used within a downloadable program (DLP), the maximum number of IF THEN ELSE ENDIF statements that can be nested is 20.

# INT
# Integer

Places the greatest integer that is less than or equal to the source value into the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: REPEAT/UNTIL.

## Example

OUTPUT 718;"INT RL,3.75;" *Resets the reference level using the integer value of 3.*

## Description

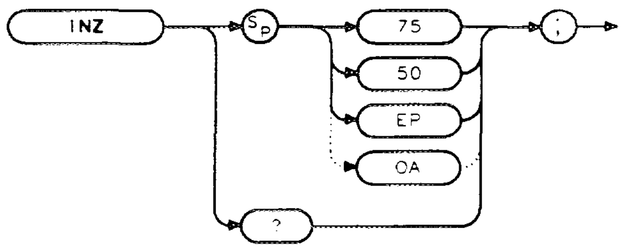
When the number of items in the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

When the spectrum analyzer is sweeping across more than one band, taking the integer value of the sweep time (ST) may yield a real number.

# INZ
# Input Impedance

Specifies the value of input impedance expected at the active input port.

## Syntax




XINZ

Equivalent Softkey: **INPUT Z 50Ω 75Ω**.

Preset Value: Returns impedance to the power-on value.

Related Commands: AUNITS.

## Example

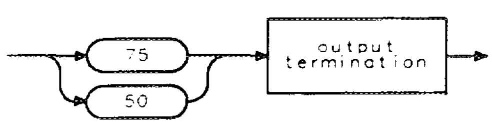
| | |
|---|---|
| `OUTPUT 718;"INZ 75;"` | *Changes input impedance to 75 ohms.* |
| `OUTPUT 718;"AUNITS V;"` | *Changes amplitude units to volts.* |

## Description

The actual impedance can be affected only by internal hardware. With the exception of Option 001 or 011 (HP 8590D or HP 8591E only), the spectrum analyzer hardware supports 50Ω only. The INZ command is used for computation purposes during power or voltage conversions.

The INZ command affects only the amplitude results that are reported in absolute relative power (dBm units or watts). (See "AUNITS.")

## Query Response




QINZ

# IP
# Instrument Preset

Performs an instrument preset.

## Syntax


XIP

Equivalent Softkey: PRESET is similar.

## Example

```
OUTPUT 718;"IP;"
```

## Description

The instrument preset command, IP, executes the following commands:

AMB: Turns off A − B mode.
AMBPL: Turns off A − B plus display line mode.
AMPCOR: Turns off amplitude correction factors.
ANLGPLUS: Turns off the Analog+ display mode.
ANNOT: Turns on annotation.
AT: Sets attenuation to 10 dB.
AUNITS: Loads the amplitude units from a configuration location in spectrum analyzer memory.
AUTO: Couples RB, AT, SS, ST, and VB. Turns off display line and threshold.
BLANK B, BLANK C: Blanks trace B and trace C.
CLRDSP: Erases user graphics.
CLRW A: Clears and writes trace A.
CONTS: Selects continuous sweep mode.
COUPLE: Selects ac coupling. (HP 8594E, HP 8595E, HP 8596E only.)
DA: Sets the display address to zero.
DET: Selects positive peak detection.
DL: Turns off the display line.
DOTDENS: Sets the dot density value to 15.
FMGAIN: Sets FM gain to 100 kHz. (Option 102 or 103 only.)
FOFFSET: Sets the frequency offset to 0 Hz.
GATE: Sets the gating to off. (Option 105 only.)
GATECTL: Sets the gate control to edge triggering. (Option 105 only.)
GD: Sets the gate delay to 1 μs. (Option 105 only.)
GDRVGDEL: Sets the gate delay to 1 μs. (Option 105 only.)
GDRVGLEN: Sets the gate length to 1 μs. (Option 105 only.)
GDRVRBW: Uncouples the resolution bandwidth and the pulse width. (Option 105 only.)
GDRVST: Uncouples the sweep time and the pulse repetition interval. (Option 105 only.)
GDRVVBW: Uncouples the video bandwidth and the gate length. (Option 105 only.)
GL: Sets the gate length to 1 ms. (Option 105 only.)
GP: Sets the gate trigger polarity to trigger on the positive edge. (Option 105 only.)
GRAT: Turns on the graticule.
HD: Hold (deactivates active function).

HNLOCK OFF: Unlocks harmonic band, allowing multiband sweeping. (HP 8592D, HP 8593E, HP 8595E, or HP 8596E only.)
GRAT: Turns on the graticule.
INZ: Loaded from a configurable location in spectrum analyzer memory.
LG: Selects 10 dB per division log scale.
LIMIDISP: Sets LIMIDISP to AUTO.
LIMIHI or LIMILO: Clears any limit-line trace specified by LIMIHI or LIMILO.
LIMITEST: Turns off limit-line testing.
MDS: Selects data size of one word, which is two 8-bit bytes.
MEASURE: Sets measurement to signal analysis.
MKDLMODE: Displays the marker amplitude values as relative to the reference level.
MKFCR: Marker counter resolution is set to AUTO, but a calculated value other than 0 may be returned if the marker counter resolution is queried. (HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or Option 013 with HP 8590D only.)
MKNOISE: Turns off noise markers.
MKOFF: Turns off all markers.
MKPAUSE: Turns off marker pause mode.
MKPX: Minimum excursion for peak identification is set to 6 dB.
MKREAD: Sets marker readouts to frequency.
MKTBL: Turns off the marker table.
MKTRACK: Turns off marker tracking.
MKTYPE: Sets the marker type as position type.
ML: Sets mixer level to −10 dBm.
MODE: Sets the operating mode to 0.
MSI: Selects the spectrum analyzer memory as the mass storage device.
NDB: Sets the number of dB for the NDBPNT measurement to −3 dB.
PD: Puts pen down at current position.
PKDLMODE: Displays all the signal peaks in the peak table.
PKSORT: Sorts the signal peaks in the peak table by decreasing amplitude.
PKTBL: Turns off the peak table.
PKZOOM: Sets the final span for the peak zoom routine to 1 MHz.
QPOFFSET: Sets the QPOFFSET to 20. (Option 103 only.)
RB: Sets the resolution bandwidth to 3 MHz.
RL: Sets reference level to 0 dBm.
RLPOS: Sets the reference level position to 8.
ROFFSET: Sets reference offset to 0.
RQS 40: Allows SRQ 110, SRQ 140 for illegal commands or broken hardware.
SPEAKER: Turns on the speaker. (Option 102, 103, or 301 only.)
SQLCH: Sets the squelch level to 0. (Option 102 or 103 only.)
SRCALC: Sets the source leveling control to internal. (Option 010 or 011 only.)
SRCNORM: Sets the source normalization to off. (Option 010 or 011 only.)
SRCPSWP: Sets the source power sweep to off. (Option 010 or 011 only.)
SRCPWR: Sets the source power level to −10 dBm. (Option 010 or 011 only.)
SS: Sets the center frequency step size to 100 MHz.
STATUS BYTE: Clear the status byte.
TH: One division above bottom graticule line, threshold line off.
TITLE: Clears the title from the spectrum analyzer screen.
TM: Selects free run trigger mode.
TDF: Selects parameter units output format.
TRB: Sets the trace values to 0.
TRC: Sets the trace values to 8000.
TVLINE: Sets TV line number to 17. (Options 101 and 102, or 301 only.)
TVSYNC: Triggers on negative polarity of the video modulation. (Options 101 and 102, or 301 only.)
VAVG: Turns off video averaging and sets the video averaging limit to 100.

VB: Sets the video bandwidth to 1 MHz.
VBR: Sets VBR to 0.300.

IP also clears all user graphics, all on-event algorithms, and turns off the windows display mode. (The on-event algorithms are ONCYCLE, ONDELAY, ONEOS, ONMKR, ONSRQ, ONSWP, and ONTIME.)

Instrument preset automatically occurs when you turn on the spectrum analyzer. IP is a good starting point for many measurement processes. When IP is executed remotely, the spectrum analyzer does not necessarily execute a complete sweep, however. You should execute a take sweep (TS) to ensure that the trace data is valid after an IP.

# KEYCLR
# Key Clear

Clears softkeys 1 through 6 of menu 1.

## Syntax


XKEYCLR

Related Commands: DISPOSE, KEYDEF, KEYEXC, KEYLBL, SAVEMENU.

## Example 1

```
OUTPUT 718;"MENU 1;"      Displays menu 1.
OUTPUT 718;"KEYCLR;"      Erases softkeys 1 through 6 of menu 1.
```

## Example 2

```
OUTPUT 718;"MENU 1;"          Displays menu 1.
OUTPUT 718;"SAVEMENU 101;"    Copies the softkey functions from menu 1 into menu 101.
OUTPUT 718;"KEYCLR;"          Erases the softkey functions of menu 1.
PAUSE
OUTPUT 718;"MENU 101;"        Displays menu 101.
```

## Description

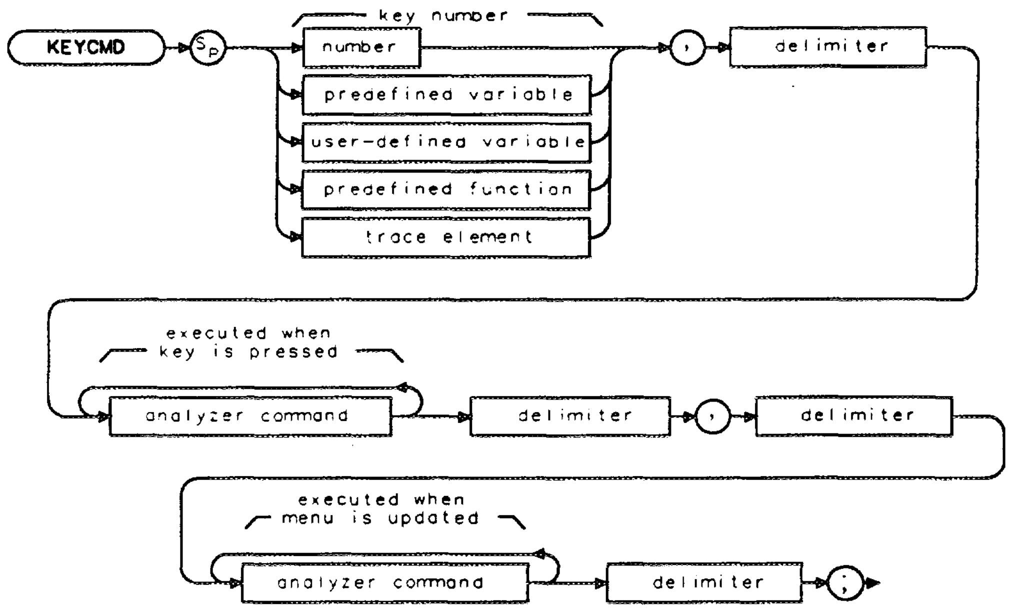
The KEYCLR command clears softkeys 1 through 6. Use the DISPOSE command to clear a single softkey.

Softkeys 1 through 6 can be displayed by executing "MENU 1;" or by pressing (MEAS/USER), **User Menus**.

# KEYCMD
# Key Command

Allows you define the function and label of a softkey. The softkey label is updated whenever a softkey is pressed.

## Syntax




XKEYCMD

| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 1 to 6, 601 to 1200 |
| Predefined variable | A command that act as a variable. Refer to Table 5-1. | |
| Analyzer command | Any valid spectrum analyzer command. | |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Related Commands: DISPOSE, ERASE, FUNCDEF, KEYENH, KEYEXC, KEYLBL.

## Example 1

This example defines softkey 1. Softkey 1 has the label "QSAD" until it is pressed. When softkey 1 is pressed, the following changes occur: center frequency changes to 105.3 MHz, span changes to 300 kHz, and the label for softkey 1 changes from "QSAD" to "KSAD." If softkey 1 is pressed again, the center frequency changes to 100.1 MHz and the label changes back to "QSAD."

```
10 OUTPUT 718;"IP;"                         Initializes spectrum analyzer.
20 !
30 OUTPUT 718;"VARDEF C_OUNTRY,1;"          Defines variable called C_OUNTRY.
40 !
50 OUTPUT 718;"KEYCMD 1,";                  Defines softkey 1.
60 OUTPUT 718;"%";
70 OUTPUT 718;"IF C_OUNTRY,EQ,
   1;THEN;";
80   OUTPUT 718;"CF 105.3MHZ;SP 300KHZ;";
90   OUTPUT 718;"MOV C_OUNTRY,0;";
100 OUTPUT 718;"ELSE;";
110   OUTPUT 718;"CF 100.1MHZ;SP 300KHZ;";
120   OUTPUT 718;"MOV C_OUNTRY,1;";
130 OUTPUT 718;"ENDIF;";
140 OUTPUT 718;"%,";
150 OUTPUT 718;"@";
160 OUTPUT 718;"IF C_OUNTRY,EQ,0 THEN;";
170   OUTPUT 718;"KEYLBL 1,%KSAD%;";
180 OUTPUT 718;"ELSE;";
190   OUTPUT 718;"KEYLBL 1,%QSAD%;";
200 OUTPUT 718;"ENDIF;";
210 OUTPUT 718;"@;";
220 END
```

## Example 2

Softkey 2 has a softkey label, "COUNTRY YES NO." If the value of the variable C_OUNTRY is 1, then YES is underlined and label of softkey 1 is "QSAD." Pressing softkey 2 moves the underline to NO and changes the label of softkey 1 to "KSAD."

```
10    OUTPUT 718;"IP;"
20    !
30    Ul$=CHR$(16)
40    Off$=CHR$(15)
50    !
60    OUTPUT 718;"VARDEF C_OUNTRY,1;"
70    !
80    OUTPUT 718;"KEYCMD 1,";
90    OUTPUT 718;"%";
100   OUTPUT 718;"IF C_OUNTRY,EQ,Q THEN;";
110     OUTPUT 718;"MOV CF 105.3MHZ;MOV SP,300KHZ;";
120     OUTPUT 718;"MOV C_OUNTRY,0;";
130   OUTPUT 718;"ELSE;";
140     OUTPUT 718;"MOV CF 100.1MHA;MOV SP,300KHZ;";
150     OUTPUT 718;"MOV C_OUNTRY,1;";
160   OUTPUT 718;"ENDIF;";
```

```
170    OUTPUT 718;"%,";
180    OUTPUT 718;"@";
190    OUTPUT 718;"IF C_OUNTRY,EQ,0 THEN;";
200      OUTPUT 718;"KEYLBL 1,%KSAD%;";
210    OUTPUT 718;"ELSE;";
220      OUTPUT 718;"KEYLBL 1,%QSAD%;";
230    OUTPUT 718;"ENDIF;";
240    OUTPUT 718;"@;";
250    !
260    OUTPUT 718;"KEYCMD 2,";
270    OUTPUT 718;"%";
280    OUTPUT 718;"IF C_OUNTRY,EQ,1 THEN;";
290      OUTPUT 718;"MOV CF,105.3MHZ;MOV SP,300KHZ;";
300      OUTPUT 718;"MOV C_OUNTRY,0;";
310    OUTPUT 718;"ELSE;";
320      OUTPUT 718;"MOV CF,100.1MHZ;MOV SP,300KHZ;";
330      OUTPUT 718;"MOV C_OUNTRY,1;";
340    OUTPUT 718;"ENDIF;";
350    OUTPUT 718;"%,";
360    OUTPUT 718;"@";
370    OUTPUT 718;"KEYENH 2,";
380    OUTPUT 718;"/";
390    OUTPUT 718;"COUNTRY|";Ul$;"YES";Off$;" NO";
400    OUTPUT 718;"/";
410    OUTPUT 718;",0,";
420    OUTPUT 718;"!";
430    OUTPUT 718;"IF C_OUNTRY,EQ,0";
440    OUTPUT 718;"!;";
450    OUTPUT 718;"@;";
460    !
470    END
```

## Description

The KEYCMD command updates the softkey label whenever the softkey is pressed (as shown in example 2).

The functions of KEYCMD and KEYDEF are similar. The advantage of KEYCMD is that the label of the softkey can change dependent on a conditional statement without the softkey itself being pressed. KEYCMD is useful for indicating the state of a function in the spectrum analyzer by changing the appearance of the softkey.

**Softkey numbers:** When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results.

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

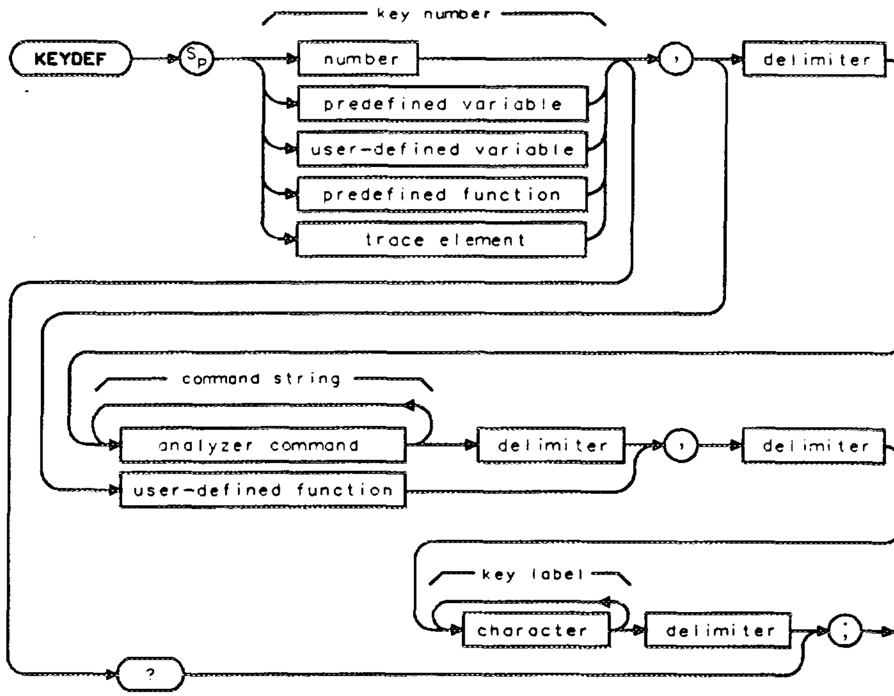
**KEYCMD Key Command**

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

# KEYDEF
# User-Defined Key Definition

Assigns a label and user-defined function to a softkey.

## Syntax




xkeydef

## KEYDEF User-Defined Key Definition

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>User-defined variable</td><td>A variable defined by VARDEF or ACTDEF commands.</td><td>Any valid variable name.</td></tr>
<tr><td>Predefined function</td><td>Function that returns a value. Refer to Table 5-1.</td><td>Any valid predefined function that returns a value within the softkey number range.</td></tr>
<tr><td>Trace element</td><td>An element of trace A, trace B, trace C, or a user-defined trace.</td><td></td></tr>
<tr><td>Number</td><td>Any valid integer.</td><td>1 to 6, 601 to 1200.</td></tr>
<tr><td>Predefined variable</td><td>A command that acts as a variable. Refer to Table 5-1.</td><td>Any valid predefined variable that returns a value within softkey number range.</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Analyzer command</td><td>Any valid spectrum analyzer command.</td><td></td></tr>
<tr><td>User-defined function</td><td>A subroutine defined by the FUNCDEF command.</td><td>Any valid function name.</td></tr>
<tr><td>Character</td><td>Any valid character. See "LB" for additional characters and label functions.</td><td>1 to 8 characters per label line, use the (|) symbol or blank spaces to separate softkey label lines.</td></tr>
</table>

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: DISPOSE, ERASE, FUNCDEF, KEYEXC, KEYLBL.

## Example 1

Connect CAL OUT to the spectrum analyzer input.

<table>
<tr><td><code>OUTPUT 718;"IP;"</code></td><td>Initializes spectrum analyzer.</td></tr>
<tr><td><code>OUTPUT 718;"FUNCDEF D_LP,@";</code></td><td>Defines a function called D_LP.</td></tr>
<tr><td><code>OUTPUT 718;"CF 300MHZ;";</code></td><td>Changes center frequency to measure the calibration signal.</td></tr>
<tr><td><code>OUTPUT 718;"SP 1MHZ;";</code></td><td>Measures the calibration signal in narrow span.</td></tr>
<tr><td><code>OUTPUT 718;"@;"</code></td><td>The "@" signifies the end of the function declaration.</td></tr>
<tr><td><code>OUTPUT 718;"KEYDEF 1,D_LP,%SHOW|CAL%;"</code></td><td>Softkey 1 will now have the "SHOW CAL" label and perform the function D_LP.</td></tr>
<tr><td><code>OUTPUT 718;"KEYEXC 1;"</code></td><td>Executes softkey 1.</td></tr>
</table>

## Example 2

To redefine the command string without changing the label, enter a single blank space for the command string parameter. If you want to delete the command string and the softkey label, enter two or more blank spaces for the softkey label parameter.

<table>
<tr><td><code>OUTPUT 718;"KEYDEF 2,%IP;CF 300MHZ;%,%MY KEY|LABEL%;"</code></td><td>Defines softkey 2.</td></tr>
<tr><td><code>OUTPUT 718;"KEYDEF 2, ,%MY KEY|LABEL%;"</code></td><td>Removes the command string functions, but the softkey label remains on screen.</td></tr>
</table>

`OUTPUT 718;"KEYDEF 2, ,  ;"` *Removes the command string functions and the softkey label.*

## Description

Limit the number of characters (between the delimiters) in the list of spectrum analyzer commands to a maximum of 2047 characters.

**Softkey numbers:** When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results.

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

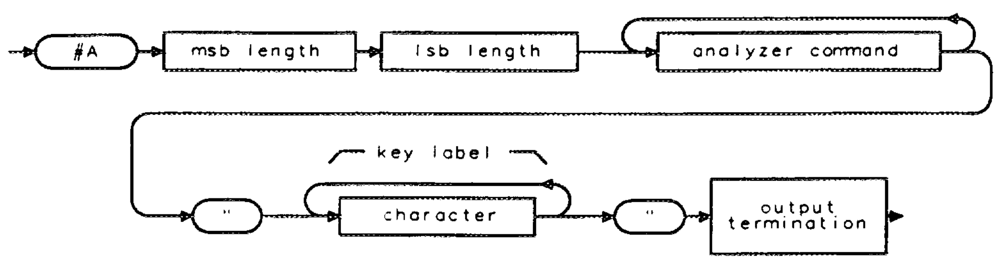
For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus**. Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

The softkey label and the command string can be deleted by entering blank spaces in the softkey label or command string. See example 2.

## Query Response

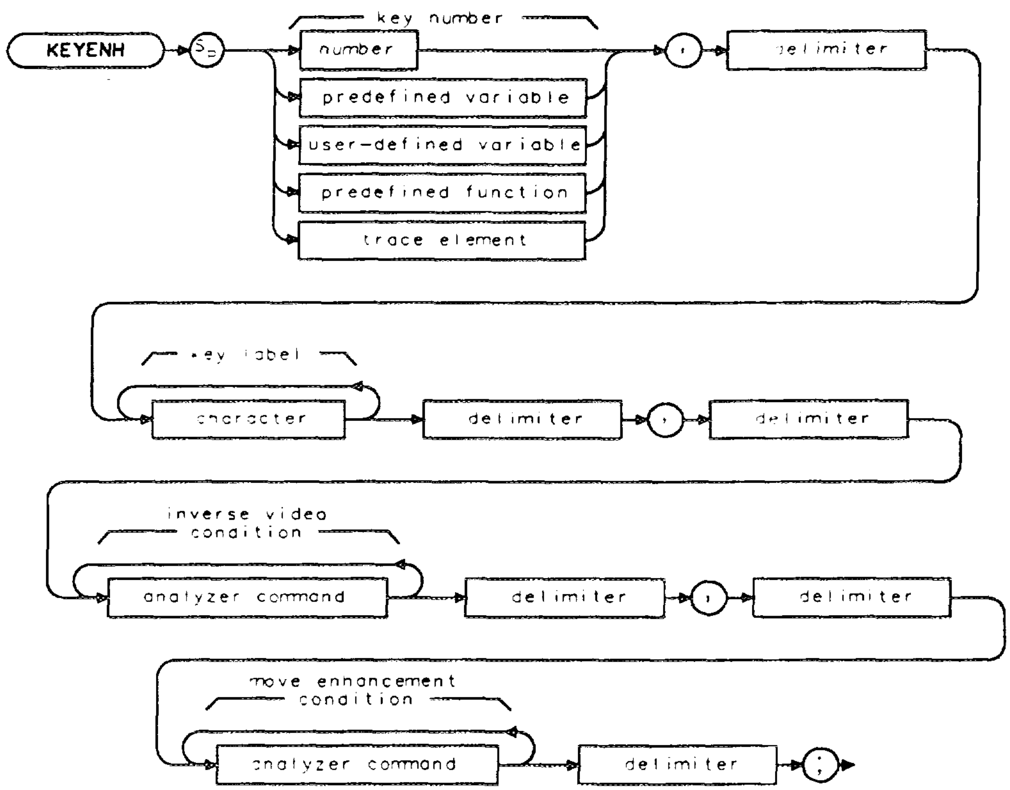



OKEYDEF

# KEYENH
# Key Enhance

Allows you to activate inverse video mode or underline part or all of the softkey label.

## Syntax




XKEYENH

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>User-defined variable</td><td>A variable defined by VARDEF or ACTDEF commands.</td><td>Any valid variable name.</td></tr>
<tr><td>Predefined function</td><td>Function that returns a value. Refer to Table 5-1.</td><td>Any valid predefined function that returns a value within the softkey number range.</td></tr>
<tr><td>Trace element</td><td>An element of trace A, trace B, trace C, or a user-defined trace.</td><td></td></tr>
<tr><td>Number</td><td>Any valid integer.</td><td>1 to 6, 601 to 1200.</td></tr>
<tr><td>Predefined variable</td><td>A command that act as a variable. Refer to Table 5-1.</td><td>Any valid predefined variable that returns a value within softkey number range.</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
<tr><td>Character</td><td>Any valid character. See "LB" for additional characters and label functions.</td><td>1 to 8 characters per line, use the (|) symbol or blank spaces to separate softkey label lines.</td></tr>
<tr><td>Analyzer command</td><td>Any valid spectrum analyzer command.</td><td></td></tr>
</table>

Related Commands: DISPOSE, ERASE, FUNCDEF, KEYCMD, KEYEXC, KEYLBL.

## Example 1

The following program lines show two different ways of using KEYENH to underline "OFF" in the softkey label.

```
OUTPUT 718;"KEYENH 2,@ON ";CHR$(16);"OFF";
CHR$(15);"@,0,0;"
```

*Underlines the "OFF" section of the label. Notice that the move enhancement condition is false, and CHR$(16) and CHR$(15) control the "OFF" section of the softkey label.*

```
OUTPUT 718;"KEYENH 2,@";CHR$(16);"ON";
CHR$(15);" OFF@,0,1;"
```

*Underlines the "OFF" section of the label. Notice that the move enhancement condition is true, and CHR$(16) and CHR$(15) control the "ON" section of the softkey label.*

The following program lines show two different ways of using KEYENH to underline "ON" in the softkey label.

```
OUTPUT 718;"KEYENH 2,@";CHR$(16);"ON";CHR$(15);
" OFF@,0,0;"
```

*Underlines the "ON" section of the label.*

```
OUTPUT 718;"KEYENH 2,@ON";CHR$(16);" OFF";
CHR$(15);"@,0,1;"
```

*Underlines the "ON" section of the label.*

## Example 2

Use the KEYENH command to turn on inverse video for the upper label line of softkey number 1.

```
U1$=CHR$(16)
```
*Defines UL$ as the character to turn the underline on.*

```
Off$=CHR$(15)
```
*Defines OFF$ as the character to turn off inverse video and underlining.*

```
OUTPUT 718;"VARDEF I_NV,0;"
```
*The value of I_NV acts as a inverse video condition.*

```
OUTPUT 718;"VARDEF M_OVENH,0;"
```
*The value of M_OVENH acts as the move enhancement condition.*

```
OUTPUT 718;"KEYENH 1,%MY KEY|";U1$;"ON";Off$;" OFF%,@IF 0,
EQ,I_NV@,@IF 0,EQ,M_OVENH@;"
```
*The MY KEY label line changes to inverse video, and OFF (in the lower label line) is underlined.*

## Example 3

Changing the condition of the inverse video mode to false turns off the inverse video.

```
U1$=CHR$(16)
```
*Defines UL$ as the character to turn the underline on.*

```
Off$=CHR$(15)
```
*Defines OFF$ as the character to turn off inverse video and underlining.*

```
OUTPUT 718;"MOV I_NV,0;"
OUTPUT 718;"MOV M_OVENH,1;"
```
*Changes the conditional value of M_OVENH.*

```
OUTPUT 718;"KEYENH 1,%MY KEY|";U1$;"ON";Off$;" OFF%,@IF 0,
EQ,I_NV@,@IF 0,EQ,M_OVENH@;"
```
*The ON portion of the lower label is underlined, the MY KEY portion of the label is still in inverse video.*

## Example 4

Omitting Ul$ and Off$ turns on inverse video for the upper and lower softkey label lines.

```
U1$=CHR$(16)
```
*Defines UL$ as the character to turn the underline on.*

```
Off$=CHR$(15)
```
*Defines OFF$ as the character to turn off inverse video and underlining.*

```
OUTPUT 718;"MOV I_NV,0;"
OUTPUT 718;"MOV M_OVENH,1;"
```

```
OUTPUT 718;"KEYENH 1,%MY KEY|ON OFF%,@IF 0, EQ,I_NV@,@IF
0,EQ,M_OVENH@;"
```

*MY KEY and ON OFF are displayed in inverse video.*

## Description

The KEYENH command has two parameters (inverse video condition and move enhancement condition). Setting these parameters to true or false controls how the softkey label is displayed. The softkey label can be displayed with sections of the label in inverse video or underlined.

If the inverse video condition for the softkey label is true, the following occurs:

- The top line of the softkey label is displayed in inverse video (see example 2).
- If there are no enhancements embedded in the softkey label for the second line of the softkey label, the second line of the softkey label is displayed in inverse video. (See example 4). (See the following section, "Using Enhancements," for more information about enhancements.)

If the inverse video condition for the softkey label is false, the inverse video is not used and the softkey label appears as specified by the move enhancement condition.

If the move enhancement condition is true, the following occurs:

- If no enhancements are used in the softkey label, the last line of the softkey label is underlined.
- If enhancements are used in the softkey label, the enhancement (inverse video or underlining) is moved to the other side of the softkey label.

If the move enhancement condition for the softkey label is false, the softkey label appears as specified by the inverse enhancement condition.

## Using Enhancements

An alternate way to control underlining and inverse video is to use "codes" to separate sections of a softkey label.

- If you want to underline different sections of the softkey label, use code CHR$(16) (turns on underlining) and CHR$(15) (turns off the enhancements).
- If you want to use inverse video on different sections of the softkey label, use code CHR$(14) (turns on inverse video) and CHR$(15) (turns off enhancements).

Example 1 demonstrates that there are two ways to underline the "OFF" section of softkey label using enhancements.

The recommended convention for using inverse video and underlining is to use inverse video to indicate an active function and underlined labels to show a choice.

**Softkey numbers:** When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results. The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

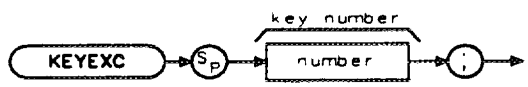
Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

# KEYEXC
# Key Execute

Executes the specified, previously defined softkey.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer | 1 to 6, 601 to 1200. |

Related Commands: DISPOSE, ERASE, FUNCDEF, KEYDEF, KEYLBL.

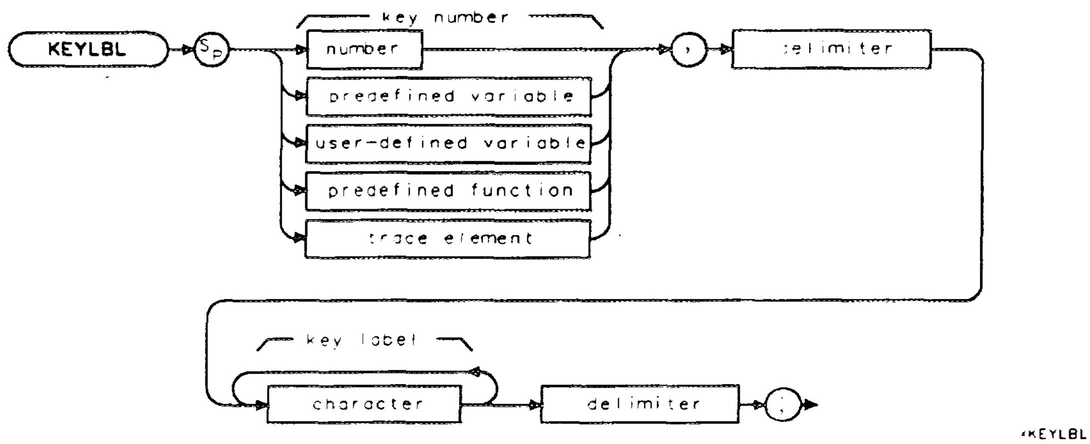
## Example

| | |
|---|---|
| `OUTPUT 718;"FUNCDEF D_LP,@";` | *Defines a function called D_LP.* |
| `OUTPUT 718;"CF 300MHZ;";` | *Changes center frequency to measure the calibration signal.* |
| `OUTPUT 718;"SP 1MHZ;";` | *Measures the calibration signal in narrow span.* |
| `OUTPUT 718;"@;"` | *The "@" signifies the end of the function declaration.* |
| `OUTPUT 718;"KEYDEF 1,D_LP,%SHOW CAL%;"` | *Softkey 1 will now have the "SHOW CAL" label and perform the function D_LP.* |
| `OUTPUT 718;"KEYEXC 1;"` | *Executes softkey 1.* |

# KEYLBL
# Key Label

Relabels a softkey without changing its function.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 1 to 6, 601 to 1200. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. See "LB" for additional characters and label functions. | 1 to 8 characters per label line, use the (\|) symbol or blank spaces to separate softkey label lines. |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: DISPOSE, ERASE, FUNCDEF, KEYDEF, KEYEXC, KEYLBL.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `10 OUTPUT 718;"FUNCDEF D_LP,@";` | *Defines a function called D_LP. The "@" symbol indicates the beginning of the function.* |
| `20 OUTPUT 718;"CF 300MHZ;";` | *Changes center frequency to measure the calibration signal.* |
| `30 OUTPUT 718;"SP 1MHZ;";` | *Measures the calibration signal in narrow span.* |

```
40 OUTPUT 718;"@;"
```
*The "@" signifies the end of the function declaration.*

```
50 OUTPUT 718;"KEYDEF 1,D_LP,%SHOW CAL%;"
```
*Softkey 1 is now called "SHOW CAL" and performs the function D_LP.*

```
60 OUTPUT 718;"KEYEXC 1;"
```
*Executes softkey 1.*

```
70 OUTPUT 718;"KEYLBL 1,%NEW NAME%;"
```
*Softkey 1 is now labeled "NEW NAME", but performs the same function.*

```
80 END
```

## Description

When specifying the softkey number, you should only use a number from 1 through 6, or 601 through 1200. Using other than the recommended softkey numbers can cause undesirable results.

The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

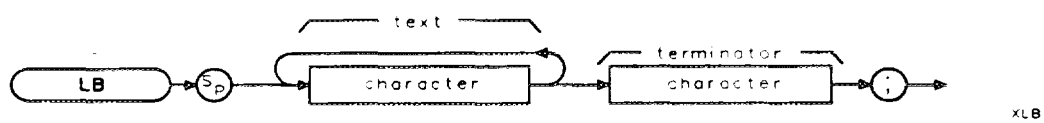
Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. See "MENU" for more information on accessing softkeys and menus.

# LB
# Label

Writes text (label) at the current pen position. The text consists of alphanumeric characters specified in the character field.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character (text) | Any valid character. See "LB" for additional characters available. | |
| Character (delimiter) | Any valid character declared as a delimiter by the DT command. | |

Prerequisite Command: DT.
Related Commands: TEXT, TITLE.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"BLANK TRA;ANNOT OFF;"` | *Clears trace and annotation from the spectrum analyzer screen.* |
| `30 OUTPUT 718;"DT@;"` | *Establishes @ as the termination of the label text.* |
| `40 OUTPUT 718;"PU;PA 75,175;LB LABEL@;"` | *Displays "LABEL" on the spectrum analyzer screen.* |
| `50 OUTPUT 718;"PU;PA 75,150;LB"; CHR$(36);"@;"` | *Displays the dollar sign "$" on the spectrum analyzer screen. The semicolons before and after CHR$(36) prevent the computer from performing a line feed.* |
| `60 OUTPUT 718;"PU;PA 75,125;LB";CHR$(16); "AN UNDERLINED LABEL";CHR$(15);"@;"` | *Underlines the text.* |
| `70 OUTPUT 718;"PU;PA 75,100;LB";CHR$(14); "A LABEL IN INVERSE VIDEO";CHR$(15);"@;"` | *Displays the text in inverse video.* |
| `80 END` | |

## Description

Each text character is specified by 8 bits in an 8 bit data byte, which immediately follows the LB command. Additional characters can be displayed using CHR$(code) where code represents the ASCII code (see line 50 of the example). Refer to the following tables for additional characters and label functions available.

LB displays the text at the current pen position. When using LB, the end of the text characters must be terminated. If the text is not terminated, instructions and other text following the actual label's statement are displayed on the spectrum analyzer screen. The label mode can always be terminated with an ASCII end-of-text code (decimal code 3), or with a character specified previously by the DT command. The terminator character itself must immediately follow the label.

To remove the text written by the LB command, write spaces over the text or use the CLRDSP command.

The LB command also enters the text into the display list. See "DA" for more information about the display list.

**Table 5-6. Character Set**

| Code | Char | Code | Char | Code | Char | Code | Char | Code | Char |
|---|---|---|---|---|---|---|---|---|---|
| 32 | (space) | 73 | I | 114 | r | 190 | ≥ | 237 | μ |
| 33 | ! | 74 | J | 115 | s | 191 | ˉ | 238 | ν |
| 34 | " | 75 | K | 116 | t | 192 | ∠ | 239 | o |
| 35 | # | 76 | L | 117 | u | 193 | A | 240 | π |
| 36 | $ | 77 | M | 118 | v | 194 | ∫ | 241 | θ |
| 37 | % | 78 | N | 119 | w | 195 | ¢ | 242 | ϱ |
| 38 | & | 79 | O | 120 | x | 196 | ∇ | 243 | σ |
| 39 | ' | 80 | P | 121 | y | 199 | g | 244 | τ |
| 40 | ( | 81 | Q | 122 | z | 200 | h | 245 | υ |
| 41 | ) | 82 | R | 123 | { | 201 | ↑ | 246 | |
| 42 | * | 83 | S | 125 | } | 204 | L | 247 | ω |
| 43 | + | 84 | T | 126 | ~ | 205 | n | 248 | Γ |
| 44 | , | 85 | U | 160 | ∧ | 206 | n | 249 | δ |
| 45 | – | 86 | V | 162 | ¨ | 207 | o | 250 | Ω |
| 46 | . | 87 | W | 163 | ≠ | 208 | p | 251 | σ |
| 47 | / | 88 | X | 164 | £ | 209 | ∞ | 252 | Λ |
| 48 | 0 | 89 | Y | 165 | ∝ | 210 | r | 253 | Υ |
| 49 | 1 | 90 | Z | 166 | ⊕ | 211 | s | 254 | Ξ |
| 50 | 2 | 91 | [ | 167 | · | 212 | T | | |
| 51 | 3 | 92 | \ | 168 | ← | 213 | Δ | | |
| 52 | 4 | 93 | ] | 169 | → | 214 | V | | |
| 53 | 5 | 94 | ^ | 170 | § | 216 | + + = + + | | |
| 54 | 6 | 95 | _ | 171 | ± | 217 | " | | |
| 55 | 7 | 96 | ` | 172 | ↓ | 218 | | | |
| 56 | 8 | 97 | a | 173 | - | 219 | π | | |
| 57 | 9 | 98 | b | 174 | × | 220 | θ | | |
| 58 | : | 99 | c | 175 | ÷ | 221 | ψ | | |
| 59 | ; | 100 | d | 176 | 0 | 222 | ϕ | | |
| 60 | < | 101 | e | 177 | 1 | 224 | φ | | |
| 61 | = | 102 | f | 178 | 2 | 225 | α | | |
| 62 | > | 103 | g | 179 | 3 | 226 | β | | |
| 63 | ? | 104 | h | 180 | -1 | 227 | χ | | |
| 64 | @ | 105 | i | 181 | 2 | 228 | Δ | | |
| 65 | A | 106 | j | 182 | 3 | 229 | ε | | |
| 66 | B | 107 | k | 183 | √ | 230 | ϕ | | |
| 67 | C | 108 | l | 184 | ~ | 231 | γ | | |
| 68 | D | 109 | m | 185 | ≃ | 232 | η | | |
| 69 | E | 110 | n | 186 | ‖ | 233 | L | | |
| 70 | F | 111 | o | 187 | ∴ | 234 | ζ | | |
| 71 | G | 112 | p | 188 | ≤ | 235 | κ | | |
| 72 | H | 113 | q | 189 | ≡ | 236 | λ | | |

**Table 5-7. Label Functions**

| Code | Function | Description |
|---|---|---|
| 8 | back space | Positions the pen back one character width. |
| 10 | line feed | Positions the pen position down one character height. |
| 11 | vertical tab | Positions the pen up one character height. |
| 12 | form feed | Position the pen to the upper-left corner of the display. |
| 13 | carriage return | Positions the pen at the far left side of the display. |
| 14 | inverse video on | Turns on inverse video. |
| 15 | enhancements off | Turns off underlining or inverse video. |
| 16 | underlining on | Turns on underlining. |

# LF
# Base Band Instrument Preset

Performs an instrument preset into base band (band 0).

## Syntax


XLF

Model Required: HP 8592D, HP 8593E, HP 8595E, HP 8596E.
Related Commands: IP.

## Example

```
OUTPUT 718;"LF;"
```

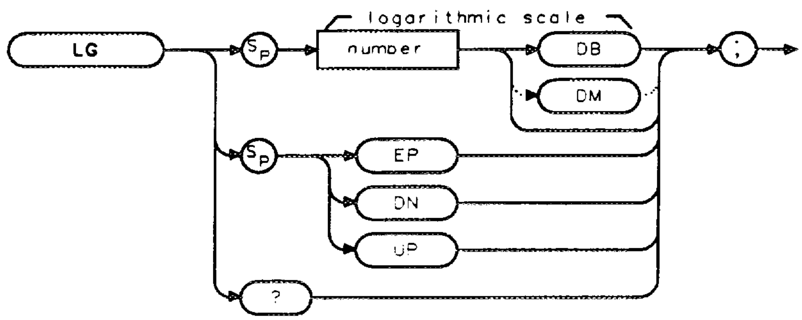
## Description

Use LF instead of instrument preset (IP) if harmonic band 0 is desired. Using LF instead of IP reduces the wear on an internal spectrum analyzer switch (the RF switch).

# LG
# Logarithmic Scale

Specifies the vertical graticule divisions as logarithmic units, without changing the reference level.

## Syntax




XLG

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default units are dB. | 0.1 to 20 dB. |

Equivalent Softkey: **SCALE LOG LIN** (when LOG is underlined).
Preset State: 10 dB.
Related Commands: LN.

## Example

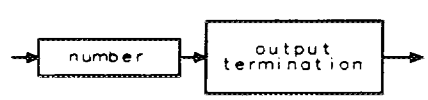
```
OUTPUT 718;"LG 1DB;"
```

## Description

The vertical scale can be specified (in tenths) from 0.1 to 0.9 dB, or in integers from 1 to 20 dB per graticule division.

If LG is used as the destination in a MOV command, it changes the log scale, but does not change the scale from linear to logarithmic.

## Query Response




QQ1

# LIMIDEL
## Delete Limit-Line Table

Deletes all upper and lower segments in the current limit-line table.

### Syntax


XLIMIDEL

Equivalent Softkey: **PURGE LIMITS** .

Related Commands: LIMIFT, LIMIHI, LIMILO, LIMIREL, LIMISEG, LIMISEGT, SEGDEL, SENTER, SENTERT.

### Example

```
OUTPUT 718;"LIMIDEL;"
```

### Description

Use LIMIDEL before entering a new limit line.

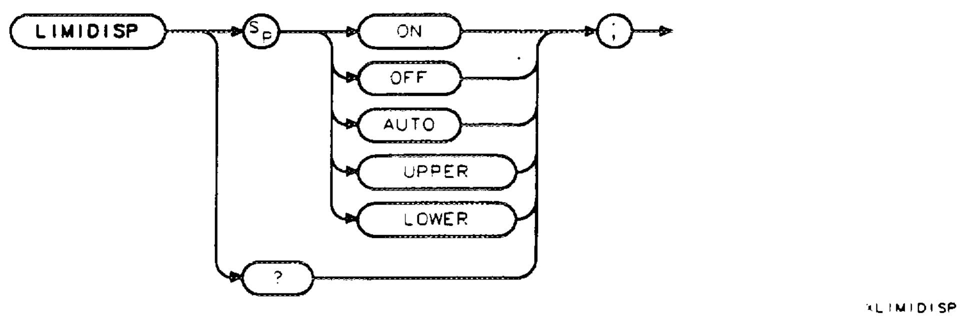
**Note** Use STOR, SAVET, or SAVRCLW if you want to save the current limit-line table. LIMIDEL does not affect stored limit-line data.

LIMIDEL sets LIMIREL OFF (specifies that the limit line is fixed) and LIMIFT FREQ (specifies that the limit line is based on frequency). See "LIMILINE" for more information about limit line construction.

# LIMIDISP
# Limit Line Display

Controls when the limit line (or limit lines) are displayed.

## Syntax




Equivalent Softkey: **LMT DISP Y N AUTO** .
Preset Value: AUTO.
Related Commands: ANLGPLUS, LIMILINE, LIMITEST.

## Example

| | |
|---|---|
| `OUTPUT 718;"LIMIDISP ON;"` | *Displays any portion of the limit lines that are currently within the spectrum analyzer screen boundaries.* |

## Description

If a limit line is currently in spectrum analyzer memory, you can use LIMIDISP to control the display of the limit lines. The parameters of LIMIDISP do the following:

| | |
|---|---|
| ON | Turns on the limit line display. |
| OFF | Turns off the limit line display. |
| AUTO | Allows LIMITEST to control the display of the limit lines. If LIMITEST is on, the limit lines will be displayed. If LIMITEST is off, the limit lines will not be displayed. |
| UPPER | Displays the upper limit line only. |
| LOWER | Displays the lower limit line only. |

**Note**

Turning on Analog+ display mode changes the way that LIMIDISP functions as follows:

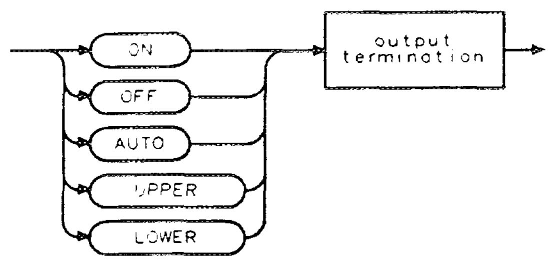
- LIMIDISP ON, LIMIDISP LOWER, and LIMIDISP UPPER do not work when the Analog+ display mode is turned on.
- LIMIDISP AUTO will still perform the limit line test if LIMITEST is on, but the limit lines will not be displayed.

**LIMIDISP Limit Line Display**

When used as a predefined variable, LIMIDISP returns a number from 0 to four, depending on the setting of the LIMIDISP parameter. The number corresponds to the LIMIDISP parameter as shown in the following table.

| LIMIDISP Parameter | Value Returned |
|---|---|
| OFF | 0 |
| UPPER | 1 |
| LOWER | 2 |
| ON | 3 |
| AUTO | 4 |

## Query Response

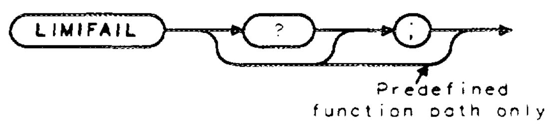



OLIMIDISP

# LIMIFAIL
# Limits Failed

Returns a "0" if the last measurement sweep of trace A is equal to or within the limit-line bounds.

## Syntax




XLIMIFAIL

Related Commands: LIMIHI, LIMILINE, LIMILO, LIMISEG, LIMISEGT, LIMITEST, SENTER, SENTERT.

## Example

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"IP;SNGLS;CF300MHZ;SP100MHZ;"` | *Initializes spectrum analyzer and changes the frequency and span settings.* |
| 20 | `OUTPUT 718;"LIMIDEL;"` | *Deletes any limit-line tables, sets the table type to fixed.* |
| 30 | `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| 40 | `OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Creates an entry for the upper limit-line table. Because the LIMISEG command is used, the limit-line will be based on the frequency.* |
| 50 | `OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| 60 | `OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| 70 | `OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| 80 | `OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| 90 | `OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| 100 | `OUTPUT 718;"LIMITEST ON;TS;"` | *Turns on limit-line testing.* |
| 110 | `OUTPUT 718;"LIMIFAIL?;"` | *Returns the status of the limit-line testing.* |
| 120 | `ENTER 718;A` | |
| 130 | `DISP A` | *Displays the result.* |
| 140 | `END` | |

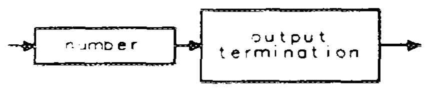
**LIMIFAIL Limits Failed**

## Description

LIMIFAIL returns one of the following values:

**0** indicates that the measurement sweep was within the limit-line bounds.
**1** indicates that the measurement sweep failed the lower limit.
**2** indicates that the measurement sweep failed the upper limit.
**3** indicates that the measurement sweep failed both the lower and upper limits.
**4** indicates that no test was performed. A "4" is returned if LIMITEST is set to OFF.

## Query Response

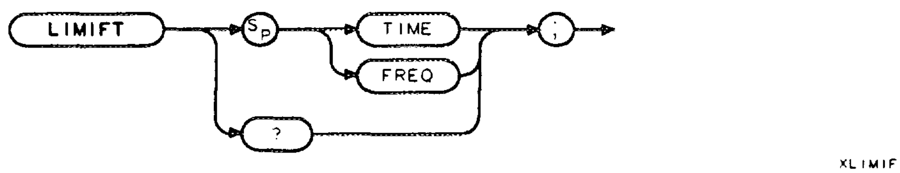



001

# LIMIFT
# Select Frequency or Time Limit Line

Selects how the limit-line segments are defined: according to frequency, or according to the sweep time setting of the spectrum analyzer.

## Syntax




Equivalent Softkey: LIMIFT is equivalent to **LIMITS FRQ TIME**.

Related Commands: LIMIDEL, LIMILINE, LIMIMODE, LIMIREL, LIMISEG, LIMISEGT, SEGDEL, SENTER, SENTERT.

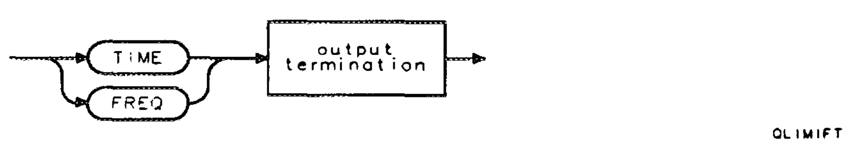
## Example

`OUTPUT 718;"LIMIFT TIME;"` *If the current limit-line table is a frequency limit-line table, it is purged. LIMIFT TIME places the limit-line segments on the spectrum analyzer display with respect to the sweep time of the spectrum analyzer.*

## Description

If you execute "LIMIFT TIME;", LIMISEGT, or SENTERT, the limit-line segments are placed on the spectrum analyzer display with respect to the sweep time setting of the spectrum analyzer. If you execute "LIMIFT FREQ;", LIMISEG, or SENTER, the limit-line segments are placed according to the frequency that is specified for each segment. If a limit line has already been defined, changing the LIMIFT setting clears the existing limit line.

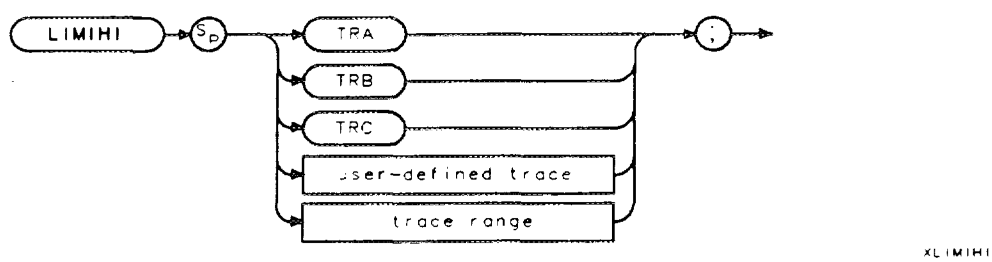
## Query Response



# LIMIHI
## Upper Limit

Allows you to specify a fixed trace as the upper limit line.

### Syntax




Related Commands: IP, LIMIDEL, LIMIFAIL, LIMILO, LIMISEG, LIMITEST, SENTER.

### Example

| | |
|---|---|
| `10 OUTPUT 718;"TRDEF M_ASK,401;"` | *Defines a trace called "M_ASK."* |
| `20 OUTPUT 718;"MOV M_ASK[1,100],1000;"` | *Moves values into sections of the M_ASK trace.* |
| `30 OUTPUT 718;"MOV M_ASK[101,200],2000;"` | |
| `40 OUTPUT 718;"MOV M_ASK[201,300],3000;"` | |
| `50 OUTPUT 718;"MOV M_ASK[301,401],4000;"` | |
| `60 OUTPUT 718;"LIMIHI M_ASK;"` | *Specifies M_ASK as the upper limit line.* |
| `70 OUTPUT 718;"LIMITEST ON;"` | *Turns on limit-line testing.* |
| `80 OUTPUT 718;"LIMIFAIL?;"` | *Tests if trace A fails limit-line testing.* |
| `90 ENTER 718;A` | |
| `100 DISP A` | *Displays result of limit-line testing.* |
| `110 END` | |

### Description

Unlike specifying a limit line with LIMISEG, LIMISEGT, SENTER, or SENTERT, the limit line specified with LIMIHI is *not* updated if the center frequency, frequency span, sweep time, or reference level are changed.

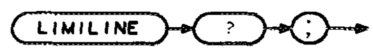
**Note** Executing IP, LIMIDEL, LIMISEG, LIMISEGT, SENTER, or SENTERT will delete the limit line specified with LIMILO or LIMIHI. Executing LIMILO or LIMIHI will delete the limit line specified with LIMISEG, LIMISEGT, SENTER, or SENTERT.

Use LIMITEST ON to display the limit line trace specified by LIMIHI. Use LIMITEST OFF to blank the limit line trace specified by LIMIHI.

# LIMILINE
## Limit Lines

Outputs the current limit-line table definitions.

### Syntax




XLIMILINE

Related Commands: LIMIFT, LIMIREL, LIMIMODE, LIMIREL, LIMISEG, LIMISEGT, LIMITEST, SAVRCLW, SENTER, SENTERT.

### Example

| | | |
|---|---|---|
| 10 | `DIM States$[2000]` | *Dimensions an array to store the limit-line information.* |
| 20 | `OUTPUT 718;"IP;CF300MHZ;SP100MHZ;"` | *Initializes spectrum analyzer.* |
| 30 | `OUTPUT 718;"LIMIDEL;"` | *Deletes any limit-line tables, sets the table type to fixed.* |
| 40 | `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| 45 | `OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| 50 | `OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Enters a value for the upper limit-line table. Because the LIMISEG command is used, the limit-line segment is for a limit-line based on frequency.* |
| 60 | `OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| 70 | `OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| 80 | `OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| 90 | `OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| 100 | `OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| 110 | `OUTPUT 718;"LIMILINE?;"` | *Gets the current limit-line table definitions.* |
| 120 | `ENTER 718 USING "#,-K";States$` | *Enters information into array.* |
| 130 | `PRINT States$` | *Prints the current limit-line table definitions.* |
| 140 | `END` | |

### Description

LIMILINE is used to query the current limit line. Executing LIMILINE returns an ASCII string containing the commands needed to create the limit line.

Use these commands (in the order given) to build a limit line:

1. Use LIMIDEL to clear the limit-line table.
2. Use LIMIFT to select a limit line that is either based on frequency or sweep time.
3. Use LIMIREL to determine whether the values of the limit line are absolute values or positioned relative to the reference-level and center-frequency settings.

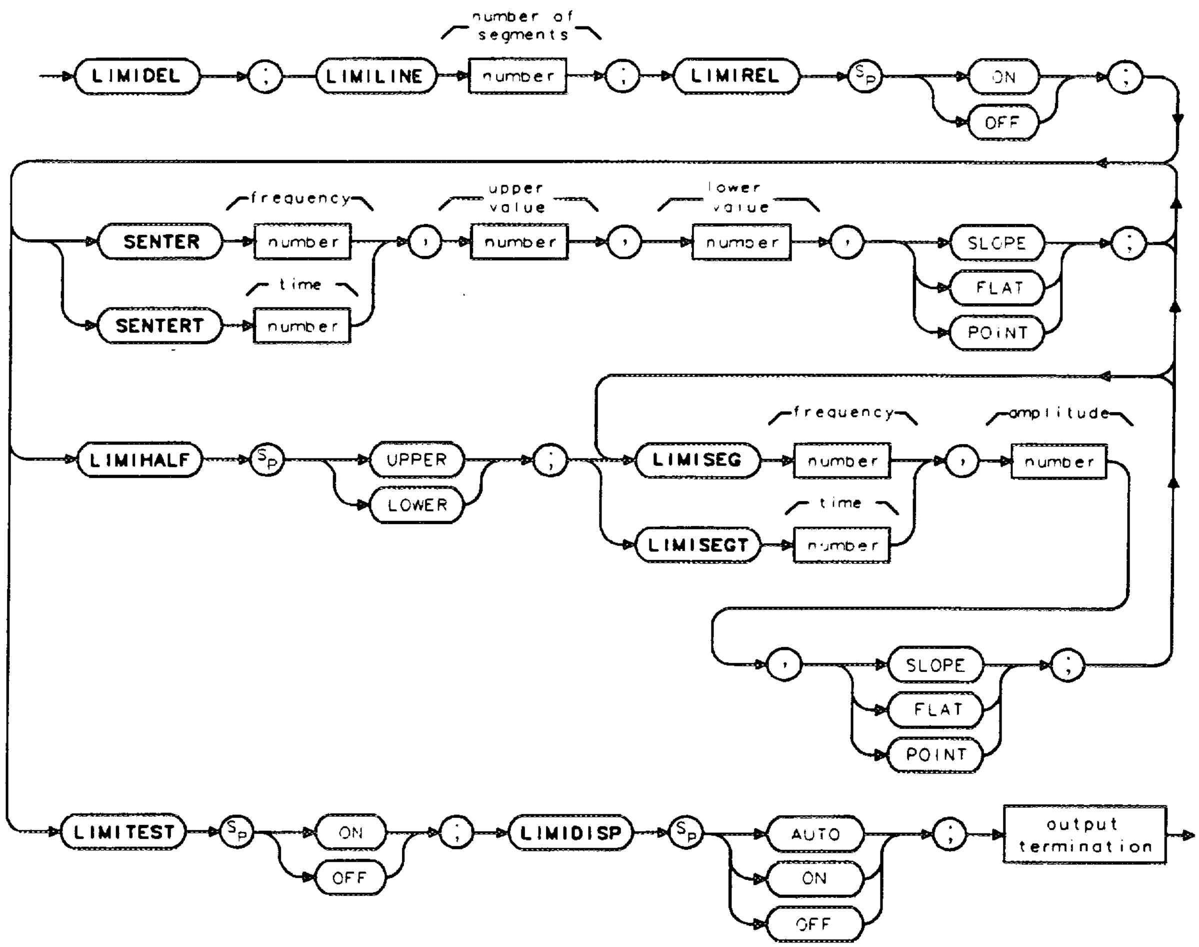
4. Use LIMIMODE, LIMISEG, LIMISEGT, SENTER, SENTERT to enter the limit-line segments. (Use LIMISEG or SENTER for a limit-line based on frequency; use LIMISEGT or SENTERT for a limit-line based on sweep time.)
5. Use the LIMIDISP command to select if the limit line is displayed or not.
6. Use the LIMITEST command to turn on limit-line testing.
7. Use the LIMIFAIL command to determine if the measurement sweep passed or failed the limit line boundaries.

**Enabling limit-line testing:** When limit testing is enabled, the segments in the current table are interpolated into the limit-line traces according to the current span and center frequency or sweep time of the spectrum analyzer. After the sweep, each value in trace A is compared to its corresponding value in the limit-line traces. If the current limit-line table is empty (for instance after using the command LIMIDEL) and limit testing is enabled, then the limit-line traces are blanked and set to out-of-range values. By using the SUB, MKPK HI, and MKF? commands, you can read the point of greatest difference between the trace and limit line. See "LIMITEST" for more information about limit-line testing.

**Saving the limit line table:** Once you have built the limit line, you can save the limit-line table on a memory card or in spectrum analyzer memory. Use the STOR or SAVRCLW commands to store the current limit-line table on the memory card. Use SAVET or SAVRCLW to store the limit-line table in spectrum analyzer memory.

## Query Response

The query response is a character string consisting of LIMILINE, LIMIREL, LIMIMODE, LIMIHALF, LIMISEG, LIMISEGT, SENTER, or SENTERT commands. LIMIMODE returns the number of for the current limit-line table. (The LIMIHALF command is for backward compatibility; it is not used as an HP 8590 Series spectrum analyzer programming command.)

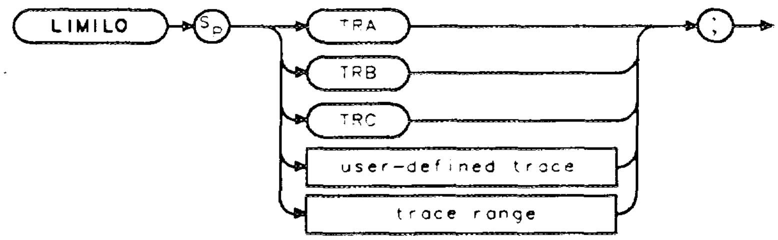

number of segments
LIMIDEL
;
LIMILINE
number
;
LIMIREL
Sp
ON
OFF
;
frequency
SENTER
number
time
SENTERT
number
,
upper value
number
,
lower value
number
,
SLOPE
FLAT
POINT
;
LIMIHALF
Sp
UPPER
LOWER
;
frequency
LIMISEG
number
time
LIMISEGT
number
,
amplitude
number
,
SLOPE
FLAT
POINT
;
LIMITEST
Sp
ON
OFF
;
LIMIDISP
Sp
AUTO
ON
OFF
;
output termination

cu120e

# LIMILO
# Lower Limit

Allows you to specify a fixed trace as the lower limit line.

## Syntax




XLIMILO

Related Commands: IP, LIMIDEL, LIMIFAIL, LIMISEG, LIMITEST, SENTER.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"TRDEF M_ASK,401;"` | *Defines a trace called "M_ASK."* |
| `20 OUTPUT 718;"MOV M_ASK[1,100],1000;"` | *Moves values into sections of the M_ASK trace.* |
| `30 OUTPUT 718;"MOV M_ASK[101,200],2000;"` | |
| `40 OUTPUT 718;"MOV M_ASK[201,300],3000;"` | |
| `50 OUTPUT 718;"MOV M_ASK[301,401],4000;"` | |
| `60 OUTPUT 718;"LIMILO M_ASK;"` | *Specifies M_ASK as the lower limit line.* |
| `70 OUTPUT 718;"LIMITEST ON;"` | *Turns on limit-line testing.* |
| `80 OUTPUT 718;"LIMIFAIL?;"` | *Tests if trace A fails limit-line testing.* |
| `90 ENTER 718;A` | |
| `100 DISP A` | *Displays result of limit-line testing.* |
| `110 END` | |

## Description

Unlike specifying a limit line with LIMISEG, LIMISEGT, SENTERT, or SENTER, the limit line specified with LIMILO is *not* updated if the center frequency, frequency span, sweep time, or reference level is changed.

**Note**

Executing IP, LIMIDEL, LIMISEG, LIMISEGT, SENTERT, or SENTER will delete the limit line specified with LIMILO or LIMIHI. Executing LIMILO or LIMIHI will delete the limit line specified with LIMISEG or SENTER.

Use LIMITEST ON to display the limit line trace specified by LIMILO. Use LIMITEST OFF to blank the limit line trace specified by LIMILO.

# LIMIMIRROR
# Mirror Limit Line

Reflects the current definition about the amplitude axis at the largest frequency (for a limit line based on frequency) or the largest sweep time (for a limit line based on the sweep time) in the definition.

## Syntax


XLIMIMIRROR

Related Commands: LIMILINE, LIMISEG, LIMISEGT, SENTER, SENTERT.

## Example

| | | |
|---|---|---|
| 10 | OUTPUT 718;"IP;CF300MHZ;SP100MHZ;" | *Initializes spectrum analyzer, changes the frequency and span.* |
| 20 | OUTPUT 718;"LIMIDEL;" | *Deletes any limit-line tables, sets the table type to fixed.* |
| 30 | OUTPUT 718;"LIMIMODE UPPER;" | *Specifies the upper limit-line table.* |
| 35 | OUTPUT 718;"LIMIFT FREQ;" | *Selects a limit line based on frequency.* |
| 40 | OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;" | *Enters a value into the upper limit-line table.* |
| 50 | OUTPUT 718;"LIMISEG 290MHZ,-50DB,SLOPE;" | |
| 60 | OUTPUT 718;"LIMISEG 295MHZ,-15DB,SLOPE;" | |
| 70 | OUTPUT 718;"LIMISEG 300MHZ,-10DB,SLOPE;" | |
| 80 | OUTPUT 718;"LIMIMIRROR;" | *Mirrors the upper limit-line entries.* |
| 90 | OUTPUT 718;"LIMITEST ON;" | *Turns on the limit-line testing and displays the limit lines.* |
| 100 | END | |

The example results in the limit-line table shown in the following table.

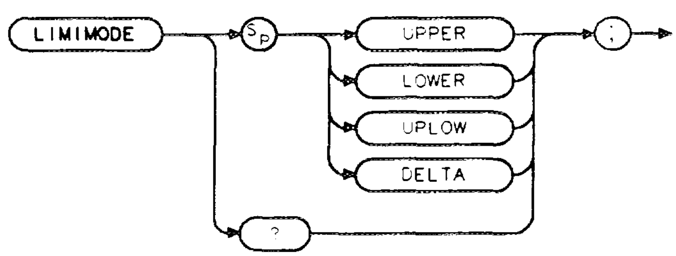
| SEG | START_FREQ | UPPER_AMP | TYPE |
|---|---|---|---|
| 1 | 250.0 MHz | −60.0 dBm | FLAT |
| 2 | 290.0 MHz | −60.0 dBm | SLOPE |
| 3 | 295.0 MHz | −15.0 dBm | SLOPE |
| 4 | 300.0 MHz | −10.0 dBm | SLOPE |
| 5 | 305.0 MHz | −15.0 dBm | SLOPE |
| 6 | 310.0 MHz | −50.0 dBm | POINT |
| 7 | 310.0 MHz | −60.0 dBm | FLAT |
| 8 | 350.0 MHz | −60.0 dBm | SLOPE |

You may notice that the LIMIMIRROR command may create more than one table entry for a frequency (for example, see segment 6 in the above table). The LIMIMIRROR command creates an extra segment so that the previous segment is explicitly ended at the correct amplitude.

# LIMIMODE
## Limit-Line Entry Mode

Determines whether the limit-line entries are treated as upper amplitude values, lower amplitude values, upper and lower amplitude values, or mid-amplitude and delta values.

### Syntax




XLIMIMODE

Related Commands: LIMILINE, LIMISEG, LIMISEGT, SEGDEL, SENTER, SENTERT.

### Example

This example uses LIMIMODE to enter segments into the upper limit-line table, and then to enter a segment into the lower limit-line table (upper and lower limit lines are treated as separate tables). Line 60 demonstrates entering a segment into a combined upper and lower limit-line table.

| | |
|---|---|
| `10 OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| `20 OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `30 OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| `40 OUTPUT 718;"LIMISEG 300MHZ,-30DB,SLOPE;"` | *Enters a segment into the upper limit-line table. Because the LIMISEG command is used, the limit-line table will be based on frequency.* |
| `50 OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| `60 OUTPUT 718;"LIMISEG 300MHZ,-70DB,SLOPE;"` | *Enters a segment into the lower limit-line table.* |
| `70 OUTPUT 718;"LIMIMODE UPLOW;"` | *Specifies the upper and lower limit-line tables.* |
| `80 OUTPUT 718;"SENTER 350MHZ,-30DB,-80DB,FLAT;"` | *Enters a segment into the upper and lower limit-line tables.* |
| `90 OUTPUT 718;"LIMIDISP ON;"` | *Displays the limit lines.* |
| `100 END` | |

## Description

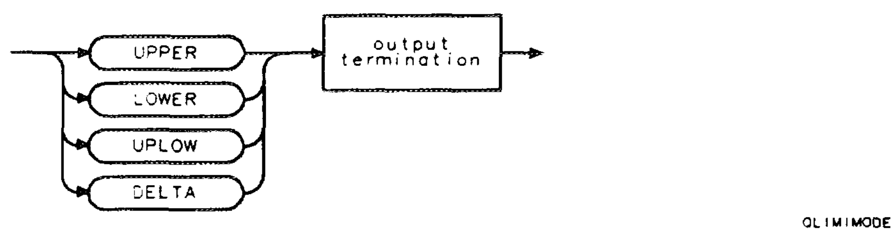
Use LIMIMODE in conjunction with LIMISEG, LIMISEGT, SENTER, or SENTERT. Specify LIMIMODE UPPER or LIMIMODE LOWER before using LIMISEG or LIMISEGT. Specify LIMIMODE UPLOW or LIMIMODE DELTA before using SENTER or SENTERT.

The LIMIMODE command determines whether the limit-line table entries are to be treated separately (upper or lower) or together (upper and lower) when deleting a segment with SEGDEL (see "SEGDEL"). If limit-line table entries are entered with LIMISEG or LIMISEGT, they are treated as entries to separate tables even if LIMIMODE UPLOW or LIMIMODE DELTA had been previously specified.

When used as a predefined variable, LIMIMODE returns a number from 0 to three, depending on the setting of the LIMIMODE parameter. The number corresponds to the LIMIMODE parameter as shown in the following table.

| LIMIMODE Parameter | Value Returned |
|---|---|
| UPLOW | 0 |
| DELTA | 1 |
| UPPER | 2 |
| LOWER | 3 |

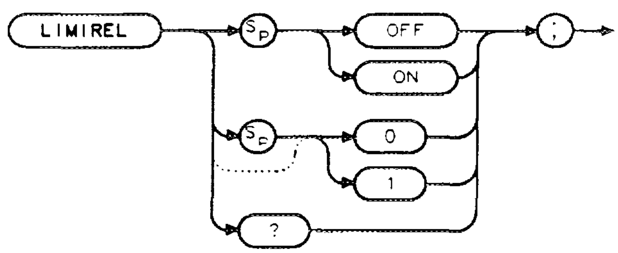
## Query Response



# LIMIREL
# Relative Limit Lines

Specifies whether the current limit lines are fixed or relative.

## Syntax




XLIMIREL

Related Commands: LIMIDEL, LIMIFT, LIMILINE.

## Example

| | |
|---|---|
| `OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| `OUTPUT 718;"LIMIREL ON;"` | *Specifies that the limit line will be relative to the reference-level and center-frequency settings.* |

## Description

You should use LIMIFT to select whether the limit lines are based on frequency or sweep time before using LIMIREL, because changing between a frequency or sweep time limit line purges the current limit line table and sets LIMIREL to OFF.

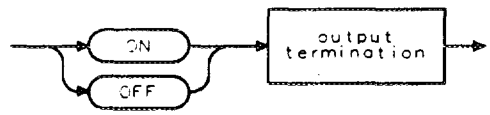
**LIMIREL and the reference level:** Regardless of whether the limit line is based on frequency or sweep time, LIMIREL determines if the amplitude parameter in a limit line table represents absolute values or relative values. If LIMIREL is set to OFF, the limit lines amplitude values are specified in absolute amplitude and do not depend on the reference level (RL) setting. If LIMIREL is set to ON, the limit line amplitude values are relative to the current reference level (RL) setting.

**For limit lines that are based on frequency:** The LIMIREL command determines whether the frequency parameter in a limit-line table represent absolute or relative values that are referenced to the center-frequency settings.

- Executing "LIMIREL OFF;" specifies that the frequency values in a limit-line table are fixed values, and the limit line is positioned accordingly. Fixed limit lines are specified in absolute frequency and do not depend upon the center frequency value.
- Executing "LIMIREL ON;" specifies that the frequency values in a limit-line table are relative values and positions the limit line relative to the center-frequency settings. Relative limit lines are specified in relative frequency and are positioned with respect to the current center frequency. When the current center frequency value is changed, the segment frequencies are converted according to the current center frequency value.

**For limit lines that are based on the sweep time:** Limit lines that are based on sweep time are always relative to the start time, and the horizontal position of the limit line is not affected by the setting of LIMIREL.

## Query Response

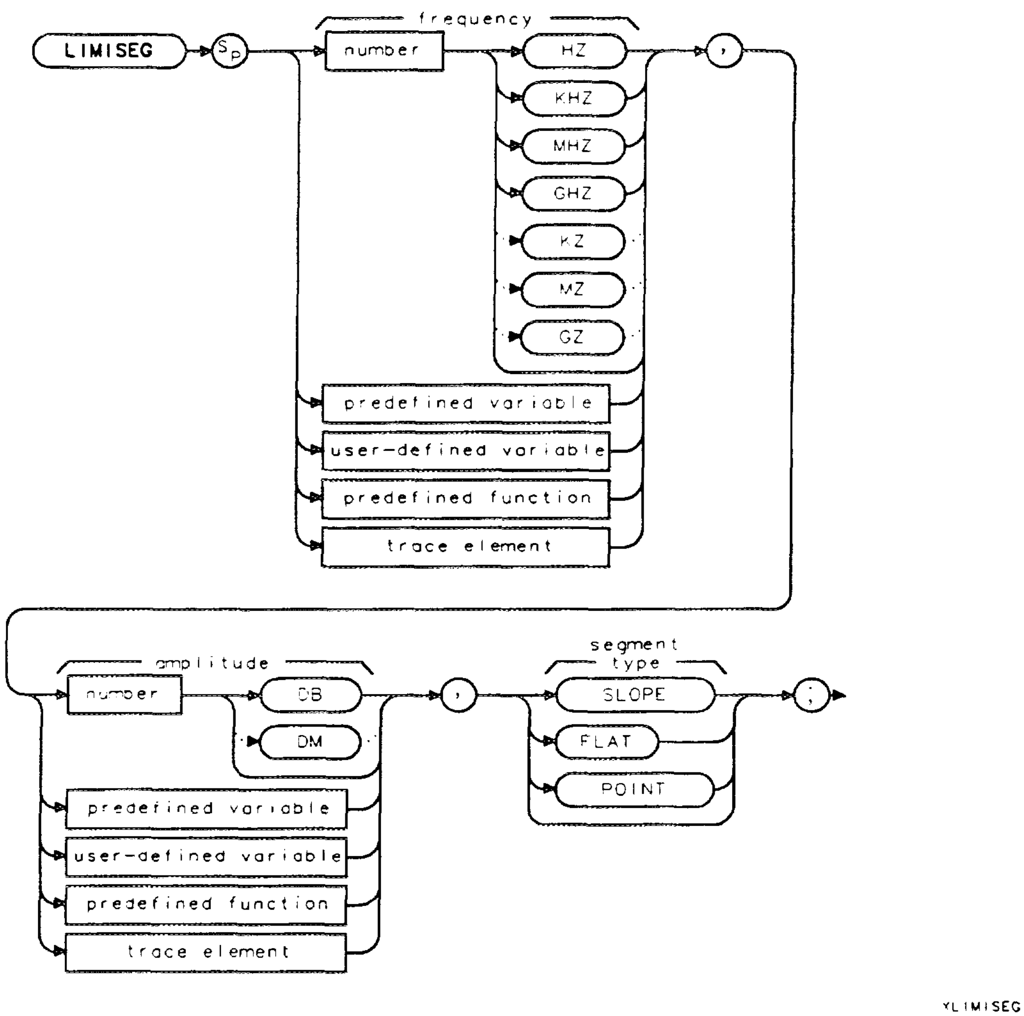



QQ2

# LIMISEG
# Enter Limit-Line Segment for Frequency

Adds new segments to the current frequency limit line in either the upper limit line or the lower limit line.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | Varies with FOFFSET and ROFFSET. |

Related Commands: LIMIDEL, LIMILINE, LIMIMODE, LIMIREL, SEGDEL, SENTER.

## Example

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"IP;SNGLS;CF300MHZ;SP100MHZ;RB 3MHZ;"` | *Initializes spectrum analyzer, changes the frequency, span, and bandwidth.* |
| 20 | `OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| 30 | `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| 35 | `OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| 40 | `OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Adds segment to the upper limit-line table.* |
| 50 | `OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| 60 | `OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| 70 | `OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| 80 | `OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| 90 | `OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| 100 | `OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| 110 | `OUTPUT 718;"LIMISEG 250MHZ,-75DB,FLAT;"` | *Adds segment to the lower limit-line table.* |
| 120 | `OUTPUT 718;"LIMISEG 910MHZ,-75DB,FLAT;"` | |
| 130 | `OUTPUT 718;"LIMITEST ON;TS;"` | *Enables limit-line testing.* |
| 140 | `OUTPUT 718;"LIMIFAIL?;"` | *Returns the result of limit-line testing.* |
| 150 | `ENTER 718;A` | |
| 160 | `DISP A` | *Displays the result.* |
| 170 | `END` | |

## Description

If the current limit line table contains lines based on sweep time (as opposed to a limit line based on the frequency), executing LIMISEG will clear the current sweep time limit line table, and set LIMIREL to OFF.

Each limit-line segment is specified with a starting frequency, an amplitude, and a segment type. The segment type defines how the line segment is to extend from its starting point to the next segment. The segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all frequencies between the two points. If the amplitude values of the two segments differ, the limit line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values for all frequencies between the two points.
- POINT specifies a limit value for the coordinate point, and no other frequency points, so that a POINT segment specifies a limit value for a single frequency. For an upper limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the top of screen. For a lower limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the bottom of screen. The

POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is used automatically. If a visible POINT segment at the right edge of the display is not desired, add an explicit last point segment (higher in frequency than the stop frequency) to the limit-line table.

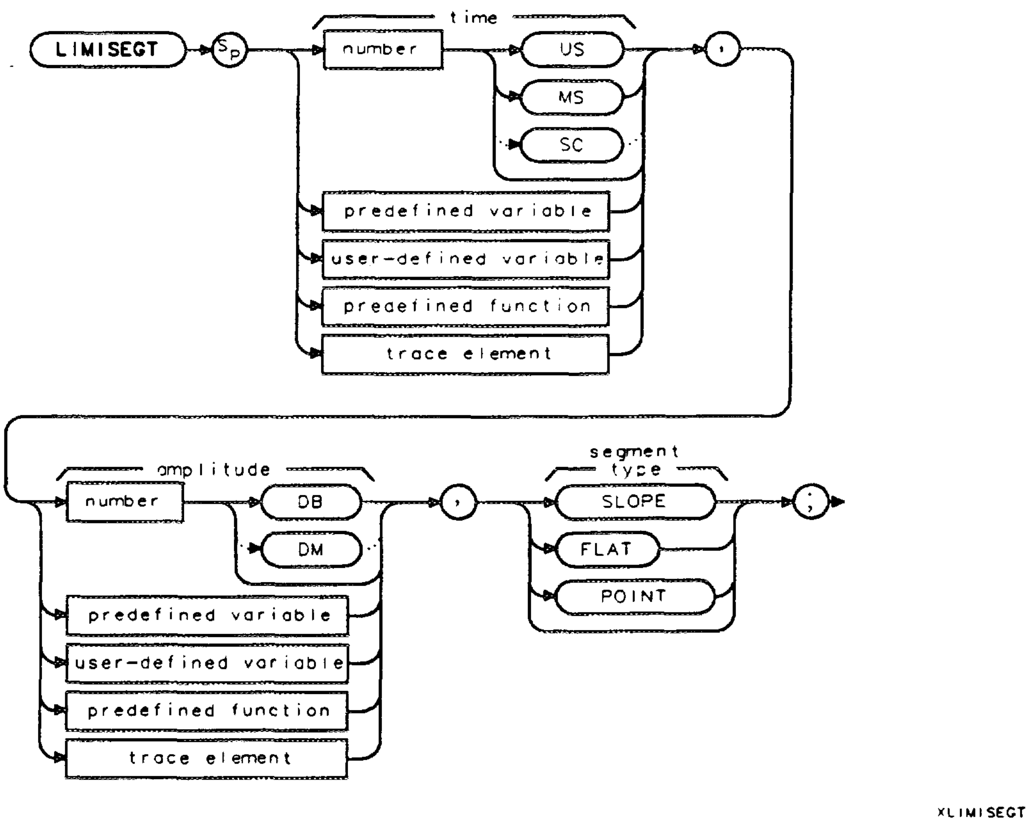
Segments are sorted according to starting frequency. A maximum of 20 segments can be defined in each of the upper and lower halves of a limit line. When the segment type is omitted, the last type given (or SLOPE if no previous type has been given) is used.

Use LIMISEG if you want to enter amplitude data in the upper or lower limit lines. If you want to enter amplitude data as upper and lower amplitude pairs or as mid and delta pairs, use the SENTER command instead of LIMISEG. Use LIMIMODE to specify entry into the upper limit-line table or the lower limit-line table (see line 30 of example).

# LIMISEGT
# Enter Limit-Line Segment for Sweep Time

Adds new segments to the current sweep time limit line in either the upper limit line or the lower limit line.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. For the sweep time, the default unit is seconds. For the amplitude value, the default unit is dBm. | The range of the sweep time is 0 to 100 s. The range of the amplitude varies with ROFFSET. |

Related Commands: LIMIDEL, LIMIFT, LIMILINE, LIMIMODE, LIMIREL, SEGDEL, SENTERT.

## Example

| | |
|---|---|
| `OUTPUT 718;"LIMIDEL;"` | *Deletes the current limit-line table, sets the table type to fixed.* |
| `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| `OUTPUT 718;"LIMIFT TIME;"` | *Selects a limit line based on the sweep time.* |
| `OUTPUT 718;"LIMISEGT 0MS,-60DB,FLAT;"` | *Adds segment to the upper limit-line table.* |
| `OUTPUT 718;"LIMISEGT 6MS,-60DB,SLOPE;"` | |
| `OUTPUT 718;"LIMISEGT 8MS,-15DB,FLAT;"` | |
| `OUTPUT 718;"LIMISEGT 11MS,-20DB,SLOPE;"` | |
| `OUTPUT 718;"LIMISEGT 14MS,-60DB,FLAT;"` | |
| `OUTPUT 718;"LIMISEGT 20MS,-60DB,POINT;"` | |
| `OUTPUT 718;"LIMIMODE LOWER;"` | *Specifies the lower limit-line table.* |
| `OUTPUT 718;"LIMISEGT 0MS,-75DB,FLAT;"` | *Adds segment to the lower limit-line table.* |
| `OUTPUT 718;"LIMISEGT 20MS,-75DB,POINT;"` | |
| `OUTPUT 718;"LIMITEST ON;TS;"` | *Enables limit-line testing.* |
| `OUTPUT 718;"LIMIFAIL?;"` | *Returns the result of limit-line testing.* |
| `ENTER 718;A` | |
| `DISP A` | *Displays the result.* |

## Description

Each limit-line segment is specified with a starting sweep time, an amplitude, and a segment type.

**Note** If the current limit line table contains limit lines based on frequency (as opposed to a limit line based on the sweep time), executing LIMISEGT will clear the current frequency limit line table, and set LIMIREL to OFF.

**Starting sweep time:** When you specify the starting sweep time, you are specifying the starting sweep time with respect to the sweep time of the spectrum analyzer. For example, if you specify a starting sweep time of 0, the limit-line segment will start at the left side of the spectrum analyzer display.

**Segment type:** The segment type defines how the line segment is to extend from its starting point to the next segment. The segment types are FLAT, SLOPE, and POINT.

- FLAT draws a zero-slope line between the coordinate point of the current segment and the coordinate point of the next segment, producing limit-line values equal in amplitude for all sweep times between the two points. If the amplitude values of the two segments differ, the limit line will "step" to the value of the second segment.
- SLOPE draws a straight line between the coordinate point of the current segment and the coordinate point of the next segment, interpolating amplitude values for all sweep times between the two points.
- POINT specifies a limit value for the coordinate point, and no other sweep time points, so that a POINT segment specifies an amplitude value for a single sweep time. For an upper limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the top of the graticule area. For a lower limit line, a POINT segment is indicated by a line drawn from the coordinate point, to a point that is vertically off the bottom of the graticule area. The POINT segment type should be used as the last segment in the limit-line table. However, if the last segment in the table is not specified as the POINT segment type, an implicit point is used automatically. If a visible POINT segment at the right

edge of the display is not desired, add an explicit last point segment to (higher in sweep time than the current sweep time setting of the spectrum analyzer) the limit-line table.

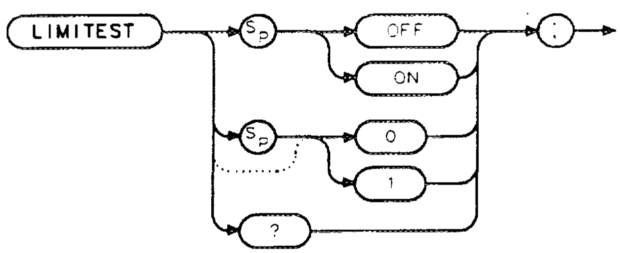
Segments are sorted according to starting sweep time. A maximum of 20 segments can be defined in each of the upper and lower halves of a limit line.

Use LIMISEGT if you want to enter amplitude data in the upper or lower limit lines. Use LIMIMODE to specify entry into the upper limit-line table or the lower limit-line table (see line 30 of example). If you want to enter amplitude data as upper and lower amplitude pairs or as mid and delta pairs, use the SENTERT command instead of LIMISEGT.

# LIMITEST
## Enable Limit Line Testing

Compares trace A with the current limit-line data.

### Syntax




Preset State: LIMITEST OFF.
Related Commands: LIMIFAIL, LIMIHI, LIMILO, LIMISEG, LIMISEGT, SENTER, SENTERT.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

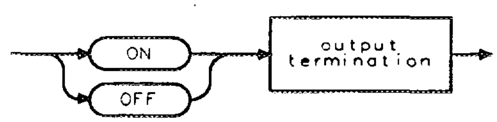
### Example

| | | |
|---|---|---|
| 10 | `OUTPUT 718;"IP;SNGLS;CF300MHZ;SP100MHZ;"` | *Initializes spectrum analyzer and changes the frequency and span settings.* |
| 20 | `OUTPUT 718;"LIMIDEL;"` | *Deletes any limit-line tables, sets the table type to fixed.* |
| 30 | `OUTPUT 718;"LIMIMODE UPPER;"` | *Specifies the upper limit-line table.* |
| 35 | `OUTPUT 718;"LIMIFT FREQ;"` | *Selects a limit line based on frequency.* |
| 40 | `OUTPUT 718;"LIMISEG 250MHZ,-60DB,FLAT;"` | *Creates an entry to the upper limit-line table.* |
| 50 | `OUTPUT 718;"LIMISEG 290MHZ,-60DB,SLOPE;"` | |
| 60 | `OUTPUT 718;"LIMISEG 295MHZ,-15DB,FLAT;"` | |
| 70 | `OUTPUT 718;"LIMISEG 305MHZ,-15DB,SLOPE;"` | |
| 80 | `OUTPUT 718;"LIMISEG 310MHZ,-60DB,FLAT;"` | |
| 90 | `OUTPUT 718;"LIMISEG 910MHZ,-60DB,FLAT;"` | |
| 100 | `OUTPUT 718;"LIMITEST ON;TS;"` | *Turns on limit-line testing.* |
| 110 | `OUTPUT 718;"LIMIFAIL?;"` | *Returns the status of the limit-line testing.* |
| 120 | `ENTER 718;A` | |
| 130 | `DISP A` | *Displays the result.* |
| 140 | `END` | |

## Description

A test is made of the data in TRA (trace A), and the result can be read, using LIMIFAIL, after each sweep.

## Query Response

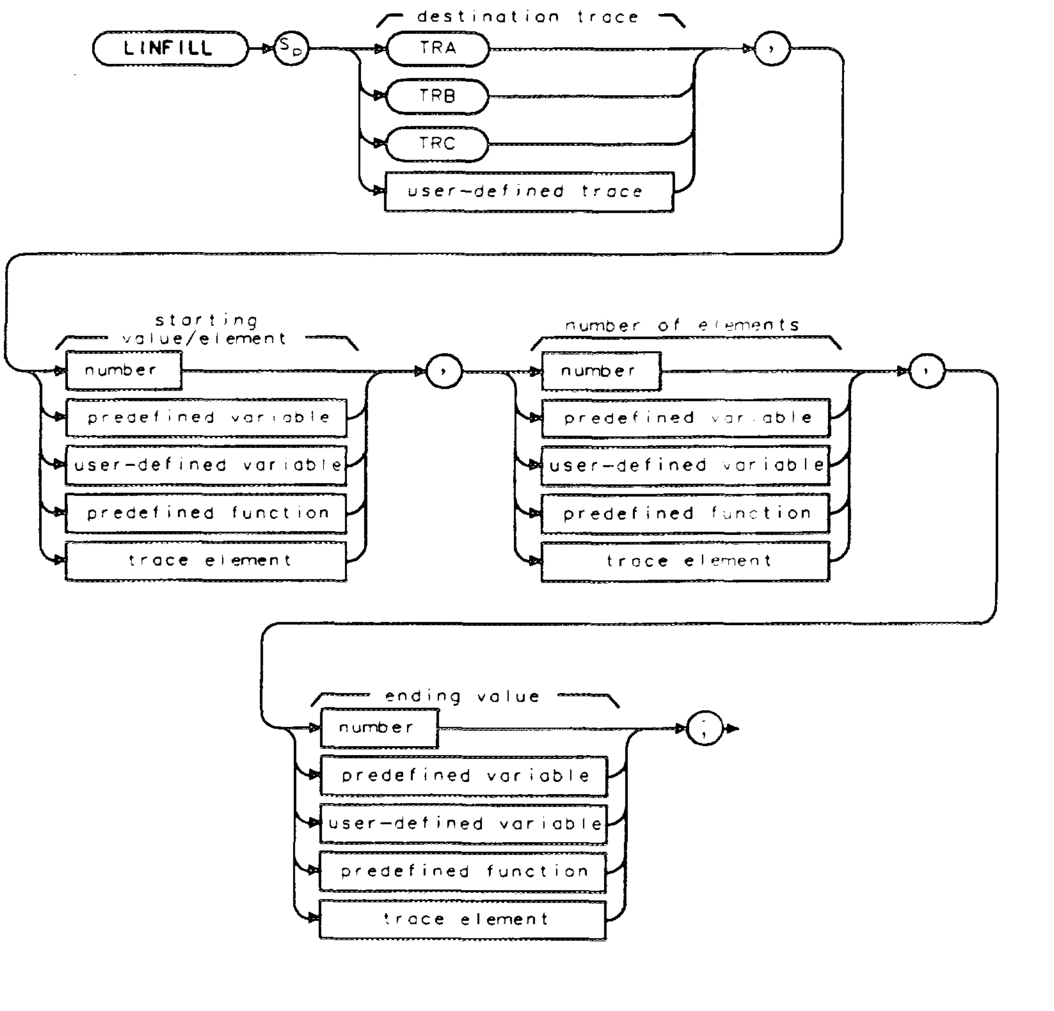



QQ2

# LINFILL
# Line Fill

Fills linear interpolated data into the specified trace data points of a destination trace.

## Syntax



| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer number. | For the starting value or number of elements, the range of the number is 0 to the length of the trace minus 1. For the ending value, the range is −32,768 to +32,767. |

## Example

`OUTPUT 718;"LINFILL TRC,0,0,0;"` *Initializes trace C.*

`OUTPUT 718;"MOV TRC[1,10],TRA[1,10];"` *Moves the first 10 elements of trace A into trace C.*

`OUTPUT 718;"LINFILL TRC,10,40,8000;"` *Uses the 10th element of trace C as the starting value, fills trace C elements 11 through 50 with the interpolated data, and places ending value (8000) into the 50th element of trace C.*

## Description

LINFILL uses the value of the starting value and the ending value to calculate the linear interpolation data (the values for ending value should be in measurement units). The "number of elements" field allows you to specify the number trace data points that are "filled in" with linear interpolation data. The number of elements field includes the starting element, so if the starting value is 10 and the number of elements is 40, the ending element will be 50.

The data will not be interpolated if the starting value is 0. If the starting value is 0, the ending value is copied into the first element of the destination trace. You may want to set the starting value to 0 to initialize a trace before using LINFILL to fill the trace with interpolated data. If the starting value and the number of elements exceed the length of the destination trace, the interpolation ends at the end of the trace array; the ending value is never reached.

# LN
# Linear Scale

Specifies the vertical graticule divisions as linear units, without changing the reference level.

## Syntax


XLN

Equivalent Softkey: `SCALE LOG LIN` (when LIN is underlined).

Related Commands: LG, RL.

## Example

```
OUTPUT 718;"LN;"            Selects linear mode.
OUTPUT 718;"LN;RL 30MV;"
```

## Description

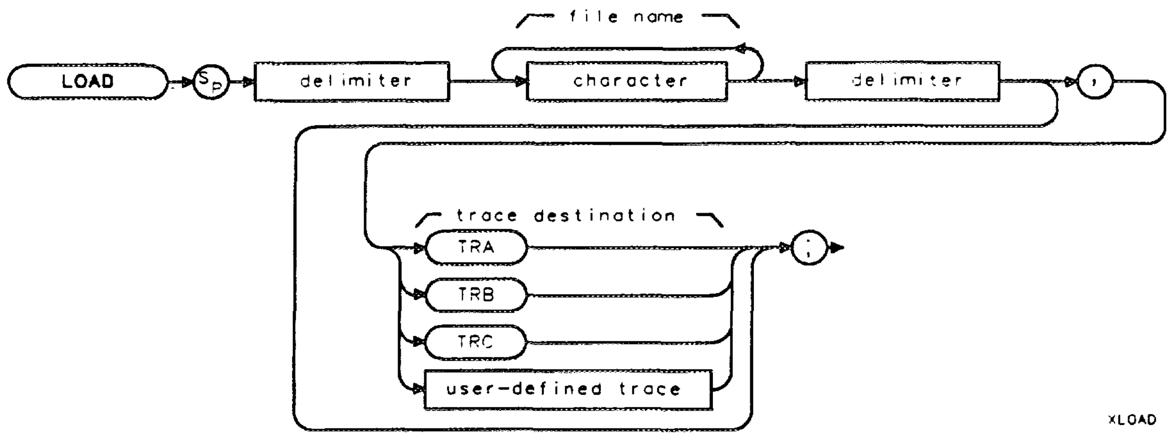
The LN command scales the amplitude (vertical graticule divisions) proportionally to the input voltage, without changing the reference level. The bottom graticule line represents a signal level of zero volts.

Voltage entries are rounded to the nearest 0.1 dB. Thus, 30.16 mV becomes −17.4 dBm for a 50Ω spectrum analyzer system.

# LOAD
# Load

Loads a file from the memory card.

## Syntax




<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>Character</td><td>Any valid character.</td><td>Any valid file name.</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
</table>

Equivalent Softkey: **LOAD FILE**.

Option Required: An HP 8590D or HP 8592D needs to have Option 003 installed in the spectrum analyzer to use the LOAD command to load a file from the memory card.

Related Commands: CAT, STOR.

## Example

| | |
|---|---|
| `OUTPUT 718;"LOAD %tMYTRA%,TRA;"` | *Loads MYTRA from the memory card into trace A.* |
| `OUTPUT 718;"LOAD %dM_YPROG%;"` | *Loads a program from the memory card into spectrum analyzer memory.* |

## Description

Be sure to insert the memory card into the spectrum analyzer's memory card reader before using the LOAD command.

To use the LOAD command, you must specify the file name of the file to be loaded from the memory card into spectrum analyzer memory, and, if you are loading trace data, you must also specify the trace destination.

**File name:** You must supply the file name of the file to be loaded. When specifying the file name, be sure to include the lowercase letter that indicates the data type, because the result of the LOAD operation is dependent on the data type. (For example, the "d" in "dM_YPROG" indicates the file type is for a downloadable program.) The lowercase letters correspond to the data type as shown in the following table.

| Lowercase Letter | File Description | Result |
|---|---|---|
| a | Amplitude correction factors | Loads the amplitude correction factors. |
| i | Display image file | Loads and displays the display image file. |
| d | Downloadable program | Loads the contents of the file that was stored with STOR. Because STOR stores a copy of user-memory in the file, more than one item may be retrieved when executing the LOAD command. |
| l | Limit lines | Loads the limit-line values into the current limit-line table. |
| s | Analyzer State | Loads the spectrum analyzer state, and changes the current spectrum analyzer state to the state that was loaded. |
| t | Trace | Loads the trace and state. The current spectrum analyzer trace and state is changed to the trace and state that was loaded. |

**Destination:** When recalling trace data, you need to specify either TRA, TRB, TRC, or a user-defined trace as the destination. Omit the destination parameter when recalling downloadable programs, states, limit-line tables, display image files, or amplitude correction factors.

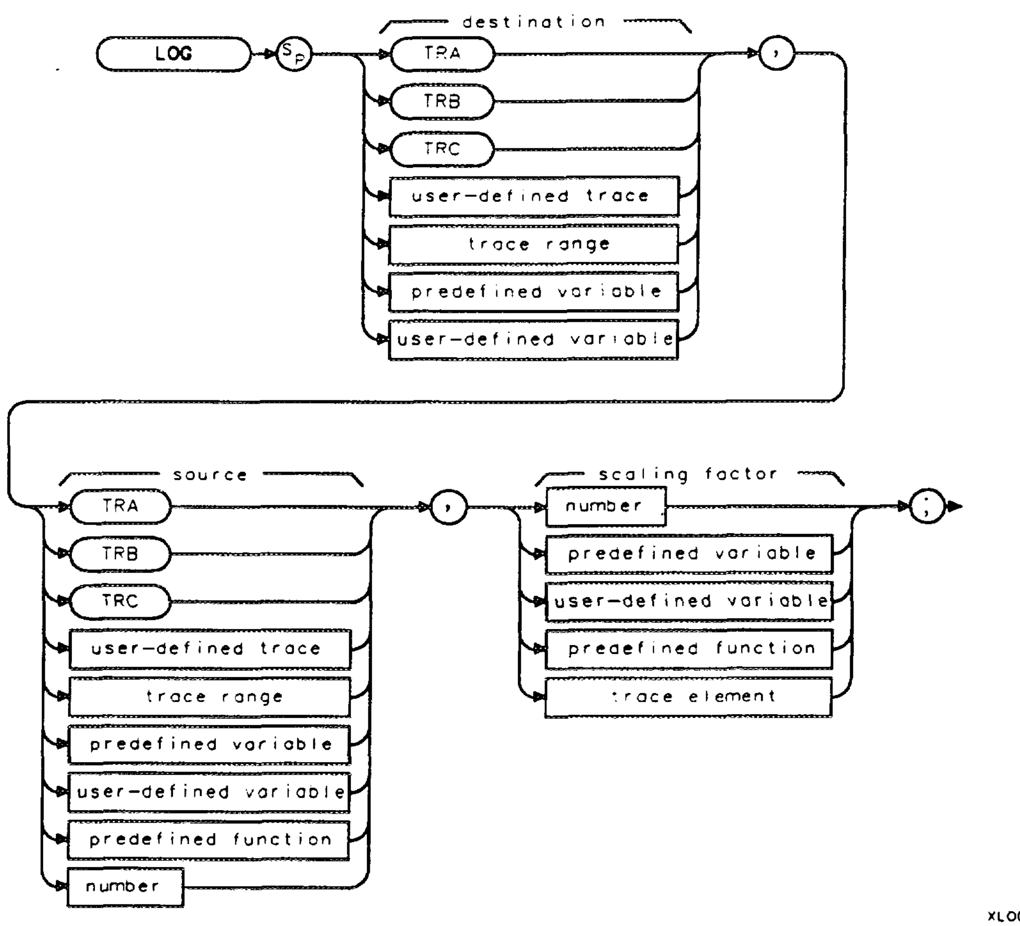
**Note**

The LOAD command recalls data from the memory card. See "SAVRCLN," "RCLT," or "RCLS" to recall data from spectrum analyzer memory.

# LOG
# Logarithm

Takes the logarithm (base 10) of the source, multiplies the result by the scaling factor, then stores it in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: EXP.

## Example 1

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"VARDEF P_OWER,0;"` | *Defines a user-defined variable, called P_OWER, and sets it equal to 0.* |
| `OUTPUT 718;"LOG P_OWER,5,10;"` | *P_OWER = 10 × LOG(5).* |
| `OUTPUT 718;"P_OWER?;"` | *Returns value to computer.* |
| `ENTER 718;N` | *Assigns value to computer variable.* |
| `DISP USING "D.DD,K";N;" dB"` | *Displays value on the computer screen.* |

## Example 2

This example finds the natural exponential of a number and uses the LOG function to return the original source value of the EXP function.

| | |
|---|---|
| `10 OUTPUT 718;"VARDEF E_XP,0;"` | *Defines a variable called E_XP.* |
| `20 OUTPUT 718;"EXP E_XP,2,2.30259;"` | *Finds the natural exponential of 2.* |
| `30 OUTPUT 718;"E_XP?;"` | *Returns the natural exponential of 2.* |
| `40 ENTER 718;Value` | |
| `50 PRINT Value` | *Prints the value of the exponential.* |
| `60 OUTPUT 718;"LOG E_XP,E_XP,2.30259;"` | *Uses the log function on the exponential value.* |
| `70 OUTPUT 718;"E_XP?;"` | *The log of the exponential value is approximately 2.* |
| `80 ENTER 718;Logvalue` | |
| `90 PRINT Logvalue` | |
| `100 OUTPUT 718;"VARDEF E_XPY,0;"` | *Declares a variable called E_XPY.* |
| `110 OUTPUT 718;"EXP E_XPY,-5,2.30259;"` | *Finds the natural exponential of −5.* |
| `120 OUTPUT 718;"E_XPY?;"` | *Returns the value of the natural exponential of −5.* |
| `130 ENTER 718;Value2` | |
| `140 PRINT Value2` | *Prints the value of the exponential.* |
| `150 OUTPUT 718;"LOG E_XPY,E_XPY,2.30259;"` | *Uses the log function on the exponential value.* |
| `160 OUTPUT 718;"E_XPY?;"` | *The log of the exponential value is approximately −5.* |
| `170 ENTER 718;Logval` | |
| `180 PRINT Logval` | |
| `190 END` | |

## Description

The scaling factor may be used to improve numerical computations when calculating logarithms of integer trace data. For example, the log of a trace value of 8000 is 3.9, which would be stored as the value 4 in a trace.

The log of trace value of 1 is 0, so the log of a trace containing values from 1 to 8000 would be compressed to values 0, 1, 2, 3, 4. Computational accuracy can be improved by using the scaling factor to scale up the log values before they are stored. In this case, because 3.903 is the log of 8000 and the largest positive trace value is 32,767, a scaling factor of 32,767 divided by 3.903 or 8,395 may be applied to the data. Because EXP and LOG are inverse functions, the EXP command has a scaling factor that may be used to "undo" the scaling factor of the LOG command.

The LOG command can be used to calculate the natural logarithm by using 2.30259 as the scaling factor.

The LOG function returns an invalid result if the source is zero or a negative number.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# LSPAN
# Last Span

Changes the spectrum analyzer's span to the previous span setting.

## Syntax


XLSPAN

Equivalent Softkey: **LAST SPAN**.
Related Commands: SP.

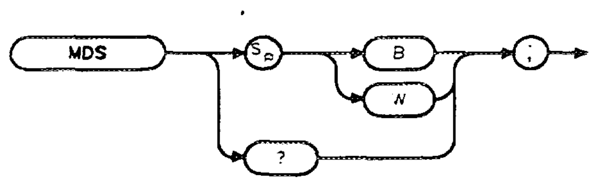
## Example

```
OUTPUT 718;"LSPAN;"
```

# MDS
# Measurement Data Size

Specifies measurement data size as byte or word.

## Syntax




XMDS

Related Commands: MKA, TDF, TRA.
Preset State: W.

## Example

These commands transfer trace A in binary, 2 bytes per word.

| | |
|---|---|
| `INTEGER TRACE_A (1:401)` | *Declares variable, Trace_A.* |
| `OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep, updates trace A.* |
| `OUTPUT 718;"TDF B;MDS W;TRA?;"` | *Reads trace A in "word" format.* |
| `ENTER 718 USING "#,401(W)";TRACE_A(*)` | *Formats trace A output using data size of one word.* |
| `PRINT TRACE_A(*)` | *Prints trace A.* |

## Description

The MDS command formats binary data in one of the following formats:

**B** selects a data size of one 8-bit byte. When transferring trace data, MDS B transfers trace data the faster than MDS W because only 401 bytes are transferred. Because MDS B combines two bytes into one byte, some resolution is lost.

**W** selects a data size of one word, which is two 8-bit bytes. When transferring trace data, MDS W transfers 802 bytes of trace data with no loss of resolution.

**How data is represented with MDS W:** When data is sent with MDS W, the trace data is converted into two bytes as follows:

1. The trace element's amplitude (in measurement units) is divided by 256. The binary representation of the result is placed in the most significant byte (MSB).
2. The binary representation of the remainder is placed in the least significant byte (LSB).

For example, a trace element that is at the reference level has the value of 8000 (in measurement units). The result of 8000 divided by 256 is 30, with a remainder of 120. For this data, the contents of the MSB would contain the binary representation for 30.

**Contents of the MSB**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 |

### MDS Measurement Data Size

For this data, the contents of the LSB would contain the binary representation for 120.

**Contents of the LSB**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |

**How data is represented with MDS B:** When data is sent with MDS B, the trace data is converted into one byte as follows:

- The trace element's amplitude (in measurement units) is divided by 32. The binary representation of the result is placed into one byte.

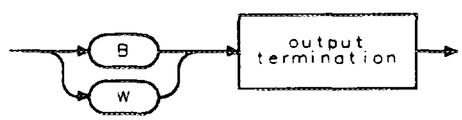
For example, a trace element that is at the reference level has the value of 8000 (in measurement units). The result of 8000 divided by 32 is 250. For this data, the contents of the byte would contain the binary representation for 250.

**Contents of Byte**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |

See "TDF" for information about using MDS for trace data transfers.

## Query Response:




QMDS

# MDU
# Measurement Data Units

Returns values for the spectrum analyzer baseline and reference level.

## Syntax


XMDU

Related Commands: TDF.

## Example

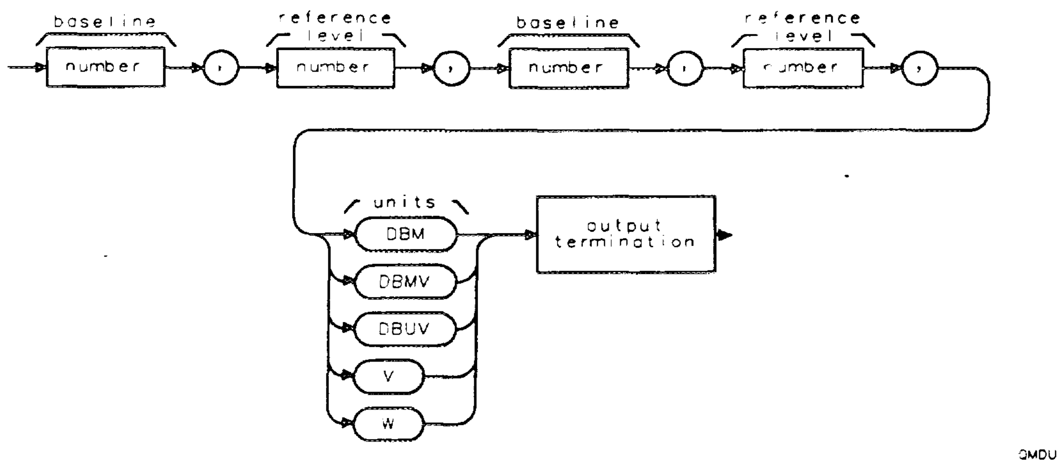
| | |
|---|---|
| `10 OUTPUT 718;"IP;TDF M;"` | *Initializes the spectrum analyzer and formats the trace data in measurement units.* |
| `20 OUTPUT 718;"RL -10DM;"` | *Changes the reference level to −10 dBm.* |
| `30 OUTPUT 718;"MDU?;"` | *Queries the position of the spectrum analyzer baseline and reference level.* |
| `40 ENTER 718;A,B,C,D,A$` | *Moves the spectrum analyzer response to the computer.* |
| `50 PRINT A,B,C,D,A$` | *Displays the results on the computer screen.* |
| `60 END` | |

The example returns the following to the controller: 0, 200, −90, −10 dBm. The first two numbers received indicate that the vertical scale spans from 0 to 200 plotter units. The third and fourth number received indicate that the baseline is at −90 dBm, and the reference level is at −10 dBm. So, the baseline value of −90 dBm is equal to 0 plotter units. The reference level of −10 dBm is equal to 200 plotter units.

## Description

The MDU command returns values for the spectrum analyzer baseline and reference level, in plotter units and measurement units.

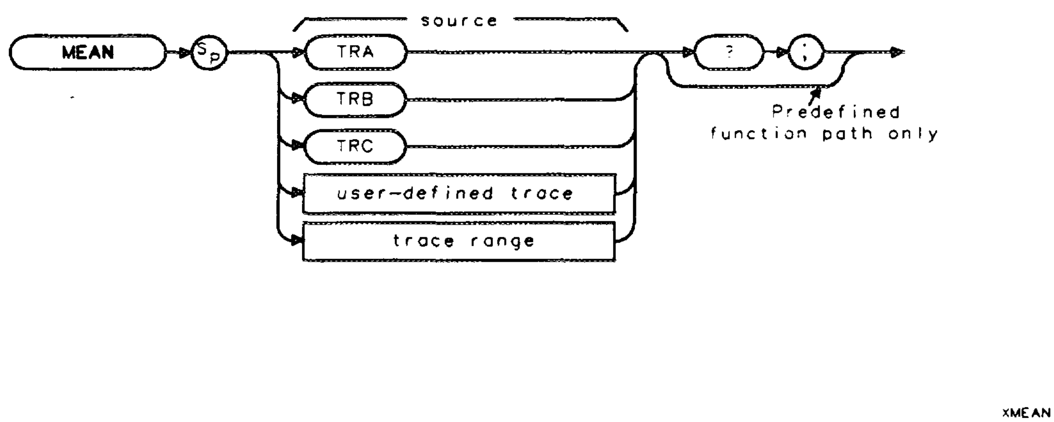
## Query Response



# MEAN
# Trace Mean

Returns the mean value of the given trace in measurement units.

## Syntax



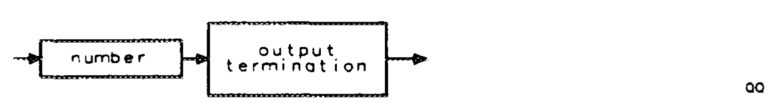

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command | Any valid trace name. |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEANTH, RMS, STDEV, VARIANCE.

## Example

```
10 OUTPUT 718;"IP;"                        Initializes spectrum analyzer.
20 OUTPUT 718;"SNGLS;"                     Activates the single-sweep mode.
30 OUTPUT 718;"CF 300MHZ;SP 1MHZ;"         Sets measurement range.
40 OUTPUT 718;"TS;"                        Sweeps trace A.
50 OUTPUT 718;"MEAN TRA?;"                 Returns the mean value of trace A to the computer.
60 ENTER 718;Number                        Assigns value to computer variable, Number.
70 DISP "MEAN OF TRACE A IS ";Number       Displays result on the computer screen.
80 END
```

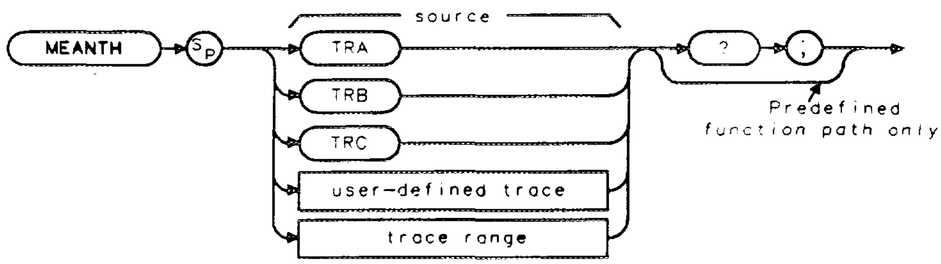
## Query Response



# MEANTH
# Trace Mean Above Threshold

Returns the mean value of the given trace above the threshold, in measurement units.

## Syntax




XMEANTH

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command | Any valid trace name. |
| Trace Range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, RMS, STDEV, TH, VARIANCE.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

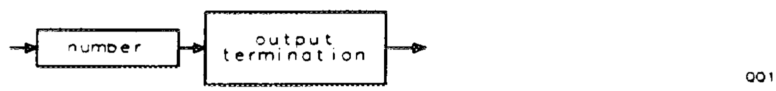
| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates the single-sweep mode.* |
| `30 OUTPUT 718;"CF 300MHZ;SP 1GHZ;"` | *Sets measurement range.* |
| `40 OUTPUT 718;"TH -40;"` | *Sets threshold level to −40 dB.* |
| `50 OUTPUT 718;"TS;"` | *Sweeps trace A.* |
| `60 OUTPUT 718;"MEANTH TRA?;"` | *Returns the mean value of trace A above the threshold to the computer.* |
| `70 ENTER 718;Number` | *Assigns value to computer variable, Number.* |
| `80 DISP "MEAN OF TRACE A ABOVE THE THRESHOLD IS ";Number` | *Displays result on the computer screen.* |
| `90 END` | |

## Description

MEANTH returns the mean value of the trace above the threshold; MEAN returns the mean value of the trace, regardless of the threshold level. MEANTH returns a "0" if there is not a signal above the threshold.

Use TH (threshold) to set the threshold level.

## Query Response



# MEASOFF
# Measurement Off

Turns off the current measurement, erases the display, and then displays the MEAS/USER menu.

## Syntax


MEASOFF

Equivalent Softkey: `MEAS OFF`.

Related Commands: ACP, ACPE, ACPGRAPH, CHP, OBW.

## Example

`OUTPUT 718;"MEASOFF;"` *Turns off the current measurement.*

## Description

If ACPPAR is set to automatic, executing MEASOFF returns the following spectrum analyzer settings back to their premeasurement settings:

- Frequency span, resolution bandwidth, video bandwidth, center frequency step size, and sweep time.
- Detector mode.
- Amplitude scale.

MEASOFF does *not* do any of the following:

- Change the values of the channel spacing (ACPSP) or the channel bandwidth (ACPBW).
- Restore the trace contents, trigger mode, amplitude units, and any trace math functions (see Table 5-4 for a list of the trace math functions) to their premeasurement state.

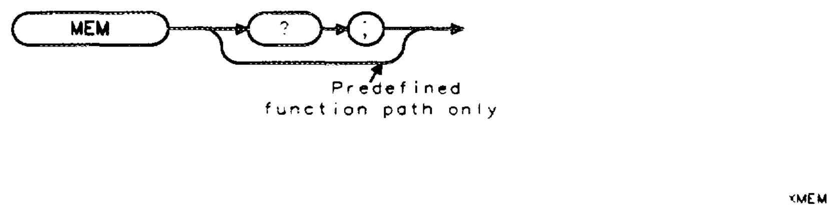
You should execute MEASOFF when you no longer want to use any of the power menu functions. (The power menu functions are ACP, ACPE, ACPGRAPH, CHP, and OBW).

MEASOFF may also turn off some other spectrum analyzer measurements. For example, MEASOFF also turns off FFTCONTS, FFTAUTO, FFTSNGLS, NDBPNT, PCTAM, GDRVUTIL, and TOI.

# MEM
# Memory Available

Returns the amount of spectrum analyzer memory available.

## Syntax




Related Commands: ACTDEF, DISPOSE, ERASE, FUNCDEF, LOAD, ONDELAY, ONEOS, ONTIME, ONSRQ, ONSWP, TRCMEM, TRDEF, TRMATH, VARDEF.

## Example

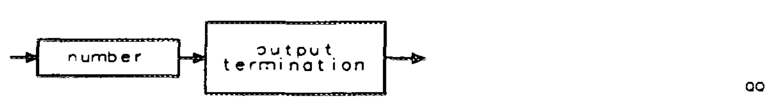
| | |
|---|---|
| `10 OUTPUT 718;"MEM?;"` | *Queries the amount of user-allotted memory available.* |
| `20 ENTER 718;How_much_memory` | *Sends response from spectrum analyzer to the computer.* |
| `30 DISP How_much_memory` | *Displays the amount of available memory.* |
| `40 END` | |

## Description

Functions that affect the amount of user-allotted memory include: ACTDEF, FUNCDEF, ONDELAY, ONEOS, ONSRQ, ONSWP, ONTIME, TRDEF, TRMATH, VARDEF.

The MEM command returns the number of bytes of user-allotted spectrum analyzer memory to the controller.

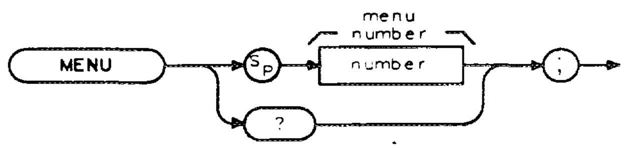
## Query Response



# MENU
# Menu

Selects and displays the softkey menus on the spectrum analyzer screen.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 1, 101 to 200. |

Related Commands: DISPOSE, ERASE, KEYDEF, KEYLBL, SAVEMENU.

## Example 1

| | |
|---|---|
| `OUTPUT 718;"MENU 1;"` | *Displays menu 1 on the spectrum analyzer screen.* |

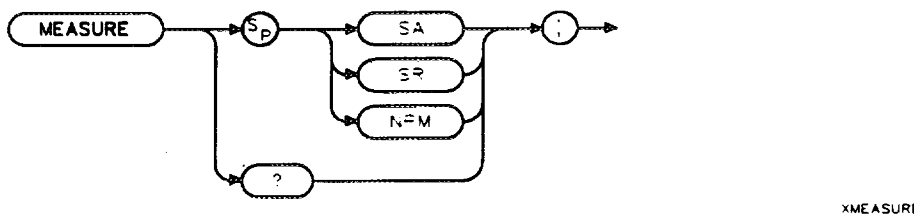
## Example 2

| | |
|---|---|
| `10 OUTPUT 718;"KEYDEF 1,!IP;CF 300MHZ;SP 100MHZ; MKPK HI;!,@SETUP|#1@;"` | *Defines softkey 1.* |
| `20 OUTPUT 718;"KEYDEF 2,!IP;CF 600MHZ;SP 100MHZ; MKPK HI;!@SETUP|#2@;"` | *Defines softkey 2.* |
| `30 OUTPUT 718;"KEYDEF 3,!IP;CF 900MHZ;SP 100MHZ; MKPK HI;!,@SETUP|#3@;"` | *Defines softkey 3.* |
| `40 OUTPUT 718;"KEYDEF 4,!SNGLS;TS;MKPK HI;MKD;MKMIN;!,@FIND|DELTA@;"` | *Defines softkey 4.* |
| `50 OUTPUT 718;"KEYDEF 5,!MKOFF ALL; CONTS;!,@RESUME|SWEEP@;"` | *Defines softkey 5.* |
| `60 OUTPUT 718;"KEYDEF 6,!MENU 102! ,@MORE|SETUPS@;"` | *Defines softkey 6.* |
| `70 OUTPUT 718;"KEYDEF 607,!FA 88MHZ;FB 108MHZ; MKPK HI;DEMOD ON;DEMOD FM;MENU 1;!,@FM |DEMOD@;"` | *Defines softkey 607. Softkey 607 is accessed by executing MENU 102 (see programming line 60).* |
| `80 OUTPUT 718;"KEYDEF 608,!FA 10KHZ;FB 88MHZ; MKPK HI;DEMOD ON;DEMOD AM;MENU 1;!,@AM |DEMOD@;"` | *Defines softkey 608. Softkey 608 is accessed by executing MENU 102 (see programming line 60).* |

# MEASURE
# Measure Mode

Determines what kind of measurements the spectrum analyzer makes: signal analysis, stimulus response, or signal normalization.

## Syntax




Option Required: Option 010 or 011.
Related Commands: Commands affecting amplitude, such as AUNITS, DL, INZ, LN, MKA, MKREAD, MKRL, RL, RLPOS, ROFFSET, TH.
Preset State: MEASURE SA.

## Example

Activate the tracking-generator source output.

| | |
|---|---|
| `OUTPUT 718;"MEASURE SR;"` | *Sets spectrum analyzer to stimulus-response mode.* |
| `OUTPUT 718;"SRCPWR -10DM;"` | *Makes the tracking generator source power the active function.* |

## Description

"MEASURE SA;" activates spectrum analysis and auto couples the spectrum analyzer functions. If AMB ON or AMBPL ON and RLPOS have been executed prior to MEASURE SA, MEASURE SA turns off the reference level position. When normalization is off, all amplitude units are specified in absolute values determined by:

- Amplitude units (AUNITS).
- Reference level (RL).
- Reference-level offset (ROFFSET).
- Input impedance (INZ).
- Logarithm scale (LG).
- Linear scale (LN).
- Amplitude Correction (AMPCOR).

"MEASURE SR;" activates stimulus-response measurements and uncouples the sweep time for faster sweep times. If AMB ON or AMBPL ON and RLPOS are executed, MEASURE SR activates the reference level position. When normalization is used, amplitude units are specified relative to the display level.

During this relative-amplitude mode, the following parameters are in dB:

- Trace data (TRA, TRB, TRC).
- Display line (DL).
- Threshold (TH).

- Marker amplitude (MKA).

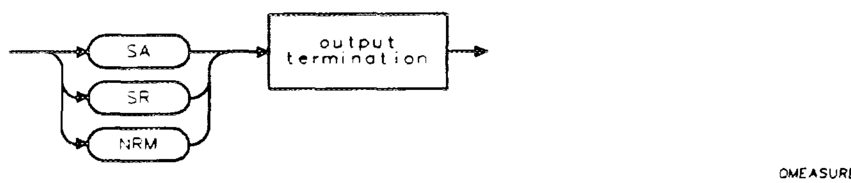
"MEASURE NRM;" recouples the sweep time for accurate signal analysis measurements. If AMB ON or AMBPL ON and RLPOS are executed, MEASURE NRM activates the reference level position.

See "RLPOS" for more information about changing the reference level position.

When used as a predefined variable, MEASURE returns a value depending on the setting of the MEASURE parameter.

| LIMIMODE Parameter | Value Returned |
|---|---|
| SA | 0 |
| SR | 1 |
| NRM | 2 |

## Query Response



## Description

When using the KEYDEF, KEYENH, or KEYCMD commands, you need to specify the softkey number. The softkey number corresponds to the menu number as follows:

softkey number = (menu number − 1) × 6 + softkey position
(The softkey position range is 1 through 6.)

For example:

Menu 1 contains softkey numbers 1 through 6
Menu 101 contains softkey numbers 601 to 606
Menu 200 contains softkey numbers 1195 to 1200

Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** . Menus 101 through 200, as well as menu 1, can be accessed using the MENU command. The MENU command is a useful way to "link" softkey menus together. For example, example 2 shows how menu 1 (with softkeys 1 through 6) can be used to access menu 102 (with softkeys 607 and 608). Menu 1 can be accessed by pressing (MEAS/USER), **User Menus** .

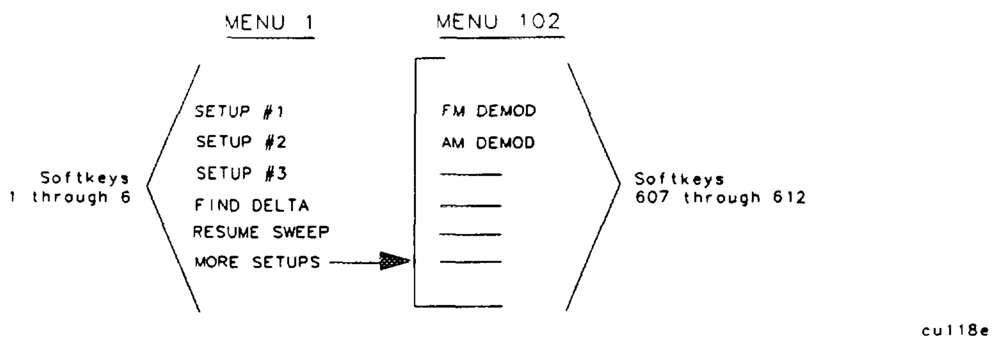
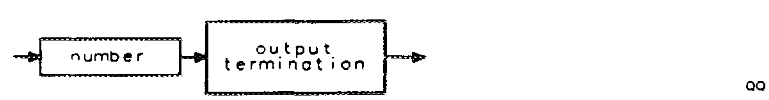



**Figure 5-7. Using the MENU Command**

The menu numbers 1 and 101 through 200 are the recommended menus available for the user to use.

Executing "MENU 0;" clears the softkey menu from the spectrum analyzer screen.

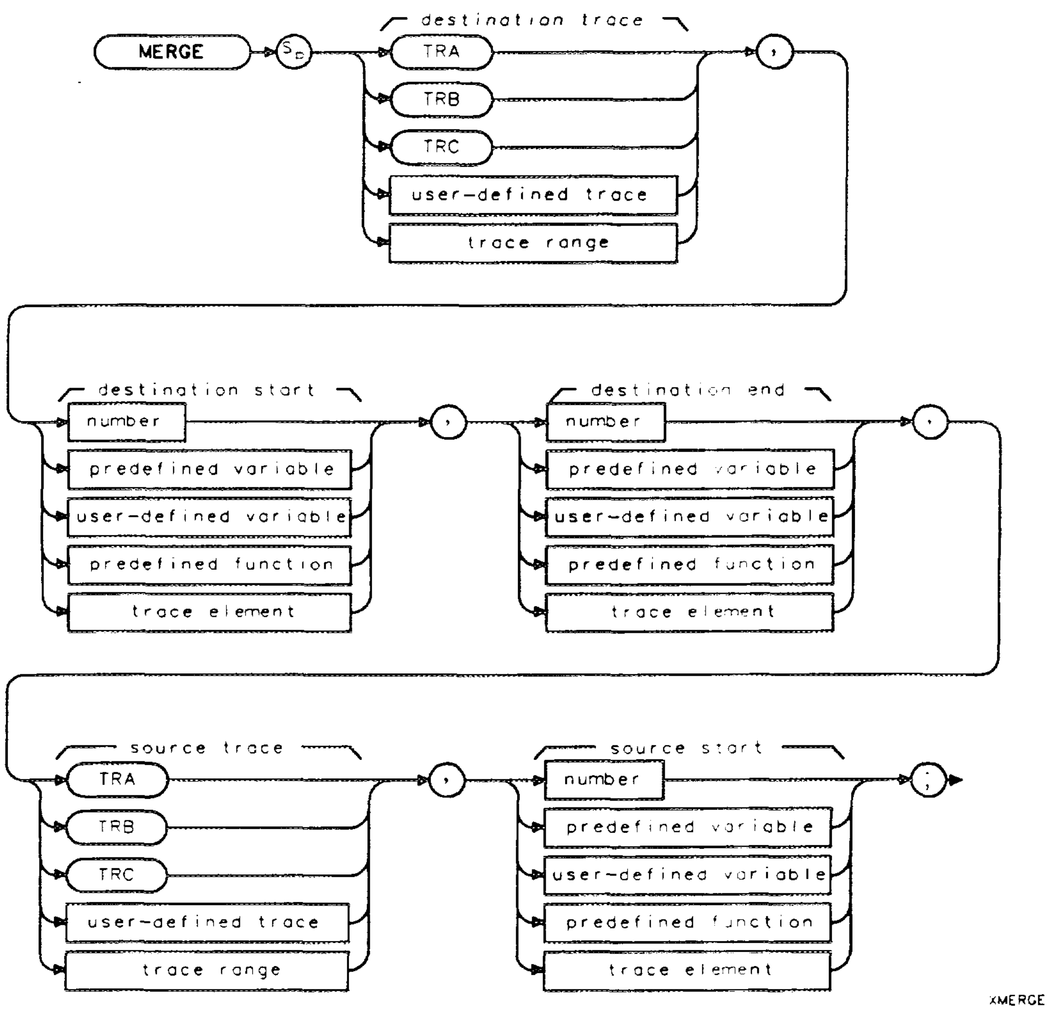
## Query Response



# MERGE
# Merge Two Traces

Merges the source trace into the specified area of the destination trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer number. | −32,768 to +32,767. |

Related Commands: All other trace math commands. See Table 5-4 for a list of trace math commands.

## Example

| | |
|---|---|
| `OUTPUT 718;"MERGE TRC,1,200,TRA,200;"` | *Merges trace A into trace C. The trace A elements 200 through 399 are merged into trace C elements 1 through 200.* |

## Description

MERGE copies the trace data from the source trace, starting at the specified trace element, into the specified trace elements of the destination trace. MERGE differs from CONCAT because MERGE does not need the trace range of the source to be specified. If the source is not a trace, its value is copied to the destination trace. If the destination segment is longer than the specified source segment, the last element of the source trace is repeated to fill the destination.

# MF
# Marker Frequency Output

Returns the frequency (or time) of the on-screen active marker.

## Syntax


XMF

Related Commands: MA, MKA, MKCF, MKD, MKF, MKN, MKPK, MKREAD.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `OUTPUT 718;"IP;SNGLS;"` | *Initializes the spectrum analyzer, activates single-sweep mode.* |
| `OUTPUT 718;"FA 280MHZ;FB 320MHZ;TS;"` | *Sets up the measurement range.* |
| `OUTPUT 718;"MKN;MKPK HI;"` | *Places marker on peak of calibrator signal.* |
| `OUTPUT 718;"MF;"` | *Takes frequency of marker.* |
| `ENTER 718;A` | *Returns frequency to the computer.* |
| `PRINT A` | *Prints the frequency on the computer screen.* |

## Description

The MF command returns the frequency of the active marker to the controller if the marker is on screen. In delta marker mode, nonzero span, "MF;" returns the frequency difference between the two markers. In zero span, "MF;" returns the marker time, or the delta marker time.

The data that is returned by "MF;" depends on many command conditions including TDF, MKREAD, and MDS.

If the trace data format P is used with MF, the result is one real value in time units or frequency units, depending on the marker readout format. (See "MKREAD.")

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF P;MKREAD FRQ;MF;"` | *This returns a frequency value (in Hz) if not in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD FRQ;MF;"` | *This returns a time value (in seconds) if in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD PER;MF;"` | *This returns the time value (in seconds) of 1/(marker frequency).* |
| `OUTPUT 718;"TDF P;MKREAD SWT;MF;"` | *This returns the marker time value (in seconds).* |
| `OUTPUT 718;"TDF P;MKREAD IST;MF;"` | *This returns the frequency value (in Hz) for 1/(marker time).* |
| `OUTPUT 718;"TDF P;MKREAD FFT;MF;"` | *This returns the frequency value (in Hz).* |

If the trace data format is used with trace data format A, the result depends on the setting of the MDS command.

## Example

```
OUTPUT 718;"TDF A;MDS B;MF;"
```
*Returns one byte representing the marker position. The byte can assume values 1 to 101.*

```
OUTPUT 718;"TDF A;MDS W;MF;"
```
*Returns two bytes in a binary word format that has a value from 1 to 401.*

If the trace data format is used with trace data format M, the result is the marker horizontal position value, from 1 to 401, in ASCII.

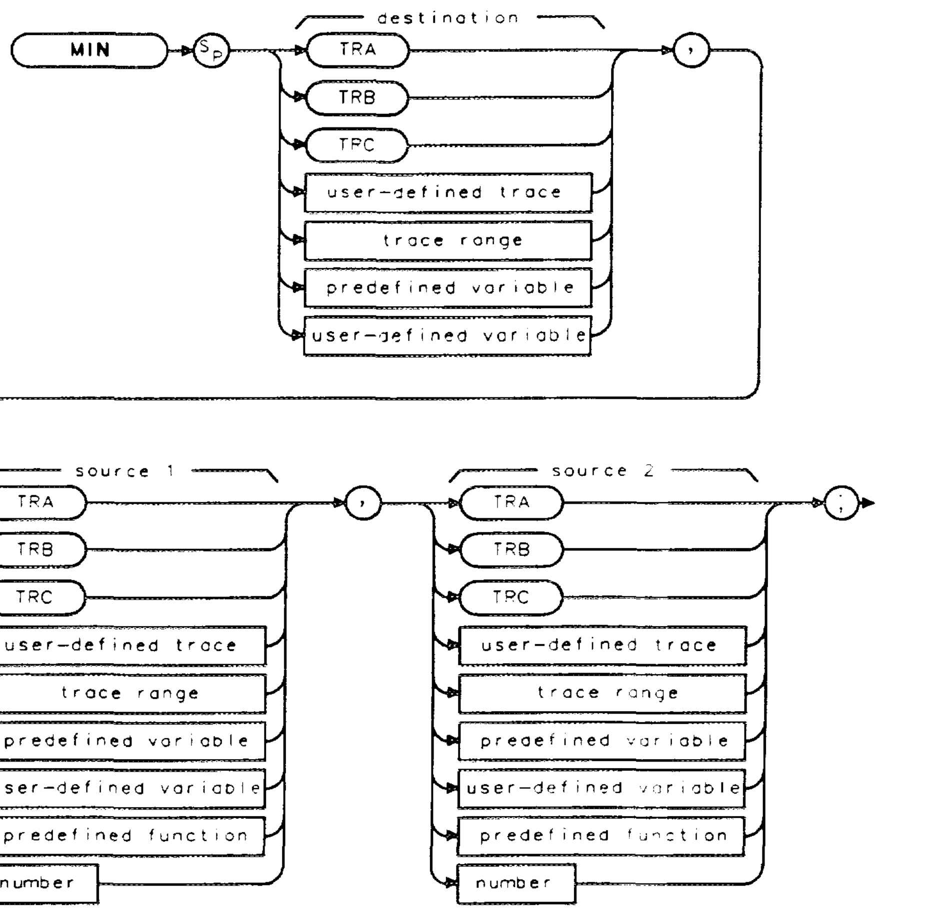
## Example

```
OUTPUT 718;"TDF M;MF;"
```
*Returns marker horizontal position value in ASCII.*

# MIN
# Minimum

Compares source 1 and 2, point by point, and stores the lesser of the two in the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF when using a user-defined variable. TS when using trace data.
Related Commands: MINPOS, MXM, TS.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;"` | *Activates the single-sweep mode.* |
| `30 OUTPUT 718;"VARDEF M_INIMUM,0;"` | *Defines variable with an initial value of 0.* |
| `40 OUTPUT 718;"TS;MKPK HI;";` | *Sweeps trace A and places the marker at the highest peak.* |
| `50 OUTPUT 718;"MIN M_INIMUM,MKA,-20;";` | *Compares the marker amplitude to −20 dBm. Stores the lesser of the two in M_INIMUM.* |
| `60 OUTPUT 718;"M_INIMUM?;"` | *Returns the result to the computer.* |
| `70 ENTER 718;Number` | *Puts the result in the computer variable, Number.* |
| `80 DISP Number` | *Displays the result.* |
| `90 END` | |

## Description

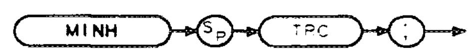
If one of the sources is a single value, it acts as a threshold, and all values equal to or less than the threshold pass to the destination. The values larger than the threshold are replaced by the threshold value in the destination.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MINH
# Minimum Hold

Updates trace C with the minimum level detected.

## Syntax




XMINH

Equivalent Softkey: **MIN HOLD C**.
Related Commands: BLANK, CLRW, MXMH, VAVG, VIEW.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example

| | |
|---|---|
| `OUTPUT 718;"CLRW TRC;CONTS;"` | *Clears trace C and begin taking data.* |
| `OUTPUT 718;"MINH TRC;"` | *Updates trace C with the minimum level detected.* |

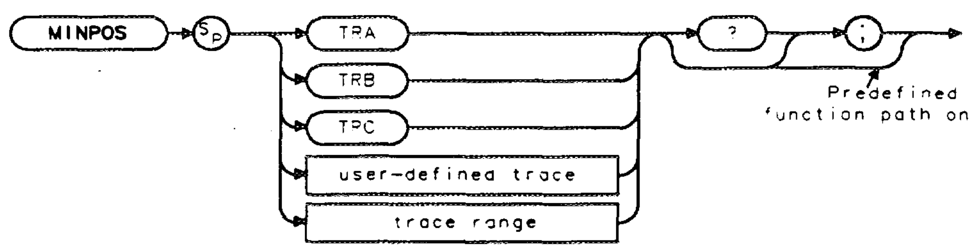
## Description

MINH updates trace C with a new value from a detector only if the new value is smaller than the previous trace data value.

# MINPOS
# Minimum Position

Returns a value, which is the $x$-axis position (in display units) of the minimum amplitude value in trace A, trace B, trace C, or user-defined trace.

## Syntax




XMINPOS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace ACTDEF. TS when using trace data.
Related Commands: MIN, MKMIN, PKPOS.

## Example

```
10 OUTPUT 718;"IP;"                Initializes spectrum analyzer.
20 OUTPUT 718;"MINPOS TRA;"        Finds the minimum value of trace A.
30 ENTER 718;Number                Returns value to the computer.
40 DISP Number                     Displays result.
50 END
```

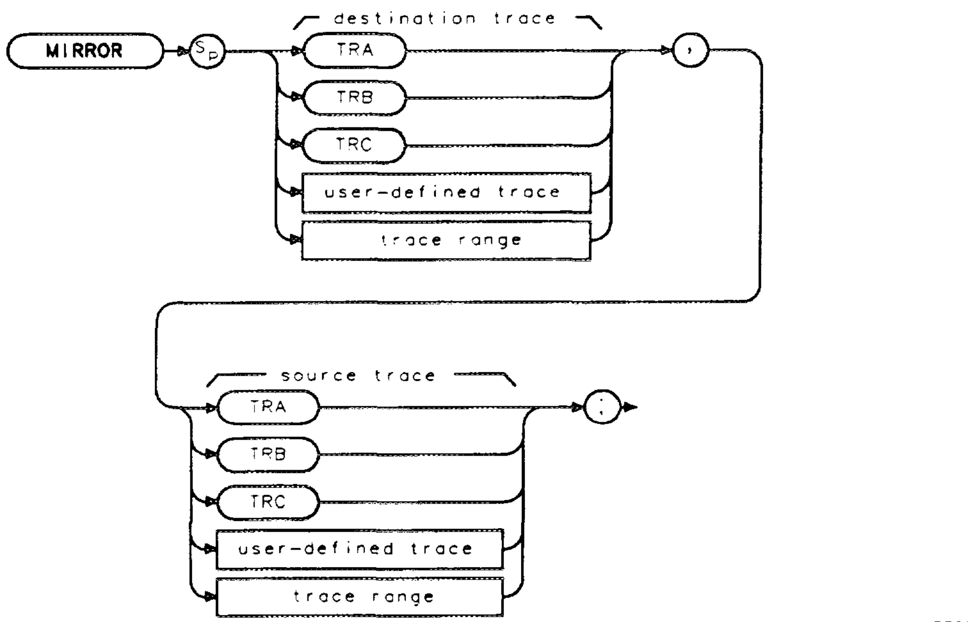
## Description

If a trace range is used with MINPOS, MINPOS returns a value relative to the first element of the trace range. For example, if a trace has a range of 150 to 300 elements, and the minimum value is element 200, MINPOS will return the value of 51.

# MIRROR
# Mirror Image

Displays the mirror image of the trace.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.

## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"SNGLS;" | *Activates the single-sweep mode.* |
| 30 OUTPUT 718;"TS;" | *Takes sweep.* |
| 40 OUTPUT 718;"BLANK TRA;" | *Blanks trace A from spectrum analyzer screen.* |
| 50 OUTPUT 718;"MIRROR TRB,TRA;" | *Moves the mirror image of trace A into trace B.* |
| 60 OUTPUT 718;"VIEW TRB;" | *Displays the result.* |
| 70 END | |

## Description

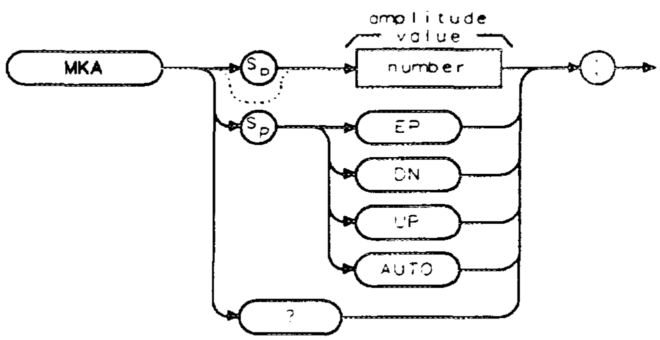
The MIRROR command stores the mirror image (with respect to the frequency axis) of a source trace in a destination trace.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# MKA
# Marker Amplitude

Specifies the amplitude of the active marker in the current amplitude units when marker type is of fixed or amplitude type. When queried, MKA returns the marker amplitude independent of marker type.

## Syntax




XMKA

| Item | Description/Default | Range |
| --- | --- | --- |
| Number | Any real or integer number. Unit is current amplitude type. | Amplitude range of spectrum analyzer. |

Step Increment: by 1 dB.
Related Commands: AUNITS, AUTO, MA, MKD, MKN, MKTYPE, TDF.

## Example

```
OUTPUT 718;"IP;"              Initializes the spectrum analyzer.
OUTPUT 718;"MKTYPE AMP;"      Changes the marker type to amplitude.
OUTPUT 718;"MKA -50;"         Places the marker at -50 dBm.
```

## Description

The MKA command specifies the amplitude of the active marker in current units when the marker is the fixed or amplitude type (see "MKTYPE"). If both the delta marker and active marker are on the screen, "MKA?;" returns the amplitude difference between the two markers. Specifying the marker amplitude moves the marker to the point of the trace closest to the given marker amplitude.

If the trace data format P (TDF P), is used with MKA, the result is one real value in the current amplitude units (AUNITS can be used to change the current amplitude units).

## Example

```
OUTPUT 718;"TDF P;AUNITS DBM;MKA?;"
```
*This returns the amplitude value of the marker (amplitude unit is dBm).*

If the trace data format is used with trace data format A, the result depends on the setting of the MDS command.

## Example

```
OUTPUT 718;"TDF A;MDS B;MKA?;"
```
*Returns one byte representing the marker vertical position (−32,768 to 32,767) divided by 32 and then ANDed with 255.*

```
OUTPUT 718;"TDF A;MDS W;MKA?;"
```
*Returns two bytes in a binary word format that has a value from −32,768 to 32,767. The value represents the binary trace amplitude value.*

Using the trace data format I is equivalent to the TDF A format. If the trace data format is used with trace data format M, the result is returned in ASCII measurement units (−32,768 to 32,767).

## Example

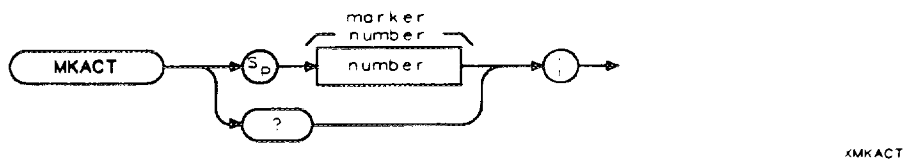
```
OUTPUT 718;"TDF M;MKA?;"
```
*Returns one vertical position value in measurement units.*

## Query Response

# MKACT
# Activate Marker

Specifies the active marker.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. Default value is 1. | 1 to 4. |

Equivalent Softkey: `SELECT 1 2 3 4`.
Related Commands: MA, MKA, MKF.

## Example

`OUTPUT 718;"MKACT 4;"` *Marker 4 becomes marker 1.*

## Description

There can be four different markers, but only one marker can be active at any time.

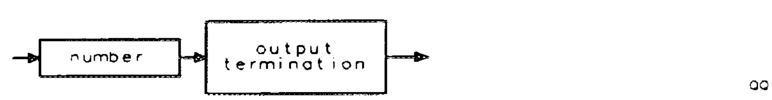
When this command is used, the following results occur:

- The marker number supplied by the command is made marker 1, the active marker.
- If the marker number is not already on, the marker is turned on with preset type (position), and the marker is placed at center screen. The trace chosen is the first displayed trace found: trace A, trace B, trace C.

**Note** Using MKACT replaces marker 1 with the new marker function. The amplitude and frequency for the previous marker are not saved.

## Query Response

"MKACT?;" returns the marker number.



# MKACTV
# Marker As the Active Function

Makes the current active marker the active function.

## Syntax


XMKACTV

Equivalent Softkey: MKACTV is equivalent to turning on a marker with **MARKER <number> ON OFF** (ON is underlined).

Related Commands: MKACT, MKN, MKTYPE.

## Example

```
OUTPUT 718;"MKACT 2;"     Makes marker number 2 the active marker.
OUTPUT 718;"MKACTV;"      Makes marker number 2 the active function.
```

## Description

If you have more than one marker displayed on the spectrum analyzer display, you need to make the desired marker the active function before you can manipulate the marker.

To make the marker the active function:

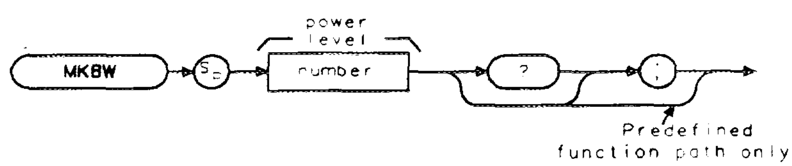
1. Select the desired marker with the MKACT command (MKACT makes the specified marker the active marker).
2. Execute MKACTV to make the active marker the active function.

If there is no active marker, executing MKACTV makes marker 1 the active marker and the active function. MKACTV makes the marker an active function according to its marker type (see "MKTYPE" for more information about marker type).

# MKBW
# Marker Bandwidth

Returns the bandwidth at the specified power level relative to an on-screen marker (if present) or the signal peak (if no on-screen marker is present).

## Syntax




xMKBW

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid negative integer. | 0 to the amplitude of the noise floor. |

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"CF 300MHZ;SP 100MHZ;SNGLS;"` | *Changes the center frequency and span, then activates the single-sweep mode.* |
| `OUTPUT 718;"TS;MKPK HI;"` | *Updates the sweep, places marker on signal peak.* |
| `OUTPUT 718;"MKBW -3;"` | *Uses the MKBW function to find the signal bandwidth at −3 dB below the marker.* |

## Description

The MKBW command also displays (in the message area) the bandwidth at the power level in dB below the current marker position or the current signal peak.

MKBW finds the bandwidth at the specified power level for one measurement sweep. If you want the spectrum analyzer to find the bandwidth at the specified power level during every measurement sweep, use the NDBPNT command instead of MKBW.

# MKCF
# Marker to Center Frequency

Sets the center frequency equal to the marker frequency and moves the marker to the center of the screen.

## Syntax


XMKCF

Equivalent Softkey: **MARKER -> CF** .
Related Commands: CF, MKF.

## Example

This example provides a quick way to center the desired frequency on the spectrum analyzer screen.

| | |
|---|---|
| `10 OUTPUT 718;"IP;SP 1MHZ;SNGLS;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 INPUT "ENTER IN DESIRED STATION FREQUENCY, IN MHZ",Freq` | |
| `30 OUTPUT 718;"CF ";Freq;"MHZ;"` | *Changes spectrum analyzer center frequency.* |
| `40 OUTPUT 718;"TS;MKPK HI;MKCF;TS;"` | *Updates the trace, places marker at the signal peak and centers it on screen.* |
| `60 END` | |

## Description

This command is performed only if an active marker is present on screen.

# MKCONT
# Marker Continue

Resumes the sweep after execution of a MKSTOP command.

## Syntax


XMKCONT

Related Commands: MKSTOP.

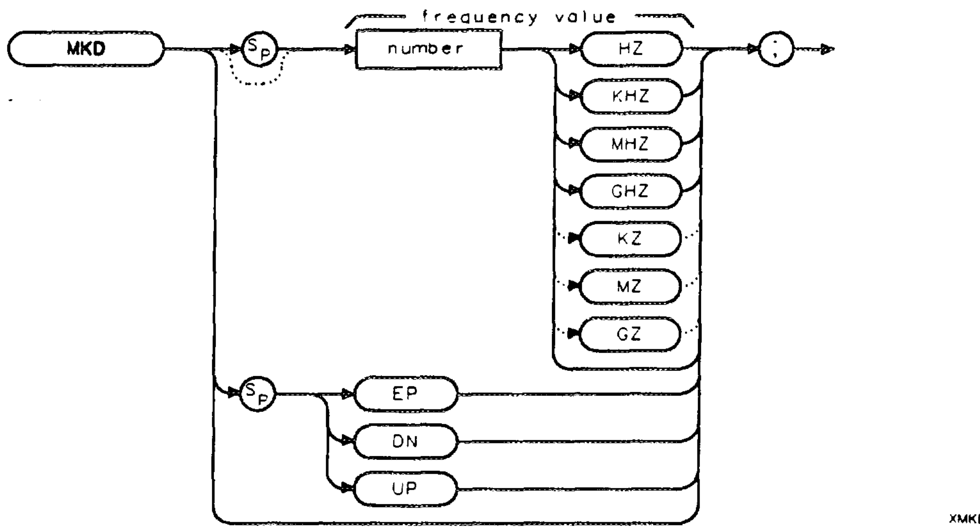
## Example

```
10 OUTPUT 718;"IP;TS;"       Initializes spectrum analyzer.
20 OUTPUT 718;"MKPK HI;"     Creates an active marker.
30 OUTPUT 718;"MKSTOP;"      Stops sweep at marker.
40 OUTPUT 718;"MKCONT;"      Resumes sweep.
50 END
```

# MKD
# Marker Delta

Activates the delta marker.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz, default value is value of the active marker. | Start frequency to stop frequency of spectrum analyzer. |

Equivalent Softkey: **MARKER Δ** .
Step Increment: by 1/10 of the frequency span.
Related Commands: AUTO, MA, MKCF, MKF, MKN, MKSP, MKSS, MKPK.

## Example

```
10 OUTPUT 718;"IP;"          Initializes spectrum analyzer.
20 OUTPUT 718;"MKMIN;"       Places a marker at the minimum amplitude of trace.
30 OUTPUT 718;"MKD;"         Activates marker delta.
40 OUTPUT 718;"MKPK HI;"     Places marker at highest amplitude of trace.
50 OUTPUT 718;"MKSP;"        Changes span to the values of the left and right markers.
60 END
```

## Description

The MKD command computes the frequency and amplitude difference of the active marker and a special marker, called the delta or differential marker. These values are displayed in the display readout.

The differential value of the frequency is equal to the active marker frequency minus the delta marker frequency. The differential value of the amplitude is equal to the active marker amplitude minus the delta marker amplitude.

If an active marker is not on the screen, MKD positions an active marker at center screen. If a delta marker is not on the screen, MKD places one at the specified frequency, or at the current active marker. If the active marker is in amplitude mode, the delta marker is placed at the same amplitude as the active marker (or a specified value).

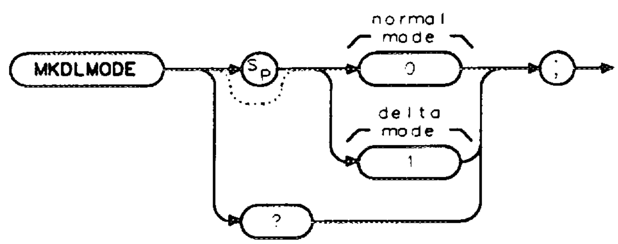
To read the amplitude, use MKA?. To read the frequency, use MKF? The results are displayed on the spectrum analyzer screen.

In linear mode, MKD computes the ratio of the amplitudes of the active and delta markers rather than the difference. This results in similar treatment for logarithmic and linear data because the delta of the difference of two logarithmically generated numbers results in the logarithmically generated value of the ratio of the two numbers. (You should not change amplitude units when making a marker delta measurement, however.)

# MKDLMODE
# Marker Delta Display Line Mode

When the marker table is turned on, MKDLMODE selects if the marker amplitude values are shown as relative to the reference level (normal mode) or relative to the display line (delta mode).

## Syntax




XMKDLMODE

Equivalent Softkey: **TABLE ΔDL NRM** .
Preset State: 0 (normal mode).
Related Commands: DL, MKTBL.

## Example

```
OUTPUT 718;"MOV MKTBL,1;"
OUTPUT 718;"DL -20;"
OUTPUT 718;"MOV MKDLMODE,1;"
```

| | |
|---|---|
| OUTPUT 718;"MOV MKTBL,1;" | *Turns on the marker table.* |
| OUTPUT 718;"DL -20;" | *Sets the display line.* |
| OUTPUT 718;"MOV MKDLMODE,1;" | *Displays the marker amplitudes values relative to the display line.* |

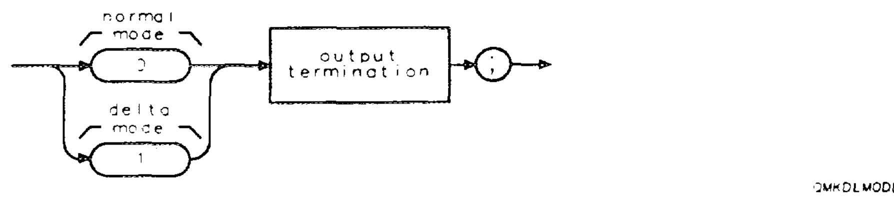
## Description

If MKDLMODE is set to 0, the spectrum analyzer displays absolute marker amplitudes or marker delta amplitudes (normal mode). If MKDLMODE is set to 1, the spectrum analyzer displays the marker amplitudes relative to the display line (delta mode). Setting MKDLMODE to 1 turns on the display line automatically. Use the DL command to place the display line.

MKDLMODE determines the way the marker amplitudes are displayed in the marker table only, it does not change the marker amplitude values that are returned remotely.

You can execute the MKDLMODE command two different ways. You can either execute the MKDLMODE command directly (for example, "MKDLMODE 1;") or use the MOV command to move the 1 or 0 into the MKDLMODE command (for example, "MOV MKDLMODE,1;"). If you use the MOV command, no text is displayed in the active function area during command execution.

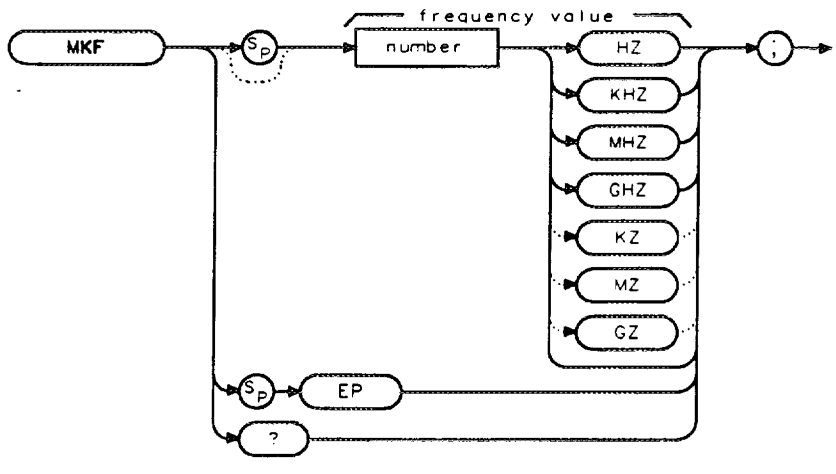
## Query Response



# MKF
# Marker Frequency

Specifies the frequency value of the active marker.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Start frequency to stop frequency of spectrum analyzer. |

Related Commands: AUTO, MKA, MKD, MKCF, MKPK.

## Example

`OUTPUT 718;"MKF 600MHZ;"` *Places an active marker at 600 MHz.*

## Description

In nonzero frequency spans, MKF returns the active marker frequency as a real number when MKF is queried. In zero span, "MKF?;" returns the time value.

The data that is returned by MKF depends on many command conditions, including TDF, MKREAD, and MDS.

**MKF results with TDF set to P:** If the trace data format P is used with MKF, the result is one real value in time units or frequency units, depending on MKREAD.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF P;MKREAD FRQ;MKF?;"` | *This returns a frequency value (in Hz) if not in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD FRQ;MKF?;"` | *This returns a time value (in seconds) if in zero-span.* |
| `OUTPUT 718;"TDF P;MKREAD PER;MKF?;"` | *This returns the time value (in seconds) of 1/(marker frequency).* |
| `OUTPUT 718;"TDF P;MKREAD SWT;MKF?;"` | *This returns the marker time value (in seconds).* |
| `OUTPUT 718;"TDF P;MKREAD IST;MKF?;"` | *This returns the frequency value (in Hz) for 1/(marker time).* |
| `OUTPUT 718;"TDF P;MKREAD FFT;MKF?;"` | *This returns the frequency value (in Hz).* |

**MKF results with TDF set to A or I:** If the trace data format is used with trace data format A, the result depends on the setting of the MDS command.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF A;MDS B;MKF?;"` | *Returns one byte representing the marker position.* |
| `OUTPUT 718;"TDF A;MDS W;MKF?;"` | *Returns two bytes in a binary word format that has a value from 1 to 401.* |

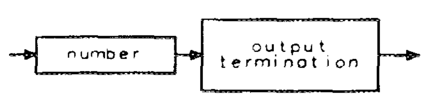
Using the trace data format I is equivalent to the TDF A format.

**MKF results with TDF set to M:** If the trace data format is used with trace data format M, the result is the marker horizontal position value, from 1 to 401, in ASCII.

## Example

| | |
|---|---|
| `OUTPUT 718;"TDF M;MKF?;"` | *Returns marker horizontal position value in ASCII.* |

## Query Response

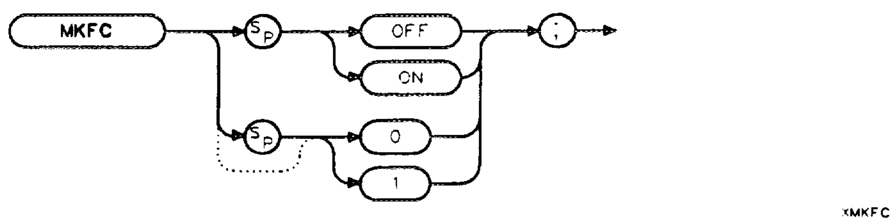



QQ1

# MKFC
# Marker Counter

Turns on or off the marker frequency counter.

## Syntax




Equivalent Softkey: **MK COUNT ON OFF**.

Model Required: HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or HP 8590D with Option 013.
Related Commands: MKFCR, MKN.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information. Not available with the marker table (MKTBL).

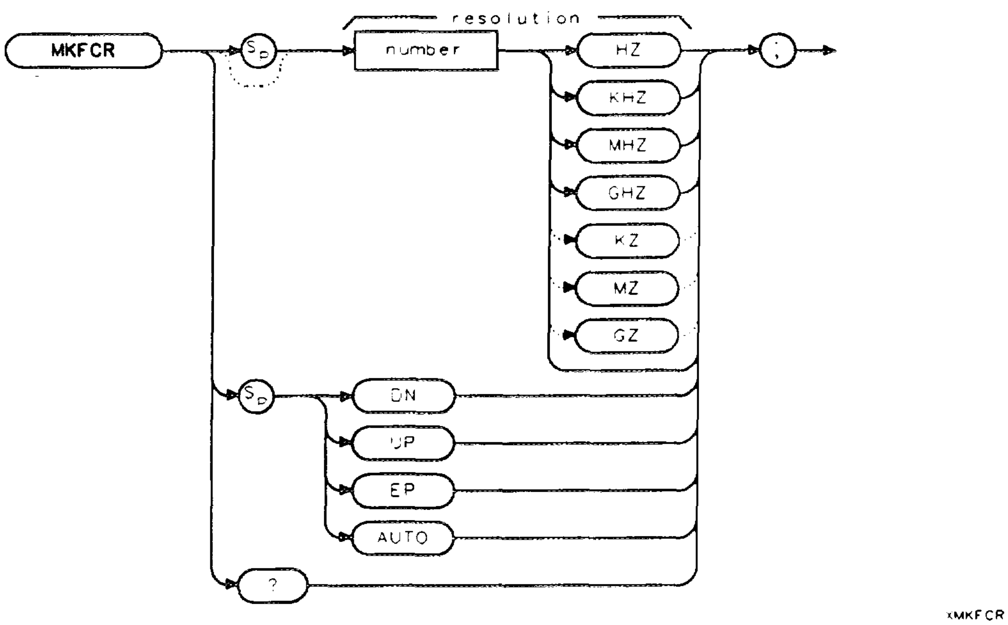
## Example

`OUTPUT 718;"MKFC ON;"` *Turns on the marker counter.*

# MKFCR
# Marker Counter Resolution

Sets the resolution of the marker frequency counter.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | 0 Hz to 100 kHz. |

Equivalent Softkey: **CNT RES AUTO MAN**.

Model Required: HP 8591E, HP 8593E, HP 8594E, HP 8595E, HP 8596E, or HP 8590D with Option 013.

Preset State: Marker counter resolution is set to AUTO. The calculated value for the marker counter resolution is returned if the MKFCR is queried.

Related Commands: AUTO, MKFC.

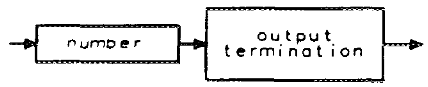
## Example

```
OUTPUT 718;"MKFCR 10KHZ;"    Sets the marker counter resolution to 10 kHz.
OUTPUT 718;"MKFCR?;"         Queries the marker counter resolution.
ENTER 718;A                  Gets the query response.
DISP A                       Displays the marker counter resolution.
```

## Description

Executing either "MKFCR 0;" or "MKFCR AUTO;" auto-couples the marker counter resolution to the frequency span.

## Query Response




QQ1

# MKMIN
# Marker Minimum

Moves the active marker to the minimum value detected.

## Syntax


/MKMIN

Related Commands: MKPK, SMOOTH, TH, VAVG.

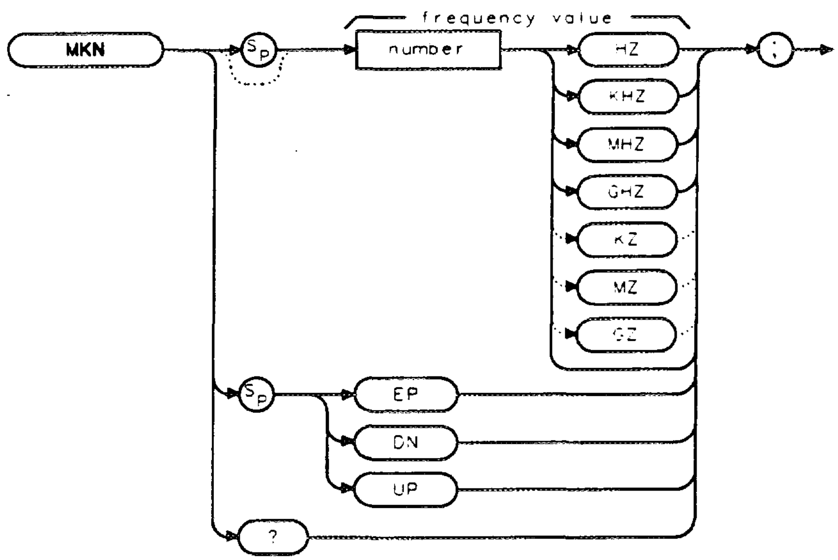
## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;"` | *Initializes spectrum analyzer, activates single-sweep mode.* |
| `20 INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq` | |
| `30 INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq` | |
| `40 OUTPUT 718;"FA ";Start_freq;"MHZ"` | *Sets the start frequency.* |
| `50 OUTPUT 718;"FB ";Stop_freq;"MHZ"` | *Sets the stop frequency.* |
| `60 OUTPUT 718;"TS;MKPK HI;MKD;MKMIN;MKF?;"` | *Updates trace, finds trace peak, turns on marker delta function, finds the minimum value of trace, and return the frequency delta.* |
| `70 ENTER 718;Delta_freq` | *Gets the result from spectrum analyzer.* |
| `80 PRINT "DIFFERENCE IN FREQUENCY IS ", Delta_freq,"HZ"` | |
| `90 END` | |

# MKN
# Marker Normal

Activates and moves the marker to the specified frequency.

## Syntax




XMKN

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. Default value is the center frequency of the spectrum analyzer. | Start frequency to stop frequency of spectrum analyzer. |

Equivalent Softkey: **MARKER NORMAL** .
Step Increment: by 1/10 of the frequency span.
Related Commands: AUTO, DEMOD, MKA, MKD, MKF, MKPK.

## Example

```
10 INPUT "ENTER IN THE START FREQUENCY, IN MHZ",Start_freq
20 INPUT "ENTER IN THE STOP FREQUENCY, IN MHZ",Stop_freq
30 OUTPUT 718;"IP;FA ";Start_freq;"MHZ"
```
*Initializes spectrum analyzer and changes the start frequency.*

```
40 OUTPUT 718;"FB ";Stop_freq;"MHZ"
```
*Changes the stop frequency.*

```
50 OUTPUT 718;"MKN EK;"
```
*Enables the front-panel knob.*

```
60 PRINT "PLACE MARKER ON THE DESIRED SIGNAL"
70 PRINT "PRESS HOLD THEN PRESS CONTINUE"
80 PAUSE
```

**MKN Marker Normal**

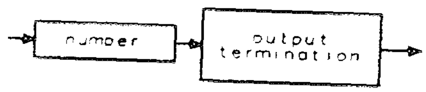
```
90  OUTPUT 718;"MKN?;"
100 ENTER 718;Mkr
110 PRINT "MARKER FREQUENCY IS ",Mkr,"Hz"
120 END
```

*Gets the frequency of the marker.*
*Puts the frequency value into the computer variable, Mkr.*
*Prints the result.*

## Description

In nonzero span, "MKN?;" returns the frequency value. In zero span, "MKN?;" returns the time value.

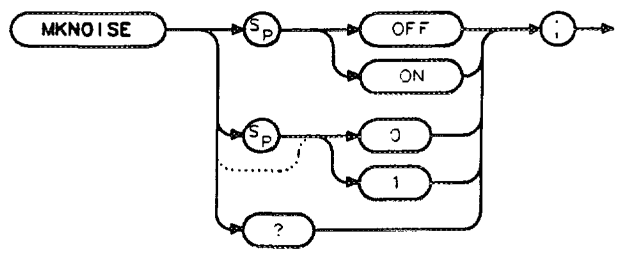
## Query Response



# MKNOISE
# Marker Noise

Displays the average noise level at the marker.

## Syntax




XMKNOISE

Restrictions: Not available with the marker table (MKTBL).
Equivalent Softkey: **MK NOISE ON OFF**.
Related Commands: MKA, MKF, MKMIN, MKN.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 300MHZ;SNGLS;"` | *Initializes spectrum analyzer, changes center frequency, activates single-sweep mode.* |
| `OUTPUT 718;"SP 10MHZ;DET SMP;TS;"` | *Changes span, activates sample detector, updates trace.* |
| `OUTPUT 718;"MKPK HI;MKA?;"` | *Places marker on highest point of trace, queries marker amplitude.* |
| `ENTER 718;Amp_one` | *Puts the spectrum analyzer response in the computer variable, Amp_one.* |
| `OUTPUT 718;"MKD UP;UP;MKNOISE ON;MKA?;"` | *Moves marker and turns on the marker noise function.* |
| `ENTER 718;Amp_two` | *Puts the spectrum analyzer response in the computer variable, Amp_two.* |
| `OUTPUT 718;"MKNOISE OFF;"` | *Turns off the marker noise function.* |
| `DISP Amp_two` | *Displays the result.* |
| `C_to_n=Amp_one - Amp_two` | *Calculates the carrier to noise ratio.* |
| `PRINT "CARRIER TO NOISE RATIO IN 1 HZ BANDWIDTH IS ";C_to_n` | *Outputs result.* |
| `PRINT " DB"` | |

## Description

The marker value is normalized to a 1-Hz bandwidth. Use "MKA?;" to read the noise marker value.

The noise marker averages 32 trace data values about the location of the marker on the frequency or time scale. The 32 values averaged, except for the first 15 or last 14 values in the trace, commence with the 16th point to the left of the marker, and end with the 15th point to the right of the marker. Note that the data values averaged are not exactly symmetrical with respect to marker position. At the trace end points, the spectrum analyzer uses the nearest 32 data values. So while the marker may be moved to trace position 1 to 15, the actual amplitude value returned will be the same value for any marker position from 1 to 15. A similar situation applies for markers at the end of the trace.

A nominal correction for equivalent noise bandwidths is made by the firmware based on a nominal 3 dB resolution bandwidth. The firmware assumes the noise bandwidth is 1.12 times the resolution bandwidth. This means the shape of the resolution bandwidth filters cause the noise power to be overstated by 1.12 times. The detection mode also affects the measurement. If in log mode, the log detector understates the noise response. To compensate, 2.5 dB is added to the measurement. If the detector is in linear mode, the firmware uses 1.05 dB as a correction value.

In log detector mode, the final reported value will then be, with the result reported in dBm in a 1-Hz bandwidth:

(Averaged value over 32 values) − 10 × (log[1.12 × Resolution bandwidth]) + 2.5 dB

In linear detector mode (dBm) units, the final reported value will then be, with the result reported in dBm in a 1-Hz bandwidth:

(Averaged value over 32 values) − 10 × (log[1.12 × Resolution bandwidth]) + 1.05 dB

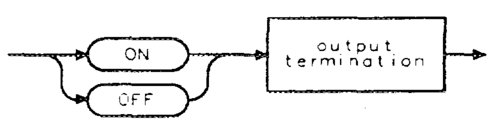
In linear detector mode with the normal display of voltage units, the noise marker voltage value will be related to the present marker voltage by this relation.

$(V\_noise\_marker)^2 = (V\_average)^2 \times 1.12 \times \text{Resolution bandwidth} \times 0.7824$

$V\_noise\_marker = V\_average/(1.12 \times \text{Resolution bandwidth} \times 0.7824)^{0.5}$

$V\_noise\_marker = V\_average \times 1.06633/(\text{Resolution bandwidth})^{0.5}$

## Query Response

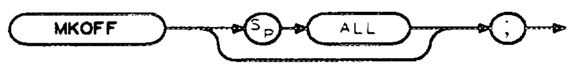



002

# MKOFF
# Marker Off

Turns off either the active marker or all the markers.

## Syntax




XMKOFF

Equivalent Softkey: **MARKER ALL OFF** .
Related Commands: MKA, MKACT, MKACTV, MKCF, MKD, MKF, MKN, MKPK.

## Example

`OUTPUT 718;"MKOFF ALL;"` *Turns off all the on-screen markers.*

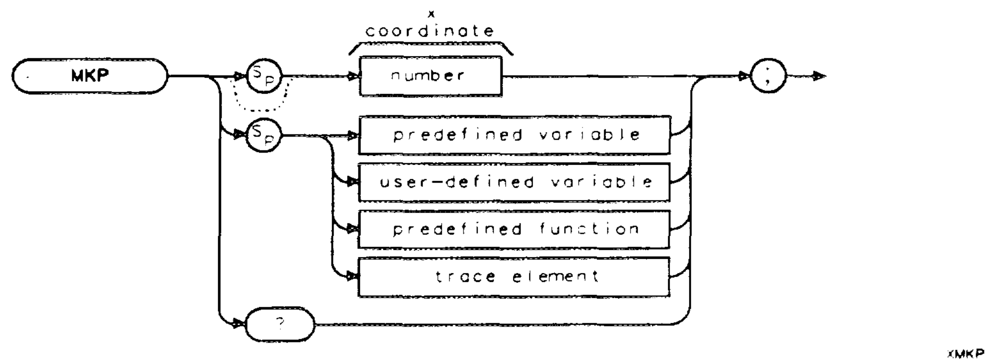
## Description

If the ALL parameter is omitted, only the active marker is turned off.

# MKP
# Marker Position

Places the active marker at the given $x$-coordinate.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | −401 to 401. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: ACTDEF or VARDEF when using a user-defined variable.
Related Commands: MKA, MKCF, MKD, MKMIN.

## Example

```
OUTPUT 718;"IP;"
OUTPUT 718;"MKP 100;"
```

| | |
|---|---|
| OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| OUTPUT 718;"MKP 100;" | *Moves the active marker to a element 100 of trace A.* |

## Description

If no marker is active, the marker is turned on with preset type (position) and marker is placed at the given screen position. The marker is placed on the first displayed trace that is found (in order): trace A, trace B, or trace C.

If the marker delta mode is active, the value of the marker position is relative to the fixed marker, and therefore MKP can return a negative position.

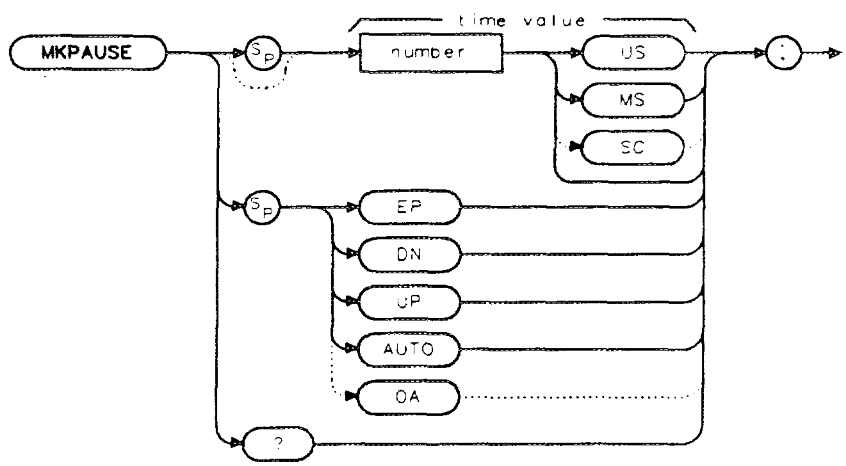
Note that MKP and MKCF commands perform different functions. MKCF sets the center frequency equal to the marker frequency and moves the marker to the center of the screen. MKP places the marker to the position of the element specified.

## Query Response

# MKPAUSE
## Marker Pause

Pauses the sweep at the active marker for the duration of the delay period.

### Syntax




XMKPAUSE

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 2 ms to 100 s. |

Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information. Not available with negative peak detection.

Equivalent Softkey: **MK PAUSE ON OFF** .

Step Decrement: Time value divided by 2.

Step Increment: Time value multiplied by 2.

Related Commands: DEMOD, MKA, MKF, MKFC, MKN, MKOFF, ST.

### Example

`OUTPUT 718;"MKPAUSE 10SC;"` *Changes the marker pause time to 10 seconds.*

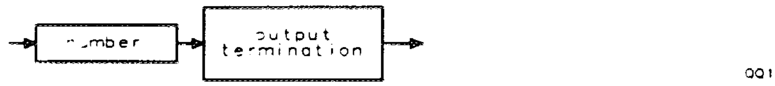
### Description

To turn MKPAUSE off, turn off markers or send "MKPAUSE 0;".

The MKPAUSE command requires a sweep time of 50 ms or longer. The sweep time is changed to 50 ms if MKPAUSE is used with a sweep time that is less than 50 ms.

After MKPAUSE is executed, the sweep must be completed before another command will be executed.

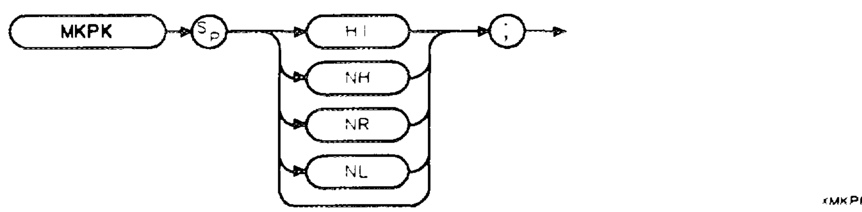
## Query Response



# MKPK
# Marker Peak

Positions the active marker on a signal peak.

## Syntax




Equivalent Softkey: **NEXT PEAK**, **NEXT PK RIGHT**, **NEXT PK LEFT**, and (PEAK SEARCH).
Related Commands: MKCF, MKF, MKOFF, MKPX, TH.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes the spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;MKPK HI;"` | *Places active marker on highest peak.* |
| `30 OUTPUT 718;"MKA?;"` | *Returns amplitude value of marker to the computer.* |
| `40 ENTER 718;A` | *Puts the spectrum analyzer response in the computer variable, A.* |
| `50 DISP A` | *Displays amplitude value.* |
| `60 END` | |

## Description

Executing MKPK HI, or simply MKPK, positions the active marker at the highest signal detected. If an active marker is on the screen, the MKPK parameters move the marker as follows:

**HI** (highest) moves the active marker to the highest peak.

**NH** (next highest) moves the active marker to the next signal peak of lower amplitude.

**NR** (next right) moves the active marker to the next signal peak of higher frequency.

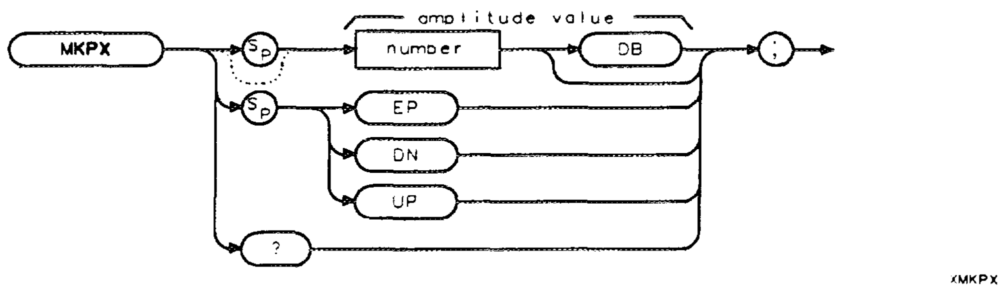
**NL** (next left) moves the active marker to the next signal peak of lower frequency.

**Note** This function is for use with the frequency markers only.

# MKPX
# Marker Peak Excursion

Specifies the minimum signal excursion for the spectrum analyzer's internal peak-identification routine.

## Syntax



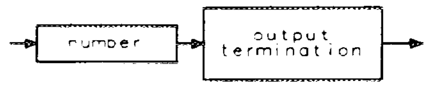

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dB. | 0 to 100 dB. |

Equivalent Softkey: **PEAK EXCURSN** .
Preset State: 6 dB.
Step Increment: by 1 dB.
Related Commands: MKPK, PEAKS.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;CF 300MHZ;SP 1GHZ;"` | *Initializes spectrum analyzer, changes start and stop frequencies.* |
| `20 INPUT "ENTER IN PEAK EXCURSION, IN DB ",Excursion` | |
| `30 OUTPUT 718;"MKPX ";Excursion;"DB;"` | *Changes peak excursion level.* |
| `40 OUTPUT 718;"TS;MKPK HI;MKPK NH;"` | *Searches for highest peaks of trace.* |
| `50 OUTPUT 718;"MKF?;"` | *Finds frequency difference between peaks.* |
| `60 ENTER 718;Freq` | *Puts the spectrum analyzer response in the computer variable, Freq.* |
| `70 IF Freq <> 0 THEN` | *Outputs results if marker amplitude was not 0.* |
| `80 PRINT "PEAK FOUND"` | |
| `90 ELSE` | *Prints "NO PEAKS FOUND" if Freq = 0.* |
| `100 PRINT "NO PEAKS FOUND"` | |
| `110 END IF` | |
| `120 END` | |

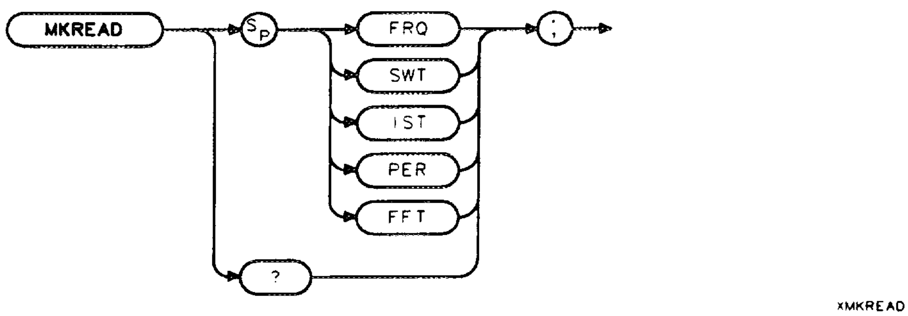
## Query Response



# MKREAD
# Marker Readout

Selects the type of active trace information displayed by the spectrum analyzer marker readout.

## Syntax




Equivalent Softkey: **MK READ F T I P** provides the marker readouts in the frequency, sweep time, inverse sweep time, and period. The fast Fourier transform readout is not available with the softkey, however.
Related Commands: FFT, MKF, MKTYPE.

## Example

```
OUTPUT 718;"MKREAD FFT;"
```

## Description

The MKREAD command can select the following types of active trace information:

**FRQ**: frequency.

**SWT**: sweep time.

**IST**: inverse sweep time.

**PER**: period.

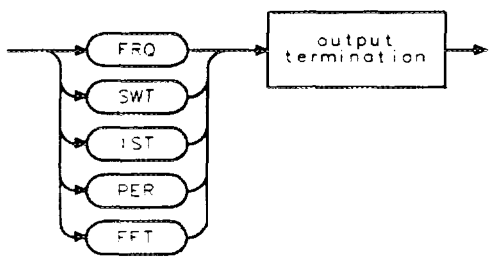
**FFT**: fast Fourier transform readout.

The results of the data depend on the MKREAD parameter, the frequency span, and if the marker delta function is used.

### MKREAD Marker Readout

| MKREAD Type | Non-Zero Span | Non-Zero Span Delta | Zero Span | Zero Span Delta |
|---|---|---|---|---|
| FRQ | Reads frequency | Reads delta frequency | Reads time | Reads delta time |
| SWT | Reads time since the start of sweep | Reads delta time between end points | Waveform measurements of detected modulation | Waveform measurements of detected modulation |
| IST | N/A | N/A | N/A | Computes frequency corresponding to delta of markers. Performs $1/(T_1 - T_2)$ |
| PER | Period of frequency | (Pulse measurement) delta time | N/A | N/A |
| FFT | N/A | N/A | Reads frequency corresponding the to FFT bucket | Reads delta frequency corresponding to delta FFT bucket |

## Query Response




QMKREAD

# MKRL
# Marker to Reference Level

Sets the reference level to the amplitude value of the active marker.

## Syntax


XMKRL

Equivalent Softkey: **MARKER -> REF LVL** .
Related Commands: MKOFF, RL.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;"` | *Initializes spectrum analyzer, changes center frequency and span.* |
| `20 OUTPUT 718;"TS;MKPK HI;MKRL;TS;"` | *Places a marker on trace peak, sets the reference level to the amplitude of the active marker, updates the sweep.* |
| `30 OUTPUT 718;"RL?;"` | *Gets the reference level.* |
| `40 ENTER 718 USING "K";Ref_level` | *Puts the spectrum analyzer response in the computer variable, Ref_level.* |
| `50 OUTPUT 718;"AUNITS?;"` | *Gets the current amplitude units.* |
| `60 ENTER 718;Aunits$` | |
| `50 PRINT "REFERENCE LEVEL IS",Ref_level,Aunits$` | |
| `60 END` | |

# MKSP
# Marker to Span

Sets the start and stop frequencies to the values of the delta markers.

## Syntax


MKSP

Equivalent Softkey: **MKR Δ -> SPAN** .

Related Commands: MKD, SP.

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"MKMIN;"` | *Places a marker at the minimum amplitude of trace.* |
| `30 OUTPUT 718;"MKD;"` | *Activates marker delta.* |
| `40 OUTPUT 718;"MKPK HI;"` | *Places marker at highest amplitude of trace.* |
| `50 OUTPUT 718;"MKSP;"` | *Changes span to the values of the left and right markers.* |
| `60 END` | |

## Description

The left marker specifies start frequency, and the right marker specifies stop frequency. If MKD is off, no operation is performed.

# MKSS
# Marker to Step Size

Sets the center-frequency step-size to the marker frequency.

## Syntax


XMKSS

Equivalent Softkey: **MARKER -> CF STEP** .

Related Commands: CF, MKA, MKCF, MKD, MKF, SS.

## Example

This example measures a harmonic of the CAL OUT signal.

| | |
|---|---|
| `10 DISP "CONNECT THE CAL OUT TO THE INPUT"` | |
| `20 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes spectrum analyzer, activates single-sweep mode, changes center frequency and span, updates trace.* |
| `30 OUTPUT 718;"MKPK HI;MKSS;MKD;CF UP;TS;MKPK HI;"` | *Places the marker on the highest point of the trace, changes the step size to the marker frequency, activates marker delta, increase center frequency, update trace, places the marker at highest point of the trace.* |
| `40 OUTPUT 718;"MKA?;"` | *Gets the amplitude of the marker.* |
| `50 ENTER 718;Delta_amp` | *Puts the spectrum analyzer response in the computer variable, Delta_Amp.* |
| `60 OUTPUT 718;"MKF?;"` | *Gets the frequency of the marker.* |
| `70 ENTER 718;Delta_freq` | *Puts the spectrum analyzer response in the computer variable, Delta_freq.* |

```
80 PRINT "DIFFERENCE IN AMPLITUDE IS ",Delta_amp,"dB"
90 PRINT "DIFFERENCE IN FREQUENCY IS ",Delta_freq,"Hz"
100 END
```

## Description

Sets the center-frequency step-size equal to the marker frequency. If in the delta mode, the step size is set to the delta frequency (absolute value).

# MKSTOP
# Marker Stop

Stops the sweep at the active marker.

## Syntax


MKSTOP

Related Commands: MKCONT.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

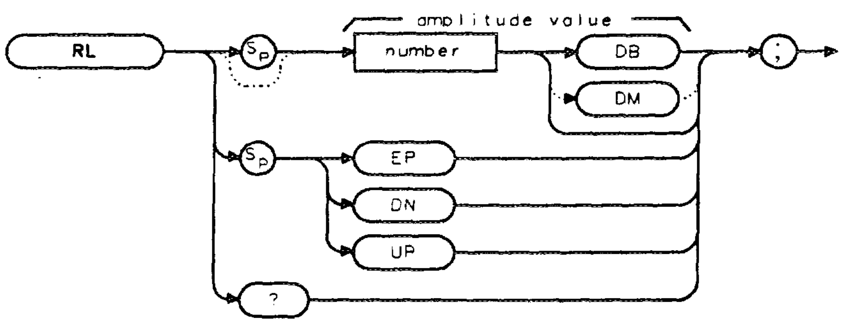
## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;TS;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"MKPK HI;"` | *Creates an active marker.* |
| `30 OUTPUT 718;"MKSTOP;"` | *Stops sweep at marker.* |
| `40 OUTPUT 718;"MKCONT;"` | *Resumes sweep.* |
| `50 END` | |

# RL
# Reference Level

Specifies the amplitude value of the reference level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is the current amplitude unit. | Amplitude range of the spectrum analyzer. |

Equivalent Softkey: REF LVL .
Preset State: 0 dBm.
Step Increment: by 10 dBm.
Related Commands: AT, MKRL, ML, RESETRL, RLPOS.

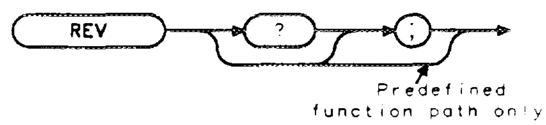
## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;SNGLS;CF 300MHZ;SP 20MHZ;"` | *Initializes spectrum analyzer, activates single-sweep mode, changes center frequency, span.* |
| `20 OUTPUT 718;"TS;MKPK HI;MKRL;TS;"` | *Takes sweep, places marker on signal peak, sets reference level to marker level.* |
| `30 OUTPUT 718;"RL?;"` | *Queries reference level.* |
| `40 ENTER 718;Ref_level` | *Puts the spectrum analyzer response in the computer variable, Ref_level.* |
| `50 PRINT "REFERENCE LEVEL IS",Ref_level,"DM"` | |
| `60 END` | |

# REV
# Revision

Returns the date code of the firmware revision date in YYMMDD format (for example, 860910 indicates 10 September 1986).

## Syntax




XREV

Equivalent Softkey: **SHOW OPTIONS** displays the firmware revision date.

Related Commands: ID, SER, TIMEDATE.

## Example

| | |
|---|---|
| `OUTPUT 718;"REV;"` | *Gets the firmware revision date of spectrum analyzer.* |
| `ENTER 718;A` | *Puts the spectrum analyzer response in the computer variable, A.* |
| `DISP A` | *Displays the firmware revision date on the computer screen.* |

## Description

The date of the firmware revision also appears when the instrument is first turned on, but it is displayed in the day, month, year format.

## Query Response


QREV

# RETURN
# Return

Stops the operation of a user-defined command and returns program operation to the point where the user-defined function was called.

## Syntax


XRETURN

Related Commands: ABORT, FUNCDEF, IF (IF/THEN/ELSE/ENDIF), REPEAT (REPEAT/UNTIL).

## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"CLRDSP;"` | *Clears graphics from memory.* |
| `30 OUTPUT 718;"TRDSP TRA,OFF;"` | *Turns off trace A.* |
| `40 OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Blanks annotation and graticule.* |
| `50 OUTPUT 718;"VARDEF C_OUNT,0;"` | *Defines variable with the initial value of 0.* |
| `60 OUTPUT 718;"FUNCDEF D_LP,@";` | *Declares a user-defined function.* |
| `70 OUTPUT 718;"REPEAT;";` | *Begins repeat loop.* |
| `80 OUTPUT 718;"ADD C_OUNT,C_OUNT,100;";` | *Add 100 to C_OUNT.* |
| `90 OUTPUT 718;"PU;PA 100,100;PD;";` | |
| `100 OUTPUT 718;"DSPLY C_OUNT,4.0;";` | *Writes value of C_OUNT.* |
| `110 OUTPUT 718;"IF C_OUNT,EQ,300 THEN;RETURN;ENDIF;";` | *Executes return when C_OUNT is equal to 300.* |
| `120 OUTPUT 718;"UNTIL C_OUNT,EQ,400;";` | |
| `130 OUTPUT 718;"@;"` | *Marks end of D_LP.* |
| `140 !` | *Defines second user-defined* |
| `150 OUTPUT 718;"FUNCDEF S_HELL,@";` | *function called S_HELL.* |
| `160 OUTPUT 718;"CLRDSP;MOV C_OUNT,0;";` | *Reinitializes C_OUNT.* |
| `170 OUTPUT 718;"D_LP;TEXT!INSIDE S_HELL...!;@";` | *Executes D_LP and writes text on screen.* |
| `180 OUTPUT 718;"S_HELL;"` | *This line executes the S_HELL program, which in turn executes the program called D_LP.* |
| `190 END` | |

## Description

The example contains a user-defined function, called D_LP, nested within another function, called S_HELL. The innermost function, D_LP, contains RETURN. When RETURN is encountered, the D_LP operation is interrupted, then program operation resumes at the first spectrum analyzer command following the function call of D_LP in line 170.

# RESETRL
# Reset Reference Level

Resets the reference level to its instrument preset level.

## Syntax


XRESETRL

Related Commands: AUNITS, IP, ML, RL, RLPOS.

## Example

```
OUTPUT 718;"RESETRL;"
```

## Example

The following program lowers any off-screen signal.

| | |
|---|---|
| `10 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `20 OUTPUT 718;"SNGLS;TS;MKPK HI;"` | *Activates single-sweep mode, takes sweep, places marker on signal peak.* |
| `30 OUTPUT 718;"IF MA,GT,RL THEN;"` | *Performs lines 40, 50 and 60 if the marker amplitude is greater than the reference level.* |
| `40   OUTPUT 718;"REPEAT;"` | *Increases reference level, takes sweep, places* |
| `50     OUTPUT 718;"RL UP;TS;MKPK HI;"` | *marker on signal peak.* |
| `60   OUTPUT 718;"UNTIL MA,LE,RL;"` | *Does line 40 until peak amplitude is less than or equal to the reference level.* |
| `70 OUTPUT 718;"ENDIF;"` | *Ends the IF THEN construct.* |
| `80 OUTPUT 718;"CONTS;"` | |
| `70 END` | |

## Description

All commands following the REPEAT command are executed until the comparison specified after the UNTIL command is true.

The following are used for comparing the operands:

**GT** Greater than

**LT** Less than

**LE** Less than or equal to

**GE** Greater than or equal to

**EQ** Equal to

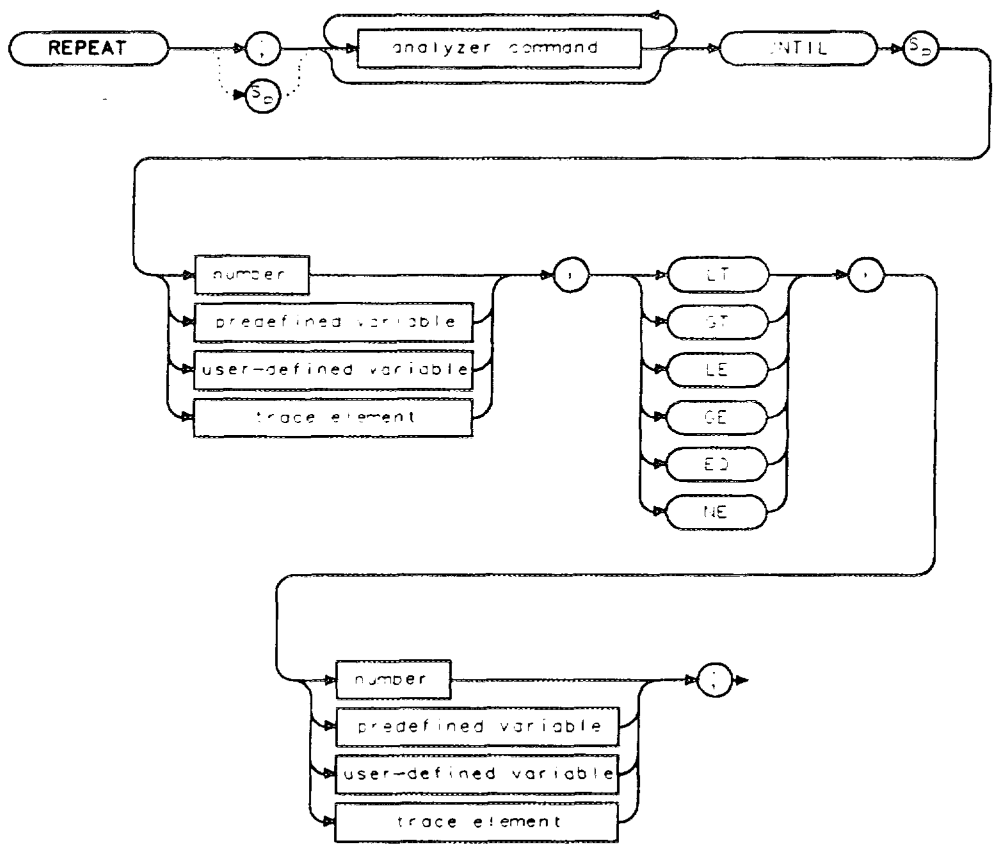
**NE** Not equal to

When used within a downloadable program (DLP), the number of REPEAT UNTIL statements that can be nested is limited to 20.

# REPEAT UNTIL
# Repeat Until

The REPEAT and UNTIL commands form a looping construct.

## Syntax




XREPEAT

| Item | Description/Default | Range |
|---|---|---|
| Analyzer command | Any valid complete spectrum analyzer command. | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Number | Any real or integer number. | Real number range. |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: FUNCDEF when using a user-defined function. ACTDEF or VARDEF when using a user-defined variable.
Related Commands: ABORT, IF (IF/THEN/ELSE/ENDIF).

# RELHPIB
# Release HP-IB

Releases spectrum analyzer control of the HP-IB.

## Syntax


XRELHPIB

Option Required: Option 021.
Related Commands: ENTER, OUTPUT.

## Example

| | |
|---|---|
| `OUTPUT 718;"RELHPIB;"` | *The spectrum analyzer releases control of HP-IB so that another device can control the bus.* |

## Description

The RELHPIB command causes the device that is acting as the controller on the HP-IB (for example, the spectrum analyzer) to relinquish control of the bus.

## Description

The state and trace data are recalled when the trace destination is trace A, trace B, or trace C. When using a user-defined trace or a trace range for the trace destination, only the trace data is recalled.

When recalling frequency-amplitude correction data, you need to specify AMPCOR as the destination. When recalling limit line table data, specify LIMILINE as the destination.

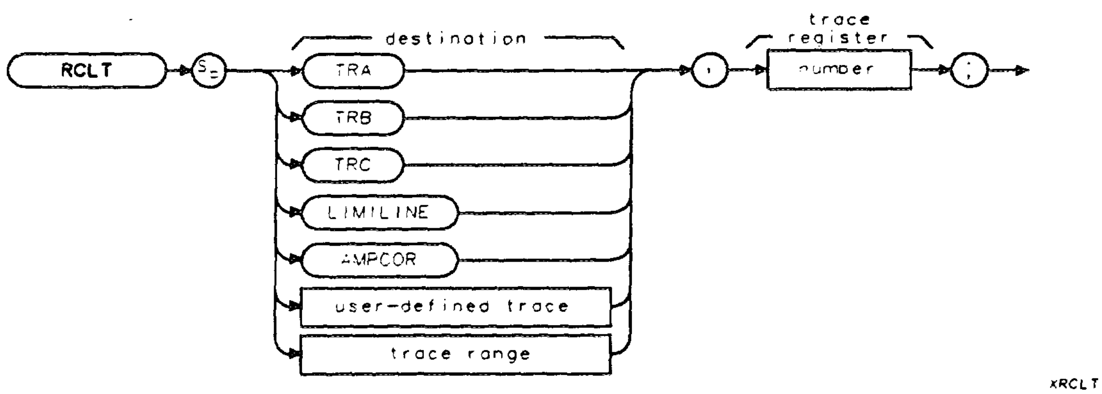
To avoid overwriting the recalled trace data, the VIEW command should be performed immediately after the RCLT command when recalling trace data (see line 40 in the example).

**Note** The RCLT recalls trace data from spectrum analyzer memory. See "LOAD" or "SAVRCLN" to recall trace data from the memory card.

# RCLT
# Recall Trace

Recalls previously saved trace data, amplitude factors, or limit-line data from the specified trace register in spectrum analyzer memory. Trace data is recalled with instrument state, date, and screen title.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any valid integer. | 0 to TRCMEM – 1. |

Equivalent Softkey: The RCLT command and the VIEW commands are equivalent to **Internal -> Trace**.

Parameter Value: 0 to TRCMEM – 1.

Prerequisite Commands: TRDEF when using a user-defined trace.

Related Commands: CAT, CLRW, LOAD, SAVET, SNGLS, TRCMEM, TS, VIEW.

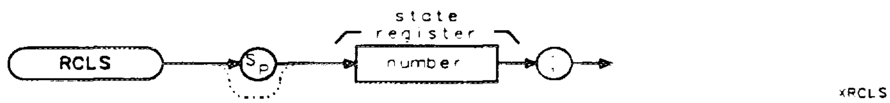
## Example

| | |
|---|---|
| `10 OUTPUT 718;"IP;CF 300MHZ;SP 20MHZ;TS;"` | *Initializes spectrum analyzer, changes the center frequency and span.* |
| `20 OUTPUT 718;"SAVET TRA,1;"` | *Saves spectrum analyzer state and trace A data in register 1.* |
| `30 OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `40 OUTPUT 718;"RCLT TRA,1;VIEW TRA;"` | *Recalls spectrum analyzer state, trace data; displays the result.* |
| `50 END` | |

# RCLS
# Recall State

Recalls spectrum analyzer state data from the specified state register in spectrum analyzer memory.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | 1 to 9 |

Equivalent Softkey: **INTERNAL -> STATE**.
Related Commands: LOAD, POWERON, RCLT, SAVES.

## Example

```
OUTPUT 718;"IP;CF 300MHZ;SP 1MHZ;"   Changes center frequency, span.
OUTPUT 718;"SAVES 3;"                Saves state in register 3.
OUTPUT 718;"IP;"
OUTPUT 718;"RCLS 3;"                 Recalls the contents of register 3.
```

## Description

You can specify a state register number from one to nine. Registers one through eight are reserved for your use. Registers one through eight contain instrument state information if instrument state information has been stored in it with the SAVES command. State register nine contains the previous state data.

**Note** The RCLS recalls state data from spectrum analyzer memory. See "LOAD" or "SAVRCLN" to recall state data from the memory card.

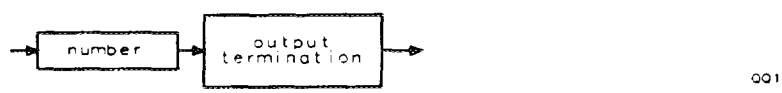
## Description

The coupling between sweep time and resolution bandwidth is terminated by this command. Execute RB AUTO to reestablish coupling. (Also see "AUTO.")

The 200 Hz, 9 kHz, and 120 kHz 6-dB resolution bandwidths (used for EMI testing) are available by specifying 200 Hz (for spectrum analyzers with Option 130 installed), 9 kHz, or 120 kHz as the frequency value; the front-panel knob, step increment keys, and auto-coupled settings provide the 1, 3, 10 resolution bandwidth sequence only. Frequencies are rounded to the nearest value in the 1, 3, 10 sequence if the frequency is other than 9 kHz, 120 kHz, 5 MHz, or in the 1, 3, 10 sequence.

The spectrum analyzer provides uncalibrated bandwidths of 300 Hz (10 Hz if the spectrum analyzer has Option 130 installed in it) and 5 MHz.

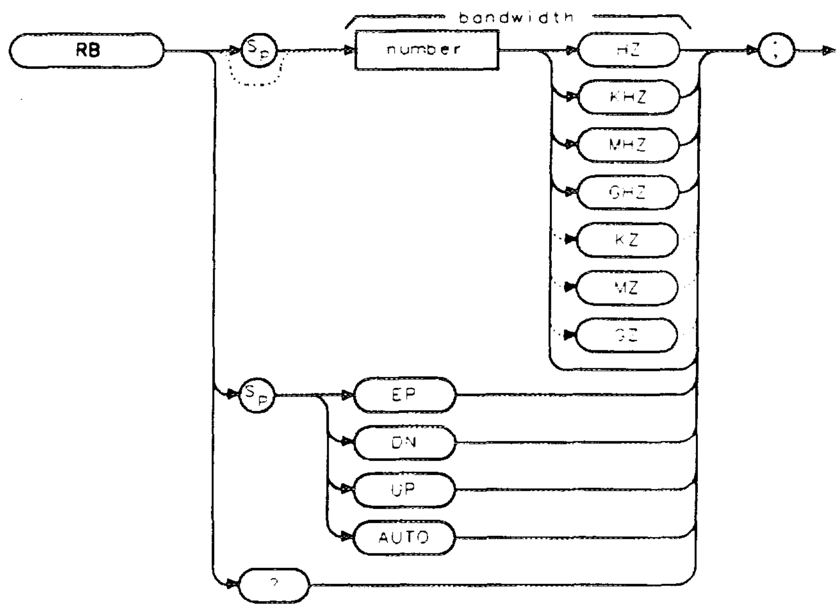
## Query Response



# RB
# Resolution Bandwidth

Specifies the resolution bandwidth.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | If Option 130 is installed, 30 Hz to 3 MHz, otherwise 1 kHz to 3 MHz. |

Equivalent Softkey: **RES BW AUTO MAN** .
Preset State: 3 MHz.
Step Increment: In a 1, 3, 10.
Related Commands: AUTO, SP, ST, VB, VBR.

## Example

`OUTPUT 718;"RB 1KHZ;"` *Sets the resolution bandwidth to 1 kHz.*

# PWRUPTIME
## Power Up Time

Returns the number of milliseconds that have elapsed since the spectrum analyzer was turned on.

### Syntax


XPWRUPTIME

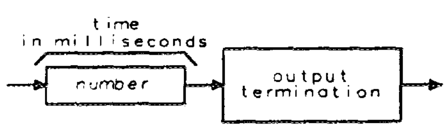
### Example

| | |
|---|---|
| `OUTPUT 718;"PWRUPTIME;"` | *Executes PWRUPTIME.* |
| `ENTER 718;A` | *Places the result of PWRUPTIME into A.* |
| `A = A/1000` | *Changes the milliseconds to seconds.* |
| `PRINT "Minutes elapsed ",A/60` | *Prints the number of minutes that have elapsed since the spectrum analyzer was turned on.* |

### Description

PWRUPTIME can count the number of milliseconds for up to $2^{32}$ milliseconds ($2^{32}$ milliseconds is equivalent to 49.7 days). If the spectrum analyzer is left on for more than 49.7 days, PWRUPTIME is reset to 0 and restarts the count.

### Query Response




QPWRUPTIME

## Example

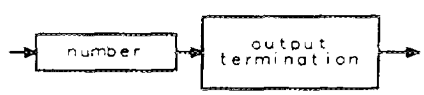
| | |
|---|---|
| `DISP "CONNECT CAL OUT TO INPUT"` | *Displays a user prompt.* |
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `OUTPUT 718;"CF 300MHZ;SP 1MHZ;RB 300KHZ;"` | *Changes center frequency, span, and bandwidth.* |
| `OUTPUT 718;"MXMH TRA;TS;TS;TS;TS;"` | *Activates the maximum hold of trace A, sweep 4 times.* |
| `OUTPUT 718;"PWRBW TRA, 99.0;"` | *Returns the 99% power bandwidth.* |
| `ENTER 718;P` | *Gets the result from the spectrum analyzer.* |
| `DISP "THE POWER BANDWIDTH AT 99 PERCENT IS";P/1.0E+3;"kHz"` | *Displays the frequency of the power bandwidth specified on the computer screen.* |

## Description

If trace A is the source, a delta marker is set at the start and stop frequencies.

If 100% is specified, the power bandwidth equals the frequency range of the screen display. If 50% is specified, trace elements are eliminated from either end of the array, until the combined power of the remaining signal responses equals half of the original power computed. The frequency span of these remaining trace elements is the power bandwidth returned.

## Query Response

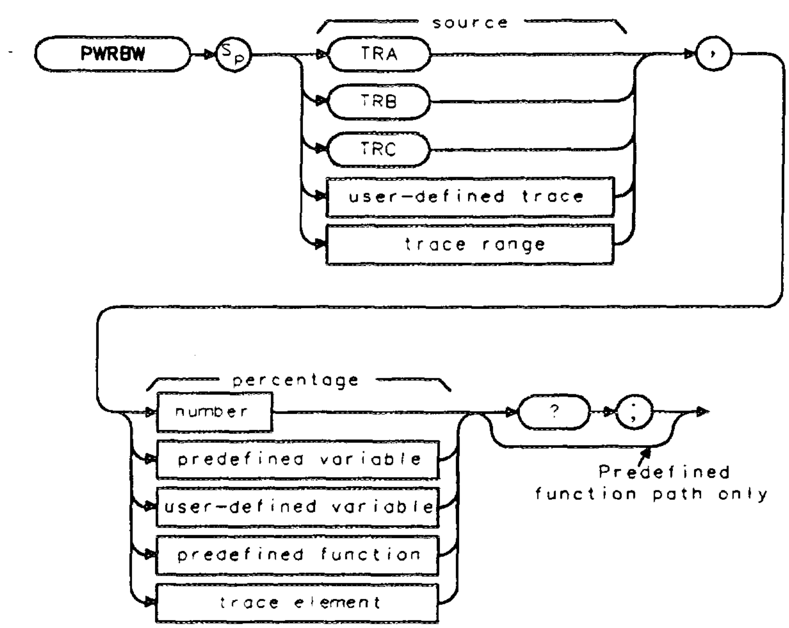



001

# PWRBW
# Power Bandwidth

Computes the bandwidth around the trace center, which includes signals whose total power is a specified percentage of the total trace signal power.

## Syntax




XPWRBW

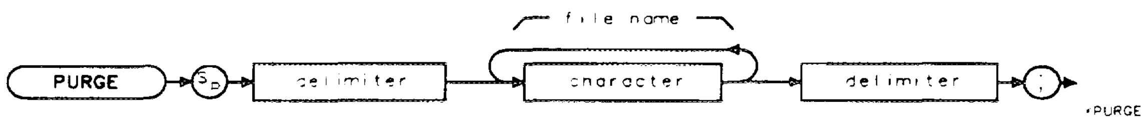
| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace element | An element of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | 0 to 100. |

Parameter Values: The field used for the percentage must use a value between 0 and 100.
Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: RB, SP.

# PURGE
# Purge File

Deletes the specified file from the current mass storage device.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. | Any valid filename. |

Related Commands: MSI.

## Example

| | |
|---|---|
| `OUTPUT 718;"MSI CARD;"` | *Selects the memory card as the mass storage device.* |
| `OUTPUT 718;"PURGE %dMYFILE%;"` | *Deletes the file called "dMYFILE" from the memory card.* |

## Description

Use the MSI command to select the mass storage device (either the spectrum analyzer memory or a memory card) before using the PURGE command. When deleting a file from a RAM card, the RAM card files are repacked automatically after a PURGE command is executed.

# PU
# Pen Up

Instructs the spectrum analyzer not to plot vectors on the spectrum analyzer screen until a PD command is received.

## Syntax


xPU

Related Commands: DSPLY, PA, PD, PLOT, PR, TEXT.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;BLANK TRA;"` | *Initializes spectrum analyzer, blanks trace A.* |
| `OUTPUT 718;"ANNOT OFF;GRAT OFF;"` | *Turns off annotation, graticule.* |
| `OUTPUT 718;"PU;"` | *Prevents initial vector from being drawn.* |
| `OUTPUT 718;"PA 100,100;PD 100,150;"` | *Positions pen, pen down.* |
| `OUTPUT 718;"150,150,150,100,100,100;"` | *Draws remaining 3 sides of rectangle.* |

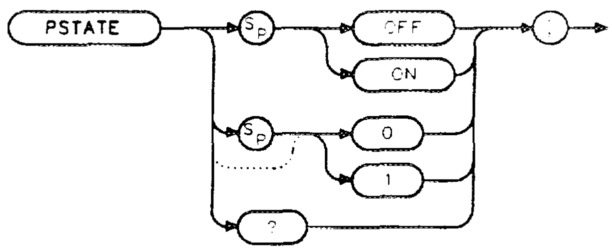
## Description

The PU command is used before the commands PA (plot absolute), or PR (plot relative), to suppress drawing while moving to the starting point of a vector. It remains in effect until a PD command is received.

# PSTATE
# Protect State

Protects all of the spectrum analyzer's user state and trace registers from being changed.

## Syntax



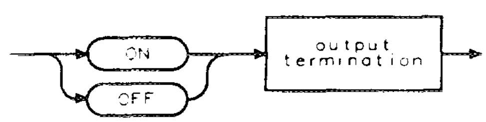

XPSTATE

Equivalent Softkey: **SAV LOCK ON OFF**.
Related Commands: ERASE, RCLS, SAVES.

## Example

```
OUTPUT 718;"PSTATE ON;"
```

## Query Response

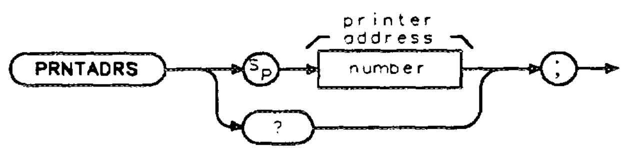



QQ2

# PRNTADRS
# Print Address

Allows you to set the HP-IB address of the printer.

## Syntax




PRNTADRS

| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer number. | 0 to 30 |

Equivalent Softkey: **PRINTER ADDRESS** .
Option Required: Option 021.

## Example

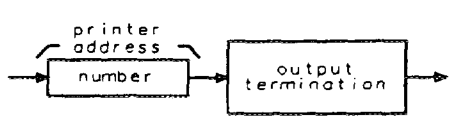
| | |
|---|---|
| `10 OUTPUT 718;"VARDEF L_OC,1;MOV L_OC,12;"` | *Defines a variable called L_OC, and then moves 12 into L_OC.* |
| `20 OUTPUT 718;"PRNTADRS 1;"` | *Sets the HP-IB address of the printer to 1.* |
| ⋮ | *You can insert programming commands here.* |
| `300 OUTPUT 718;"OUTPUT PRNTADRS,F3.0,L_OC;"` | *You could use this statement within a DLP. This statement outputs the number 12 to the printer.* |

## Description

You may find it useful to assign PRNTADRS near the beginning of your program, and, from then on, refer to the printer address in your program as PRNTADRS. The advantage of using PRNTADRS in this way is that if you need to change the printer address, you need only change the programming line that assigns the printer address to PRNTADRS (see line 20 of the programming example).

## Query Response

PRNTADRS? returns the current HP-IB address of the printer.

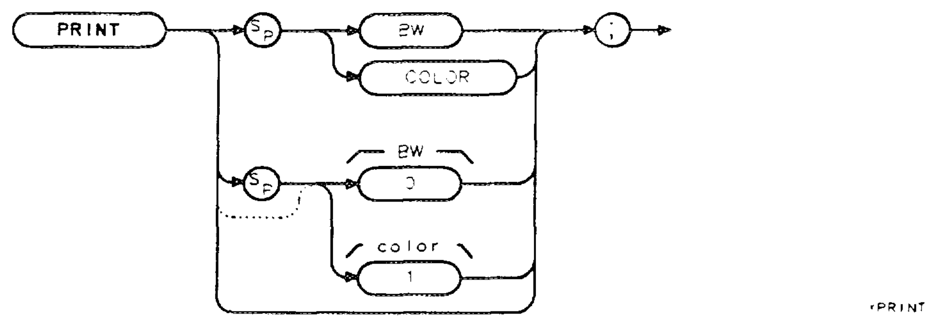



QPRNTADRS

# PRINT
# Print

Initiates a output of the screen data to the remote interface. With appropriate HP-IB commands, the HP-IB can be configured to route the data to an external printer.

## Syntax




Related Commands: GETPRNT, PLOT.

## Example for the HP-IB Interface

The printer usually resides at address 1 and the plotter at address 5. (The program is only valid for HP 9000 Series 200 and 300 computers and HP Vectra personal computer with an HP raster graphics printer, such as the HP Thinkjet.)

This example illustrates how an external controller can initiate the sending of print data to an external printer.

```
OUTPUT 718;"PRINT;"
SEND 7;UNT UNL LISTEN 1 TALK 18 DATA
```
*Sends data to printer.*

**Note**

To print without disconnecting the computer, you must execute the following BASIC commands:

```
ABORT 7
LOCAL 7
```

Then press COPY.

## Description

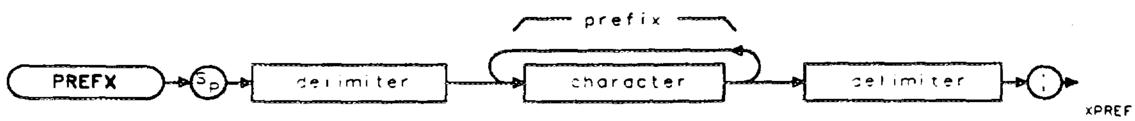
The data is output in HP raster graphics format. PRINT, PRINT 0, or PRINT BW produces a monochrome printout. PRINT 1 and PRINT COLOR produces a "color format" output for an HP PaintJet printer. Execute "MENU 0;" before printing to blank the softkeys.

The PRINT command should not be used within a DLP; you should use the GETPRNT command instead.

# PREFX
## Prefix

Specifies or changes the prefix used in save and recall operations.

### Syntax




| Item | Description/Default | Range |
|---|---|---|
| Character | Any valid character. | 0 to 6 characters long, A through Z and the underscore (the underscore cannot be the first character of the prefix). |
| Delimiter | Matching characters marking the beginning and end of the list of spectrum analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |

Equivalent Softkey: **Change Prefix**.
Related Commands: CAT, SAVRCLN, STOR.

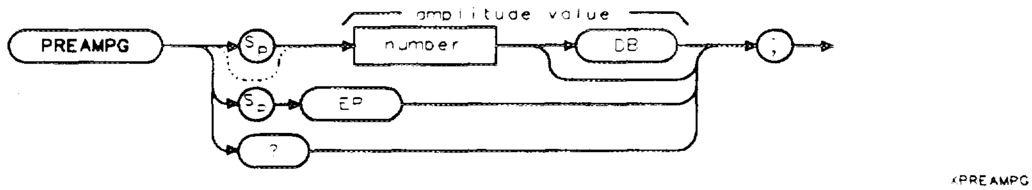
### Example

```
OUTPUT 718;"PREFX %DAVE%;"
```

# PREAMPG
# External Preamplifier Gain

Subtracts a positive or negative preamplifier gain value from the displayed signal.

## Syntax




## Example

```
OUTPUT 718;"PREAMPG 10DB;"
```

## Description

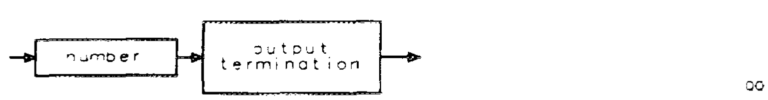
Unlike using ROFFSET, PREAMPG can change the attenuation depending on the preamplifier gain entered.

A preamplifier gain offset is used for measurements that require an external preamplifier or long cables. The offset is subtracted from the amplitude readout so that the displayed signal level represents the signal level at the input of the preamplifier or long cable. The preamplifier gain offset is displayed at the top of the screen and is removed by entering zero.

**Note** PREAMPG is not reset to 0 by an instrument preset (IP). Be sure to execute "PREAMPG 0;" when the preamplifier gain is no longer needed.

Press **CAL STORE** if you want the spectrum analyzer to use the current preamplifier gain offset when power is turned on. Preamplifier gain offset is set to zero by **DEFAULT CONFIG** .

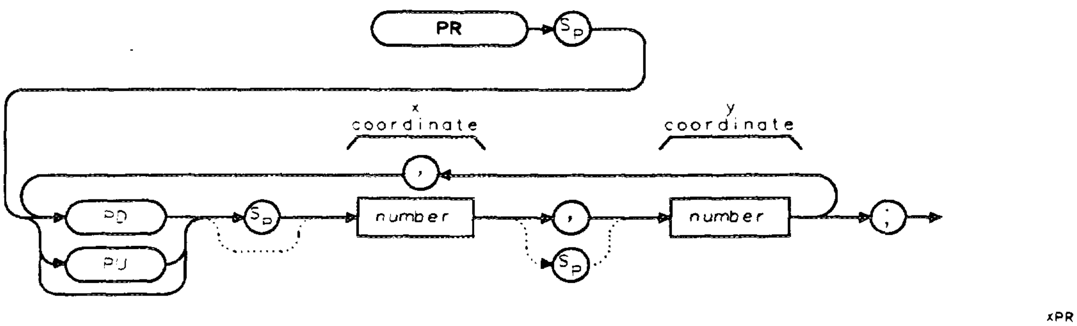
## Query Response



# PR
# Plot Relative

Moves the pen to a new plot location on the spectrum analyzer screen relative to the current coordinates in display units.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any valid integer. | Dependent on the current pen position. |

Related Commands: DSPLY, PA, PLOT, PRINT, PU, TEXT.

## Example

```
OUTPUT 718;"IP;"                                  Initializes spectrum analyzer.
OUTPUT 718;"BLANK TRA;ANNOT OFF;"                 Clears the display.
OUTPUT 718;"GRAT OFF;"                            Turns off graticule.
OUTPUT 718;"PU;PA 0,100;"                         Positions pen.
OUTPUT 718;"PD;PR 100,0,0,-100,-100,0,0,100;"     Draws a rectangle.
```

## Description

Vector coordinate sets (x,y pairs) following the PR command can be either positive or negative, depending on the direction of the individual vectors to be drawn. PU (pen up) and PD (pen down) commands tell the spectrum analyzer to draw or not draw the vectors on the screen. (See "PU" and "PD.")

Display units are the scaling units of the spectrum analyzer display for on screen graphics commands such as PA or PR. See "PA" for more information about display units.

The coordinates of the lower left screen corner of the screen are −40,−22 and the upper right screen corner of the screen are 471,233. For the graticule area, the coordinates of the lower left corner of the graticule are 0,0 and the coordinates of the upper right graticule area are 400,200. For example, you could execute "PU;PA 0,0;PD;PA 0,200,400,200,400,0,0,0;" to draw a box around the graticule area.

Because PR is an active function, executing PR causes the active function area on the spectrum analyzer screen to blank. To prevent the text following PR from being written in the active function area, execute hold (HD) after PR.

# PP
# Preselector Peak

Peaks the preselector.

## Syntax


Equivalent Softkey: **PRESEL PEAK** .

Restrictions: Not compatible with Analog+ display mode. See "ANLGPLUS" for more information.

Model Required: HP 8592D, HP 8593E, HP 8595E, or HP 8596E.

Related Commands: MKA, MKCF, MKD, MKF, MKN, MKPK.

## Example

| | |
|---|---|
| `OUTPUT 718;"IP;CF 3GHZ;SP 500KHZ;"` | *Initializes spectrum analyzer, changes center frequency, span.* |
| `OUTPUT 718;"TS;MKPK HI;MKCF;PP;"` | *Peaks the highest on-screen signal.* |

## Description

To use PP, set the desired trace to clear-write mode, place a marker on a desired signal, then execute PP. Commands following PP are not executed until after the spectrum analyzer has finished peaking the preselector.

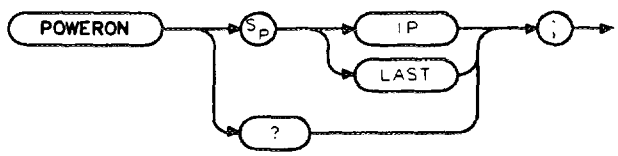
PP automatically adjusts the preselector tracking to peak the signal at the active marker. (When the marker is tuned to a signal and **PRESEL PEAK** is pressed, an internal routine searches for the peak response of the preselector and adjusts the tracking accordingly.) Using preselector peak prior to measuring a signal yields the most accurate amplitude reading.

Preselector peak operates with the **MARKER NORMAL** or **MARKER Δ** markers. If the marker is OFF, pressing **PRESEL PEAK** initiates a peak search routine and then peaks the response at that marker; otherwise, it peaks around the active marker. The `CAL:PEAKING` message appears on the active graticule area to indicate operation of the peaking routine. Preselector peak only operates in the 2.75 to 22 GHz preselector bands.

# POWERON
## Power-On State

Selects the state of the spectrum analyzer when the spectrum analyzer is turned on: the IP state (same state as an instrument preset command) or last state (the state the spectrum analyzer was in when the spectrum analyzer was turned off).

### Syntax




XPOWERON

Equivalent Softkey: **POWER ON IP LAST**.

### Example

```
OUTPUT 718;"POWERON LAST;"
```

### Description

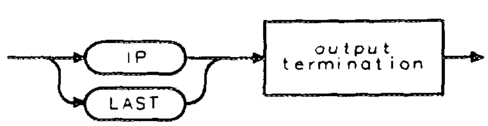
POWERON LAST restores the last state of the spectrum analyzer. Limit line testing is not considered to be a spectrum analyzer state and is not resumed after the spectrum analyzer is turned off. The limit line table will be restored even if the spectrum analyzer is turned off, however.

**Note** The last state of the spectrum analyzer is not retained in the case of battery power failure of the spectrum analyzer's internal battery.

When used as a predefined variable, POWERON returns either a "0" or a "1," depending on the setting of the POWERON parameter. Refer to the following table.

| Parameter Setting | Value Returned |
|---|---|
| IP | 0 |
| LAST | 1 |

### Query Response




QPOWERON

## Description

The PLOT command transfers the trace data, graticule, and annotation of the spectrum analyzer screen to a plotter via the spectrum analyzer interface (softkey labels excluded). The data is transferred in ASCII, HPGL format.

The example routes the data to an external plotter; however, the controller can read the data into a string if desired.

When using the PLOT command, the scaling points (P1x, P1y; P2x, P2y) can be specified. These scaling points specify the (x,y) coordinates, which determine the size of the plot. (P1x,P1y) refers to the lower-left plotter coordinates. (P2x,P2y) refers to the upper-right plotter coordinates.

The PLOT command should not be used within a DLP; you should use the GETPLOT command instead.

---

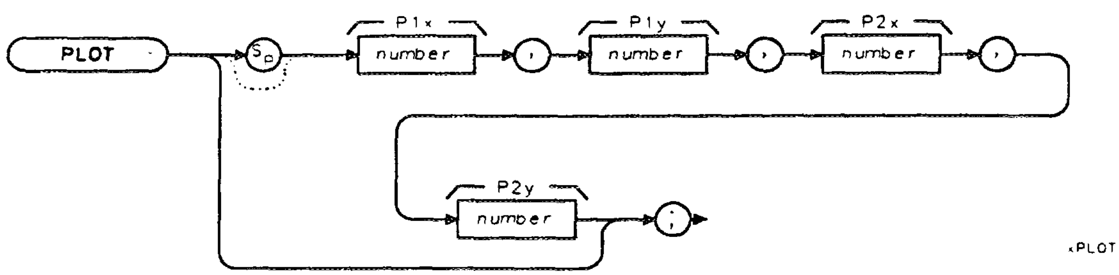
**Note** The HP 7470A plotter does not support 2 plots per page. If you use an HP 7470A plotter with an HP 8590 Series spectrum analyzer, you can select one plot per page or four plots per page but not 2 plots per page.

---

# PLOT
# Plot

Initiates a plotter output of the screen data to the remote interface. With the appropriate HP-IB commands, the HP-IB can be configured to route the data to an external plotter.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Number within the plotter coordinates. |

Related Commands: GETPLOT, PRINT, SNGLS, TS.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

## Example for the HP-IB Interface

The plotter is at address 5 and the spectrum analyzer is at address 18 in this example. (The program is only valid for HP 9000 series 200 and 300 computers.)

This example illustrates how an external controller can initiate the sending of print data to an external printer.

| | |
|---|---|
| `10 DIM P$[80]` | *Allocates room in memory.* |
| `20 OUTPUT 705;"OP;"` | *Plotter outputs lower-left and upper-right display dimensions.* |
| `30 ENTER 705;P$` | *Puts the plotter response in the computer string.* |
| `40 OUTPUT 718;"PLOT";P$` | *Plots the spectrum analyzer display according to the dimensions stored in the computer string.* |
| `50 SEND 7;LISTEN 5 TALK 18 DATA` | *Configures the interface to output data from spectrum analyzer to plotter.* |
| `60 END` | |

## Description

PKZOOM finds the highest displayed signal and narrows the frequency span to the specified value. PKZOOM ignores the spectrum analyzer's local oscillator (LO) feedthrough signal. PKZOOM sets the reference level to the signal's amplitude, sets the center frequency step size to the signal's frequency, and if the signal is within a preselected band, performs the preselector peak routine (HP 8592D, HP 8593E, HP 8595E, or HP 8596E only). The minimum value for the final frequency span depends on the model of the spectrum analyzer.

| Spectrum Analyzer Model | Frequency Span |
|---|---|
| HP 8590D or HP 8592D | 500 kHz |
| HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E | 10 kHz |
| HP 8591E, HP 8593E, HP 8594E, HP 8595E, or HP 8596E with Option 130 | 300 Hz |

To be able to find a valid signal, PKZOOM changes the following commands:

| | |
|---|---|
| TH | Sets the threshold to 8 divisions from the top screen. |
| LG | Changes the amplitude scale to logarithmic. |
| MKPX | Sets the peak excursion to 6 dB. |
| VAVG | Sets video averaging to off. |
| AT, RB, VB | Attenuation, resolution bandwidth, and video bandwidth are autocoupled. |
| MKSS | The center frequency step size is set to the marker's frequency. |

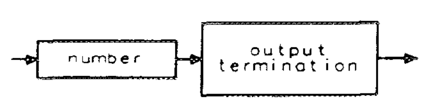
If the local oscillator feedthrough signal is the only signal found, PKZMOK will be set to zero and the PKZOOM routine will end. Otherwise, PKZMOK will be set to one and the routine will continue. For a signal to be found by PKZOOM, the signal must have a peak excursion (rise and fall) by at least 6 dB.

**Note** If the local oscillator feedthrough signal is not found, the PKZOOM routine assumes a valid signal is present.

### Restrictions

Executing PKZOOM turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), and power menu measurements (ACP, ACPE, CHP, and OBW).

## Query Response

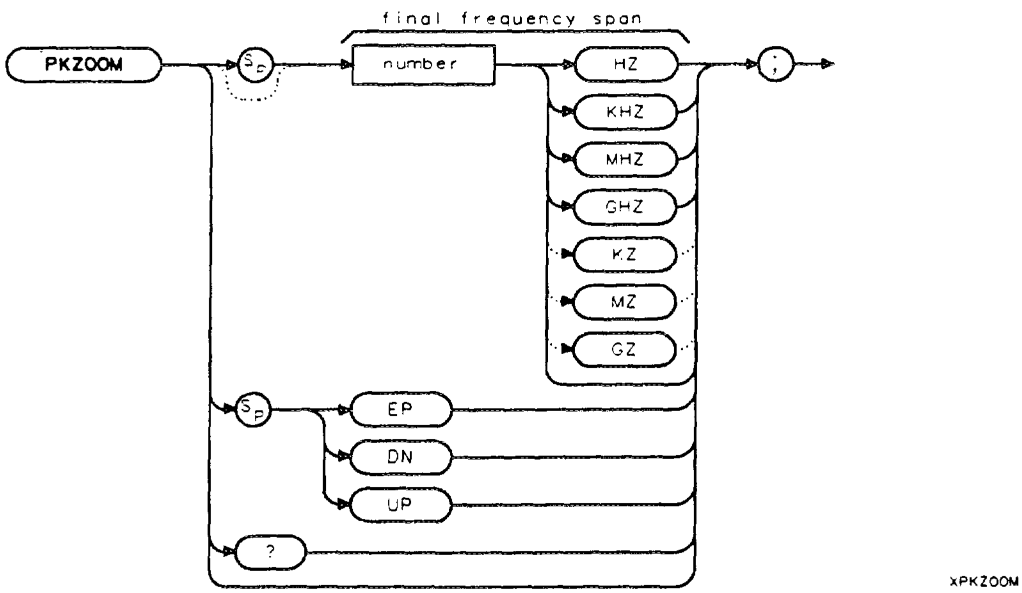



001

# PKZOOM
# Peak Zoom

Automatically tunes the spectrum analyzer to the signal with the highest amplitude level while narrowing the frequency span to the specified frequency span.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is Hz. | Minimum frequency span depends on model, maximum frequency span is 1 GHz. |

Equivalent Softkey: **PEAK ZOOM** .
Preset State: 1 MHz.
Related Commands: PKZMOK.

## Example

```
OUTPUT 718;"PKZOOM 1MHZ;"
OUTPUT 718;"PKZMOK?;"
ENTER 718;Peak_zoom_ok
IF Peak_zoom_ok = 0 THEN

   PRINT "Found LO feedthrough"
ELSE
:
```

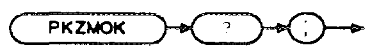
*Sets the final frequency span to 1 MHz.*
*Queries the value of PKZMOK.*

*If PKZMOK is equal to 0, the PKZOOM routine found the LO feedthrough.*

# PKZMOK
# Peak Zoom Okay

Returns a "0" if the peak zoom routine (PKZOOM) found only the spectrum analyzer's local oscillator feedthrough, otherwise a "1" is returned.

## Syntax




XPKZMOK

Related Commands: PKZOOM.

## Example

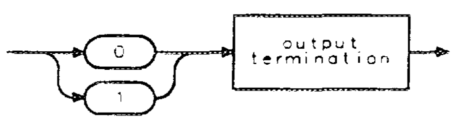
```
OUTPUT 718;"PKZOOM 1MHZ;"
OUTPUT 718;"PKZMOK?;"
ENTER 718;Peak_zoom_ok
IF Peak_zoom_ok = 0 THEN

   PRINT "Found LO feedthrough"
ELSE
:
```

*Sets the final frequency span to 1 MHz.*

*Queries the value of PKZMOK.*

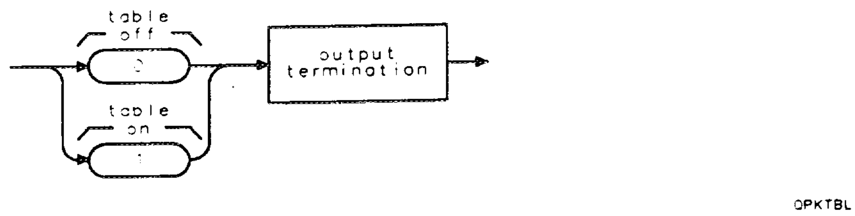
*If PKZMOK is equal to 0, the PKZOOM routine found the LO feedthrough.*

## Query Response




QPKZMOK

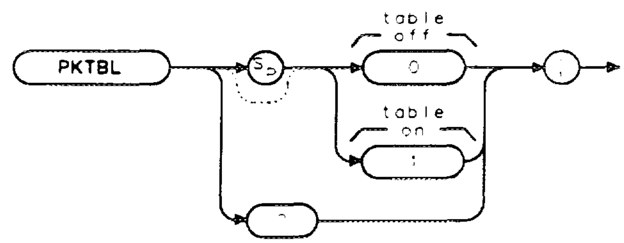
## Query Response



# PKTBL
# Peak Table

Turns on or off the peak table.

## Syntax




XPKTBL

Equivalent Softkey: PK **TABLE ON OFF** .
Preset State: 0 (Off).
Related Commands: DL, PKRES, PKSORT, PKDLMODE.

## Example

`OUTPUT 718;"MOV PKTBL,1;"` *Turns on the peak table.*

## Description

When the peak table is turned on, the spectrum analyzer screen displays two windows. The upper window displays trace A, with the signal peaks of trace A identified and numbered (the peaks are numbered according to their frequency or amplitude, see "PKSORT" for more information). The lower window displays the peak table. The peak table displays the following information about the on-screen signal peaks: the number of the peak, the frequency of the peak, and the amplitude of the peak. A signal must be equal to or exceed the peak excursion to be considered a peak. (See "MKPX" for more information about the peak excursion.) While the peak table is turned on, the frequency and amplitude of each peak is updated at the end of every sweep (PKTBL command uses the ONEOS command to update the peak table information).

See "PKRES" for information about how to get the information in the peak table remotely.

You can execute the PKTBL command two different ways. You can either execute the PKTBL command directly (for example, "`PKTBL 1;`") or use the MOV command to move the 1 or 0 into the PKTBL command (for example, "`MOV PKTBL,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

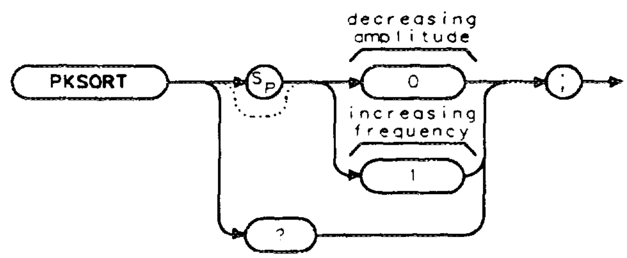
**Restrictions**
Turning on the peak table turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), TOI measurement (TOI), marker table (MKTBL), percent AM (PCTAM), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW).

You should turn off the peak table (set PKTBL to 0) when you are done with the peak table.

# PKSORT
# Peak Sort

Selects how the signal peaks listed in the peak table are sorted: by decreasing amplitude or by ascending frequency.

## Syntax




XPKSORT

Equivalent Softkey: **PK SORT FRQ AMP** .

Preset State: 0 (sort by decreasing amplitude).

Related Commands: DL, PKSORT, PKTBL.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV PKTBL,1;"` | *Turns on the peak table.* |
| `OUTPUT 718;"MOV PKSORT,0;"` | *Sorts the peaks by decreasing amplitude.* |

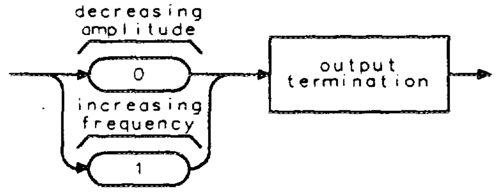
## Description

If PKSORT is set to 0, the spectrum analyzer sorts and displays the list of the peaks according to the amplitude of the peaks (highest amplitude first). If PKSORT is set to 1, the spectrum analyzer sorts and displays the list of the peaks according to frequency (lowest frequency signal peak is listed first).

See "PKRES" for information about how to get the information in the peak table remotely.

You can execute the PKSORT command two different ways. You can either execute the PKSORT command directly (for example, `"PKSORT 1;"`) or use the MOV command to move the 1 or 0 into the PKSORT command (for example, `"MOV PKSORT,1;"`). If you use the MOV command, no text is displayed in the active function area during command execution.

## Query Response




QPKSORT

## Description

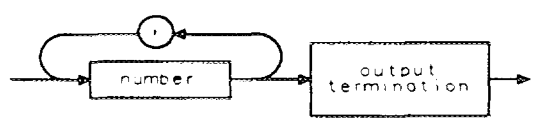
PKRES is an array that contains 10 elements. Each element of the PKRES array contains the $x$-axis coordinate of a signal peak, if a signal peak was found. If a signal peak was not found, the PKRES element contains a 0. The order in which the signal peaks are placed in the PKRES array depends on how the signal peaks were sorted (see "PKSORT" for more information).

You must do the following before using PKRES:

1. Set the trace data format to TDF A, TDF B, TDF I, or TDF M only. You cannot use the TDF P trace data format before PKRES is queried.
2. Use PKSORT to select sorting the signal peaks by amplitude or by frequency.
3. Turn on the peak table with PKTBL.
4. Execute a take sweep (TS) to ensure that valid data is stored in PKRES.

## Query Response

Querying PKRES returns the values of the 10 trace elements, with each value separated by a comma. Querying one element of PKRES (for example, "PKRES [1]?;") returns the value of that element, followed by the output termination.

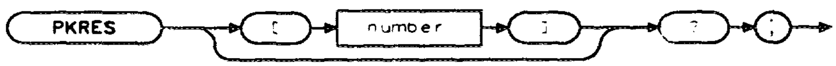



QPKRES

# PKRES
## Peak Result

PKRES returns the $x$-axis coordinates of the peaks in the peak table.

### Syntax




XPKRES

| Item | Description/Default | Range |
|---|---|---|
| Number | An integer number. | 1 to 10. |

Related Commands: DL, PKSORT, PKTBL, TDF.

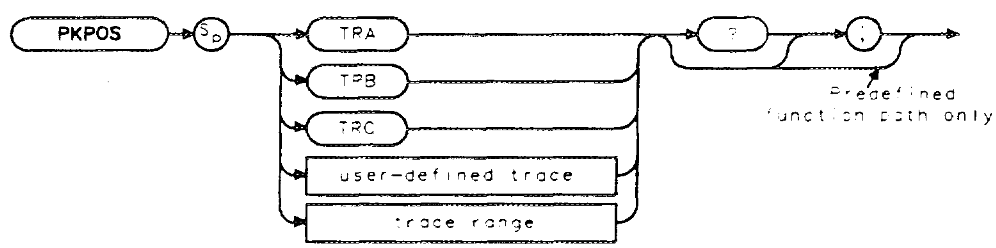
### Example

| | |
|---|---|
| `DIM Results(10)` | *Dimensions an array to hold the results.* |
| `OUTPUT 718;"TDF M;"` | *Changes the trace data format to measurement units.* |
| `OUTPUT 718;"PKSORT 0;"` | *Selects listing the peaks by decreasing amplitude.* |
| `OUTPUT 718;"MOV PKTBL,1;"` | *Turns on the peak table.* |
| `OUTPUT 718;"TS;"` | *Performs a take sweep.* |
| `FOR I=1 TO 10` | *Uses a FOR NEXT loop to get the data from PKRES.* |
| `  OUTPUT 718;"PKRES[";I;"]?"` | *Queries each PKRES element.* |
| `  ENTER 718;Results(I)` | *Enters the PKRES element into the Results element.* |
| `NEXT I` | |
| `OUTPUT 718;"TDF P;"` | *Changes the trace data format to parameter units.* |
| `PRINT "PEAK","FREQUENCY","AMPLITUDE"` | *Prints a heading.* |
| `FOR I=1 TO 10` | *Uses a FOR NEXT loop to print the results.* |
| `  IF Results(I)>0 THEN` | *Results(I) is greater than zero if peak was found.* |
| `    OUTPUT 718;"MKP ";Results(I);";"` | *Places a marker at the x- axis coordinate.* |
| `    OUTPUT 718;"MKF?;"` | *Returns the frequency of the marker.* |
| `    ENTER 718;A` | *Enters the marker's frequency into A.* |
| `    OUTPUT 718;"MKA?;"` | *Returns the amplitude of the marker.* |
| `    ENTER 718;B` | *Enters the marker's amplitude into B.* |
| `    PRINT I,A,B` | *Prints the peak number, frequency, and amplitude.* |
| `  END IF` | *Ends the IF THEN statement.* |
| `NEXT I` | |

# PKPOS
# Peak Position

Returns a value, which is the index of the maximum value in trace A, trace B, trace C, or user-defined trace.

## Syntax




XPKPOS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MINPOS, MXM.

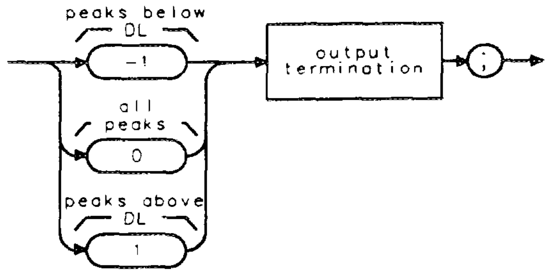
## Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep mode, takes sweep.* |
| `OUTPUT 718;"PKPOS TRA;"` | *Finds the position of the highest peak.* |
| `ENTER 718;Pkresult` | *Outputs result to the computer.* |
| `DISP Pkresult` | *Displays the result.* |

## Description

If a trace range is used with PKPOS, PKPOS returns a value relative to the first element of the trace range. For example, if a trace has a range of 150 to 300 elements, and the maximum value is element 200, PKPOS will return the value of 51.

## Query Response

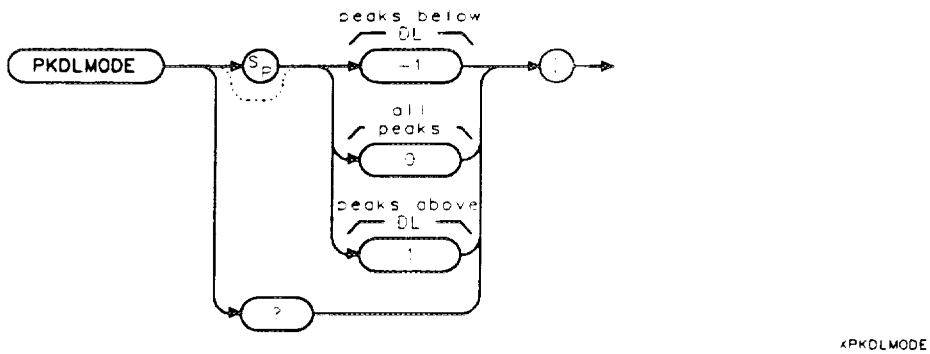



OPKDLMODE

# PKDLMODE
# Peak Table Delta Display Line Mode

Selects the signal peaks that are displayed in the peak table. The signal peaks can be selected as follows: all the signal peaks, only the signal peaks that are above the display line, or only the peaks that are below the display line.

## Syntax




Equivalent Softkey: **PK MODE <>DL NRM**.
Preset State: 0 (display all the signal peaks).
Related Commands: DL, PKSORT, PKTBL.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV PKTBL,1;"` | *Turns on the peak table.* |
| `OUTPUT 718;"DL -20;"` | *Sets the display line.* |
| `OUTPUT 718;"MOV PKDLMODE,1;"` | *Displays the only the signal peaks that are above the display line.* |

## Description

The value of PKDLMODE determines how the signal peaks are displayed. You can set PKDLMODE to the following values:

- If PKDLMODE is set to 0, all signal peaks are displayed and listed.
- If PKDLMODE is set to −1, only the signal peaks below the display line are displayed and listed.
- If PKDLMODE is set to 1, only the signal peaks above the display line are displayed and listed.

You can execute the PKDLMODE command two different ways. You can either execute the PKDLMODE command directly (for example, "`PKDLMODE 1;`") or use the MOV command to move the 1 or 0 into the PKDLMODE command (for example, "`MOV PKDLMODE,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

### PEAKS Peaks

If the FRQ parameter is used with the PEAKS command, the programming example returns the values that shown in the following table.

| Trace Element | Amplitude | Frequency |
|---|---|---|
| TRB[1] | −28.98 | −3E+8 |
| TRB[2] | −14.02 | 4.E+6 |
| TRB[3] | −28.21 | 3.04E+8 |
| TRB[4] | −42.29 | 6.04E+8 |
| TRB[5] | −32.69 | 9.07+8 |

If the AMP parameter is used with the PEAKS command, the programming example returns the values that are shown in the following table.

| Trace Element | Amplitude | Frequency |
|---|---|---|
| TRB[1] | −13.95 | 4.E+6 |
| TRB[2] | −28.14 | 3.04E+8 |
| TRB[3] | −28.89 | −2.96E+8 |
| TRB[4] | −32.6 | 9.07E+8 |
| TRB[5] | −42.23 | 6.08+8 |

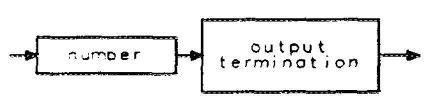
Notice that MKA? and MKF? are used to determine the amplitude and frequency of the peak position.

PEAKS sorts only signals that are above the threshold value. To be classified as a signal peak, a signal must be MKPX above the threshold value and it must rise and fall at least the peak excursion (MKPX value). To change the threshold, use the TH command before PEAKS is executed.

If necessary, the last sorted value is repeated to fill remaining elements of the destination trace.

PEAKS must be used as either a query or as a source in another spectrum analyzer-command function. Form a query by ending the PEAKS statement with a "?." When used as a query, PEAKS returns the number of peaks found. When querying the trace elements of destination trace, the $x$-axis coordinate (relative to the first trace element) of the peak is returned.

## Query Response




QQ1

| | |
|---|---|
| `OUTPUT 718;"PEAKS TRB,TRA,FRQ?;"` | *Returns the number of peaks in trace A above the threshold.* |
| `ENTER 718;Number` | *Gets the number of peaks from the spectrum analyzer.* |
| `DISP Number` | *Displays the result on the computer screen.* |
| `FOR I=1 TO Number` | *For one to the number of peaks, do the following steps.* |
| `    OUTPUT 718;"MKP TRB[";I;"]";` | *Place marker at the position of the first trace B element.* |
| `    OUTPUT 718;"MKA?;"` `ENTER 718;A` | *Find the amplitude of the marker.* |
| `    OUTPUT 718;"MKF?;"` `ENTER 718;B` | *Find the frequency of the marker.* |
| `    PRINT A,B` | *Print the amplitude and the frequency of the marker.* |
| `NEXT I` | *Repeat the FOR NEXT loop for all of the peaks that were found.* |

## Description

When sorting by frequency (FRQ), PEAKS first computes the horizontal position of all peaks. These positions are loaded into the destination trace consecutively, with the lowest frequency value occupying the first element. Thus, signal frequencies, from low to high, determine the amplitude of the destination trace from left to right.

When sorting by amplitude (AMP), PEAKS first computes the amplitudes of all peaks in the source trace in measurement units, and sorts these values from high to low. The positions of the peaks are then loaded into the destination trace, with the position of the highest amplitude value occupying the first element.

For example, executing the programming example results in the following spectrum analyzer display:

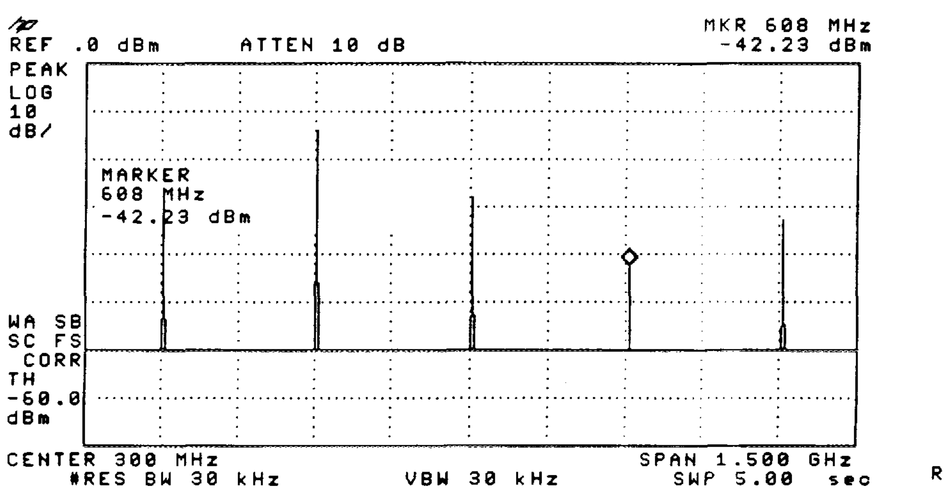
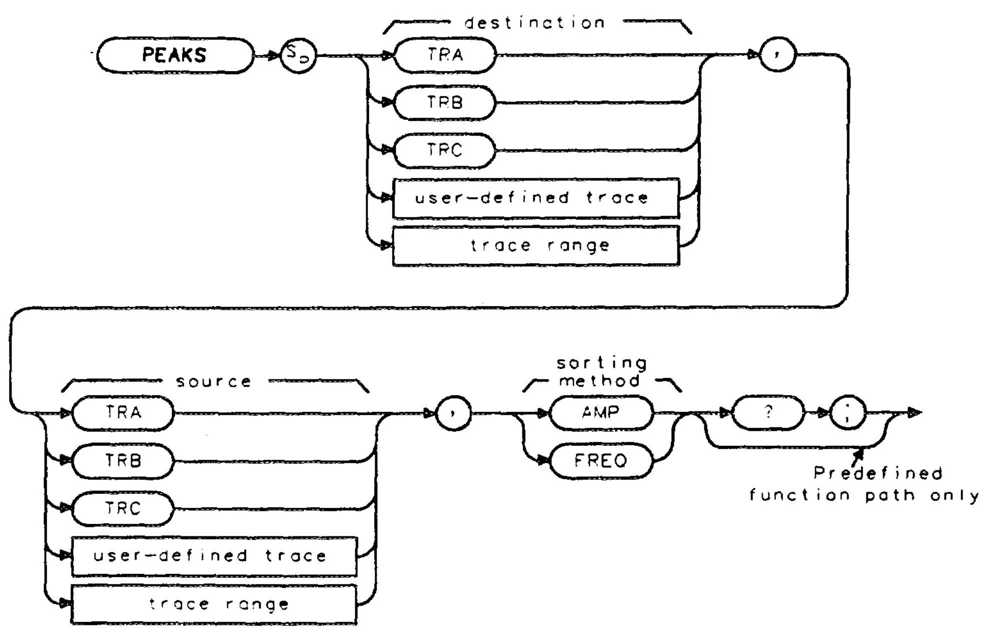



**Figure 5-2. Frequency and Amplitude of the Peaks**

# PEAKS
# Peaks

Sorts signal peaks by frequency or amplitude, stores the results in the destination trace, and returns the number of peaks found.

## Syntax




XPEAKS

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MKPX, TH.

## Example

Connect CAL OUT to the spectrum analyzer input.

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"CF 300MHZ;SP 1500MHZ;RB 30KHZ;SNGLS;"` | *Changes the center frequency, span, bandwidth. Activates single-sweep mode.* |
| `OUTPUT 718;"TH -60DM;MKPX 10DB;TS;"` | *Sets up threshold, sets minimum peak excursion.* |

```
90 FOR I = 1 TO Num_sweeps
```

*This finds the maximum number of sweeps that can be taken before numerical overflow (greater than 32,767.)*

```
100  OUTPUT 718;"TS;PDF TRB,TRA;"
```

*When I = Num_sweeps, trace B contains the number of sweep that had amplitudes at or above the threshold level of −50 dBm.*

```
110 NEXT I
120 END
```

## Description

The TH command permits the user to set an amplitude threshold value. When PDF is performed, measurement buckets of the source trace that exceed the threshold increment the corresponding frequency bucket in the destination trace.

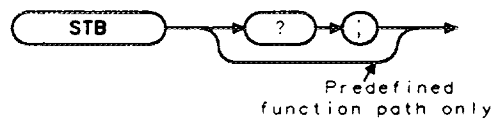
The destination trace should be set to zeros before PDF is executed for the first time. Subsequent calls to PDF increment the destination trace.

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination. The PDF function is similar to the probability density function in statistics. The probability density function has the $y$-axis as the probability of an occurrence, where the PDF function of the HP 8590 Series spectrum analyzer has the number of occurrences as its $y$-axis. The PDF could be converted to a probability density function by dividing, in an external controller, the value on each bucket by the total number of buckets. Note that performing the division inside the spectrum analyzer would not be appropriate because the result is less than 1, which would be truncated to 0.

# STB
# Status Byte Query

Returns to the controller the decimal equivalent of the status byte.

## Syntax




XSTB

Related Commands: RQS, SRQ.

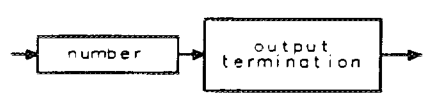
## Example

| | |
|---|---|
| 10 OUTPUT 718;"IP;" | *Initializes spectrum analyzer.* |
| 20 OUTPUT 718;"SNGLS;" | *Activates single-sweep mode.* |
| 30 OUTPUT 718;"CLS;" | *Clears the status bits.* |
| 40 OUTPUT 718;"TS;" | *Takes sweep.* |
| 50 OUTPUT 718;"STB?;" | *Returns the status bits.* |
| 60 ENTER 718;Status_Byte | *Puts the spectrum analyzer response in the computer variable, Status_Byte.* |
| 70 PRINT Status_byte | *Displays the result.* |
| 80 END | |

## Description

The STB command is equivalent to a serial poll command. The RQS and associated bits are cleared in the same way that a serial poll command would clear them. The bits in the status byte are explained under the RQS command.

## Query Response

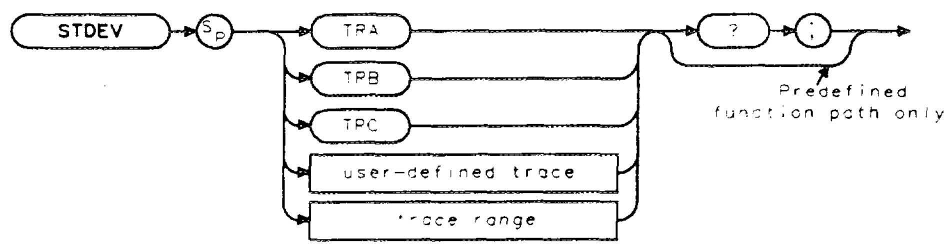



QQ1

# STDEV
## Standard Deviation of Trace Amplitudes

Returns the standard deviation of the trace amplitude in measurement units.

### Syntax




XSTDEV

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: MEAN, PDA, PDF, VARIANCE.

### Example

The following program segment finds the standard deviation of the amplitude of trace A.

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;"` | *Activates single-sweep mode.* |
| `OUTPUT 718;"CF 300MHZ;SP 2MHZ;RB 100KHZ;"` | *Changes the center frequency, span, and resolution bandwidth.* |
| `OUTPUT 718;"TS;"` | *Takes sweep.* |
| `OUTPUT 718;"STDEV TRA?;"` | *Finds the standard deviation of trace A.* |
| `ENTER 718;Number` | *Get the response from the spectrum analyzer.* |

```
PRINT "THE STANDARD DEVIATION OF TRACE A ";Number/100;"DB"
```

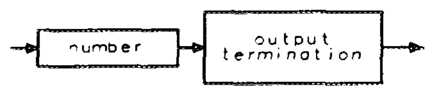
## Description

The formula to calculate the standard deviation is as follows:

$$\sqrt{\frac{\sum_{i=1}^{n}(\bar{x} - x_i)^2}{n - 1}}$$

$n$ represents the number of data points.
$x_i$ represents a data point.
$\bar{x}$ represents the mean of data.

## Query Response

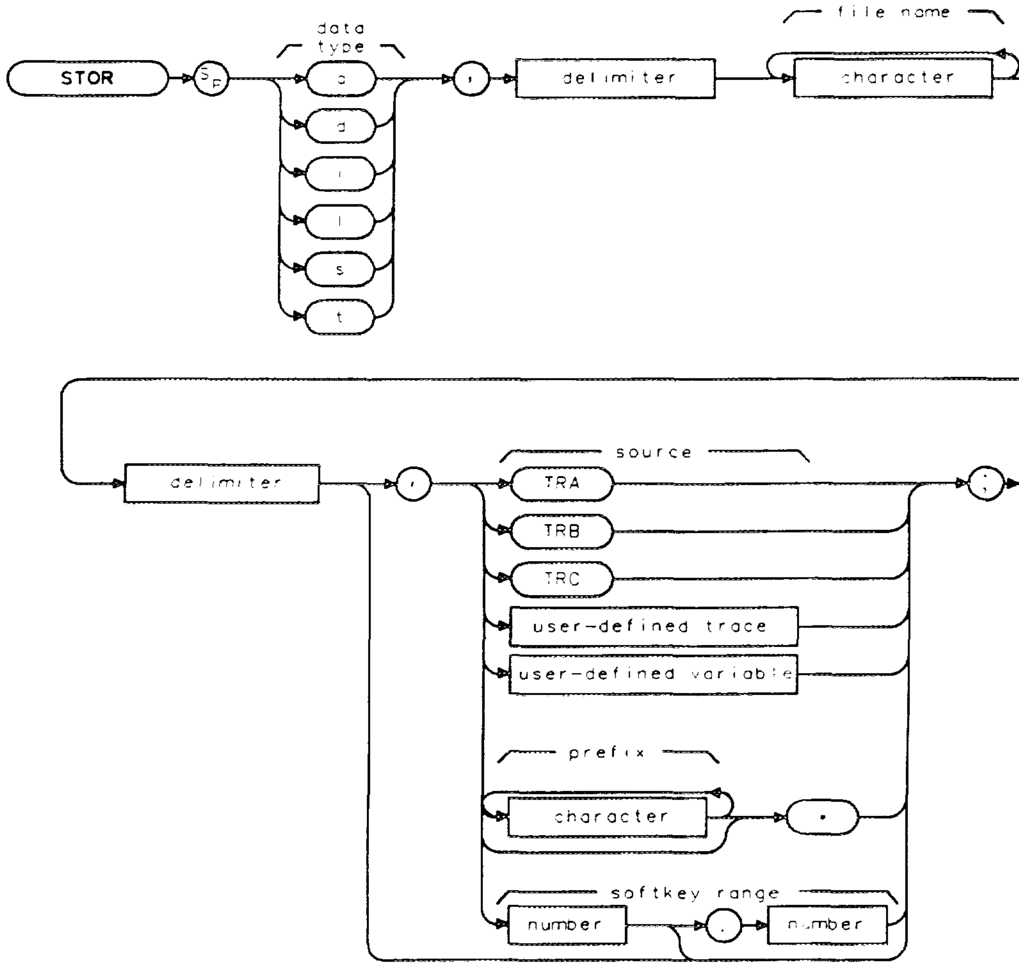



001

# STOR
# Store

Stores data on a RAM card.

## Syntax




xSTOR

<table>
<tr><th>Item</th><th>Description/Default</th><th>Range</th></tr>
<tr><td>User-defined trace</td><td>A trace defined by the TRDEF command.</td><td>Any valid trace name.</td></tr>
<tr><td>User-defined variable</td><td>A variable defined by VARDEF or ACTDEF commands.</td><td>Any valid variable name.</td></tr>
<tr><td>Character (file name)</td><td>Any valid character. Characters form the file type and file name.</td><td>File type (lowercase a, c, d, i, l, s, or t) should precede the file name. File name is 0 to 6 characters long, A through Z and the underscore (the underscore should be used as the second character of the label).</td></tr>
<tr><td>Character (prefix)</td><td>Any valid character.</td><td></td></tr>
<tr><td>Number</td><td>A valid softkey number range. Use a decimal point to separate the softkey numbers when specifying a softkey range.</td><td>1 to 6, 601 to 1200.</td></tr>
<tr><td>Delimiter</td><td>Matching characters marking the beginning and end of the list of spectrum analyzer commands.</td><td>~ | \ @ = / ^ $ % ; ! ' : " &</td></tr>
</table>

Option Required: An HP 8590D or HP 8592D spectrum analyzer needs Option 003 installed in it to use STOR.
Related Commands: CAT, LOAD, PREFX.

## Example

| | |
|---|---|
| `OUTPUT 718;"TRDEF N_EW,400;"` | *Defines a trace.* |
| `OUTPUT 718;"MOV N_EW,TRA;"` | *Moves the contents of trace A into N_EW.* |
| `OUTPUT 718;"STOR t,%tF_UNCX%,N_EW;"` | *Stores N_EW under the file name of tFUNCX as trace data.* |
| `OUTPUT 718;"STOR d,%dP_ROG_1%,*;"` | *Stores all downloadable programs in the spectrum analyzer memory on the RAM card.* |
| `OUTPUT 718;"STOR a,%aA_MPDATA_7%;"` | *Stores the current amplitude correction factors.* |
| `OUTPUT 718;"STOR l,%lL_IMITS_1%;"` | *Stores the current limit-line tables.* |
| `OUTPUT 718;"STOR s,%sS_TATE_1%;"` | *Stores the spectrum analyzer state.* |
| `OUTPUT 718;"STOR d,%dK_EYS_15%,601.606;"` | *Stores softkey functions 601 through 606 in the file dKEYS_1.* |
| `OUTPUT 718;"STOR d,%dK_EY_1%,601;"` | *Stores softkey function 601 in the file dKEY_1.* |
| `OUTPUT 718;"STOR d,%dF_ILES_1%,KEN*;"` | *Stores all downloadable programs with the prefix "KEN" on the RAM card.* |

## Description

The STOR command stores the source data on the RAM card under the specified file name and data type.

**Data type:** Use the data type as the first character of the file name in order to catalog the file by the file type. For example, use tFUNCX instead of FUNCX to catalog it by traces. If the file type is not specified as the first character of the file name, the file is stored as an ASCII file. It is necessary to use the correct data type (a, d, i, l, s, or t) to load the file into spectrum analyzer memory correctly. The letters correspond to the data type as shown in the following table.

| Data Type | Description |
|---|---|
| a | Amplitude correction factor table. |
| d | Downloadable program. |
| i | Displays image. |
| l | Limit-line table. |
| s | Instrument state. |
| t | Trace and instrument state. |

**Note**

The STOR saves data on a RAM card. See "SAVET," "SAVES," or "SAVRCLN" to save data in spectrum analyzer memory.

With the memory card reader, the spectrum analyzer can read from either a RAM (random-access memory) card or a ROM (read-only memory card). To write to a memory card, the card must be a RAM card. The spectrum analyzer cannot write to a ROM card.

## Specifying the source

When storing trace data, enter the location of the trace data (trace A, trace B, trace C, or user-defined trace) as the source.

Downloadable programs can be stored as follows:

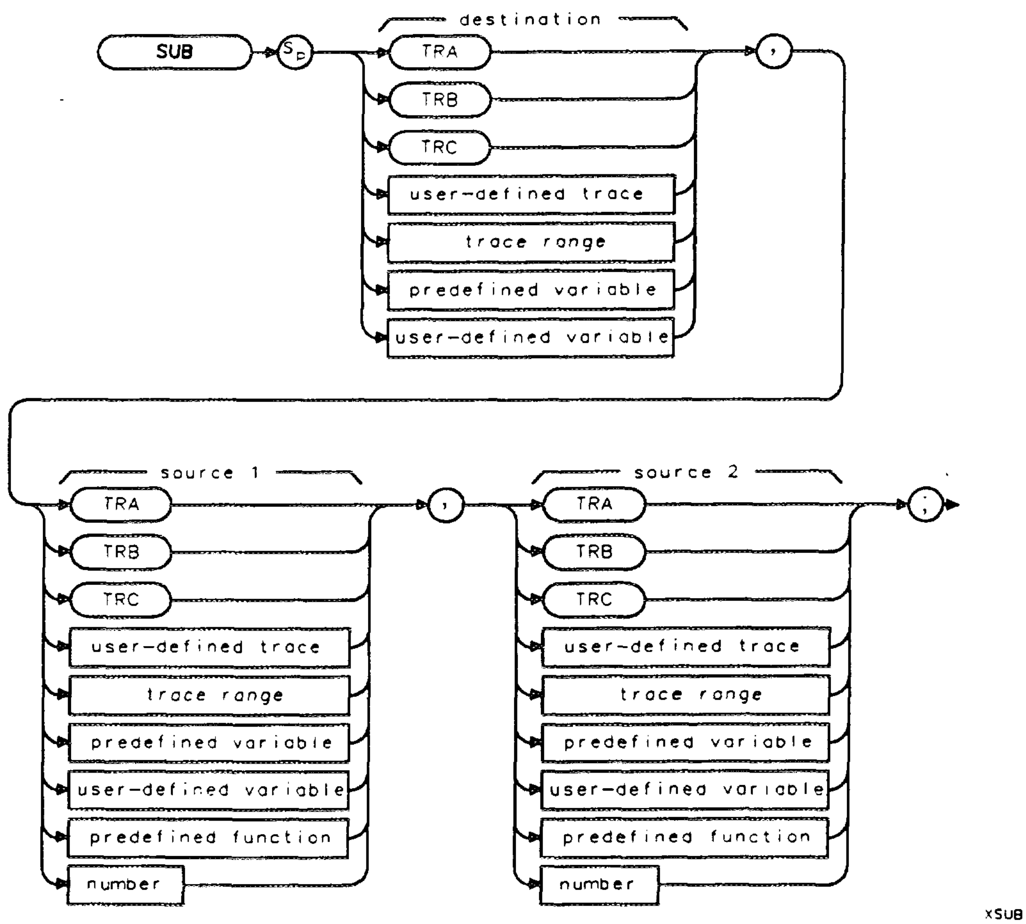
- For storing all downloadable programs in spectrum analyzer memory on a RAM card, use an asterisk as the source.
- For storing all downloadable programs with a certain prefix, use a prefix followed by an asterisk as the source.
- For storing a range of softkey functions, specify the softkey numbers separated with a decimal. Use the downloadable program file type when storing user-defined variables.

**Space required:** To store a file on a memory card, there must be enough space on the memory card for the file. See "Determining the Amount of Space on a RAM Card" in Chapter 4 for more information about space requirements.

# SUB
# Subtract

Subtracts source 2 from source 1, point by point, and sends the difference to the destination.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| User-defined variable | A variable defined by VARDEF or ACTDEF commands. | Any valid variable name. |
| Predefined variable | A command that acts as a variable. Refer to Table 5-1. | |
| Predefined function | Function that returns a value. Refer to Table 5-1. | |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |
| Number | Any real or integer number. | Real number range. |

Prerequisite Commands: TRDEF when using a user-defined trace. ACTDEF or VARDEF for a user-defined variable. TS when using trace data.
Related Commands: AMB, AMBPL, BML, LIMITEST, SUM.

## Example

OUTPUT 718;"SUB TRA,TRB,TRC;" *Subtracts trace C from trace B and places the result in trace A.*

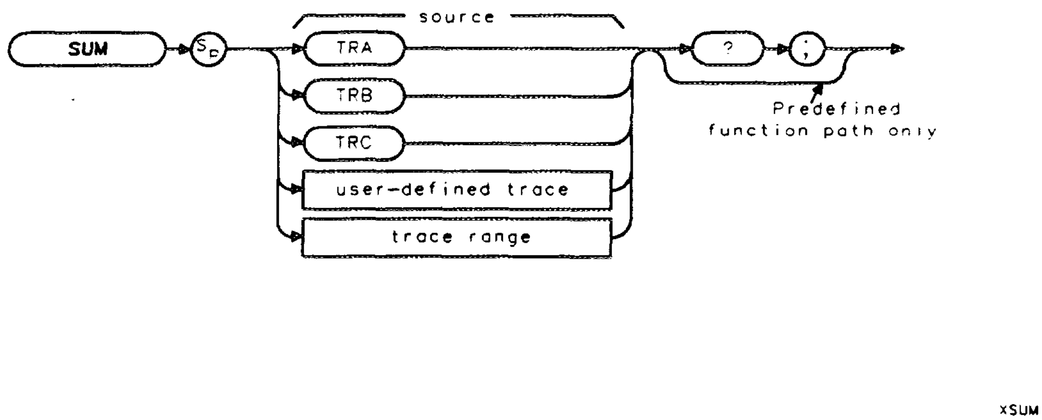
## Description

When the source is longer than the destination, the source is truncated to fit. When the source is shorter than the destination, the last element is repeated to fill the destination.

# SUM
# Sum of Trace Amplitudes

Returns the sum of the amplitudes of the trace elements in measurement units.

## Syntax



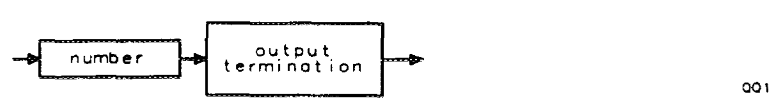

| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.
Related Commands: ADD, DIV, MEAN, MPY, SUB, TS, VARIANCE.

## Example

```
10 OUTPUT 718;"IP;"                        Initializes spectrum analyzer.
20 OUTPUT 718;"SNGLS;TS;"                  Activates single-sweep mode, takes sweep.
30 OUTPUT 718;"SUM TRA?;"                  Gets the result.
40 ENTER 718;Trace_sum                     Puts the spectrum analyzer response in the
                                           computer variable, Trace_sum.
50 DISP Trace_sum;"MEASUREMENT UNITS"      Displays the result.
60 END
```

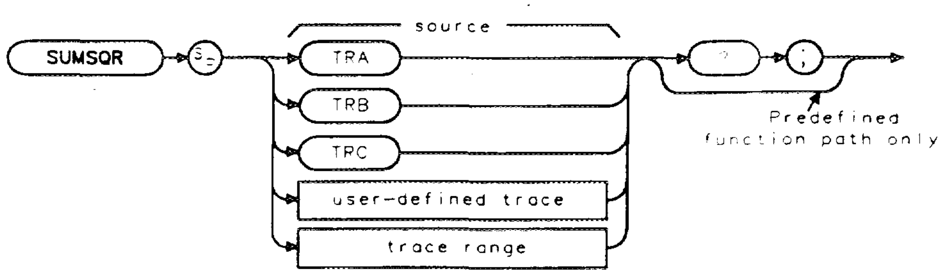
## Query Response



# SUMSQR
## Sum of Squared Trace Amplitudes

Returns the sum of the squares of the amplitude of each trace element in measurement units.

### Syntax




XSUMSQR

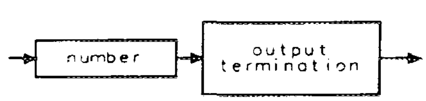
| Item | Description/Default | Range |
|---|---|---|
| User-defined trace | A trace defined by the TRDEF command. | Any valid trace name. |
| Trace range | A segment of trace A, trace B, trace C, or a user-defined trace. | |

Prerequisite Commands: TRDEF when using a user-defined trace. TS when using trace data.

### Example

| | |
|---|---|
| `OUTPUT 718;"IP;"` | *Initializes spectrum analyzer.* |
| `OUTPUT 718;"SNGLS;TS;"` | *Activates single-sweep mode, takes sweep.* |
| `OUTPUT 718;"SUMSQR TRA?;"` | *Gets the result.* |
| `ENTER 718;Trace_sqrsum` | *Puts the spectrum analyzer response in the computer variable, Trace_sqrsum.* |
| `DISP Trace_sqrsum;"MEASUREMENT UNITS"` | *Displays the result.* |

### Query Response

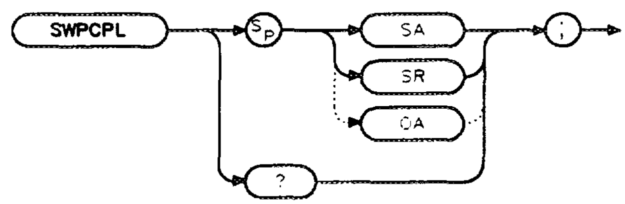



001

# SWPCPL
# Sweep Couple

Selects either a stimulus-response (SR) or spectrum-analyzer (SA) auto-coupled sweep time.

## Syntax




XSWPCPL

Equivalent Softkey: **SWP CPLG SR SA** .

Option Required: Option 010 or 011.
Preset State: SWPCPL SA.
Related Commands: SRCPWR.

## Example

```
10 OUTPUT 718;"IP;SNGLS;"
20 OUTPUT 718;"FA 300KHZ;FB 1GHZ;"
30 OUTPUT 718;"SRCPWR -10DB;"
40 OUTPUT 718;"SWPCPL SR;"
50 OUTPUT 718;"SRCTKPK;DONE?;"
60 ENTER 718;Done
70 LOCAL 718
80 END
```

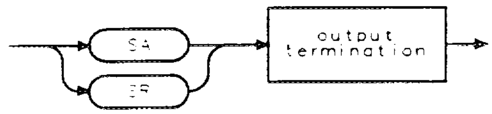
## Description

In stimulus-response mode, auto-coupled sweep times are usually much faster for swept-response measurements. Stimulus-response auto-coupled sweep times are typically valid in stimulus-response measurements when the system's frequency span is less than 20 times the bandwidth of the device under test.

When used as a predefined variable, SWPCPL returns either a "0" or a "1," depending on the setting of the SWPCPL parameters. Refer to the following table.

| Parameter setting | Value returned |
|---|---|
| SA | 0 |
| SR | 1 |

## Query Response

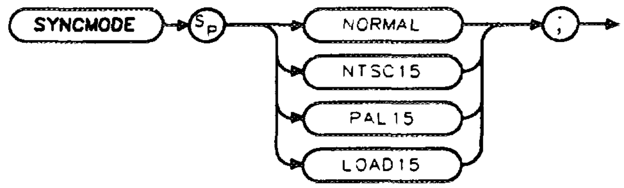



QSWPCPL

# SYNCMODE
# Synchronize Mode

Selects either the horizontal and vertical synchronizing constants, or the synchronization rate for both the internal monitor of the spectrum analyzer and the video signal that is output to the MONITOR OUTPUT connector.

## Syntax




XSYNCMODE

Equivalent Softkey: **SYNC NRM NTSC**, **DEFAULT SYNC**, **SYNC NRM PAL**.

Related Commands: CRTHPOS, CRTVPOS, IP.

## Example

| | |
|---|---|
| `OUTPUT 718;"SYNCMODE NTSC15;"` | *Selects the NTSC format for the spectrum analyzer monitor and monitor output.* |
| `OUTPUT 718;"IP;"` | *An instrument preset activates the new synchronizing constants.* |

## Description

Whenever you use SYNCMODE to change the synchronizing constants, you must press (PRESET) or execute IP to activate the new synchronizing constants. Changing the vertical scanning rate may change the location of the time and date display on the spectrum analyzer display.

The SYNCMODE parameters NORMAL and LOAD15 allow you to change the horizontal and vertical synchronizing constants for both the spectrum analyzer's internal monitor and the video signal to the MONITOR OUTPUT connector.

The SYNCMODE parameters NTSC15 and PAL15 allow you to change the vertical scanning rate for both the spectrum analyzer's internal monitor and the video signal that is output to the MONITOR OUTPUT connector. The regular vertical scanning rate for the spectrum analyzer's monitor is 57 Hz; the NTSC15 changes the vertical scanning rate to 60 Hz, and the PAL15 changes the vertical scanning rate to 50 Hz. If you want to record the spectrum analyzer display on a video cassette recorder (VCR) that uses the NTSC format, you must use the NTSC15 parameter to change the vertical scanning rate of the spectrum analyzer monitor to 60 Hz. If you want to record the spectrum analyzer display on a VCR that uses the PAL format, you must use the PAL15 parameter to change the vertical scanning rate of the spectrum analyzer monitor to 50 Hz. The parameters for SYNCMODE are described below.

NORMAL — Restores the previous values for the horizontal and vertical synchronizing constants of the spectrum analyzer display if SYNCMODE NTSC15 or SYNCMODE PAL15 was previously executed. The previous values for the horizontal and vertical position are the positions that were set by CRTHPOS and CRTVPOS. SYNCMODE NORMAL is equivalent to **SYNC NRM NTSC** (with NRM underlined).

NTSC15 Selects the NTSC format for a spectrum analyzer that has an internal monitor with a horizontal scanning rate of 15.75 kHz (the monitors for the HP 8590D, HP 8591E, HP 8592D, HP 8593E, HP 8594E, HP 8595E, and HP 8596E all have horizontal scanning rates of 15.75 kHz). SYNCMODE NTSC15 is equivalent to **SYNC NRM NTSC** (with NTSC underlined).

PAL15 Selects the PAL format for a spectrum analyzer that has an internal monitor with a horizontal scanning rate of 15.75 kHz (the monitors for the HP 8590D, HP 8591E, HP 8592D, HP 8593E, HP 8594E, HP 8595E, and HP 8596E all have horizontal scanning rates of 15.75 kHz). SYNCMODE PAL15 is equivalent to **SYNC NRM PAL** (with PAL underlined).

LOAD15 Loads the default constants horizontal and vertical position for the display of a spectrum analyzer with an internal monitor with 15.75 kHz horizontal scanning (the HP 8590D, HP 8591E, HP 8592D, HP 8593E, HP 8594E, HP 8595E, and HP 8596E all have horizontal scanning rates of 15.75 kHz). The default constants are the constants that are stored into the spectrum analyzer's read-only memory (ROM). SYNCMODE LOAD15 is equivalent to **DEFAULT SYNC**.

When used as a predefined variable, SYNCMODE returns a number from 0 to 5. The value that is returned by SYNCMODE depends on the SYNCMODE parameter, as shown in the following table.

| Parameter setting | Value returned |
|---|---|
| NORMAL | 0 |
| NTSC15 | 1 |
| PAL15 | 3 |
| LOAD15 | 5 |

# TA
# Transfer A

Returns trace A amplitude values from the spectrum analyzer to the controller.

## Syntax


XTA

Related Commands: MDS, TB, TDF.

## Example

This example stores the TA results in array A.

| | |
|---|---|
| `DIM A(401)` | *Reserves memory area for array.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"SNGLS;CF 300MHZ;SP 2MHZ;TS;"` | *Activates single-sweep mode, changes center frequency and span, takes sweep.* |
| `OUTPUT 718;"TDF P;TA;"` | *Changes trace data format, outputs trace A.* |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves each element of trace A to the computer.* |
| `  ENTER 718;A(N)` | |
| `NEXT N` | |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves the trace values from the computer to the printer.* |
| `  PRINT A(N)` | *Prints out the results.* |
| `NEXT N` | |

## Description

The display unit values are transferred in sequential order (from left to right) as seen on the screen.

Transfer of trace amplitude data should be done only as follows:

1. Select single sweep mode (SNGLS).
2. Select desired spectrum analyzer settings.
3. Take one complete sweep (TS).
4. Transfer data (TA).

This procedure ensures that the current settings of the spectrum analyzer are reflected in the transferred data.

See Chapter 3, "Different Formats for Trace Data Transfers," for more information about transferring trace data. Items are separated by a comma when in TDF P format.

# TB
# Transfer B

Transfers trace B amplitude values from the spectrum analyzer to the controller.

## Syntax


Related Commands: MDS, TA, TDF.

## Example

| | |
|---|---|
| `DIM A(401)` | *Reserves memory area for array.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"SNGLS;CF 300MHZ;SP 2MHZ;TS;"` | *Activates single-sweep mode, changes center frequency and span, takes sweep.* |
| `OUTPUT 718;"TDF P;TB;"` | *Changes trace data format, outputs trace B* |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves each element of trace A to the computer.* |
| `  ENTER 718;A(N)` | |
| `NEXT N` | |
| `FOR N = 1 TO 401` | *FOR NEXT loop moves the trace values from the computer to the printer.* |
| `  PRINT A(N)` | *Prints out the results.* |
| `NEXT N` | |

## Description

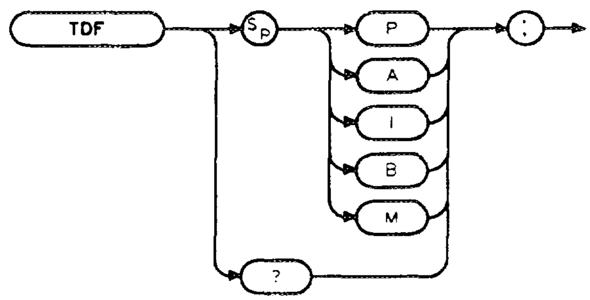
The operation of TB is similar to the operation of TA.

See Chapter 3, "Different Formats for Trace Data Transfers," for more information about transferring trace data.

# TDF
# Trace Data Format

Formats trace information for return to the controller.

## Syntax




XTDF

Related Commands: MDS, MKA, TA, TB, TRA.

## Example

| | |
|---|---|
| `DIM A(401)` | *Holds trace data.* |
| `OUTPUT 718;"IP;"` | *Initializes analyzer.* |
| `OUTPUT 718;"BLANK TRA;CLRW TRB;"` | *Views trace B.* |
| `OUTPUT 718;"SNGLS;CF 300MHZ;SP 2MHZ;TS;"` | *Activates single-sweep mode, changes center frequency and span.* |
| `OUTPUT 718;"TDF P;TB;"` | *Formats trace data.* |
| `FOR N = 1 TO 401` | *Transfers trace data to array A, one element at a time.* |
| `  ENTER 718;A(N)` | |
| `  NEXT N` | |
| `FOR N = 1 TO 401` | *Loop prints out trace B data.* |
| `  PRINT A(N)` | *Prints out the results.* |
| `NEXT N` | |

## Description

The different trace data formats are as follows:

## TDF P

**Description:** TDF P is the real number format. An example of a trace element returned with the real number format is 10.00 dB. When querying the trace or marker value, the value is returned using the amplitude unit set by AUNITS (for example, watts or dBm).

**Restrictions:** The spectrum analyzer must be in log scale to use TDF P. To send the trace data back to the spectrum analyzer, the data must be converted to measurement units.

**How data is returned:** The following table describes what is transferred when the trace data format is set to P, but the AUNITS are changed. In every case, the trace data transfer is ended by a carriage return, and a line feed with an EOI.

### TDF Trace Data Format

**Trace Data Transfers with TDF P**

| AUNITS Setting | Example | Description |
|---|---|---|
| Watts | TDF P;AUNITS W;TA; | Transfers 401 real values, in watts, with each value separated by a carriage return and a line feed. |
| dBm | TDF P;AUNITS DBM;TA; | Transfers 401 real values, in dBm, with each value separated by a carriage return and a line feed. |
| dBmV | TDF P;AUNITS DBMV;TA; | Transfers 401 real values, in dBmV, with each value separated by a carriage return and a line feed. |
| dBμV | TDF P;AUNITS DBUV;TA; | Transfers 401 real values, in dBμV, with each value separated by a carriage return and a line feed. |
| Volts | TDF P;AUNITS V;TA; | Transfers 401 real values, in volts, with each value separated by a carriage return and a line feed. |

**Example of how data is returned:** For example, if the reference level of the spectrum analyzer is set to −10 dBm, the amplitude scale is set to 10 dB per division, and trace A contains the following data:

TRA[1] contains 8000 (in measurement units). The value 8000 indicates trace element 1 is at the reference level.
TRA[2] = 7000 measurement units (trace element 2 is −10 dB below the reference level).
TRA[3] through TRA[401] each contain 6000 (in measurement units). The value 6000 indicates that the trace elements 3 through 401 are all at −20 dB below the reference level.

Querying trace A with the TDF P format and AUNITS set to DBM returns ASCII character codes for the following:

−10.00,−20.00,−30.00,(−30.00 is repeated 398 times),<CR><LF><EOI>

## TDF A

**Description:** TDF A is the A-block data format. With the A-block data format, trace data is preceded by "#," "A," and a two-byte number (the two byte number indicates the number of trace data bytes). The setting of the MDS command determines whether the trace data is transferred as one or two 8-bit bytes.

**Restrictions:** To use the A-block format for sending data, you must provide the number of data bytes.

**How data is returned:** The following table describes what is transferred when the trace data format is set to A, but the MDS setting is changed.

**Trace Data Transfers with TDF A**

| MDS Setting | Example | Description |
|---|---|---|
| Binary | TDF A;MDS B;TA; | Transfers "#A," the number of bytes of trace data, then the 401 bytes of trace data. Using MDS B "reduces" each trace value into one byte by dividing (DIV) the trace value by 32. The trace data transfer is ended with an EOI. |
| Word | TDF A;MDS W;TA; | Transfers "#A," the number of bytes of trace data, then 802 bytes of trace data. MDS W uses two bytes per trace element to transfer trace data. The first byte contains the trace value divided by (DIV) 256, the second byte contains the remainder (MOD) of that division. The trace data transfer is ended with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF A format and MDS set to binary (MDS B) would return the ASCII character codes for the following:

#A(401 div 256)(401 mod 256)(8000 div 32)(7000 div 32)(6000 div 32)(the number for 6000 div 32 is repeated 398 times)<EOI>

Notice that #A is followed by the two bytes that contain the number of trace elements. Because MDS is set to binary, the number of trace elements is 401.

If MDS is set to W, querying trace A with the TDF A format would return the ASCII character codes for the following:

#A(802 div 256)(802 mod 256)(8000 div 256)(8000 mod 256)(7000 div 32)(7000 mod 256)(6000 div 256)(6000 mod 256)(the number for 6000 div 256, then the number for 6000 mod 256 is repeated 398 times)

Notice that #A is followed by the two bytes that contain the number of trace elements. Because MDS is set to W (word), the number of trace elements is 802.

## TDF I

**Description:** TDF I is the I-block data format. With the I-block data format, trace data must be preceded by "#," and "I." The setting of the MDS command determines whether the trace data is transferred as one or two 8-bit bytes. Unlike using the A-block format, you do not provide the number of data bytes when sending trace data back to the spectrum analyzer.

**Restrictions:** This format is not recommended for use with an RS-232 interface.

**How data is returned:** The following table describes what is transferred when the trace data format is set to I, but the MDS setting is changed.

**Trace Data Transfers with TDF I**

| MDS Setting | Example | Description |
|---|---|---|
| Binary | TDF I;MDS B;TA; | Transfers "#I," then the 401 bytes of trace data. Using MDS B "reduces" the trace value into 1 byte by dividing (DIV) the trace value by 32. The trace data transfer is ended with an EOI. |
| Word | TDF I;MDS W;TA; | Transfers "#A," then 802 bytes of trace data. MDS W uses two bytes per trace element to transfer trace data. The first byte contains the trace value divided by (DIV) 256, the second byte contains the remainder (MOD) of that division. The trace data transfer is ended with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF I format and MDS set to binary (MDS B) would return the ASCII character codes for the following:

#I(8000 div 32)(7000 div 32)(6000 div 32)(the number for 6000 div 32 is repeated 398 times)

If MDS is set to W, querying trace A with the TDF I format would return the ASCII character codes for the following:

#I(8000 div 256)(8000 mod 256)(7000 div 32)(7000 mod 256)(6000 div 256)(6000 mod 256)(the number for 6000 div 256, then the number for 6000 mod 256 is repeated 398 times)

# TDF B

**Description:** TDF B enables the binary format. With the binary format, the marker or trace data is transferred as bytes. Of all the trace data formats, TDF B transfers trace data the fastest. The setting of the MDS command determines whether the trace data is transferred as one or two 8-bit bytes.

**Restrictions:** The TDF B format cannot be used to send data back to the spectrum analyzer (you must use the A-block format to send data back to the spectrum analyzer).

**How data is returned:** The following table describes what is transferred when the trace data format is set to B, but the MDS setting is changed.

**Trace Data Transfers with TDF B**

| MDS Setting | Example | Description |
|---|---|---|
| Binary | TDF B;MDS B;TA; | Transfers the 401 bytes of trace data. Using MDS B "reduces" the trace value into 1 byte by dividing (DIV) the trace value by 32. The trace data transfer is ended with an EOI. |
| Word | TDF B;MDS W;TA; | Transfers the 802 bytes of trace data. MDS W uses two bytes per trace element to transfer trace data. The first byte contains the trace value divided by (DIV) 256, the second byte contains the remainder (MOD) of that division. The trace data transfer is ended with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF B format and MDS set to binary (MDS B) would return the ASCII character codes for the following:

(8000 div 32)(7000 div 32)(6000 div 32)(the number for 6000 div 32 is repeated 398 times)

If MDS is set to W, querying trace A with the TDF B format would return the ASCII character codes for following:

(8000 div 256)(8000 mod 256)(7000 div 32)(7000 mod 256)(6000 div 256)(6000 mod 256)(the number for 6000 div 256, then the number for 6000 mod 256 is repeated 398 times)

# TDF M

**Description:** TDF M is the measurement data format. The measurement data format transfers trace data in measurement units, and the measurement data can range from −32768 to +32767.

**Restrictions:** TDF M cannot be used to send trace data back to the spectrum analyzer.

**How trace data is returned:** The following table describes what is transferred when the trace data format is set to M.

**Trace Data Transfers with TDF M**

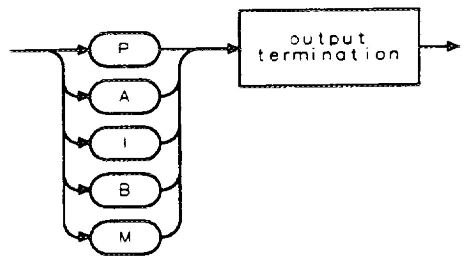
| Example | Description |
|---|---|
| TDF M;TA; | Transfers 401 bytes, with each trace value in measurement units. The trace data transfer is ended with a carriage return, a line feed with an EOI. |

**Example of how data is returned:** For the same trace A data that is used in the TDF P description, querying trace A with the TDF M would return the ASCII character codes for the following:

8000,7000,6000,(6000 repeated 398 times),<CR><LF>

Refer to Chapter 3, "Different Formats for Trace Data Transfers," for more information about transferring trace data.

## Query Response

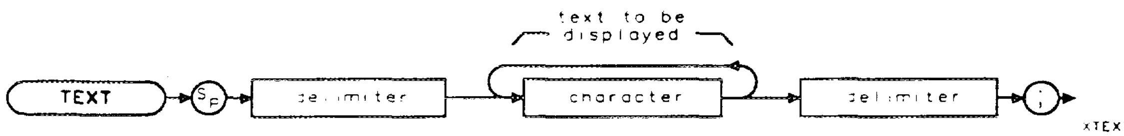



QTDF

# TEXT
# Text

Writes text on the spectrum analyzer screen at the current pen position.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. See "LB" for additional characters available. | |

Related Commands: DSPLY, LB, PA, PD, PU, PR.

## Example

```
OUTPUT 718;"PU;PA 80,80;TEXT%CONNECT ANTENNA%;"
```
*Displays CONNECT ANTENNA on the analyzer screen.*

```
OUTPUT 718;"PU;PA 100,100;TEXT%50";CHR$(250);"%;"
```
*Displays 50Ω on the analyzer screen.*

## Description

The TEXT origin is at the lower-left corner of the first character. The pen is placed to the right of and behind the last character position after the text characters. Line feeds are not automatically generated for lines that extend past the edge of the screen.

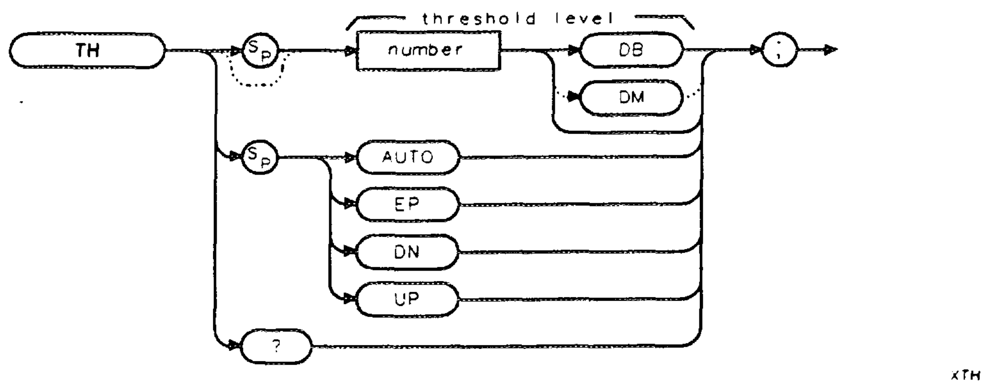
See "LB" for the additional characters available by specifying the ASCII character code. (See second line of the example for an example of using the ASCII character code.)

The TEXT command also enters the text into the display list. See "DA" for more information about the display list.

# TH
# Threshold

Clips signal responses below the threshold level.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. Default unit is dBm. | Range dependent on RL setting. |

Equivalent Softkey: **THRESHLD ON OFF**.
Preset State: Clip off, positioned one division above bottom graticule line.
Step Increment: One division.
Related Commands: AUTO, DL, MEANTH, MKPK, PEAKS, RL.
Restrictions: Not available with Analog+ display mode. See "ANLGPLUS" for more information.

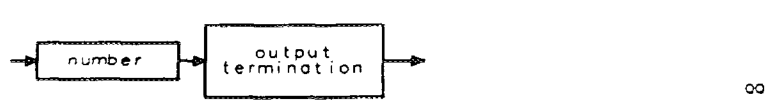
## Example

`OUTPUT 718;"TH UP;"` *Increases the threshold level.*

## Description

The threshold level is eight graticule divisions below the top of the screen unless otherwise specified. The threshold level is annotated in reference level units at the lower-left corner of the spectrum analyzer screen. AUTO deactivates clipping. The TH level is used for next peak marker movements (see "MKPK") and the PEAKS command even if the display clipping is off.

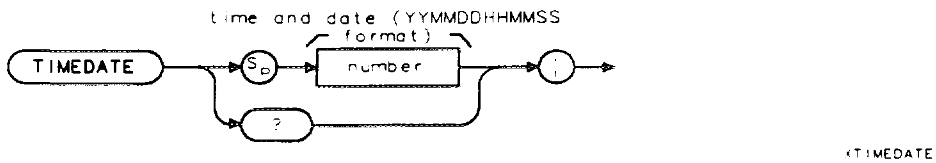
## Query Response



# TIMEDATE
# Time Date

Allows you to set the time and date for the spectrum analyzer real-time clock in the YYMMDDHHMMSS format.

## Syntax



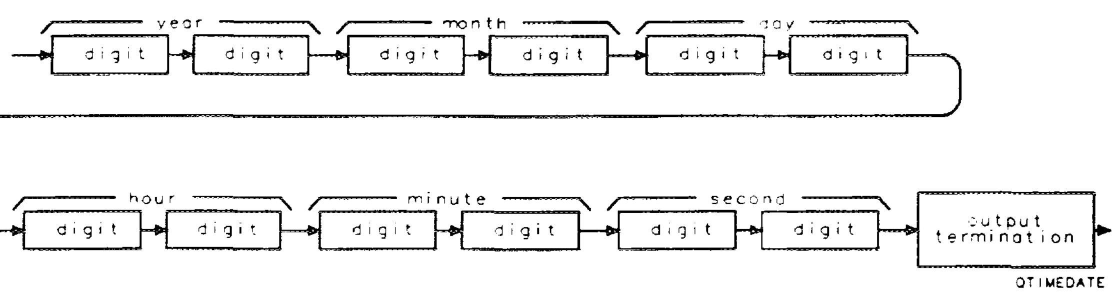

| Item | Description/Default | Range |
|---|---|---|
| Number | A number representing the date and time in the YYMMDDHHMMSS (24 hour) format. | A valid date and time. |

Related Commands: SETDATE, SETTIME, TIMEDSP.

## Example

`OUTPUT 718;"TIMEDATE 881231135501;"` *Sets the analyzer time and date to 1:55:01* PM *on 31 December 1988.*

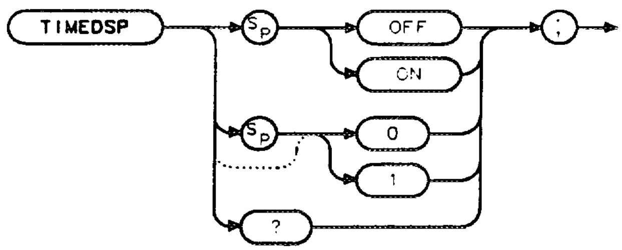
## Query Response



# TIMEDSP
# Time Display

Enables the display of the time and date on the spectrum analyzer screen.

## Syntax



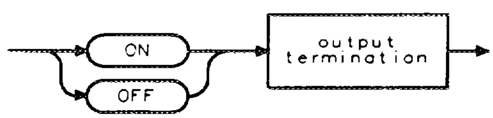

XTIMEDSP

Equivalent Softkey: **TIMEDATE ON OFF**.
Related Commands: ANNOT, SETDATE, SETTIME, TIMEDATE.

## Example

```
OUTPUT 718;"TIMEDSP OFF;"
```

## Query Response

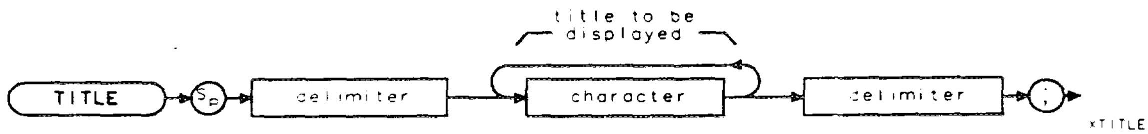



002

# TITLE
# Title

Activates the screen title mode. The title is displayed above the top graticule and is left justified.

## Syntax




| Item | Description/Default | Range |
|---|---|---|
| Delimiter | Matching characters marking the beginning and end of the list of analyzer commands. | ~ \| \ @ = / ^ $ % ; ! ' : " & |
| Character | Any valid character. See "LB" for additional characters available. | Up to 53 characters. |

Equivalent Softkey: **Change Title** .

Related Commands: IP, LB, SAVES, TEXT.

## Example

`OUTPUT 718;"TITLE %ADJUST ANTENNA%;"` *Displays "ADJUST ANTENNA" on the analyzer screen.*

## Description

This function writes a message at the top of the spectrum analyzer

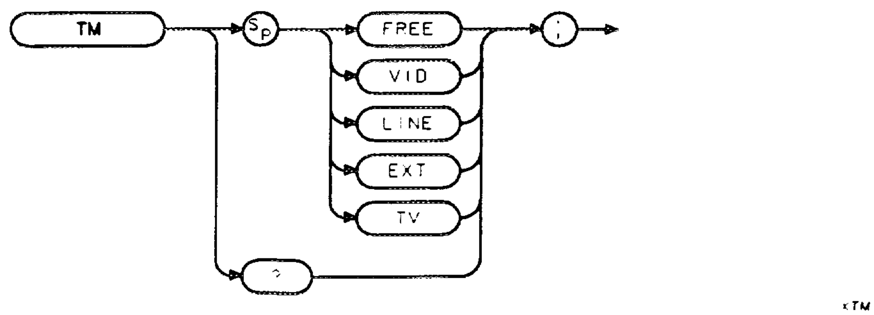
screen. The full width of the display is available for writing a maximum of 53 characters. However, the marker readout may interfere with the last 26 characters. IP removes the message.

The SAVET command saves the screen title is along with the trace in the trace register.

# TM
# Trigger Mode

Selects a trigger mode: free, line, video, TV, or external.

## Syntax




Equivalent Softkeys: The keys accessed by (TRIG).
Related Commands: DL.

## Example

`OUTPUT 718;"TM EXT;"` *Activates the external trigger mode.*

## Description

The conditions of the four trigger modes are as follows:

**FREE** allows the next sweep to start as soon as possible after the last sweep. The functions of TM FREE and **FREE RUN** are identical.

**VID** allows the next sweep to start if the trace data rises across a level set by the display line. The functions of TM VID and **VIDEO** are identical.

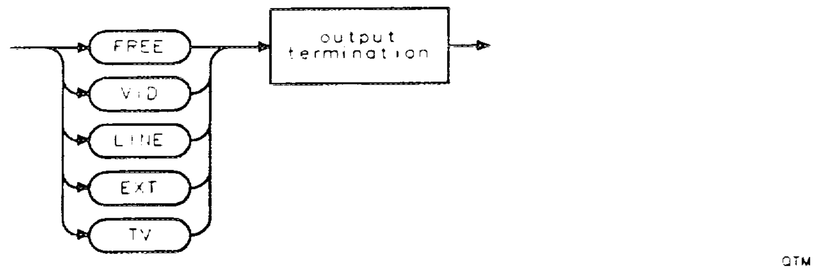
**LINE** allows the next sweep to start when the line voltage passes through zero, going positive. The functions of TM LINE and **LINE** are identical.

**EXT** allows the next sweep to start when an external voltage level passes through approximately 1.5 V, going positive. The external trigger signal level must be between 0 V and +5 V. Connect the external trigger to the EXT TRIG INPUT. The functions of TM EXT and **EXTERNAL** are identical.

**TV** allows TV triggering if Options 101 and 102, or Option 301 is installed. The functions of TM TV and **TV TRIG** are similar. TM TV does not select the TV line number, set up the amplitude level, change the span, change the bandwidth, or change the sweep time.

**Note** Some spectrum analyzer functions are not performed until the spectrum analyzer is triggered.

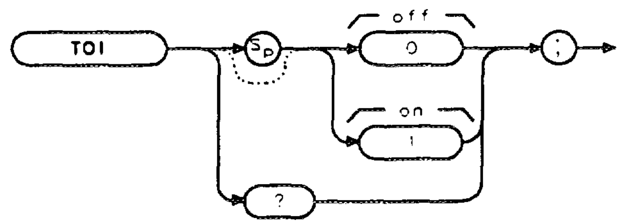
## Query Response



# TOI
# Third-Order Intermodulation Measurement

Turns on or off the third-order intermodulation (TOI) measurement.

## Syntax




XTOI

Equivalent Softkey: **TOI ON OFF**.
Related Commands: AUNITS, MKPX, TH, TOIR.

## Example

| | |
|---|---|
| `OUTPUT 718;"MOV TOI,1;"` | *Turns on the third-order intermodulation measurement.* |
| `OUTPUT 718;"TOIR?;"` | *Queries TOIR. TOIR contains the results of the third-order intermodulation measurement.* |
| `ENTER 718;Toi` | *Stores the value of TOIR in the variable Toi.* |
| `PRINT "Third-order intermodulation is ",Toi` | *Prints the results.* |
| `OUTPUT 718;"MOV TOI,0;"` | *Turns off the third-order intermodulation measurement.* |

## Description

Setting TOI to 1 turns on the third-order intermodulation measurement. Setting TOI to 0 turns off the third-order intermodulation measurement. When the third-order intermodulation measurement is turned on, the spectrum analyzer first determines that there are four signals on the spectrum analyzer display; the four signals must be the two fundamental signals and two distortion products. All of the signals must be greater than the peak excursion above the threshold. If four valid signals could not be found for the third-order intermodulation measurement, the value of TOIR is −100. If four valid signals could be found, the spectrum analyzer does the following:

1. Finds the four highest on-screen signals. (If the four highest on-screen signals are not the two signals and two distortion products, the TOI measurement cannot be performed.)
2. Determines the spacing between the highest two signals. The highest two signals are tone A and tone B.
3. Verifies that the third and fourth highest signals (distortion A and distortion B) fall above and below tone A and tone B by the frequency difference between tone A and tone B.

## TOI Third-Order Intermodulation Measurement

4. Measures the levels of the four signals (tone A, tone B, distortion A, and distortion B) and calculates the third-order intermodulation intercept.

The third-order intermodulation intercept is calculated as follows:

$$TOI = \frac{(2 \times Level_{Tone\ A} - Level_{Distortion\ A} + Level_{Tone\ B})}{2}$$

The frequency of the distortion product (Distortion A) is equal to the following:

$$Frequency_{Distortion\ A} = 2 \times Frequency_{Tone\ A} - Frequency_{Tone\ B}$$

You must query TOIR to determine the value of the higher third-order intermodulation product.

The third-order intermodulation measurement is repeated at the end of every sweep (TOI uses the ONEOS command to update the measurement data) until you turn off the third-order intermodulation measurement.

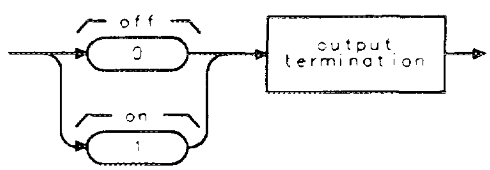
**Restrictions**

Turning the TOI measurement on turns off the following functions: windows display mode (WINON), N dB point measurement (NDBPNT), the FFT menu measurements (FFTAUTO, FFTCONTS, FFTSNGLS), gate utility functions (GDRVUTIL), marker table (MKTBL), peak table (PKTBL), percent AM (PCTAM), peak zoom (PKZOOM), and power menu measurements (ACP, ACPE, CHP, and OBW).

You can execute the TOI command two different ways. You can either execute the TOI command directly (for example, "`TOI 1;`") or use the MOV command to move the 1 or 0 into the TOI command (for example, "`MOV TOI,1;`"). If you use the MOV command, no text is displayed in the active function area during command execution.

Because TOI is performed at the end of every measurement sweep, you should turn off the third-order intermodulation measurement (set TOI to 0) when you are done with the third-order intermodulation measurement.

## Query Response

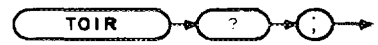


QTOI

# TOIR
# Third-Order Intermodulation Response

Returns the intercept point for the highest third-order intermodulation product measured by the third-order intermodulation measurement (TOI).

## Syntax




XTOIR

Related Commands: AUNITS, MKPX, TH, TOI.

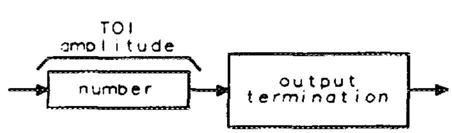
## Example

| | |
|---|---|
| `OUTPUT 718;"MOV TOI,1;"` | *Turns on the third-order intermodulation measurement.* |
| `OUTPUT 718;"TOIR?;"` | *Queries TOIR. TOIR contains the results of the third-order intermodulation measurement.* |
| `ENTER 718;Toi` | *Stores the value of TOIR in the variable Toi.* |
| `PRINT "Third-order intermodulation is ",Toi` | *Prints the results.* |
| `OUTPUT 718;"MOV TOI,0;"` | *Turns off the third-order intermodulation measurement.* |

## Description

TOIR returns a −100 if the TOI function has not been turned on, or if four on-screen signals are not valid or are not present. For TOI to perform a third-order intermodulation measurement, there needs to be four signals on the spectrum analyzer display, and all four signals must be greater than the peak excursion above the threshold.

## Query Response

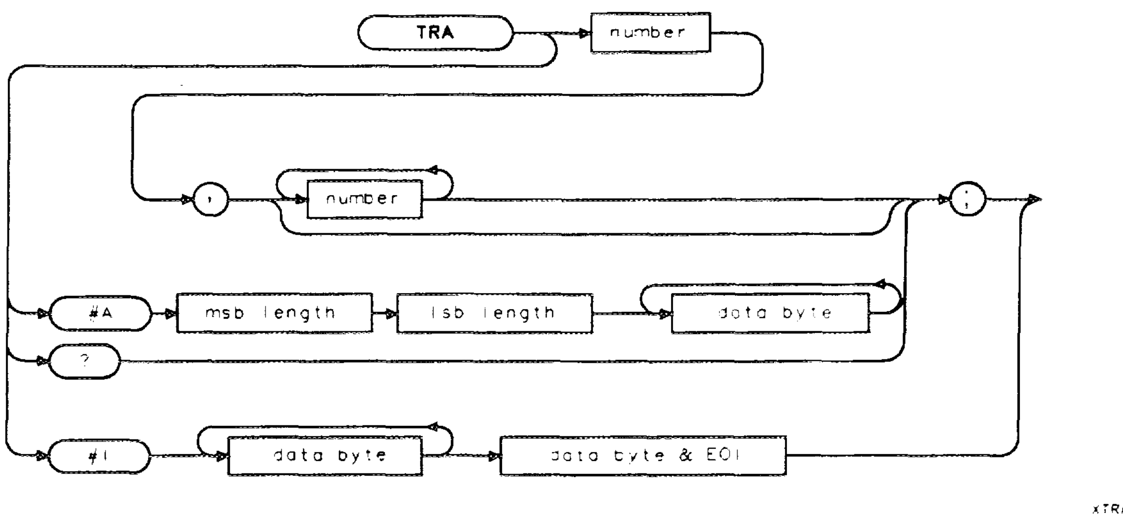



QTOIR

# TRA/TRB/TRC
# Trace Data Input and Output

The TRA/TRB/TRC commands provide a method for returning or storing 16-bit trace values.

## Syntax




Use the same syntax for TRB and TRC as shown for TRA, just substitute TRB or TRC for TRA.

| Item | Description/Default | Range |
|---|---|---|
| Number | Any real or integer number. | Integer number range |
| Msb length | Most significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Lsb length | Least significant byte of a two-byte word that describes the number of bytes transmitted. | |
| Data byte | 8-bit byte containing numeric or character data. | |
| Data byte & EOI | 8-bit byte containing numeric or character data followed by END. | |

Related Commands: LOAD, ONEOS, RCLT, SAVET, STOR, TDF.

## Example

```
10 REAL Trace_a(1:401)          Creates a 401-point trace array.
20 OUTPUT 718;"IP;"             Initializes analyzer.
30 OUTPUT 718;"TDF P;"          Changes the format for real numbers.
40 OUTPUT 718;"SNGLS;"
50 OUTPUT 718;"CF 300MHZ;"      Changes the center frequency.
60 OUTPUT 718;"SP 200MHZ;"      Changes the span.
70 OUTPUT 718;"TS;"
80 OUTPUT 718;"MKPK HI;"
90 OUTPUT 718;"MKCF;"           Moves peak to center of analyzer screen.
100 OUTPUT 718;"TS;"            Updates measurement trace.
110 OUTPUT 718;"TRA?;"          Gets the trace data.
```

## HP 35665A Dynamic Signal Analyzer

# Operator's Reference

For Instruments with Firmware Revision
A.01.08

HEWLETT
PACKARD

**HP Part Number: 35665-90050**
**Microfiche Part Number: 35665-90250**
**Printed in U.S.A.**

**Print Date: September 1993**

## Herstellerbescheinigung

Hiermit wird bescheinigt, daß das Gerät/System

## HP 35665A DYNAMIC SIGNAL ANALYZER

in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Meß- und Testgeräte

Werden Meß- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Meßaufbauten verwendet, so ist vom Betreiber sicherzustellen, daß die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

## Manufacturer's declaration

This is to certify that the equipment

## HP 35665A DYNAMIC SIGNAL ANALYZER

is in accordance with the Radio Interference Requirements of Directive FTZ 1046/1984. The German Bundespost was notified that this equipment was put into circulation, the right to check the series for compliance with the requirements was granted.

Additional Information for Test- and Measurement Equipment

If Test- and Measurement is operated with unscreened cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the Radio Interference Limits are still at the border of his premises.

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## Safety Summary

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

## Ground The Instrument

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

## Do Not Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

## Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

## Do Not Service or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

## Do Not Substitute Parts or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure the safety features are maintained.

## Dangerous Procedure Warnings

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

---

**Warning** **Dangerous voltages, capable of causing death, are present in this instrument. Use extreme caution when handling, testing, and adjusting.**

---

HEWLETT PACKARD

## Safety Symbols

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

### General Definitions of Safety Symbols Used On Equipment or In Manuals.

| | |
|---|---|
| ⚠ | Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect against damage to the instrument. |
| ϟ | Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked.) |
| ⏚ OR ⏚ (circled) | Protective conductor terminal. For protection against electrical shock in case of a fault. Used with field wiring terminals to indicate the terminal which must be connected to ground before operating equipment. |
| ⏚ (circled) | Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment. |
| ⏊ OR ⊥ | Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures. |
| ∼ | Alternating current (power line). |
| ⎓ | Direct current (power line). |
| ≂ | Alternating or direct current (power line). |

---

**Warning** **The WARNING sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which if not correctly performed or adhered to, could result in injury or death to personnel.**

---

**Caution** The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

---

**Note** The NOTE sign denotes important information. It calls attention to procedure, practice, condition or the like, which is essential to highlight.

# Guide to HP 35665A Documentation

| If you are thinking about... | And you want to... | Then read... |
|---|---|---|
| ◆ Unpack and install the HP 35665A | Install the HP 35665A Dynamic Signal Analyzer | *HP 35665A Installation and Verification Guide* |
| | Do operation verification or performance verification tests | *HP 35665A Installation and Verification Guide* |
| ◆ Getting started | Make your first measurements with your new analyzer | *HP 35665A Quick Start Guide* |
| | Review measurement basics | *HP 35665A Concepts Guide* |
| | Learn what each key does | *HP 35665A Operator's Reference* or use the analyzer's [ **Help** ] key |
| ◆ Making measurements | Learn how to make typical measurements with the HP 35665A | *HP 35665A Operator's Guide* |
| | Understand each of the analyzer's instrument modes | *HP 35665A Concepts Guide* |
| ◆ Creating automated measurements | Learn the HP Instrument BASIC interface | *Using HP Instrument BASIC with the HP 35665A* |
| | Record keystrokes for a particular measurement | *HP 35665A Operator's Guide* |
| | Program with HP Instrument BASIC | *HP Instrument BASIC User's Handbook* |
| ◆ Remote operation | Learn about the HP-IB | *HP–IB Programming with the HP 35665A* |
| | Learn how to program with HP-IB | *HP–IB Programming with the HP 35665A* |
| | Find specific HP-IB commands | *HP 35665A HP-IB Commands: Quick Reference* |
| ◆ Servicing the analyzer | Adjust, troubleshoot, or repair the analyzer | *HP 35665A Service Guide* |

# Table of Contents

1

# Before You Begin

## About this Book

This operating manual provides a detailed overview of the analyzer's controls and features. As such, it's the correct book to use if you're already comfortable with the HP 35665A Dynamic Signal Analyzer and what you really need is more in-depth information about specific instrument controls and features.

This book does not teach you how to use the analyzer. If you haven't used the analyzer before—or haven't used it very much—read the *HP 35665A Quick Start Guide*. This contains a few sample measurement tasks and essential background information necessary for you to get comfortable, quickly, with the HP 35665A Dynamic Signal Analyzer. The *HP 35665A Operator's Guide* includes more detailed and advanced measurement tasks.

For more information, see "Where to find Additional Information" later in this chapter.

## Firmware Revision Date

This book should be used with HP 35665A Dynamic Signal Analyzers having firmware version A.01.00. If your analyzer has a significantly different firmware revision, contact your local HP Sales/Service office to obtain a documentation set that matches your firmware revision date.

Firmware revisions are significant *only if the first two digits in the firmware revision date are changed.* For example, A.01.00 indicates a significant change from A.00.00. However, a change to A.00.01 from A.00.00 indicates very minor changes that do not affect the documentation set.

To check the firmware revision date of your instrument, press [ **System Utility** ] and then [ S/N VERSION ].

## Need Assistance?

If you need assistance, contact your nearest Hewlett-Packard Sales and Service Office listed in the HP Catalog, or contact your nearest regional office listed at the back of this guide. If you are contacting Hewlett-Packard about a problem with your HP 35665A Dynamic Signal Analyzer, please provide the following information:

- Model number: HP 35665A
- Serial number:
- Firmware revision date:
- Options :
- Date the problem was first encountered:
- Circumstances in which the problem was encountered:
- Can you reproduce the problem?
- What effect does this problem have on you?

# Notation Conventions

## Hardkeys

Throughout this book, hardkeys are printed like this: [ **Inst Mode** ]. Hardkeys are front-panel buttons whose functions are always the same. Hardkeys have a label printed directly on the key itself.

## Softkeys

Throughout this book, softkeys are printed like this: [ FFT ANALYSIS ]. Softkeys are keys whose functions change with the analyzer's current menu selection. A softkey's function is indicated by a video label to the left of the key (at the edge of the analyzer's screen).

## Toggle Keys

Some keys toggle through different settings. Toggle softkeys have a highlighted word in their label that changes with each press of the softkey. Throughout this book, toggle softkeys are depicted as they *appear after you make the keypress*. For example, "toggle to [ X-AXIS **LIN** LOG ]" means to press[ X-AXIS LIN/LOG ] until the word LIN is highlighted.

There is only one toggle hardkey. This is the [ **Pause-Cont** ] hardkey.

## Ghosted Softkeys

Occasionally, a softkey may be inactive—this occurs when a softkey is not appropriate for a particular measurement. When this happens, the analyzer "ghosts" the inactive softkey. For example, if you set the analyzer to one-channel mode, and then press [ **Meas Data** ], the [ FREQUENCY RESPONSE ] softkey will be ghosted. This is because frequency response data is only available when the analyzer is in two-channel mode.

## Key Press Sequences

When instructions or descriptions include a series of key presses, they are printed like this:

[ **Inst Mode** ] → [ CAPTURE SETUP ]

This example means that you first press the [ **Inst Mode** ] hardkey, then the [ CAPTURE SETUP ] softkey.

## Where to find Additional Information

### Using the [ Help ] key

The [ **Help** ] key on the analyzer's front panel provides fast, easy-to-read information about specific instrument controls and features. Using [ **Help** ] is particularly convenient when you need assistance and you don't have the analyzer's *Getting Started Guide* or *Operating Manual* near at hand.

The [ **Help** ] key is also a good way to learn about the analyzer (or to refresh your memory if you don't use the analyzer often). The help facility also has an index that lets you request information by key name or by topic.

### The Quick Start Guide

Use the *HP 35665A Quick Start Guide* as an introduction to the HP 35665A. If you haven't read this book yet, you should probably do so. The Quick Start Guide is very short, but it's designed to get you comfortable with the analyzer by helping you make a sample measurement within fifteen minutes.

### The Operator's Guide

The *HP 35665A Operator's Guide* shows you how to make typical measurements with the HP 35665A Dynamic Signal Analyzer. In addition, this book shows you how to perform common analysis tasks, such as building limits, using keystroke recording, and using math operations. It also shows you how to do other common tasks, such as plotting or printing your measurement results, and saving, recalling, and copying files.

### The Concepts Guide

For a conceptual overview of the analyzer and in-depth discussion of the analyzer's major features, use the *HP 35665A Concepts Guide*. Where appropriate, the *Concepts Guide* includes sample tasks to help you get comfortable with some of these features.

The *Concepts Guide* also contains essential background material to help you understand and use the HP 35665A. This is particularly useful if you haven't used a spectrum/network analyzer before, or if you haven't used an FFT analyzer before. It may also be useful if you just want to review some basic measurement concepts.

### Programmer's Reference

To help you operate the analyzer remotely via HP-IB, see *HP-IB Programming with the HP 35665A*. Here you'll find a conceptual overview of the HP-IB and how you can use it to control you instrument remotely. There is also a command reference that lists all HP-IB commands specific to the HP 35665A. This includes a description of each command, its proper syntax, and example statements. Additionally, there are sample programs to help you create your own HP-IB programs.

### HP Instrument BASIC

To learn more about using HP Instrument BASIC (a subset of the HP BASIC programming language) with your new analyzer, see *Using HP Instrument BASIC with the HP 35665A*. This shows you how to record and develop programs for the HP 35665A. There are also sample programs to help you get started with HP Instrument BASIC.

For more global information about HP Instrument BASIC, see the *HP Instrument BASIC User's Handbook*. This is a generic handbook for the HP Instrument BASIC language.

### Installation and Verification Test Guide.

For specifications, installation instructions, and performance tests, see the *HP 35665A Installation and Verification Guide*.

### Service Guide

For service information, see the *HP 35665A Service Guide*. This manual includes adjustments, replaceable parts, circuit descriptions, and troubleshooting.

### Demonstration Disc

Consider ordering the *HP Dynamic Signals Demo Disc* (HP part number 35665-95900). This contains captured signals from microphones and vibration transducers for 72 different types of signals. These may be helpful as you learn to use the HP 35665A Dynamic Signal Analyzer—particularly if you are interested in making acoustics or vibration measurements.

To use the demonstration disc, you simply connect a standard audio Compact Disc player to the analyzer's input connectors. Each disk is shipped with documentation to explain the signals and to offer appropriate measurement suggestions. For more information, contact your local Hewlett-Packard Sales and Service Office.

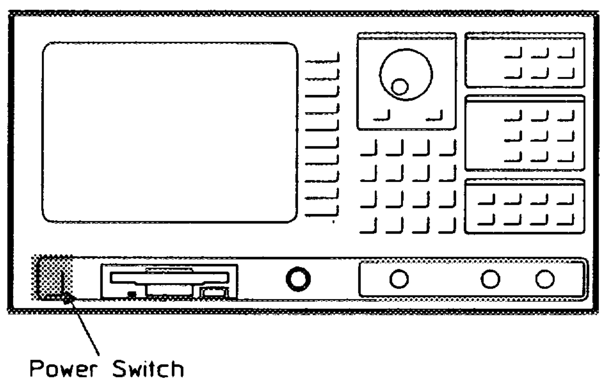
### Related Information

Additionally, you will find applications information in numerous Hewlett-Packard application notes. These are available from your local HP Sales and Service Office.

# Front-Panel Overview

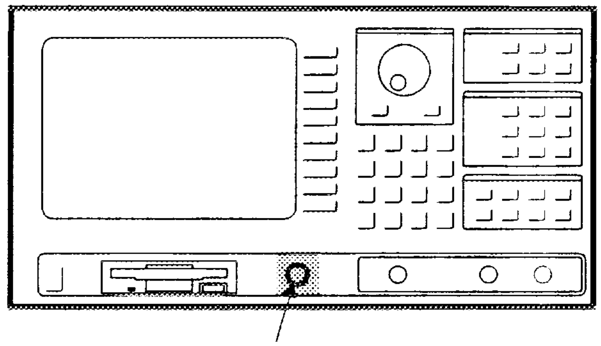
With few exceptions, individual hardkeys (and their associated softkeys) are not described in this section. For specific information about a particular hardkey or softkey, see chapter 4, "Key Reference," or use the analyzer's [ **Help** ] key.

## Power Switch




The analyzer's power switch has two positions: on ( I ) and standby ( ⏻). In the standby position, the analyzer appears off but line power is still applied to the instrument's power supply.

## Keyboard Connector




The HP 35665A analyzer has a connector that lets you attach an optional alphanumeric keyboard. You can use the keyboard to perform the same functions as you would using the alpha-shifted front-panel keys—for example, when specifying filenames or when entering a trace title. The external keyboard is most useful for developing HP Instrument BASIC programs. For detailed information, see "Developing Programs" in the *Using HP Instrument BASIC with the HP 35665A* manual.

**Note** Some HP 35665A analyzers have the keyboard connector on the rear panel. See the next chapter for more information.

The keyboard remains active *even when the analyzer is not in alpha entry mode*. This means that you can operate the analyzer using the external keyboard rather than the front panel. Pressing the appropriate keyboard key does the same thing as pressing a hardkey or a softkey on the analyzer's front panel. See "Keyboard Mapping" later in this chapter for more information.

**Caution**

Use only the approved keyboard for this product. Hewlett-Packard does not warrant damage or performance loss caused by a non-HP approved keyboard. Currently, approved Hewlett-Packard keyboards are as follows:

- U.S. ASCII (C1405A #ABA)
- U.K. English (C1405A #ABU)
- German (C1405A #ABD)
- French (C1405A #ABF)
- Italian (C1405A #ABZ)
- Spanish (C1405A #ABE)
- Swedish/Finnish (C1405A #ABS)

In addition to the U.S. English keyboard, the HP 35665A Dynamic Signal Analyzer supports French, German, Italian, Spanish, U.K./English, and Swedish/Finnish keyboards. To configure your analyzer for a keyboard other than U.S. English, press [ **System Utility** ] → [ KEYBOARD SETUP ]. Then press the appropriate softkey to select the language.

Configuring your analyzer to use a different keyboard only ensures that the analyzer recognizes the proper keys for that particular keyboard. Configuring your analyzer to use another keyboard *does not* localize the on-screen annotation or the analyzer's online help facility.

## Special Considerations when Using the Keyboard

Here are some things to keep in mind when using the keyboard:

- The numeric keys 0 through 9, the up arrow and down arrow keys, the backspace key, and the Enter key do the same thing from the keyboard as from the front panel.
- F1 through F10 correspond to the softkeys. F1 is the top softkey; F10 is the bottom softkey.
- F12 corresponds to the [ **Help** ] hardkey.
- Right arrow and left arrow keys correspond to turning the knob clockwise and counter-clockwise.
- Pressing Alt, CTRL, and Del simultaneously corresponds to the [ **Preset** ] hardkey.
- Print Screen transfers the analyzer screen (without softkey labels) to an appropriate destination—for example, a plotter, a printer, or a file. (This is the equivalent of pressing front panel keys [ **Plot/Print** ] → [ START PLOT/PRNT ].) You can select the destination of the screen data by pressing the appropriate softkeys under the [ **Plot/Print** ] menu.
- The alpha keys A through Z correspond to the hardkeys on the analyzer's front panel. You can use either uppercase or lowercase alpha characters.

## Keyboard Mapping

You can use the external keyboard to operate the front-panel hardkeys and softkeys when the analyzer is not in alpha entry mode. Pressing the appropriate keyboard key does the same thing as pressing a hardkey or a softkey on the analyzer's front panel. The following tables are helpful for using this feature.

**Note**

The following keyboard-to-front-panel-hardkey tables apply to *all* approved keyboards—not just to U.S. ASCII keyboards. Because key functions are mapped to the alpha character and not the actual keyboard key location, it makes no difference if you use an external keyboard with a different language option.

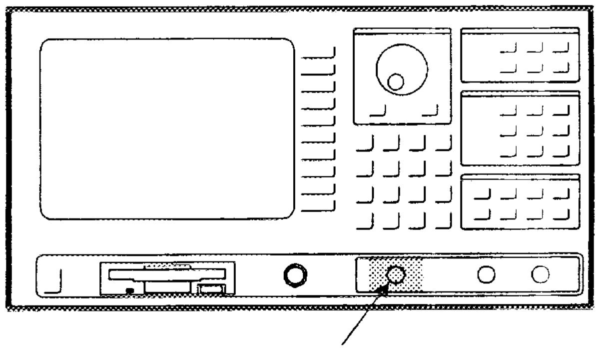
**Keyboard to front-panel hardkey mapping (alphabetically by keyboard key)**

| Keyboard | Front Panel | Keyboard | Front Panel |
|---|---|---|---|
| A | Meas Data | N | Pause/Cont |
| B | Trace Coord | O | Avg |
| C | Scale | P | Save/Recall |
| D | Active Trace | Q | Disk Utility |
| E | Analys | R | System Utility |
| F | Disp Format | S | BASIC |
| G | Inst Mode | T | Plot/Print |
| H | Freq | U | Local/HP-IB |
| I | Window | V | Marker |
| J | Input | W | Marker Fctn |
| K | Source | X | up arrow (↑) |
| L | Trigger | Y | down arrow (↓) |
| M | Start | Z | Marker Value |

**Front-panel key to keyboard mapping (alphabetically by front-panel key)**

| Front Panel | Keyboard | Front Panel | Keyboard |
|---|---|---|---|
| Active Trace | D | Marker Value | Z |
| Analys | E | Meas Data | A |
| Avg | O | Pause/Cont | N |
| Disk Utility | Q | Plot/Print | T |
| Disp Format | F | Save/Recall | P |
| down arrow (↓) | Y | Scale | C |
| Freq | H | Source | K |
| BASIC | S | Start | M |
| Input | J | System Utility | R |
| Inst Mode | G | Trace Coord | B |
| Local/HP-IB | U | Trigger | L |
| Marker | X | up arrow (↑) | V |
| Marker Fctn | W | Window | I |

# Source




The analyzer has an internal signal source, with a choice of several waveforms:

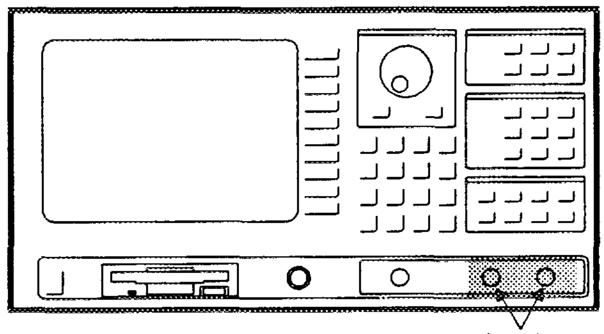
- Random noise.
- Burst random noise.
- Periodic chirp.
- Burst chirp.
- Pink noise.
- Fixed sine.
- Arbitrary (option 1D4).

The source output impedance is less than 5Ω, so you do not need to terminate the analyzer's source.

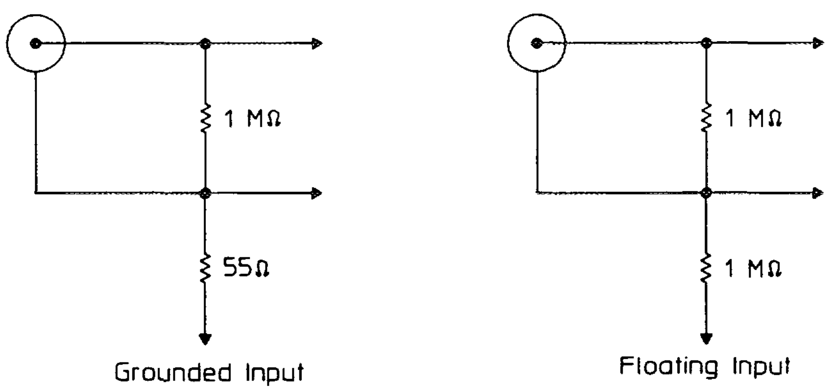
**Caution** When you turn on the analyzer's power (and when you turn off power), a brief pulse may appear at the source output connector. Therefore, do not cycle power if you have sensitive test devices connected to the analyzer's source.

Also, during calibration a small ac voltage (around 2 mV) appears at the source output connector.

# Inputs




The analyzer has two input connectors. Both have input resistance of 1 MΩ, shunted by less than 100 pF of capacitance.




You can select grounded or floating inputs for either input channel. The floating input has a MΩ resistance from the shell of the BNC connector to the analyzer's chassis ground. The grounded input has a 55Ω resistance from the shell of the BNC connector to the analyzer's chassis ground.

The input channels can be ac or dc coupled. With ac coupling, the input signal rolls off 3 dB at 1 Hz. So for very small spans at low frequencies, you should use dc coupling to avoid measurement error.

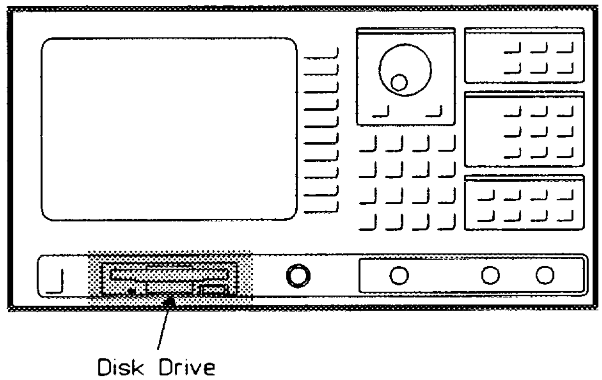
The HP 35665A Spectrum analyzer has input amplitude ranges from 3.99 mVpk to 31.7 Vpk.

## Autoranging

When autoranging is on, the analyzer continuously monitors the amplitude of the input signals and, if necessary, automatically changes the input range. If the input signal increases enough to exceed the current input range, the analyzer changes to a less-sensitive input range. If the input signal decreases enough to compromise the dynamic range of the current measurement, the analyzer does not adjust the range.

When autoranging occurs, you'll see an "Autorange in progress" message on the screen.

# Disk Drive



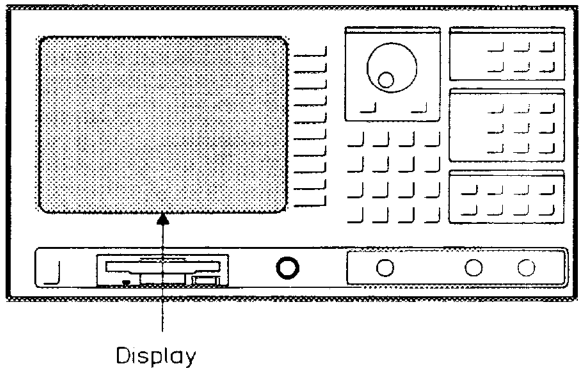

The analyzer has a built-in 3.5-inch flexible disk drive that you can use to load HP Instrument BASIC programs. You can also use the disk drive to store traces, instrument setup states, limit tests, math functions, and HP Instrument BASIC programs.

The disk drive accepts the standard gray 3.5-inch, 710 kilobyte double-sided flexible disks (for example, the HP 92192A) or high-density disks (for example, the HP 92190X). If you load disks that are already formatted, keep in mind that the disk drive recognizes only those disks that have been formatted using the Logical Interchange Format (LIF) or MS-DOS format (MS-DOS is a U.S. registered trademark of Microsoft Corporation).

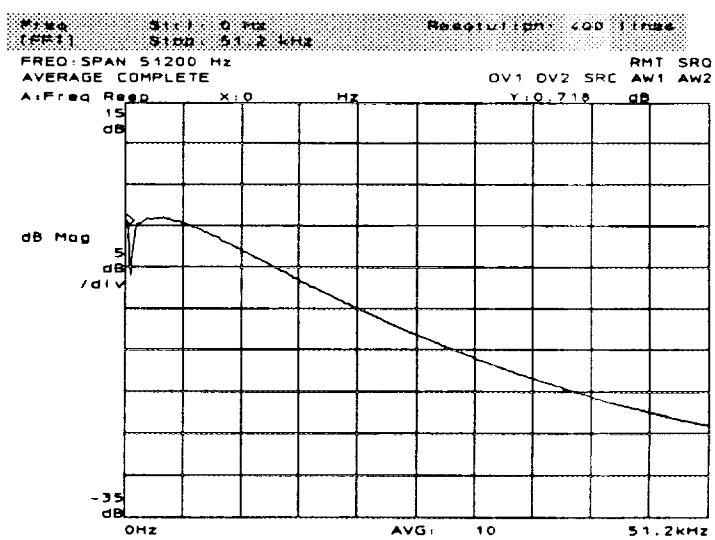
**Note**

The disk drive is designed for operation in a typical office environment. Use of the equipment in an environment containing dirt, dust, or corrosive substances will drastically reduce the life of the disc drive and the flexible disks. The disks should be stored in a dry, static-free environment.

# Display Area



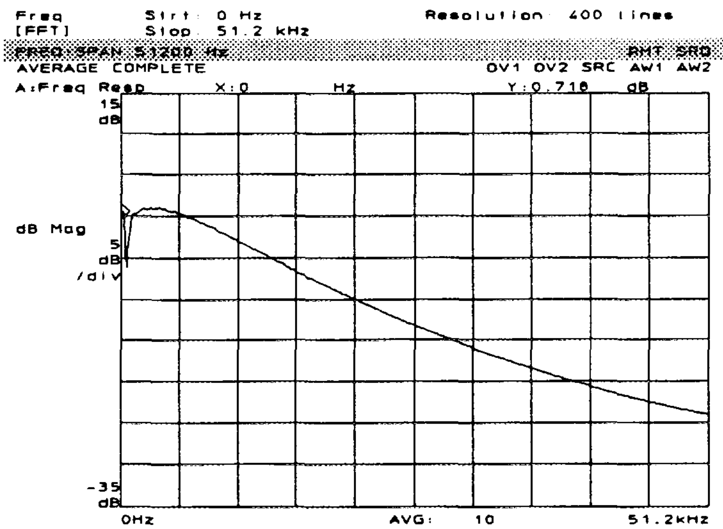

## Mini-state




The top two lines of the display show the "mini-state." The mini-state lists several of the analyzer's current settings, including:

- Name of last hardkey pressed.
- Current instrument mode (if softkeys under the hardkey are mode dependent).
- Current values for parameters under the hardkey (such as start, stop, center, and span frequencies for the [ **Freq** ] hardkey).

## HP-IB Information Area

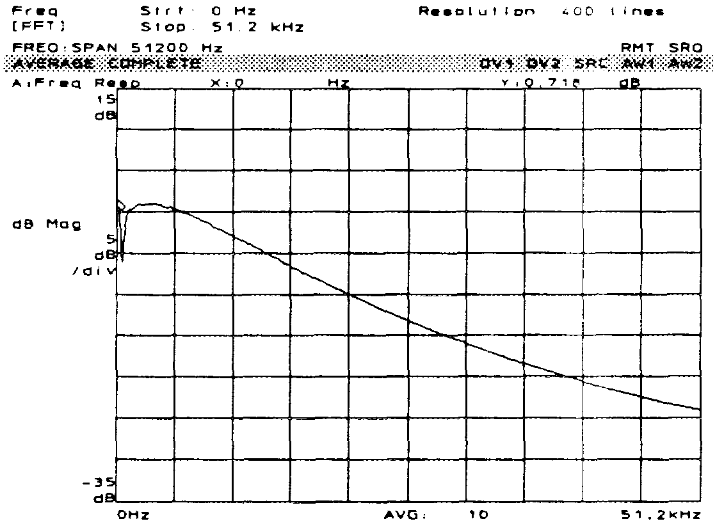



The third line of the display shows HP-IB information. The left side of the line displays HP-IB mnemonics. When you turn on [ GPIB ECHO ] (under the [ **Local/HP-IB** ] hardkey), the analyzer displays the HP-IB command equivalent to keys you press on the front panel.

The right side of the third line contains two HP-IB status indicators. The indicators turn bold only while the conditions they represent remain active. These status indicators are:

- RMT (remote); indicates the presence of an external device that has control of the analyzer's HP-IB.
- SRQ (service request); indicates an analyzer request, via HP-IB, to communicate with the current HP-IB controller.

## Measurement Status Area

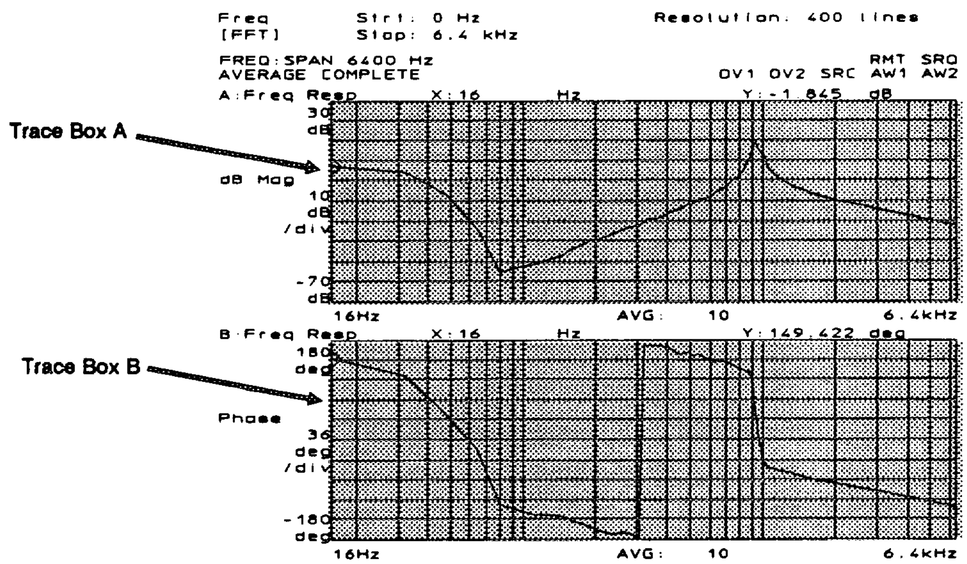



The fourth line of the display is for measurement status information. The left side of the line displays measurement information, such as "AVERAGE COMPLETE" or "MEASUREMENT PAUSED."

The right side of the line contains five measurement status indicators. The indicators turn bold only while the conditions they represent remain active. These status indicators are:

- OV1 (overload channel 1); indicates an overload on the channel 1 input. This message occurs when the input signal exceeds the current channel 1 range.
- OV2 (overload channel 2); indicates an overload on the channel 2 input. This message occurs when the input signal exceeds the current channel 2 range.
- SRC (source); indicates the source is turned on.
- AW1 (A-weight channel 1); indicates the A-weight filter for channel 1 is enabled.
- AW2 (A-weight channel 2); indicates the A-weight filter for channel 2 is enabled.

## Trace Box A and Trace Box B




The analyzer has two display traces. You can display these two traces several ways—single (one trace at a time), upper/lower (trace A on top, trace B on bottom), front/back (one trace overlaid on the other), or waterfall (one trace in a smaller upper trace box and a waterfall of one or more traces in a larger lower trace box). Each trace shows measurement data with 401 points of resolution, regardless of span.

Both Trace A and Trace B are both independent and are not dedicated to showing specific parameters. Rather, you can display one of several different types of information:

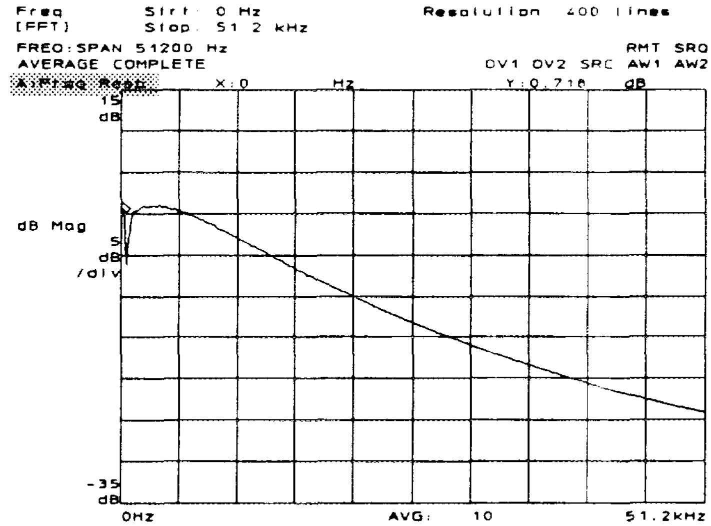
- Current measurement data.
- Functions F1 through F5 (math functions).
- Waveform capture buffer contents.
- Data Registers D1 through D8 (you can save traces, limits, and math functions to a data register and then display them using the [ **Meas Data** ] hardkey.

One trace is "active" at any given time (indicated by the highlighted trace title). The active trace is the target of any adjustments you make with the display keys. For example, if you press [ **Meas Data** ] and press [ DATA REG (D1-D8) ] to call up a stored trace, the stored trace will only appear in the currently active trace box.

Pressing [ **Active Trace** ] lets you designate, alternately, Trace A or Trace B as the active trace.

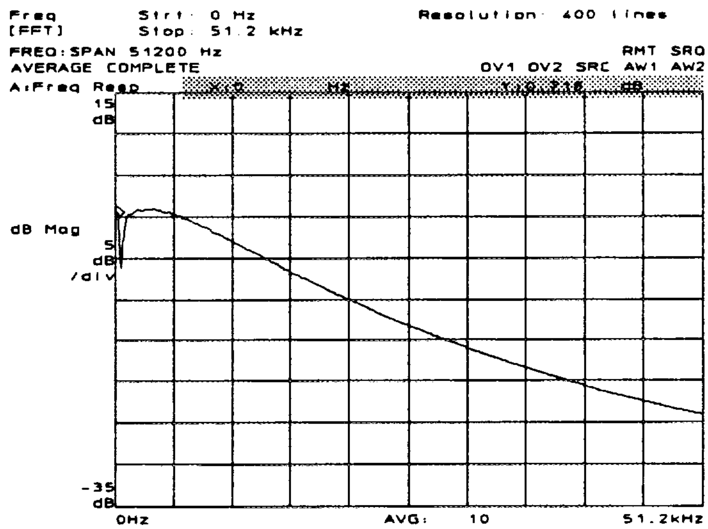
The [ **Marker** ] and [ **Marker Fctn** ] hardkeys are also tied to the active trace. For example, if you press [ **Marker** ] and [ MARKER TO PEAK ], the marker will move to the peak on the active trace only. If the markers are coupled, moving a marker in one trace also moves the marker in the other trace.

## Trace Title




This area normally lists the type of measurement data displayed in the trace. You can change the title for the trace by pressing [ **Disp Format** ], [ MORE ], [ TRACE TITLE ], then using the alpha shift keys and numeric keypad.

## Marker Readout



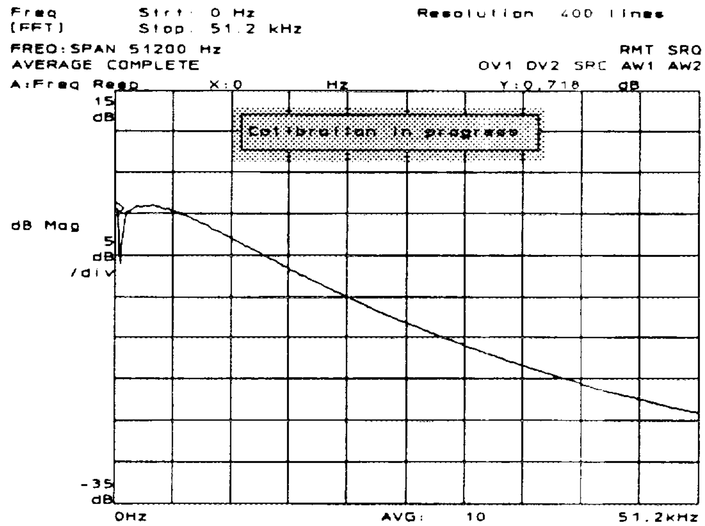

The marker readout provides the X-axis and Y-axis values of the current marker position. When the relative marker is on, the marker readout indicates X-axis and Y-axis values relative to the point where you set the reference marker.

There is a separate marker readout for each trace.

**Note**

When the units for the amplitude value are too long for the marker readout line, the analyzer puts an asterisk (*) in the marker readout area and prints the units in the top right corner of the trace box.

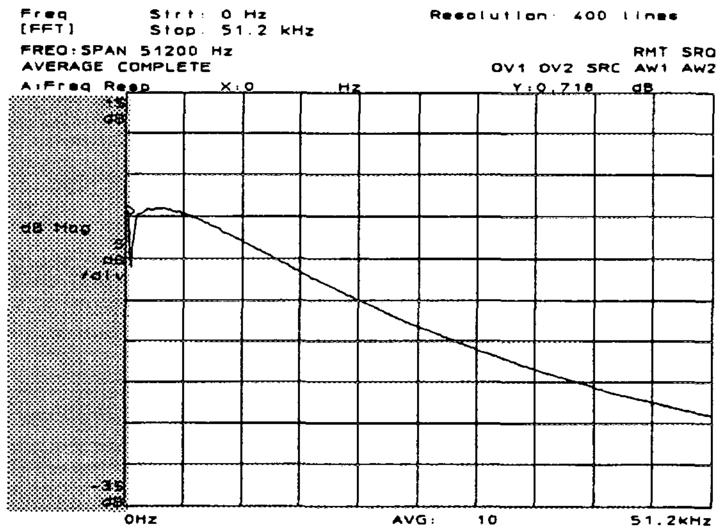
## Pop-up Message Area




When necessary, the analyzer displays a pop-up message window at the center of the screen. Some examples of these messages are:

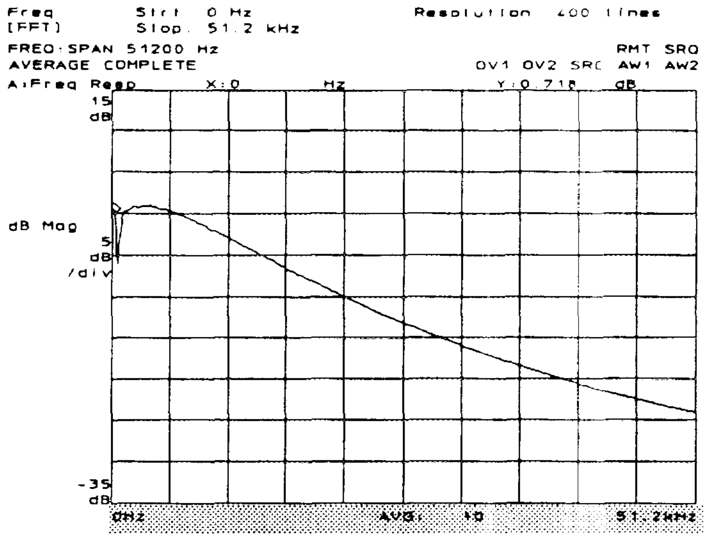
- Autorange in progress.
- Calibration in progress.
- User error.
- Hardware errors.

## Y-axis Notation




The y-axis notation includes the Trace Coord (such as dB Mag or Real),the top and bottom amplitude values for the current y-axis scale, and the y-axis units per division.

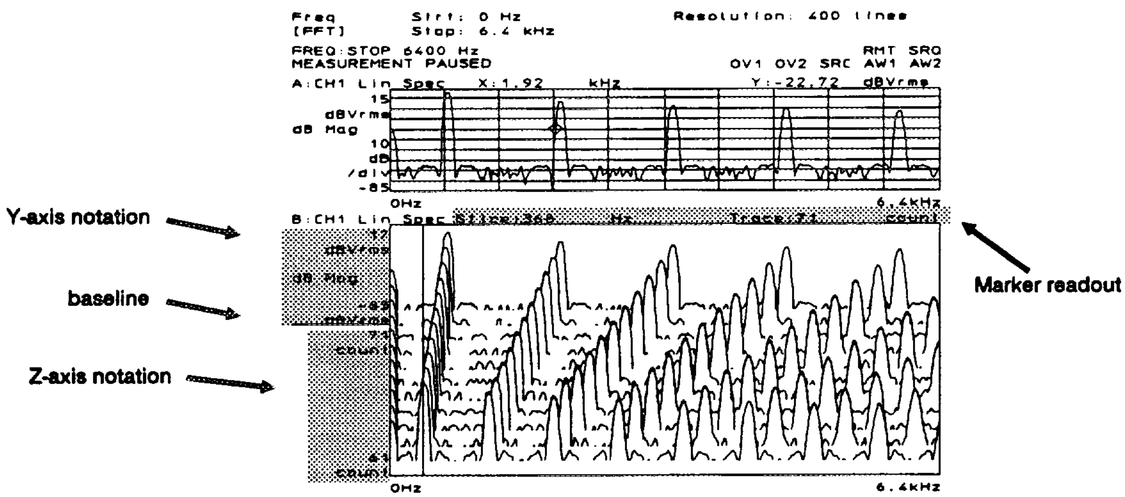
## X-axis Notation




The x-axis notation indicates the range (frequency, time, orders, amplitude, or count).

The center of the line indicates the number of averages completed (if averaging is turned on).

## Waterfall Notation




The waterfall is a two-dimensional display of three-dimensional data.

The notation for the upper trace is the same as for other display formats. The notation for the lower trace includes additional information.

The line on the left side of the waterfall trace indicates the baseline of the top trace. The Y-axis notation is above this line. The Z-axis notation is below this line. It includes the values for the first and last traces in the waterfall. The units vary depending on the data displayed.

The marker readout for the waterfall trace lists the slice marker and trace marker values. For more information on these markers, see the [ SLICE SELECT ] and [ TRACE SELECT ] softkeys in chapter 4.

## CRT care and cleaning

The analyzer's CRT is protected by a plastic screen that also provides RFI shielding. During normal operating conditions, the only cleaning that should be required is an occasional dusting with a soft brush. A household-type tack cloth, or other type of lint remover, may also be used.

If foreign material adheres to the screen, dampen a soft, lint-free cloth moistened with a mild detergent (diluted with water) and carefully wipe the screen.

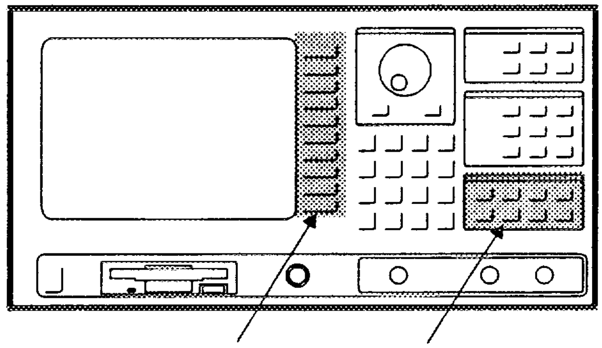
The plastic screen is not operator replaceable. In the unlikely event that it becomes damaged, contact your nearest Hewlett-Packard Sales/Service office.

**Warning**

**Always clean the screen with the power switch in the standy by position. Do not apply any water mixture directly to the screen or allow moisture to go behind the front panel. Moisture behind the front panel will severely damage the instrument and may present a shock hazard.**

**To clean, dampen a soft, lint-free cloth and carefully wipe the screen. Use only a mild detergent mixed with water.**

## Hardkeys and Softkeys



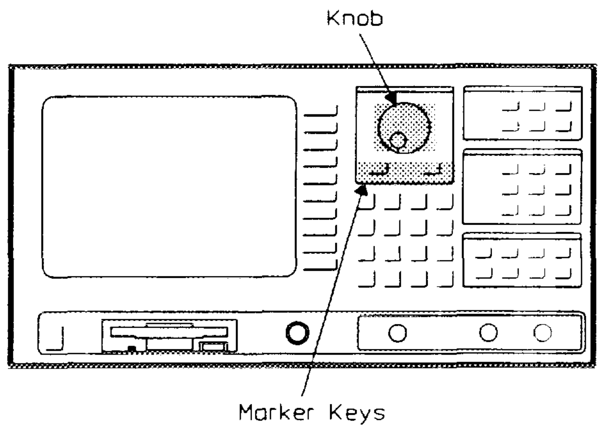

*Hardkeys* are front-panel buttons whose functions are always the same. Hardkeys have a label printed directly on the key itself. Throughout this book, they are printed like this: [ **Hardkey** ].

*Softkeys* are keys whose functions change with the analyzer's current menu selection. There are 10 softkeys in a column just to the right of the screen, marked F1 through F10. A softkey's function is indicated by a video label to the left of the key (on the edge of the analyzer's screen). The set of video labels to the left of the ten softkeys form the *softkey menu*. Throughout this book, softkeys are printed like this: [ SOFTKEY ].

Some softkeys toggle between two settings. Toggle softkeys have a highlighted word in their label that changes with each press of the softkey. Throughout this book, toggle softkeys are depicted as they appear after you make the keypress. For example, "toggle to [ COUPLING **AC** DC ]" means to press [ COUPLING AC DC ] until the word AC is highlighted.

Some softkeys are inactive for particular analyzer setups. The labels for inactive softkeys appear dimmer (or "ghosted"). For example, the [ COHERENCE ] measurement data softkey is inactive during 1-channel measurements. This is because the coherence computation requires data from two channels.

# Marker Keys and Knob




## The Marker Keys

The marker keys call up menus that let you control the location and movement of the on-screen marker. These controls affect only the markers for the currently-active trace.

## The Knob

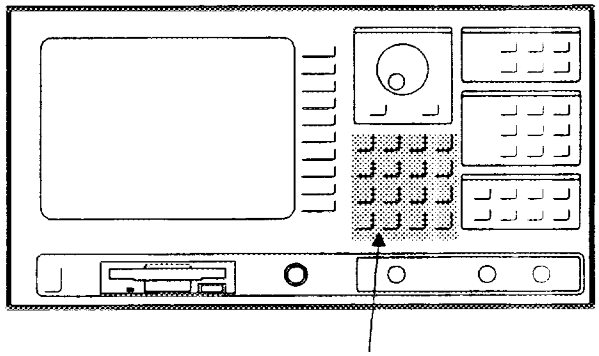
The *knob* is an RPG (rotary pulse generator) that controls two things—movement of the on-screen marker and continuous entry of numeric values. Usually, the knob simply moves the marker. But after pressing a softkey that requires a numeric entry, the knob becomes dedicated to numeric entry. Turn the knob to the right and the analyzer steps through larger numeric entries. Turn to the left and the analyzer steps through increasingly smaller entries.

When numeric entry is active, an entry box appears at the top of the screen with the currently-selected numeric value. This box remains on screen for several seconds to give you a chance to enter a numeric value. After using the knob (or, alternatively, the numeric entry keypad) this box soon disappears and the knob returns to marker movement.

Although the analyzer uses a default step size to control the "sensitivity" of the knob—that is, the interval between each numeric entry as you turn the knob—you can select your own "step size" for frequency. Press [ **Freq** ] and [ ENTRY STEP SIZE ]. Then use the numeric keypad to enter your own step size.

When numeric entry is active, an entry window appears at the top of the screen with the currently-selected numeric value. This window remains on screen for several seconds to give you a chance to enter a numeric value. If you don't make an entry, the window disappears after several seconds. If you use the knob (or the numeric entry keypad) to make an entry, this window remains on the screen. After you complete your entry, the window soon disappears and the knob returns to marker movement.

# Numeric Entry Keys




The numeric entry keys work the same way as the knob does during numeric entry. Use the numeric entry keys when you need to enter specific values. If you only need approximate values, it may be easier to use the knob instead of the numeric entry keys.

## Active Entry

It isn't always necessary to first press a softkey before making a numeric entry. A highlighted softkey is the softkey that is currently dedicated to the numeric keypad.

For example, press [ **Freq** ]. If the [ CENTER ] softkey is highlighted, pressing any of the numeric keypad keys automatically brings up a numeric entry window for center frequency. You don't have to press [ CENTER ] to set the center frequency.

**Note** This is true only for the numeric entry keys. If you want to use the knob, you must first press the appropriate softkey. If you don't, turning the knob moves the marker rather than changing the numeric entry.

## The Arrow Keys

Like the knob, you can use the arrow keys to step through larger or smaller numeric entries. Press [ ↑ ] to step through increasingly larger numeric entries—for example, to raise the current center frequency). Press [ ↓ ] to step through increasingly smaller numeric entries—for example, to lower the current center frequency.

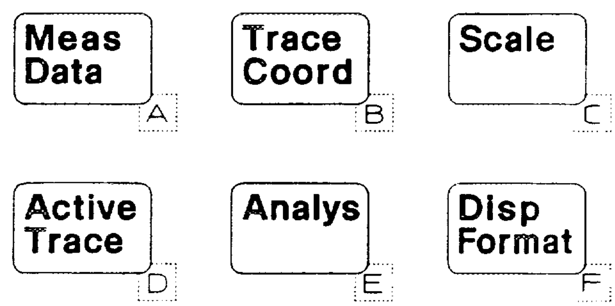
You can use the arrow keys to modify a numeric entry at any time—unlike the knob, which you can use for numeric entry only after pressing a softkey to activate the numeric entry mode.

And like the knob, the analyzer uses the same default step size to control the "sensitivity" of the arrow keys—that is, the interval between each numeric entry as you press an arrow key.

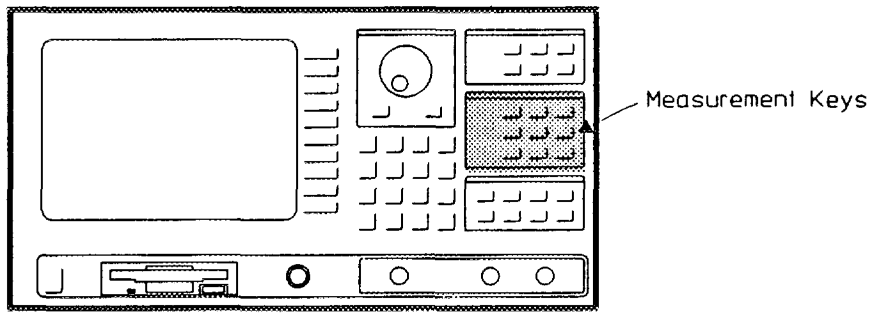
As we mentioned earlier, you can select your own "step size" for frequency entries. Press [ Freq ] and [ ENTRY STEP SIZE ]. Then use the numeric keypad to enter your own step size.

## Alpha Entry Keys

It is occasionally necessary to specify alpha characters—for example, when entering a trace title or when saving or recalling a specific file. At these times, the analyzer automatically shifts certain front-panel keys to alpha entry keys (note the alpha characters engraved on the front panel below these hardkeys). When it's no longer necessary to enter alpha characters, the analyzer automatically returns these hardkeys to their normal functions.



## Measurement Keys

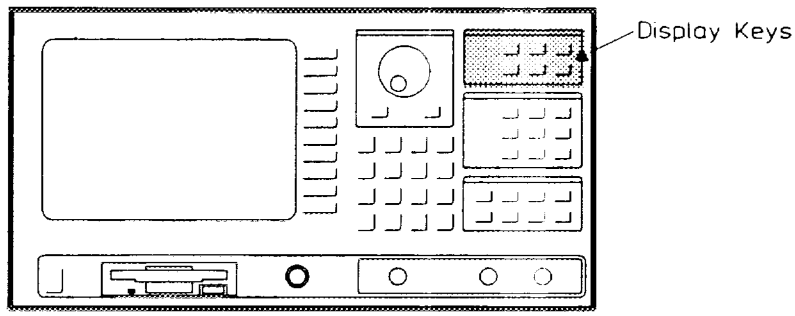



The Measurement keys let you control the analyzer's input configuration, measurement range, and measurement resolution. Measurement keys change measurement parameter setups. Pressing keys in this area may erase current measurement data.

Here's a brief summary of the Measurement keys and their significant functions:

- [ **Inst Mode** ] determines the kind of measurement the analyzer makes.
- [ **Freq** ] determines the frequency range measured.
- [ **Window** ] determines the window or weighting function applied to the input signals.
- [ **Input** ] sets the current range, coupling, and other input parameters for each channel independently.
- [ **Source** ] controls the analyzer's source output.
- [ **Trigger** ] provides trigger and arming choices.
- [ **Start** ] initiates a new measurement.
- [ **Pause/Cont** ] pauses and continues a measurement.
- [ **Avg** ] determines the type of averaging for measurements.

# Display Keys

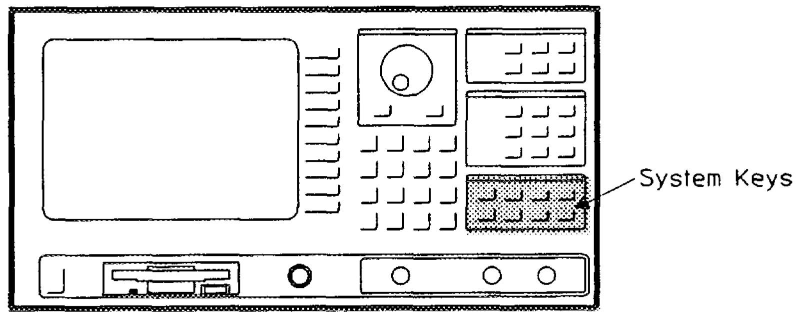



The Display keys let you control what appears on the analyzer's two traces. The Display keys only affect how data is displayed; they do not change any measurement parameters. You can press any softkeys under the Display hardkeys without losing measurement results.

Since only one trace is "active" at any given time, only one trace is the target of any adjustments you make using the display keys. Here's a brief summary of the Display keys and their significant functions:

- [ **Meas Data** ] determines the measurement results shown on the active display—this can be current measurement data or stored data.
- [ **Trace Coord** ] selects the Y-axis coordinate system for the displayed data.
- [ **Scale** ] adjusts the position and size of the displayed data.
- [ **Active Trace** ] switches the active trace between trace A and trace B.
- [ **Analys** ] lets you define math functions and constants, perform limit testing, and edit data. The curve fit and synthesis operations are also available under this hardkey *if your analyzer is equipped with option 1D3.*
- [ **Disp Format** ] selects the number of traces displayed and adjusts their appearance. Pressing [ **Disp Format** ] also lets you view the analyzer's "setup state"—a listing of the analyzer's current measurement parameters.

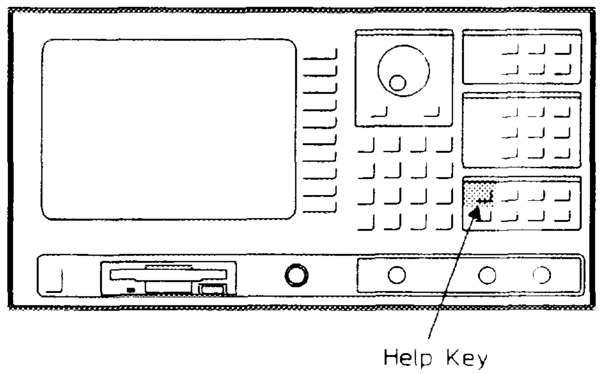
# System Keys




The System keys let you control how the analyzer communicates the external devices, the HP-IB controller, and external measurement programs. Here's a brief summary of the System keys and their significant functions:

- [ **Help** ] provides information about specific analyzer controls and functions (see "The Help Key" later in this chapter).
- [ **Save/Recall** ] lets you save and recall traces, instrument states, limits, math operations, and HP INSTRUMENT BASIC programs.
- [ **Disk Utility** ] provides useful utilities to let you format disks and copy or delete files stored on the mass storage devices (including the internal RAM disks, flexible disk drive, or external disks).
- [ **System Utility** ] lets you perform a calibration procedure, set the analyzer's internal clock, and perform diagnostic tests.
- [ **BASIC** ] lets you create (and run) HP Instrument BASIC programs *if your analyzer is equipped with HP Instrument BASIC (option 1C2).*
- [ **Plot/Print** ] controls selection and configuration of an external plotter or printer.
- [ **Local/HP-IB** ] provides HP-IB options when the analyzer is under local (front panel) control.
- [ **Preset** ] lets you return most of the analyzer settings to their default positions or recall a saved instrument state (see "The Preset Key" later in this chapter).

## The Help Key

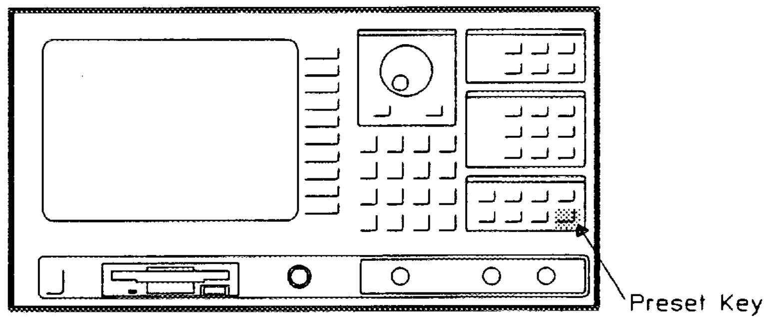



The [ **Help** ] key provides fast, easy-to-read information about specific instrument controls and features. Using [ **Help** ] is particularly convenient when you need assistance and you don't have the analyzer's *Operator's Guide* or *Operator's Reference* near at hand.

The [ **Help** ] key is also a good way to learn about the analyzer (or to refresh your memory if you don't use it often). The help facility has an index that lets you request information by key name or by topic.

For information on using the [ **Help** ] key, press the key or see the *User's Guide.*

# The Preset Key




Pressing [ **Preset** ] → [ DO PRESET ] returns most of the analyzer settings to their default positions.

Before pressing [ DO PRESET ], you may want to save the analyzer's settings, particularly if your measurement setup was rather complex. You can save an instrument setup state to disk by pressing [ **Save/Recall** ] and using [ SAVE STATE ]. You can recall this setup by pressing [ **Preset** ] → [ RECALL AUTOSTATE ]

If you simply want a hardcopy of the instrument setup state, press [ **Display Format** ]. Then press [ MEASURMNT STATE ] to view a listing of the analyzer's current setup state. Then press [ **Plot/Print** ] → [ PLOT DATA SELECT ] → [ ALL ] → [ RETURN ] → [ START PLOT/PRNT ].

Keep in mind that pressing [ DO PRESET ] is not the same thing as turning off the analyzer and turning it on again (a power-up cycle). There are some settings that are unaffected by preset but are changed when a power-up cycle occurs. These include:

- Definitions of constants and functions.
- Contents of data registers.
- HP Instrument BASIC programs currently loaded.
- Memory size.
- Scratch option.
- Renumber start and increment.
- Secure start and end line.

Additionally, there are even some settings that survive both [ DO PRESET ] and power-up. You must change these settings from the front-panel or via HP-IB. These settings include:

- Storage configuration (default disk selection).
- System controller mode (system controller or addressable-only).
- HP-IB, disk, printer, and plotter addresses.
- Disk volume and unit numbers.
- Time and date.

See "[ DO PRESET ] softkey" in chapter 4 for a list of the settings affected by preset and the default settings.

# 3

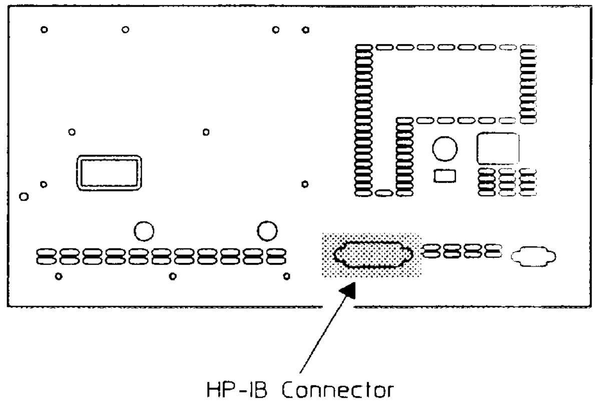
# Rear-Panel Overview

For more detailed information, see chapter 4, “Key Reference,” or use the analyzer’s [ **Help** ] key.

## Fuse, Voltage Selector, and Line connector

For information about these items, see the *HP 35665A Installation and Performance Test Guide.*

# HP-IB connector



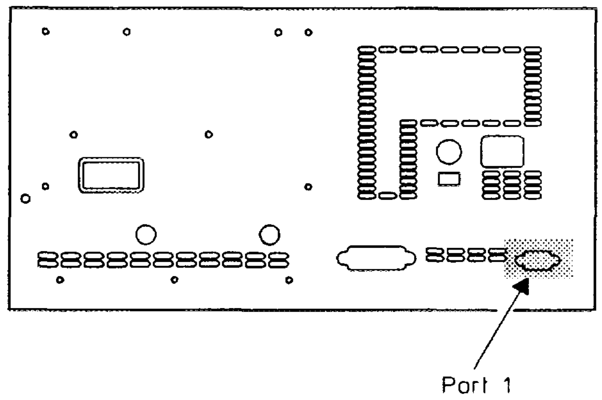

The HP 35665A Dynamic Signal Analyzer is compatible with the Hewlett-Packard Interface Bus (HP-IB). The HP-IB is Hewlett-Packard's implementation of the IEEE Standard 488-2.

To connect the analyzer to a compatible HP-IB device, use an HP-IB interface cable. The total allowable transmission path length is 2 meters times the number of devices or 20 meters, whichever is less. Operating distances can be extended using an HP-IB extender.

To learn more about controlling the analyzer over the HP-IB, see the *HP 35665A HP-IB Programing Reference.*

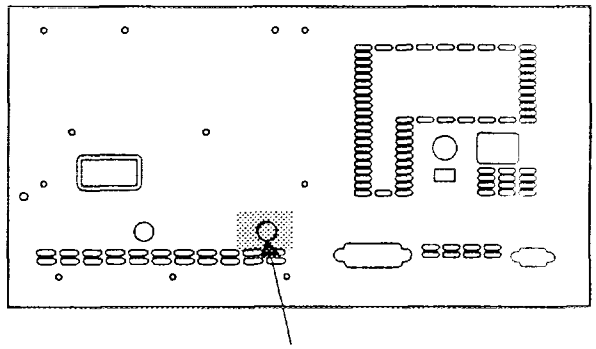
**Caution** The analyzer contains metric-threaded HP-IB cable mounting studs as opposed to English threads. Metric-threaded HP-IB cable lockscrews must be used to secure the cable to the analyzer. Metric-threaded fasteners are colored black while English-threaded fasteners are colored silver.

# Port 1 (RS-232 Serial Port)




This connector can only be used via HP Instrument BASIC. See the chapter "Interfacing with the RS-232-C Serial Port" in *Using HP Instrument BASIC with the HP 35665A.*

## External Trigger Input

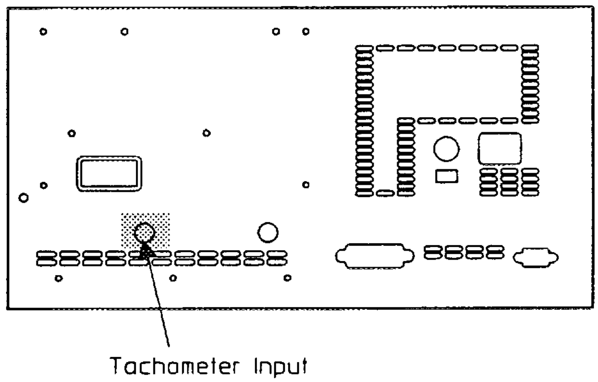


External Trigger Input

This input lets you synchronize a measurement with an external device. If you've selected the external trigger mode (using the [ Trigger ] hardkey), the analyzer begins a measurement when the external trigger line goes low (TTL-level signals). A trigger also occurs when you short the center pin to ground (the shell of the EXT TRIG connector).

If you've selected automatic arming, subsequent trigger signals are ignored while the measurement is in progress. If you've selected manual arming, the analyzer ignores trigger signals until you press the [ ARM ] softkey (or send this command via HP-IB).

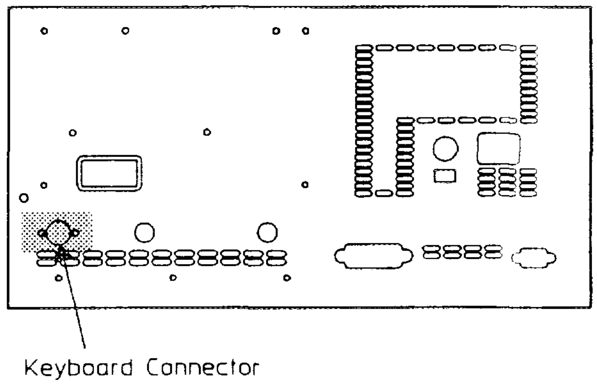
## Tachometer Input




The tachometer input is useful for arming in runup or rundown measurements of any kind. This feature virtually eliminates the need for external signal-shaping circuitry for order measurements. The analyzer accepts a signal up to +/− 20 volts.

If you've selected rpm step arming, the analyzer begins a measurement when the tachometer input signal matches the arm parameter settings.

# Keyboard Connector




The analyzer allows you to connect an external PC-style keyboard (option 1CL). This is most useful for developing HP Instrument BASIC programs. For detailed information, see "Developing Programs" in the *HP-IB Programming with the HP 35665A* manual.

For more information on the external keyboard, see the previous chapter.

**Note**

Some HP 35665A analyzers have the keyboard connector on the front panel. See the previous chapter for more information.

4

# Key Reference

## How to use this chapter

This chapter contains the same information as the analyzer's online help facility. Like online help, there are definitions here for both hardkeys and softkeys—and information about more general topics. Also included are softkeys that appear when your instrument is equipped with the HP Instrument BASIC option.

This chapter is arranged alphabetically. To find an individual hardkey or softkey, simply use this chapter as you would a dictionary. The topic entries are also arranged alphabetically and are mixed with the hardkey and softkey entries.

If you don't know the name of a hardkey, a softkey, or a topic entry, use the index at the back of this book. The index is where you should go to locate information by concept. The index also guides you to related information in this book.

Chapter 5 is a menu map of the hardkeys and softkeys in the analyzer. It is also helpful for locating a specific key if you are not sure of the key name.

## [*jOMEGA() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Multiply each data point by j$\omega$, where $\omega$ is the frequency at that point in radians per second. The argument must be frequency domain data.

## [+ j] softkey

Designate the next value entered as the imaginary part of a complex number. To change + j to – j, press [ +/– ] after you press [ + j ].

For example, to enter the complex number 1 –j 12, press:
[ 1 ] [ + j ] [ +/– ] [ 1 ] [ 2 ] [ Enter ].

## [+/–] hardkey

This hardkey has two functions:

- When you are changing a numeric parameter: Press this hardkey to toggle your entry between positive and negative values or to change the sign of an exponent.
- When you are changing a text string: Press this hardkey to insert a dash (or minus sign) to the left of the cursor.

## [/jOMEGA() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Divide each data point by j$\omega$, where $\omega$ is the frequency at that point in radians per second. The argument must be frequency domain data.

One application for /jomega is converting frequency domain data from acceleration to velocity. If you are converting data in V (such as a linear spectrum), divide the spectrum by jomega once. If you are converting data in V ^ 2 (such as a power spectrum), divide the spectrum by jomega twice. (For time domain data, use the "INTEG" operation.)

*See also:* [ INTEG( ] softkey

## [1 CHANNEL] softkey

Key Path: [ Inst Mode ]

Specify a one-channel measurement. The analyzer takes data from channel 1 only.

**Caution** The maximum specified frequency for a one-channel measurement is 102.4 kHz. Although the analyzer will display data up to 115 kHz, the range from 102.4 kHz to 115 kHz is not calibrated and is significantly affected by the antialias filter. Published specifications do not apply to frequencies above 102.4 kHz.

## [1/12 OCTAVE] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ Freq ]

Specify 1/12 octave band measurements.

1/12 octave analysis is the measurement of a frequency spectrum by the use of 144 constant percentage bandwidth filters 1/12 octave wide and spaced at 1/12 octave intervals. The analyzer displays a total RMS power band and up to 144 frequency bands. The center frequency of each 1/12 octave frequency band is 2 ^ (1/12), or 1.0594, times the center frequency of the previous 1/12 octave band.

You can specify the start and stop frequencies by pressing the [ START ] and [ STOP ] softkeys. When you change one of these frequencies, the analyzer changes the other frequency if the specified band if more than 12 octaves.

For 1/12 octave measurements, the maximum stop frequency is 12.34 kHz ; the minimum start frequency is 99.73 mHz.

The exact center frequencies are determined by starting at 1029.3 Hz and multiplying by 1.0594 to get higher bands or dividing by 1.0594 to get lower bands (1.0594 = 2 ^ (1/12)). The reference frequency is shifted by 1/24 octave so that 1/12 octave bands can be summed to synthesize full octave or 1/3 octave bands.

**Note** Markers return the ANSI Standard preferred frequencies.

*See also:* [ START ] softkey (octave frequency), [ STOP ] softkey (octave frequency)

## [1/3 OCTAVE] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Freq** ]

Specify 1/3 octave band measurements.

1/3 octave analysis is the measurement of a frequency spectrum by the use of 36 constant percentage bandwidth filters 1/3 octave wide and spaced at 1/3 octave intervals. The analyzer displays a total RMS power band and up to 36 frequency bands. The center frequency of each 1/3 octave frequency band is 2 ^ (1/3), or 1.2599, times the center frequency of the previous 1/3 octave band.

You can specify the start and stop frequencies by pressing the [ START ] and [ STOP ] softkeys. When you change one of these frequencies, the analyzer changes the other frequency if the specified band if more than 12 octaves.

For 1/3 octave measurements, the maximum stop frequency is 31.5 kHz ; the minimum start frequency is 80 mHz.

The exact center frequencies are determined by starting at 1000 Hz (band 30) and multiplying by 1.2599 to get higher bands or dividing by 1.2599 to get lower bands.

---

**Note** Markers return the ANSI Standard preferred frequencies.

---

*See also:* [ STOP ] softkey (octave frequency), [ START ] softkey (octave frequency)

## [2 CHANNEL] softkey

Key Path: [ **Inst Mode** ]

Specify a two-channel measurement. The analyzer takes data from channel 1 and channel 2.

---

**Caution** The maximum specified frequency for a two-channel measurement is 51.2 kHz. Data above 51.2 kHz is not calibrated and is significantly affected by the antialias filter. Published specifications do not apply to 2-channel data above 51.2 kHz.

---

## [A WT FLTR ON OFF] softkey

Key Path: [ **Input** ] → [ CHANNEL x SETUP ]

Enable or disable the hardware A-weight filter for the corresponding input channel.

The A-weight filter is normally used with octave measurements. It simulates the frequency response of the human ear.

You cannot enable the A-weight filter without the antialias filter. Turning on the A-weight filter also turns on the antialias filter; turning off the antialias filter also turns off the A-weight filter.

---

**Note** The A-weight filter conforms to ANSI Standard S1.4-1983 and to IEC 651-1979, Type 0 Tolerance.

---

*See also:* [ ANTIALIAS ON OFF ] softkey, [ OCTAVE ANALYSIS ] softkey

## [ABORT CAPTURE] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Stop the time capture process. Data already in the time capture buffer is retained. The actual amount of data will be less than the specified [ CAPTURE LENGTH ].

*See also:* [ CAPTURE LENGTH ] softkey

## [ABORT FIT] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]

Stop a curve fit operation in process. Trace B displays the last results of the computation.

---

**Caution** The pole and zero values for the current estimate are lost when you press [ ABORT FIT ]. The table is empty or contains the values from the previous curve fit operation.

---

## [ABORT HP-IB] softkey

Key Path: [ **Local/HP-IB** ]

Halt any HP-IB activity initiated by the analyzer.

## [ABORT PLOT/PRNT] softkey

Key Path: [ **Plot/Print** ]

Stop the current plot or print operation before it is completed.

## [ACCEPT TIME REC] softkey

Key Path: [ **Avg** ] → [ PREVIEW SETUP ]

Include the last time record in the measurement data.

When manual preview or timed preview is on, you can decide which data should be included in the measurement results.

After each time record is collected, it is displayed. You must either accept or reject the time record for both channels. That is, you cannot accept the time record for one channel and reject it for the other channel.

When you accept a time record, the analyzer returns to the data displayed before the time record was collected. If the data displayed uses the time record you accepted, the analyzer incorporates the time record and updates the display.

*See also:* [ TIMED PREVIEW ] softkey, [ MANUAL PREVIEW ] softkey

## [Active Trace] hardkey

Toggle the active trace between trace A and trace B.

The analyzer has two independent display buffers for trace data: trace A and trace B. The [ **Active Trace** ] hardkey toggles between these two buffers, making one active and the other inactive, so you can modify them separately.

With a few exceptions, the softkeys under the [ **Meas Data** ], [ **Trace Coord** ], [ **Scale** ], [ **Input** ], [ **Marker** ], and [ **Marker Fctn** ] hardkeys affect only the active trace.

When you use a two-trace format, annotation fonts and trace line types indicate which trace is active. The active trace uses a plain font and a solid line. The inactive trace uses a ghosted font. For a front/back display, the inactive trace uses a dotted line

*See also:* Fonts

## [ADD VALUE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ EDIT TABLE ]
or: [ **Analys** ] → [ SYNTHESIS ] → [ EDIT TABLE ]

Add an entry to the curve fit or synthesis table. Enter the new value as follows:

1. Type the real part first, including an exponent if required.
2. If the entry is real, go to step 3. If the entry is complex, press [ + j ], then type the imaginary part.
3. Press the appropriate unit key ([ kHz ], [ Hz ], or [ mHz ]) for poles and zeros. For other entries, press [ ENTER ]. This terminates editing and puts the new entry in the table.

---

**Note**

The analyzer requires that complex entries be conjugate pairs for poles and zeros. When you include "+ j" in the entry, the analyzer interprets the complex entry as a conjugate pair.

---

**Note**

Residues are also interpreted as conjugate pairs. The sign of the residue imaginary value is significant. Because each residue entry is associated with the pole entry in the same row, the sign indicates which complex residue from the pair is associated with each complex pole.

---

Added terms are tagged as fixed when you edit a curve fit table.

*See also:* [ FIX VALUE TOGGLE ] softkey

## [ADDRESSBL ONLY] softkey

See Controller capability softkey group.

## [ALL] softkey

See [ PLOT DATA SELECT ] softkey.

## [ALLOCATE CAPTURE] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Force the immediate memory allocation of the time capture buffer based on the defined [ CAPTURE LENGTH ], number of channels, and the frequency span.

The analyzer asks you for confirmation before it performs the allocation.

If there is not enough memory for the specified time length, the analyzer allocates as much memory as possible and displays an error message.

---

**Note** Some instrument modes require more memory than others. For example, FFT analysis requires more memory than octave analysis. If you allocate the maximum size for the capture buffer in the octave mode, you may not have enough memory to run FFT analysis on the captured data.

---

*See also:* [ CAPTURE LENGTH ] softkey

### Alpha entry menu

The alpha entry menu and its submenus provide access to special characters and string editing functions when the analyzer is in the alpha entry mode.

- [ ENTER ] accepts the current string and exits the alpha entry mode.
- [ INSERT SPACE ] inserts a space before the cursor.
- [ DELETE CHARACTER ] deletes the character under the cursor.
- [ UPPERCASE lowercase ] specifies whether alpha characters (entered by pressing redefined hardkeys) should be uppercase (A-Z) or lowercase (a-z).
- The [ MORECHARS ] softkeys allow you to insert special characters before the cursor.
- [ CLEAR ENTRY ] deletes the string, but does not exit alpha entry.
- [ CANCEL/RETURN ] abandons the string and exits alpha entry.

*See also:* Alpha entry mode

## Alpha entry mode

Some analyzer keys ask you to enter a text string. When you press one of these keys, the analyzer enters alpha entry mode and remains there until you accept or abandon the string using the alpha entry menu.

An entry window replaces the mini-state at the top of the screen. The window may include a default entry. You can use the default entry by pressing [ ENTER ] or delete the default entry by pressing [ CLEAR ENTRY ].

Most hardkeys are redefined as alpha characters when the analyzer is in alpha entry mode. Engraved letters, adjacent to the lower right corners of these keys, tell you which characters they will insert in a string.

The [ +/ –] hardkey inserts a minus (or dash) in the string rather than toggling a number between positive and negative values.

The [ **Help** ], [ **Preset** ], number, decimal point, and [ **Back Space** ] hardkeys are not redefined.

*Hint:* Use the knob to move the text cursor to the right or left when you edit a string.

*See also:* Knob, Alpha entry menu

## [ALPHA PEN] softkey

Key Path: [ **Plot/Print** ] → [ PLOT PEN SETUP ]

Specify which plotter pen should be used for plotting the instrument state and the disk catalog.

When you plot a trace, the alpha pen is used for the state information (at the top of the screen) and for any status or error information.

## [AMPLITUDE PEAK RMS] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Specify whether amplitude is displayed in peak or rms units.

## [Analys] hardkey

Access the following analysis tools:

- Define math functions and constants.
- Limit test.
- Curve fit (Option 1D3).
- Synthesis (Option 1D3).
- Data edit.

*See also:* [ DATA EDIT ] softkey, [ SYNTHESIS ] softkey, [ CURVE FIT ] softkey, [ LIMIT TEST ] softkey, [ DEFINE CONSTANT ] softkey, [ DEFINE FUNCTION ] softkey

## [ANALYSIS REGION] softkeys

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Specify the portion of the time capture buffer data to be used for a measurement. You can specify a start time and stop time for each channel individually. The start time and stop time are referenced to the beginning of the capture buffer. If the data is triggered, the times are referenced to the trigger point.

You can examine the capture buffer by selecting [ CAPTURE CHANNEL 1 ] or [ CAPTURE CHANNEL 2 ] under [ **Meas Data** ]. Use the axis scale markers to look at the data more closely and identify the start and stop times for the data of interest.

*See also:* [ AXES SCAL MARKERS ] softkey, [ STOP TIME CHANNEL x ] softkey, [ STRT TIME CHANNEL x ] softkey

## [ANALYZER ADDRESS] softkey

Key Path: [ **Local/HP-IB** ]

Change the analyzer's HP-IB address. An entry window is displayed so you can enter the new address.

Limits: integers 0 through 30 Default: 11

---

**Note** The analyzer's address is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

---

## [ANTIALIAS ON OFF] softkey

Key Path: [ Input ] → [ CHANNEL x SETUP ]

Enable or disable the antialias filter for the corresponding input channel.

The default is enabled (on) for all measurements except histogram. You cannot turn on the antialias filters for histogram measurements.

The analyzer always applies dc offset correction, regardless of the status of the antialias filters.

The analyzer corrects frequency domain data (magnitude and phase) for front end and digital flatness only when the antialias filter is on.

**Caution** If the antialias filter is off, published specifications for the analyzer are not guaranteed.

## [ARB SRC SETUP] softkey

(Available only with option 1D4, Arbitrary Source)

Key Path: [ Source ]

Turn repeat on or off and specify which data register should be used to drive the source output. These setups are used when the source type is set to [ ARBITRARY (D1-D8) ].

*See also:* [ ARBITRARY (D1-D8) ] softkey, [ DATA REG Dx ] softkey, [ REPEAT ON OFF ] softkey (source)

## [ARBITRARY (D1-D8)] softkey

(Available only with option 1D4, Arbitrary Source)

Key Path: [ Source ]

Specify that the source output be driven by one of the data registers. The register must contain time domain data.

You can specify which data register should be used by pressing [ ARB SRC SETUP ] → [ DATA REG Dx ].

The analyzer scales the data so that its peak voltage corresponds to the current source level in Vpk. Then the analyzer outputs the scaled signal to the source connector.

*See also:* [ DATA REG Dx ] softkey

## [ARM SETUP] softkey

Key Path: [ Trigger ]

Set up the arm parameters. The arm options are as follows (some instrument modes do not allow all arming options):

- Automatic arm.
- Manual arm.
- rpm step arm.
- Time step arm.

From this menu you also set up the following arm parameters:

- Start rpm usage.
- Start rpm.
- rpm step size.
- Time step size.
- Number of steps.

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

*See also:* [ WATERFALL STEPS ] softkey, [ TIME STEP SIZE ] softkey, [ START RPM USAGE ] softkeys, [ START RPM ] softkey, [ TIME STEP ARM ] softkey, [ RPM STEP SIZE ] softkey, [ RPM STEP ARM ] softkey, [ MANUAL ARM ] softkey, [ AUTOMATIC ARM ] softkey

## [ARM] softkey

Key Path: [ Trigger ]

Arm the analyzer's trigger—this applies only when you've selected manual arming. After arming, the analyzer makes a measurement when the trigger conditions are met.

**Note** You must press [ ARM ] again for each subsequent measurement.

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

*See also:* [ MANUAL ARM ] softkey

## Arrow keys

Like the knob, you can use the arrow keys, [ ↑ ] and [ ↓ ], to step through larger or smaller numeric entries. Press the up arrow key to step through increasingly larger numeric entries—for example, to raise the current center frequency). Press the down arrow key to step through increasingly smaller numeric entries—for example, to lower the current center frequency.

You can use the arrow keys to modify a numeric entry at any time—unlike the knob, which you can use for numeric entry only after pressing a softkey to activate the numeric entry mode.

And like the knob, the analyzer uses the same default step size to control the "sensitivity" of the arrow keys—that is, the interval between each numeric entry as you press an arrow key.

You can select your own "step size" for frequency entries. Press [ **Freq** ] → and [ ENTRY STEP SIZE ]. Then use the numeric keypad to enter your own step size.

*See also:* [ ENTRY STEP SIZE ] softkey

## [AUTO CAL ON OFF] softkey

Key Path: [ **System Utility** ] → [ CALIBRATN ]

Enable or disable the analyzer's autocalibration function (autocal).

Calibration is done for all amplitude ranges and all frequencies regardless of instrument setup.

---

**Note** Autocal is enabled automatically whenever you turn the analyzer on or press the [ **Preset** ] hardkey.

---

When autocal is enabled, the analyzer automatically calibrates several times during the first two hours of operation. Subsequently, it automatically calibrates at intervals of 2 hours 20 minutes. When autocal is disabled, the analyzer only calibrates when you press [ SINGLE CAL ].

During calibration a small ac voltage (around 2 mV) appears at the source output connector.

---

**Note** If a calibration occurs while a measurement is paused, the analyzer will start a new measurement when you press [ **Pause/Cont** ]. This prevents a measurement using two different sets of calibration data.

---

For more information on calibration, see the analyzer's *Service Guide*.

*See also:* [ **Pause/Cont** ] hardkey

## [AUTO CORR CHANNEL x] softkey

Key Path: [ **Meas Data** ]

Display the most recent autocorrelation for the specified channel.

Auto correlation displays the similarity between a signal and a time-shifted version of itself. Auto correlation is calculated by multiplying the signal by its time-shifted version and summing over all points. The result is plotted as a function of the time shift value.

Autocorrelation is useful for detecting echoes in a signal. Each echo shows up as a separate peak in the display. The width of each peak is inversely proportional to the bandwidth of the signal. For example, random noise produces a very narrow peak.

This function is also useful for isolating low-level periodic signals from noise. A sine wave signal shows up as a sine wave in autocorrelation. A square wave signals shows up as a triangular wave of the same frequency.

The autocorrelation computation depends on the type of averaging selected.

| Average Type | | Autocorrelation Computation |
|---|---|---|
| Average off | : | IFFT (FFT (time) * conj (FFT (wtime))) |
| rms | : | IFFT (sum (FFT (time) * conj (FFT (wtime)))) / N |
| rms exponential | : | IFFT (xavg (FFT (time) * conj (FFT (wtime)))) |
| Vector | : | IFFT (sum (FFT( time)) * conj (sum (FFT (wtime)))) / N |
| Vector exponential | : | IFFT (xavg(FFT(time)) * conj (xavg(FFT (wtime)))) |

| | | |
|---|---|---|
| where: time | = | time for associated channel |
| wtime | = | time with weighting function applied |
| N | = | number of averages |
| xavg | = | (1/N) * new + ((N–1)/N) * old |

*See also:* [ **Window** ] hardkey, [ NUMBER AVERAGES ] softkey, [ TIME CHANNEL x ] softkey, [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey

## [AUTO MEMORY] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ]

Automatically allocate stack space for your program.

*Hint:* If you press [ MEMORY SIZE ], the value displayed in the resulting entry window tells you how many bytes of volatile RAM was allocated.

[ AUTO MEMORY ] provides a convenient way to allocate stack space for programs you develop in the analyzer or load via the HP-IB. If the automatically-set value is not adequate, use [ MEMORY SIZE ] to change it.

**Note**

If you see the message "ERROR 2 Memory overflow" while your program is running, you need to allocate more stack space or increase the memory available by removing such things as time capture data and waterfall registers. The keys are under [ **System Utility** ] → [ MEMORY USAGE ].

*See also:* [ MEMORY SIZE ] softkey

## [AUTO RES ON OFF] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ] → [ RESOLUTN SETUP ]

Turn autoresolution on or off for a swept sine measurement.

If autoresolution is off, the frequency spacing between measurement points is determined by the sweep resolution and does not change during the sweep.

If autoresolution is on, the analyzer adjusts the frequency spacing between measurement points to finer or coarser steps to accommodate varying response changes. This allows you to make faster measurements without missing critical information.

At each frequency point, the analyzer compares the frequency response to the frequency response at the previous frequency point. The analyzer uses this comparison to determine the size of the next step, as follows:

- If the transfer function change is small, the step size increases.
- If the transfer function change is large but less than ([ MAXIMUM % CHANGE ] times the square root of 2), the step size decreases.
- If the transfer function change is greater than ([ MAXIMUM % CHANGE ] times the square root of 2), the measurement backs up and takes the measurement again at a frequency closer to the previous measurement frequency.

The analyzer will not use frequency step sizes smaller than the [ MINIMUM RESOLUTN ] you specify.

*See also:* [ MINIMUM RESOLUTN ] softkey, [ MAXIMUM % CHANGE ] softkey, [ RESOLUTN ] softkey, [ SWEPT SINE ] softkey

## [AUTOLEVEL ON OFF] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Source ]

Turn autoleveling on or off. The active selection is highlighted. Autoleveling is available only for swept sine measurements.

The autolevel feature allows the analyzer to adjust the source output level to keep the amplitude of one input channel within a specified range. You can also specify a maximum source level and a maximum input level for the other input channel.

When autolevel is off, the source has a constant amplitude (level) at all measurement points.

When autolevel is on, the amplitude at the measurement frequency is monitored. At each measurement point, the analyzer adjusts the source amplitude until the reference channel amplitude is within a specified tolerance band around the reference level.

*See also:* [ REFERENCE LEVEL ] softkey, [ MAX INPUT LEVEL ] softkey, [ MAX SRC LEVEL ] softkey, [ REFERENCE TOLERANCE ] softkey, [ REF CHAN CH1 CH2 ] softkey, [ SWEPT SINE ] softkey

## [AUTOLEVEL SETUP] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Source ]

Set up the following autolevel parameters for a swept sine measurement:

- Reference channel.
- Reference level.
- Reference tolerance.
- Maximum source output.
- Maximum input level.

The analyzer uses these parameters when you turn on autoleveling.

*See also:* [ AUTOLEVEL ON OFF ] softkey, [ MAX INPUT LEVEL ] softkey, [ MAX SRC LEVEL ] softkey, [ REF CHAN CH1 CH2 ] softkey, [ REFERENCE LEVEL ] softkey, [ REFERENCE TOLERANCE ] softkey, [ SWEPT SINE ] softkey

## [AUTOMATIC ARM] softkey

Key Path: [ **Trigger** ]
or: [ **Trigger** ] → [ ARM SETUP ]

Select automatic trigger arming. This means the analyzer will make a measurement as soon as it receives an appropriate trigger signal. After making the measurement, the analyzer automatically rearms the trigger and will make another measurement when triggered again.

Histogram measurements are only armed and triggered once. The measurement runs for the specified [ HISTOGRAM LENGTH ] and stops.

If you've just turned on the analyzer (or pressed [ **Preset** ]), automatic arming will be selected already.

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

*See also:* [ HISTOGRAM LENGTH ] softkey, Time record

## [AUTOSCALE ON OFF] softkey

Key Path: [ **Scale** ]

Turn autoscaling on or off for the active trace. With autoscaling on, the analyzer will vertically scale the active trace to best fit the trace box each time the display updates.

**Note** Autoscaling can affect a waterfall display. If the scale changes, the analyzer clears the waterfall display and displays the next traces using the new scale. This affects only the display, not the measurement. The cleared traces are still kept in the waterfall buffer.

*See also:* [ WATERFALL ] softkey, Trace boxes, [ **Active Trace** ] hardkey

## [AVERAGE ON OFF] softkey

Key Path: [ Avg ]

Turn averaging on or off.

If a measurement is running when you turn on averaging, the analyzer begins an averaged measurement right away, without waiting for you to press [ Start ].

When you turn averaging off, the analyzer begins an unaveraged measurement.

## [AVERAGE TIME] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ Avg ]

Specify the time over which you want to average for octave measurements.

Limits and default vary depending on the stop frequency, number of channels, hold setup, and octave type (1/12, 1/3, or full octave). For example, for 2-channel octave analysis with max hold average, the average time cannot be less than 250 ms.

The analyzer uses your specified average time as follows for each average type:

- Linear: linear integration time.
- Exponential: time constant.
- Equal confidence: not used; average time varies.
- Peak hold: integration time over which to hold peaks (with repeat off).

See [ REPEAT ON OFF ] for more information on how that parameter affects linear and peak hold averaging.

*See also:* [ HOLD SETUP ] softkeys, [ STOP ] softkey (octave frequency), [ REPEAT ON OFF ] softkey (octave), [ PEAK HOLD ] softkey (octave), [ EQUAL CONFID ] softkey, [ EXPONENTL ] softkey, [ STABLE ] softkey, [ OCTAVE ANALYSIS ] softkey

## [AVERAGE TYPE] softkey (Correlation)

Key Path: [ **Avg** ]

Specify the kind of averaging the analyzer should perform for correlation analysis.

- rms averaging.
- rms exponential averaging.
- Vector averaging.
- Vector exponential averaging.

*See also:* [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey

## [AVERAGE TYPE] softkey (FFT analysis)

Key Path: [ **Avg** ]

Specify the kind of averaging the analyzer should perform for FFT analysis.

- rms averaging.
- rms exponential averaging.
- Vector averaging.
- Vector exponential averaging.
- Peak hold averaging.

*See also:* [ PEAK HOLD ] softkey, [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey

## [Avg] hardkey

Select averaging appropriate for the type of measurement you want to make. The types of averaging available depend on the instrument mode selected.

For information on averaging for each instrument mode, see the following topics:

- FFT averaging.
- Octave averaging.
- Order averaging.
- Swept sine averaging.
- Correlation averaging.
- Histogram averaging.

*See also:* [ **Inst Mode** ] hardkey, Histogram averaging, Correlation averaging, Swept sine averaging, Order averaging, Octave averaging, FFT averaging

## [AWEIGHT() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Apply A-weight filtering to the operand. The argument must be frequency or octave domain data.

## [AXES SCAL MARKERS] softkey

Key Path: [ **Scale** ]

Scale the trace using special markers.

- Specify X-axis or Y-axis scaling.
- Move markers using the knob or numeric entry keys.
- Return to a full-span display.
- Expand the band identified by the markers to fill the display.
- Specify which of the markers should hold its position and which should move.

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [ EXP ] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[ 1 ] [ 5 ] [ EXP ] [ +/− ] [ 3 ] [ ENTER ]

The following table explains how the hold keys work.

| Pressing this key: | Holds this: | Lets you change: |
|---|---|---|
| Hold Right | Right value | Left value |
| Hold Top | Top value | Bottom value |
| Hold Center | Center value | Width (distance between markers) |
| Hold Left | Left value | Right value |
| Hold Bottom | Bottom value | Top value |
| Hold Wdth (Scroll) | Width (distance between markers) | Center value |

*See also:* [ HOLD BOTTOM ] softkey, [ HOLD LEFT ] softkey, [ HOLD CENTER ] softkey, [ HOLD TOP ] softkey, [ HOLD RIGHT ] softkey, [ HOLD WDTH (SCROLL) ] softkey, [ FULL SCALE ] softkey, [ AXIS X Y ] softkey

## [AXIS X Y] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Specify whether the axis scale markers apply for the X-axis or the Y-axis.

*See also:* [ AXES SCAL MARKERS ] softkey

## [Back Space] hardkey

Use [ **Back Space** ] to correct mistakes in the following situations:

- When entering or editing a text string: Press [ **Back Space** ] to delete the character to the left of the cursor.
- When entering a number: Press [ **Back Space** ] to delete the last digit of the number.
- When defining a math function: Press [ **Back Space** ] to delete the last operator or operand in the definition.

## [BAND CENTER] softkey

Key Path: [ **Marker Fctn** ] → [ BAND MARKER ]

Define the center X-axis value for the band within which you want the analyzer to calculate power.

This also anchors the band center X value, so that when you change the band span the band start and stop X values change.

## [BAND MARKER] softkey

Key Path: [ **Marker Fctn** ]

Turn on and set up band markers. You can use band markers to define an X-axis band and then calculate the power within this band. From the band marker menu you can do the following things:

- Specify the band.
- Turn off computation.
- Display band power.
- Display rms square root power.

*See also:* [ RMS SQRT (PWR) ] softkey, [ COMPUTE OFF ] softkey, [ BAND POWER ] softkey, [ BAND SPAN ] softkey

## [BAND POWER] softkey

Key Path: [ **Marker Fctn** ] → [ BAND MARKER ]

Compute and display the band power. The value is displayed in the lower left corner of the trace box.

For linear spectra, power spectra, or time domain measurement data, band power is the total power within the specified band. The value will be given in dBVrms or Vrms ^ 2, depending on the current trace coordinate. For all other measurement data, the analyzer simply sums the magnitudes of the points within the band and displays the result in the current Y-axis units.

The band power calculation compensates for the effect of a Hanning or Flat Top window. The correction differs depending on whether the band contains multiple points or just a single point. For this reason, the power in a band containing multiple points will differ from the sum of the power at each point computed separately.

*See also:* [ **Trace Coord** ] hardkey

## [BAND SPAN] softkey

Key Path: [ **Marker Fctn** ] → [ BAND MARKER ]

Define the X-axis span for the band within which you want the analyzer to calculate power.

If the band start is anchored, the band center and band stop change to reflect the new span. If the band center is anchored, the band start and band stop X values change. A box around the [ BAND START ] or [ BAND CENTER ] softkey indicates which is anchored.

*See also:* [ BAND STOP ] softkey, [ BAND CENTER ] softkey, [ BAND START ] softkey

## [BAND START] softkey

Key Path: [ **Marker Fctn** ] → [ BAND MARKER ]

Define the left (lower) X-axis value for the band within which you want the analyzer to calculate power. The first data point included in the band will be the one whose X value is closest to the band start value.

For example, suppose that one data point has an X value of 10 Hz, the next point is at 15 Hz, and the band start value is 12 Hz. In this case, the point at 10 Hz will be the first point in the band. If the band start value were 13 Hz, the point at 15 Hz would be the first point in the band.

Pressing this key also anchors the band start position, so that when you change the band stop position or span, the band start remains fixed.

## [BAND STOP] softkey

Key Path: [ **Marker Fctn** ] → [ BAND MARKER ]

Define the left (lower) X-axis value for the band within which you want the analyzer to calculate power. The last data point included in the band will be the one whose X value is closest to the band stop value.

For example, suppose that one data point has an X value of 10 Hz, the next point is at 15 Hz, and the band stop value is 12 Hz. In this case, the point at 10 Hz will be the last point in the band. If the band stop value were 13 Hz, the point at 15 Hz would be the last point in the band.

If the band start position is anchored, changing the band stop position will also change the center and span values. If instead the band center position is anchored, the start position and span will change.

## [BASELINE SUPPRESS] softkey

Key Path: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Specify a percentage of the waterfall traces to be suppressed in the display. The analyzer does not display this percentage of the bottom of each trace. This is useful for removing noise floor clutter from the display.

Limits: 0 to 100% Default: 0%

For example, if you set baseline suppress to 10%, the lower 10% of each trace is not displayed. If the Y-axis scale is from –100 dB to 0 dB, only amplitudes above –90 db are displayed.

If you set baseline suppress to 0%, the analyzer displays the full trace.

*See also:* [ WATERFALL ] softkey

## [BASIC] hardkey

Access the HP Instrument BASIC softkeys (except those used to save and recall a program).

If your analyzer does not have HP Instrument BASIC (option 1C2), the analyzer displays an error message when you press this key.

---

**Note**

HP Instrument BASIC allows you to automatically load and run a designated program when you turn on the analyzer. To make an autoloading program, save it with the file name "AUTO_BAS" in non-volatile memory or on a floppy disk in the internal drive.

At power-up, and analyzer searches first on the internal disk drive and then the non-volatile drive for the file "AUTO_BAS." If the file is found, HP Instrument BASIC loads and executes the program immediately.

If you do not want to load the AUTO_BAS program when you turn on the analyzer, hold down the [ Preset ] key while you turn on the analyzer.

---

[ BASIC ] has a special purpose in each of the following situations:

- HP Instrument BASIC's keystroke recording feature is enabled. In this situation, you can press [ BASIC ] to end the current recording session.
- An HP Instrument BASIC program is running. In this situation, you can press [ BASIC ] to pause the program. (You can also stop a program in other ways.)

For detailed information on HP Instrument BASIC, see the *Using HP Instrument BASIC with the HP 35665A* or *HP Instrument BASIC User's Handbook* manuals.

*See also:* Stopping a program

## [BEEPER ON OFF] softkey

Key Path: [ System Utility ]

Turn on or off the analyzer's beeper.

The beeper sounds when some messages are displayed. Also, if [ FAIL BEEP ON OFF ] is ON during limit testing, the beeper sounds when a trace falls outside the specified limits.

*See also:* [ FAIL BEEP ON OFF ] softkey

## Bins defined

Each trace is divided along its X-axis into a number of evenly-spaced lines. Each line is called a "bin." These bins determine the resolution of the analyzer's X-axis. The number of bins depends on the resolution (number of lines) and the type of data displayed.

The following table shows the number of bins for frequency domain and time domain data from an FFT measurement.

**Resolution versus bins**

| Resolution | Baseband (Start freq = 0) | | Zoom (Start freq ≠ 0) | |
|---|---|---|---|---|
| | Frequency domain (complex points) | Time domain (real points) | Frequency domain (complex points) | Time domain (real points) |
| 100 | 101 | 256 | 100 | 128 |
| 200 | 201 | 512 | 200 | 256 |
| 400 | 401 | 1024 | 400 | 512 |
| 800 | 801 | 2048 | 800 | 1024 |

For an octave measurement, each bin is either 1/12 octave, 1/3 octave, or 1 octave wide, depending the current selection under the [ Freq ] hardkey.

The following description is for frequency domain data.

Each bin has a nominal value. This is the value used for the marker's X-axis readout. For frequency domain data, the nominal value of the first bin (bin 0) is the start frequency. The nominal value of the last bin is the stop frequency.

Each frequency bin represents a band of frequencies, not just the nominal value. The amplitude of the bin is the total power in the band. The width of this band is related to the current frequency span and the number of lines of resolution:

bin bandwidth = span / number of lines

For FFT measurements, a frequency bin represents all frequencies between (NF – 1/2 BBW) and (NF + 1/2 BBW), where NF is the nominal frequency and BBW is the bin bandwidth.

The following table shows the relationship between frequency span, number of lines, and bin bandwidth (in Hz) for FFT measurement data.

**Bin Bandwidths**

| Span | Resolution (Number of Lines) 100 | 200 | 400 | 800 |
|---|---|---|---|---|
| 97.65625 uHz | 976.6 uHz | 488.3 uHz | 244.1 uHz | 122.1 uHz |
| 195.31 mHz | 1.9 mHz | 976.6 uHz | 488.3 uHz | 244.1 uHz |
| 390.625 mHz | 3.9 mHz | 1.9 mHz | 976.6 uHz | 488.3 uHz |
| 781.25 mHz | 7.8 mHz | 3.9 mHz | 1.9 mHz | 976.6 uHz |
| 1.5625 Hz | 15.6 mHz | 7.8 mHz | 3.9 mHz | 1.9 mHz |
| 3.125 Hz | 31.3 mHz | 15.6 mHz | 7.8 mHz | 3.9 mHz |
| 6.25 Hz | 62.5 mHz | 31.3 mHz | 15.6 mHz | 7.8 mHz |
| 12.5 Hz | 125 mHz | 62.5 mHz | 31.3 mHz | 15.6 mHz |
| 25 Hz | 250 mHz | 125 mHz | 62.5 mHz | 31.3 mHz |
| 50 Hz | 500 mHz | 250 mHz | 125 mHz | 6.3 mHz |
| 100 Hz | 1 Hz | 500 mHz | 250 mHz | 125 mHz |
| 200 Hz | 2 Hz | 1 Hz | 500 mHz | 250 mHz |
| 400 Hz | 4 Hz | 2 Hz | 1 Hz | 500 mHz |
| 800 Hz | 8 Hz | 4 Hz | 2 Hz | 1 Hz |
| 1.6 kHz | 16 Hz | 8 Hz | 4 Hz | 2 Hz |
| 3.2 kHz | 32 Hz | 16 Hz | 8 Hz | 4 Hz |
| 6.4 kHz | 64 Hz | 32 Hz | 16 Hz | 8 Hz |
| 12.8 kHz | 128 Hz | 64 Hz | 32 Hz | 16 Hz |
| 25.6 kHz | 256 Hz | 128 Hz | 64 Hz | 32 Hz |
| 51.2 kHz | 512 Hz | 256 Hz | 128 Hz | 64 Hz |
| 102.4 kHz | 1024 Hz | 512 Hz | 256 Hz | 128 Hz |

*See also:* [ RESOLUTN (LINES) ] softkey, [ STOP ] softkey (frequency), [ START ] softkey (frequency), [ SPAN ] softkey (frequency)

## [BLANK ANNOTATN] softkey

Key Path: [ **Disp Format** ] → [ MORE ]

Turn off the trace annotation.

Each trace box is surrounded by fields that define the trace within that box. These fields are collectively referred to as "trace annotation."

When trace annotation is turned off, trace information is not displayed on the screen and it is not printed or plotted.

**Note** You must preset the analyzer to turn on blanked annotation from the front panel. You must send DISP:ANN ON over the HP-IB to turn on blanked annotation without presetting.

*See also:* Trace boxes

## [BLANK DISPLAY] softkey

Key Path: [ **Disp Format** ] → [ MORE ]

Blank (turn off) all information on the analyzer's screen except the softkey labels.

When the screen is blanked, the message "DISPLAY BLANKING ON" replaces all other information. Only this message is plotted or printed.

**Caution** You must preset the analyzer (or cycle power) to turn on a blanked screen from the front panel. You must send DISP:ENAB ON over the HP-IB to turn on a blanked screen without presetting.

## [BODE DIAGRAM] softkey

Key Path: [ **Disp Format** ]

Display a Bode diagram. For a transfer function, a Bode diagram is a plot of log gain and phase vs. log frequency. This display mode is available only for FFT analysis and swept sine.

When you select the Bode diagram display format, the following changes are made in the display:

- The measurement data for traces A and B is changed to frequency response.
- The trace coordinate for trace A is changed to dB magnitude.
- The trace coordinate for trace B is changed to phase.
- The X-axis scale is changed to log.
- Markers are enabled and coupled.

**Note**

To change the X-axis back to linear spacing, press the following keys:
[ **Trace Coord** ] → [ X-AXIS LIN LOG ].

*See also:* [ FFT ANALYSIS ] softkey, [ SWEPT SINE ] softkey, [ X-AXIS LIN LOG ] softkey (trace coord), [ COUPLED ON OFF ] softkey, [ **Trace Coord** ] hardkey, [ **Meas Data** ] hardkey

## [BOTTOM REFERENCE] softkey

Key Path: [ Scale ]

Select a reference value for the bottom of the scale. Then use the appropriate softkeys and the numeric keypad to enter this value. When you change the [ Y PER DIV ] value, the bottom of the scale remains fixed and the top changes.

The ratio between the reference value and the [ Y PER DIV ] value cannot be greater than 1e15.

---

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [ EXP ] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[ 1 ] [ 5 ] [ EXP ] [ +/- ] [ 3 ] [ ENTER ]

---

*See also:* [ Y PER DIV (DECADES) ] softkey

## [BURST CHIRP] softkey

Key Path: [ Source ]

Select the burst chirp waveform. Chirp is a fast sine sweep across the current frequency span that repeats with the same period as the time record.

Burst chirp allows you to specify the percentage of the time record that the source is active. The analyzer rounds your entry to the closest valid value.

Limits: 0% to 100% Default: 50%

**Note**

The analyzer uses the same burst percentage for burst random and burst chirp. If you change the percentage for one burst waveform, the analyzer also changes the percentage for the other burst waveform.

Because the burst chirp output is periodic, it's best to use the Uniform window when making measurements using this waveform. Also, source triggering is recommended for burst source outputs.

In time capture mode with source triggering, the source outputs a single burst at the beginning of the capture rather than a burst for each time record. With input triggering, the source outputs a burst at the trigger time.

The timing of the source output is slightly different in different trigger modes. In source trigger mode, the output begins at trigger time. In external trigger, HP-IB trigger, or input trigger modes, the output will be delayed slightly (less than 30 usec).

*See also:* [ CHANNEL x TRIGGER ] softkey, [ START CAPTURE ] softkey, [ SOURCE TRIGGER ] softkey, [ UNIFORM ] softkey, Time record

## [BURST RANDOM] softkey

Key Path: [ **Source** ]

Select the burst random waveform. In this mode, the source outputs a random noise waveform during the specified percentage of the time record and nothing during the remainder of the record.

You can specify the percentage of the time record by pressing [ BURST RANDOM ] and entering the percent from the numeric keys. The analyzer rounds your entry to the closest valid value.

Limits: 0% to 100% Default: 50%

---

**Note** The analyzer uses the same burst percentage for burst random and burst chirp. If you change the percentage for one burst waveform, the analyzer also changes the percentage for the other burst waveform.

---

Because the burst random output is periodic, it's best to use the Uniform window when making measurements using this waveform. Also, source triggering is recommended for burst source outputs.

The timing of the source output is slightly different in different trigger modes. In source trigger mode, the output begins at trigger time. In external trigger, HP-IB trigger, or input trigger modes, the output will be delayed slightly (less than 30 usec).

The bandwidth of burst random noise is set so that most of the energy in the source signal is within the measured span.

In time capture mode with source triggering, the source outputs a single burst at the beginning of the capture rather than a burst for each time record. With input triggering, the source outputs a burst at the trigger time.

*See also:* [ CHANNEL x TRIGGER ] softkey, [ START CAPTURE ] softkey, [ SOURCE TRIGGER ] softkey, [ UNIFORM ] softkey, Time record

## [BWEIGHT(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Apply B-weight filtering to the operand. The argument must be frequency or octave domain data.

## [CAL CONST ON OFF] softkey

Key Path: [ **System Utility** ] → [ SERVICE TESTS ] → [ SPCL TEST MODES ] → [ MORE SPCL MODES ]

Turn on an off the use of calibration constant.

If cal const is on, the analyzer uses the results of the last calibration cycle as correction for measurement data. If cal const is off, the analyzer saves the calibration results but does not apply the correction to measurement data.

---

**Caution** If you turn cal const off, correction is not applied to the measured data and published specifications are not guaranteed.

---

*See also:* [ AUTO CAL ON OFF ] softkey

## [CALIBRATN] softkey

Key Path: [ **System Utility** ]

Access the calibration utilities:

- Single calibration.
- Turn autocalibration on or off.
- Save the calibration trace for either channel to a data register.

For more information on calibration, see the analyzer's *Service Guide*.

*See also:* [ SAVE CHx CAL TRACE ] softkey, [ AUTO CAL ON OFF ] softkey, [ SINGLE CAL ] softkey

## [CAPTURE CHANNEL x] softkey

Key Path: [ **Meas Data** ]
or: [ **Meas Data** ] → [ MORE ]

Display the contents of the time capture buffer for the specified channel.

If the capture buffer contains more than one record (1024 points), the analyzer samples the data based on the X-axis scale and displays the sampled data. Information that falls between the sampled points (such as transients) is not displayed.

If you want to look at more of the points in the buffer, you can scale the X-axis as follows:

1. Press [ **Scale** ] → [ AXES SCAL MARKERS ].
2. Press [ HOLD CENTER ] and turn the knob to adjust the distance between markers.
3. Press [ HOLD WDTH (SCROLL) ] → [ SCALE AT MARKERS ].
4. Turn the knob to scroll through the captured data.

If you want to zoom in more on the data, repeat from [ HOLD CENTER ].

## [CAPTURE HEADER] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Display the following header information for the time capture buffer:

- Length, both in seconds and number of 1024-point records.
- File size (in bytes).
- Number of channels.
- Start, stop, center, and span frequencies.
- Record length.
- Delta T.
- Input setup information for the active channel or channels.
- Tach data setting. If tach data is on (or the instrument mode is order analysis) and tach data present, the following information is also displayed:
  - rpm at beginning of capture data (not the min rpm).
  - rpm at end of capture data (not the max rpm).

The capture header display remains until you press [ RETURN ].

*See also:* [ TACH DATA ON OFF ] softkey

## [CAPTURE LENGTH] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Specify the length of the time capture buffer. You can specify seconds, number of records, or number of points.

For time capture, a record is always 1024 points. If you set a record length that is not an integral multiple of 1024 points, the analyzer captures the next higher multiple of 1024 point. The mini-state reflects the number you enter, not the larger number that the analyzer uses.

The limits for capture length vary depending on such things as the amount of memory available, the number of channels, and the frequency span.

Memory is not allocated until you press [ START CAPTURE ] or [ ALLOCATE CAPTURE ].

To calculate the amount of memory required:

2 bytes per point (2048 bytes per record) per channel
+ 4 bytes per record
+ 5088 bytes 1 channel or 9228 bytes 2 channel for SDF overhead and correction vectors
+ extra for tach data

For example, if you want to capture 10 time records for 1 channel, (tach data off) you need 25608 bytes:

| | | |
|---:|---|---|
| 10 records x 2048 bytes/record | = | 20480 bytes |
| 10 records x 4 bytes/record | = | 40 bytes |
| 5088 bytes overhead | = | 5088 bytes |
| total | = | 25608 bytes |

## [CAPTURE ON OFF] softkey

Key Path: [ Inst Mode ]

Specify whether measurement data comes from the time capture buffer or the input channels.

When capture is on, the analyzer takes data from the time capture buffer. When capture is off, the analyzer takes data from the input channels.

**Note**

When you start a measurement with capture on, the analyzer turns off the source. When the measurement is complete, the analyzer returns the source to its original on/off state.

When you start a time capture, the analyzer automatically toggles Capture On Off to On when the capture is complete.

You can select what part of the time capture data should be used for the measurement by specifying a start time and stop time for each channel.

**Note**

The message "End of CAPTURE data" appears when the analyzer reaches the end of the time capture data. This message also appears if there is no time capture data or the [ CAPTURE LENGTH ] is less than the [ RECORD LENGTH ].

*See also:* [ STRT TIME CHANNEL x ] softkey, [ STOP TIME CHANNEL x ] softkey, [ CAPTURE LENGTH ] softkey, [ RECORD LENGTH ] softkey

## [CAPTURE SETUP] softkey

Key Path: [ **Inst Mode** ]

Set up time capture parameters.

Time capture allows you to record real-time data containing frequencies up to 51.2 kHz (2 channel) or 102.4 kHz (1 channel).

The analyzer stores the data to memory. The amount of data you can capture depends on the amount of memory available in your analyzer. To find out how much memory is available, press [ **System Utility** ] → [ MEMORY USAGE ]. You can free up more memory by removing waterfall displays, HP Instrument BASIC programs, and RAM disk from memory.

After the capture is complete, you can save the captured data to disk, using [ **Save/Recall** ] → [ SAVE DATA ] → [ SAVE CAPTURE ].

You must set up the following parameters *before* capturing data:

- Instrument Mode (you can change this when you analyze the data).
- Number of channels.
- Capture length.
- Tach data on/off.
- Frequency settings.
- Triggering.
- Source (if using internal source).
- Input setup.

You can setup or change the following parameters *after* capturing data:

- Instrument Mode.
- Averaging.
- Windowing.
- Analysis region.
- Resolution.

*See also:* [ **Inst Mode** ] hardkey, [ RESOLUTN (LINES) ] softkey, [ ANALYSIS REGION ] softkeys, [ **Window** ] hardkey, [ **Avg** ] hardkey, [ **Input** ] hardkey, [ **Freq** ] hardkey, [ **Source** ] hardkey, [ **Trigger** ] hardkey, [ TACH DATA ON OFF ] softkey, [ CAPTURE LENGTH ] softkey, [ 1 CHANNEL ] softkey, [ **Inst Mode** ] hardkey, [ SAVE CAPTURE ] softkey

## [CARRIER FREQ] softkey

Key Path: [ **Marker Fctn** ] → [ SIDEBAND MARKER ]

Specify the carrier frequency for the sidebands you want to examine. The analyzer needs the carrier frequency to find the appropriate sidebands and to make the sideband marker calculations.

---

**Note** The carrier frequency you specify does not have to be within the current frequency span.

---

*See also:* [ SIDEBAND MARKER ] softkey

## [CATALOG ON OFF] softkey

Key Path: [ **Save/Recall** ]
or: [ **Disk Utility** ]

Turn the disk catalog on and off. The catalog describes the contents of the default disk in a tabular format.

The catalog header includes the disk label and the space available The file descriptions include each file's name, size (in bytes), type, and the date and time that each file was last changed. It also indicates if the file is open by an HP Instrument BASIC program (indicated by a " > ") or a LIF protected file (indicated by a " * ").

You can simplify many file operations by turning the catalog on. When the catalog is on, you can select one of the listed files by turning the knob. Then when you request a file operation that asks for a filename, the name of the selected file is automatically placed in the entry window.

The analyzer automatically updates the catalog whenever you perform a save or disk utility operation.

The catalog is turned off automatically when you do any of the following:

- Eject a flexible disk whose catalog is being displayed (for the internal disk drive only).
- Press any hardkey in the MARKER, DISPLAY, or MEASUREMENT group.
- Press any hardkey other than [ **Save/Recall** ] or [ **Disk Utility** ] in the SYSTEM group.

*See also:* [ DEFAULT DISK ] softkey

## [CDF CHANNEL x] softkey

Key Path: [ **Meas Data** ]

Display the Cumulative Density Function for the specified channel. This shows the probability that a level equal to or less than a specific level occurred. It is computed by integrating the probability density function (PDF).

The analyzer uses the Real Part trace coordinate and scales the Y-axis from 0 to 1 to display CDF.

*See also:* [ PDF CHANNEL x ] softkey

## [CENTER REFERENCE] softkey

Key Path: [ **Scale** ]

Select a reference value for the center of the scale. Then use the appropriate softkeys and the numeric keypad to enter this value. When you change the [ Y PER DIV ] value, the center of the scale remains fixed and the top and bottom change.

The ratio between the reference value and the [ Y PER DIV ] value cannot be greater than 1e15.

---

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [ EXP ] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[ **1** ] [ **5** ] [ EXP ] [ +/− ] [ **3** ] [ ENTER ]

---

*See also:* [ Y PER DIV (DECADES) ] softkey

## [CENTER] softkey (frequency)

Key Path: [ Freq ]

Specify the center frequency for the frequency band that you want to analyze.

| | | |
|---|---|---|
| Limits: | 98 mHz to 25.6 kHz (2 channel) | Default: 25.6 kHz |
| | 98 mHz to 51.2 kHz (1 channel) | 51.2 kHz |

(limits depend on the instrument mode and span selected)

This also anchors the center frequency. If you change the span frequency or record length, the center frequency remains constant and the start and stop frequencies change.

The analyzer does not display any frequency data less than 0 Hz. Therefore, if you specify a start value of less than zero, you won't see anything displayed to the left of 0 Hz. Nor does the analyzer display frequency data greater than 115 kHz.

**Caution** Although the analyzer will display data up to 115 kHz, the range from 102.4 kHz to 115 kHz is not calibrated and is significantly affected by the antialias filter.

*See also:* [ RECORD LENGTH ] softkey, [ SPAN ] softkey (frequency)

## [CENTER] softkey (swept sine frequency)

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Specify the center of the band of frequencies to be analyzed for a swept sine measurement.

Limits: 23.438 mHz to (51.2 kHz – 15.625 mHz)
Default: 25.6 kHz

The center frequency will be held constant (and selected as the new anchor for span); start and span will change to appropriate values.

*See also:* [ SWEPT SINE ] softkey

## [CHANGE VALUE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ EDIT TABLE ]
or: [ **Analys** ] → [ SYNTHESIS ] → [ EDIT TABLE ]

Modify the value highlighted by the cursor.

When you press a number key, an edit box appears. Type in the new value as follows:

1. Type the real part first, including an exponent if required.
2. If the entry is real, go to step 3. If the entry is complex, press [ + j ], then enter the imaginary part.
3. Press the appropriate unit key, [ kHz ], [ Hz ], or [ mHz ]. This terminates editing and puts the modified entry in the table.

---

**Note** The analyzer requires that complex entries be conjugate pairs for poles and zeros. When you include [ + j ] in the entry, the analyzer interprets the complex entry as a conjugate pair.

---

**Note** Residues are also interpreted as conjugate pairs. The sign of the residue imaginary value is significant. Because each residue entry is associated with the pole entry in the same row, the sign indicates which complex residue from the pair is associated with each complex pole.

---

## Changing numeric parameters

You can change the value of numeric parameters in the following ways:

- Enter a value using the number keys.
- Step the current value up or down using the arrow keys.
- Scroll the current value up or down using the knob.

**Note**

Scrolling a value is similar to stepping a value with one important exception: the numeric entry softkey's entry window *must* be displayed before you turn the knob.

Some numeric parameters can also be changed using the [ **Marker Value** ] hardkey.

*See also:* [ **Marker Value** ] hardkey, Knob, Arrow keys

## [CHANNEL x DELAY] softkey

Key Path: [ Trigger ] → [ TRIGGER SETUP ]

Set a pre- or post-trigger delay for the input channel.

You can enter a time delay in seconds, milliseconds, or microseconds.

Limits: –8191 samples to 0 pre-trigger
0 to 16,384 seconds post-trigger
(Pre-trigger is span-dependent; post-trigger is span-independent.)

Default: 0

**Note** For time capture, pre-trigger delay is limited to 1 time record.

For a pre-trigger delay, enter a negative value (as in –10 ms). For a post-trigger delay, enter a positive value (as in 10 ms). The amount of trigger delay possible varies with the width of the frequency span.

The maximum trigger delay difference between channels varies depending on the resolution as follows:

| Resolution | Max delay difference |
|---|---|
| 800 lines | 3 time records |
| 400 lines | 7 time records |
| 200 lines | 15 time records |
| 100 lines | 31 time records |

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* Time record, [ CAPTURE SETUP ] softkey, [ RESOLUTN (LINES) ] softkey

## [CHANNEL x FORCE EXPO] softkey

Key Path: [ **Window** ]

Toggle between the force window and exponential window for the corresponding channel.

---

**Note** When you specify the force window, the analyzer applies both the force and exponential weighting functions for that channel.

---

The force window passes the first part of the time record (specified by the force width) and sets the last part to the average value of the time record's remaining data.

The force window is often used in impact testing to minimize unwanted signals occurring after the actual impact.

The exponential window attenuates the input signal at a decaying exponential rate determined by the specified time constant.

The exponential window is often used in lightly damped systems with frequency responses that do not decay within one time record.

To learn more about the force and exponential windows and their applications, see the analyzer's *Concepts Guide.*

*See also:* [ FORCE WIDTH ] softkey, [ EXPO DECAY ] softkey

## [CHANNEL x RANGE] softkey

Key Path: [ Input ]

To manually set the range for an input channel, press [ CHANNEL 1 RANGE ] or [ CHANNEL 2 RANGE ]. Then use the numeric keypad to enter an input range value. This also changes the range mode for the channel to fixed range

Limits: –51 dBVrms to 27 dBVrms    Default:–51 dBVrms
Steps: 2 dB

**Note**

The analyzer rounds up your entered value to the next valid range. You can also use the arrow hardkeys to step through the valid ranges.

You should set the input range manually when you want to maintain a specific input range setting. Ideally, the signal peak should fall within the upper half of the input range.

If you set the input range too low (more sensitive than necessary), the analyzer's input circuitry introduces distortion into the measurement. But if you set the input range too high (less sensitive than necessary), the resulting loss of dynamic range introduces additional noise—in some cases, the increase in the noise floor may even obscure low-level frequency components.

*See also:* [ CHx FIXED RANGE ] softkey

## [CHANNEL x SETUP] softkey

Key Path: [ Input ]

Set up the following input parameters for the corresponding input channel:

- Specify the grounding mode.
- Specify ac or dc coupling.
- Turn the antialias filter on or off.
- Turn the A-weight filter on or off.
- Turn the ICP power supply on or off.
- Specify engineering units label and multiplier.

*See also:* [ ICP SUPLY ON OFF ] softkey, [ ENG UNIT MULTIPLIER ] softkey, [ ENG UNIT LABEL ] softkey, Engineering units, [ A WT FLTR ON OFF ] softkey, [ ANTIALIAS ON OFF ] softkey, [ COUPLING AC DC ] softkey, [ INPUT LOW FLOAT GND ] softkey

## [CHANNEL x TRIGGER] softkey

Key Path: [ **Trigger** ]

Select the specified channel as the input trigger source. This means the analyzer begins a measurement when the input signal meets the trigger conditions you've specified.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ TRIGGER SETUP ] softkey

## [CHx AUTO RANGE] softkey

Key Path: [ **Input** ]

Activate autorange up for the corresponding input channel. When you turn on autoranging, the analyzer sets the input to the most sensitive range, and automatically steps through less-sensitive input ranges until the input channel is no longer overloaded.

---

**Note** Autorange is the default range mode. To turn autorange off, you must either specify a range or press [ CHX FIXED RANGE ].

---

If the input signal amplitude increases after the range is set (enough to overload the input), the analyzer begins stepping through even less-sensitive ranges. Again, this stops when the input is no longer overloaded or the analyzer reaches the maximum range (27 dBVrms).

If the input signal amplitude decreases, the analyzer does NOT change to a different range (except in swept sine mode). The input range remains at the highest setting the analyzer found appropriate.

During a swept sine measurement, the analyzer performs an "up-down" autorange at each measurement point. If the analyzer detects an overload, it changes to a less sensitive range. If the signal is below half-range, the analyzer changes to a more sensitive range.

*See also:* [ OVLD REJ ON OFF ] softkey, [ CHANNEL x RANGE ] softkey, [ CHx FIXED RANGE ] softkey

## [CHx FIXED RANGE] softkey

Key Path: [ **Input** ]

Disable autoranging for the specified channel.

If you want to change the range for the channel, press the [ CHANNEL x RANGE ] softkey and use the numeric entry keys or the arrow keys to change the range.

*See also:* [ CHx AUTO RANGE ] softkey

## [CLEAR TABLE] softkey

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ EDIT TABLE ]
or: [ **Analys** ] → [ SYNTHESIS ] → [ EDIT TABLE ]

Clear the table. The analyzer asks you for confirmation before it clears the table.

**Caution** You cannot recover a table after it has been cleared. To save a table for future use, use [ SAVE FIT TABLE ] or [ SAVE SYNTH TABLE ] before clearing the table.

Clearing the table also resets the system gain to 1.0, frequency scale to 1.0, and time delay to 0.0 seconds.

*See also:* [ SAVE SNTH TABLE ] softkey, [ SAVE FIT TABLE ] softkey

## [CLEAR SCREEN] softkey (BASIC display)

See [ DISPLAY SETUP ] softkey group.

## [CLOCK SETUP] softkey

Key Path: [ **System Utility** ]

Set up the time, date, and time stamp options.

*See also:* [ TIMESTAMP SETUP ] softkey, [ TIME HHMM ] softkey, [ DATE MMDDYY ] softkey

## [COHERENCE] softkey

Key Path: [ **Meas Data** ]

Display the most recent coherence function on the active trace.

Coherence indicates the similarity between two signals. Coherence is scaled from 0.0 (complete incoherence) to 1.0 (unity, or perfect coherence). Coherence less than unity indicates the presence of external extraneous noise, system nonlinearities, or unexpected input signals.

Coherence is computed only for two-channel measurements and for rms or rms exponential averaging with at least 2 averages.

The analyzer calculates coherence as follows:

| | | | |
|---|---|---|---|
| | coherence | = | (cspec * conj (cspec)) / (pspec1 * pspec2) |
| where: | cspec | = | cross spectrum |
| | pspec | = | power spectrum |

For more information on coherence, see the analyzer's *Concepts Guide.*

*See also:* [ PWR SPEC CHANNEL x ] softkey, [ CROSS SPECTRUM ] softkey

## [COMP PWR CHANNEL x] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Meas Data** ] → [ MORE ]

Display the composite power for the specified channel. This is the sum of the power for all orders (not just the orders you have chosen to track).

You can include dc bins in the calculation by pressing [ DC BINS ON OFF ] under [ **Window** ].

**Note** This data is only available if track is on.

*See also:* [ TRACK ON OFF ] softkey, Bins defined, [ CP DC BINS ON OFF ] softkey

## [COMPUTE COEFFICNT] softkey

Key Path: [ **Marker Fctn** ] → [ FREQ & DAMPING ]

Compute and display the resonant frequency and the damping ratio for active trace. The values are displayed in the lower left and right corners of the trace box.

The analyzer uses only the data between the start frequency and stop frequency markers for the computation. Frequency and damping are computed using the following equations:

frequency = I

damping = –R / sqrt (R^2 + I^2)

where R = real part of the complex pole pair corresponding to the resonance

I = imaginary part of the complex pole pair corresponding to the resonance

The algorithm for frequency and damping computes a conjugate pole pair, implicitly assuming an underdamped resonance. If the frequency response behaves as a critically or overdamped system between markers, the algorithm will return meaningless values. The damping is always less than 1.

Frequency and damping can only be computed for complex frequency-domain data. It cannot be computed for Nyquist trace coordinates.

The damping computation for the HP 35665A is different than that for the HP 3562/3563; the computed frequency is the same for both analyzers. To convert HP 35665A damping to HP 3562/3563 damping, use the following equation:

a = – b* freq / sqrt (1 – b^2)

where a = HP 3562/3563 damping

b = HP 35665A damping

*See also:* [ STOP FREQUENCY ] softkey, [ START FREQUENCY ] softkey

## [COMPUTE MARGINS] softkey

Key Path: [ **Marker Fctn** ] → [ GAIN PHAS MARGINS ]

Compute and display gain and phase margins and crossovers for the active trace. Gain and phase values are shown in the lower left and right corners of the trace box. Crossover frequencies are indicated by solid band markers in the trace box and listed in the mini-state.

The analyzer uses only the data between the start frequency and stop frequency markers for the computation.

The gain margin is defined as the magnitude level (in dB) when the phase crosses below –180 degrees. A value greater than – 6 dB indicates the possibility of an unstable system.

The phase margin is defined as 180 degrees minus the absolute value of the phase angle when the gain is equal to 0 dB or 1. A value less than +/– 10 indicates the possibility of an unstable system.

If the gain or phase crossover occurs between measured data points, the actual crossover is linearly interpolated.

The analyzer begins searching for zero gain and phase at the start and continues until it finds the first gain and phase crossovers. If the analyzer finds no crossovers before reaching the stop marker, the gain and phase are undefined; the mini-state displays this information.

*See also:* [ STOP FREQUENCY ] softkey, [ START FREQUENCY ] softkey

## [COMPUTE OFF] softkey

Key Path: [ **Marker Fctn** ] → [ a marker function ]

Turn off the computation and display of marker function results.

*See also:* [ **Marker Fctn** ] hardkey

## [CONFIDNCE LEVEL] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Avg** ]

Specify the acceptable amount by which the measured results can vary from the true mean value for equal confidence averaging.

Choices: 0.25, 0.5, 1, or 2 dB | Default: 0.5 dB

For equal confidence averaging, the analyzer varies the average time so that there is a 68% probability that the measured results will be within the specified confidence level of the true mean value. There is a 96% probability that the results will be within twice the confidence level of the true mean value.

For example, if you specify a confidence level of .5 dB, the probability is 68% that the measured level is less than .5 dB different from the true mean value. The probability is 96% that the measured level is less than 1 dB different from the true mean value.

*See also:* [ EQUAL CONFID ] softkey

## [CONFIRM ALLOCATE] softkey

See [ ALLOCATE CAPTURE ] softkey.

## [CONFIRM CLEAR] softkey

See [ CLEAR TABLE ] softkey.

## [CONFIRM DELETE] softkey

See [ DELETE ALL ] softkey.

## [CONFIRM REMOVE] softkey

See [ REMOVE CAPTURE ] softkey.

## [CONJ() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the complex conjugate of the operand.

The complex conjugate of a complex value a + jb is defined to be a – jb. In polar form, the complex conjugate of me ^ jp is me ^ (–jp).

## [CONTINUE RECALL] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Continues the recall of a file saved on multiple disks.

When you recall a split file, type the first file in the sequence, such as "WFALL1." The analyzer then tells you which disk to insert next (in this example, "WFALL2").

*See also:* [ CONTINUE SAVE ] softkey

## [CONTINUE SAVE] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Continues the save operation for a large buffer by splitting it over multiple disks. If the buffer contents will not fit on one disk, the analyzer splits the file and asks you to insert another disk when the current disk is full.

---

**Note** This command only works for flexible disks in the internal or external disk drives. It does not work for non-volatile RAM, volatile RAM, or fixed external disks.

---

The analyzer keeps track of the order of the disks by appending a number to the file name on each disk. For example, if you enter the filename "WFALL," the analyzer names the first file "WFALL1," the second file "WFALL2," and so on. When you recall a split file, the analyzer tells you which disk to insert next.

## [CONTINUE] softkey

(Available only with opt. 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ]
or: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ DEBUG ]

Resume execution of a paused program from the point at which the program was paused.

---

**Note** You can only continue a paused program. However, you can restart any program from its first statement by pressing [ RUN PROGRAM x ].

---

*See also:* [ RUN PROGRAM x ] softkey, Stopping a program

## Controller capability softkey group

Key Path: [ **Local/HP-IB** ]

Specify whether the analyzer should be the system controller in your HP-IB system. The following general rules will help you decide which key to select:

- Select [ SYSTEM CONTROLLR ] if you want to initiate plotting or printing from the analyzer's front panel.
- Select [ SYSTEM CONTROLLR ] if you want to control other HP-IB devices with an HP Instrument BASIC program.
- Select [ ADDRESSBL ONLY ] if you want to operate the analyzer from an external HP-IB controller.

## [CONVERT TABLE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ]

Access the softkeys for converting the synthesis table. Synthesis tables can be in one of three forms:

- Pole-zero.
- Pole-residue (partial fraction).
- Polynomial.

---

**Caution**

Table conversions are not exact because of finite precision in the math operations. It may not always be possible to convert from one format to another and back without slight variations.

---

**Note**

If you want to copy a table from synthesis to curve fit, you must first convert it to pole-zero form.

---

*See also:* [ CONVRT TO POLYNMIAL ] softkey, [ CONVRT TO POLE RESD ] softkey,
[ CONVRT TO POLE ZERO ] softkey

## [CONVRT TO POLE RESD] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ] → [ CONVERT TABLE ]

Convert the synthesis table to pole residue form. This is also known as partial fraction form. The table lists poles in the left column and residues in the right column. Complex poles and residues always appear as conjugate pairs.

At the bottom of the table are listed the time delay, frequency scale, and gain.

Residues are the numerator constants in partial fraction form. A residue is always associated with the pole in the same row.

When you convert a blank table in another form to pole residue form, a Laurent term appears. This term represents unity gain. It may not be needed in your desired pole residue representation. If you do not need the Laurent terms, press [ CLEAR TABLE ] before you add poles and residues. (You cannot directly edit, add, or delete Laurent terms.)

If you need to specifically add Laurent terms, you must do so before adding any poles and residues. To enter Laurent terms, follow these steps:

1. Press [ CONVERT TABLE ] → [ CONVRT TO POLYNMIAL ].
2. Press [ EDIT TABLE ] → [ CLEAR TABLE ] → [ CONFIRM CLEAR ].
3. Add the desired Laurent terms as numerator terms.
4. Press [ CONVERT TABLE ] → [ CONVRT TO POLE RESD ].

The desired Laurent terms should appear in the table, and you can complete the table by now adding your poles and residues. Remember, there must be a residue for each pole, and the Laurent terms will appear below the residues in the completed table.

For more information on Laurent terms, see the analyzer's *Concepts Guide*.

*See also:* [ GAIN FACTOR ] softkey, [ FREQUENCY SCALE ] softkey, [ TIME DELAY ] softkey

## [CONVRT TO POLE ZERO] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ] → [ CONVERT TABLE ]

Convert the synthesis table to pole-zero form.

The table lists poles and the left column and zeros in the right column. Complex poles and zeros always appear as conjugate pairs in the table.

At the bottom of the table are listed the time delay, frequency scale, and gain.

Pole-zero is the most numerically accurate of the three synthesis formats.

*See also:* [ GAIN FACTOR ] softkey, [ FREQUENCY SCALE ] softkey, [ TIME DELAY ] softkey

## [CONVRT TO POLYNMIAL] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ] → [ CONVERT TABLE ]

Convert the synthesis table to polynomial form.

Polynomial form is the expanded (or "multiplied out") pole-zero form. In this form, the left column lists the numerator coefficients. The right column lists the denominator coefficients. The column headings list the order of each polynomial.

At the bottom of the table are listed the time delay, frequency scale, and gain.

---

**Note**

All synthesis calculations are done in terms of Hz. If you want calculations to be done in radians, use [ FREQUENCY SCALE ] to convert Hz to radians.

---

For example, consider the following polynomial table:

| NUMERATOR 1 | SYNTH | DENOMINATOR 2 | |
|---|---|---|---|
| -375 | s^0 | 1.578 | s^0 |
| 1 | s^1 | -250 | s^1 |
| | | 1 | s^2 |
| TIME DELAY = 0 s<br>FREQUENCY SCALE = 1 | | GAIN = 1 | |

This table represents the following expression:

$$\frac{s - 375}{s\hat{}2 - 250s + 1.578}$$

In this expression, 375 and 250 each has implicit units of Hz, and 1.578 has implicit units of Hz ^ 2. This is because s is taken to be in Hz, and each term of the denominator (or numerator) must have the same units. The units for each term result from multiplying the s-factor by its coefficient. Thus, in this example, each term in the denominator has units of Hz ^ 2, and each term in the numerator has units of Hz.

*See also:* [ FREQUENCY SCALE ] softkey, [ GAIN FACTOR ] softkey, [ FREQUENCY SCALE ] softkey, [ TIME DELAY ] softkey

## [COPY ALL FILES] softkeys

Key Path: [ **Disk Utility** ]

Copy all files from one disk to another disk using the following softkeys:

- [ SOURCE DISK ] asks you for the disk specifier of the disk you want to copy.
- [ DESTIN DISK ] asks you for the disk specifier of the disk that will receive the new copy.
- [ PERFORM COPY ALL ] copies the contents of the source disk to the destination disk.

When a disk entry window is displayed, it already contains the specifier for the default disk. You can use the specifier in the entry window or modify it with the alpha entry keys.

The source disk must be different from the destination disk.

*Hint:* Although the analyzer does not provide a "Pack Disk" utility, you can accomplish this using the following steps:

1. Delete all files from a NEW disk.

2. Copy all the files from the OLD disk to the NEW disk.

Now the NEW disk is a packed version of the OLD disk.

*See also:* [ DEFAULT DISK ] softkey, Alpha entry mode

## [COPY FILE] softkeys

Key Path: [ **Disk Utility** ]

Create a new copy of a file using these softkeys:

- [ SOURCE FILENAME ] asks you for the name of the file you want to copy.
- [ DESTIN FILENAME ] asks you for the name you want to give the new copy.
- [ PERFORM FILE COPY ] creates a new copy of a file using your entries in the two filename entry windows.

Source and destination files are assumed to be on the default disk unless you precede filenames with disk specifiers. Use disk specifiers when you want to copy files from one disk to another.

*Hint:* To copy all files from one disk to another, use the [ COPY ALL FILES ] softkey.

When a filename entry window is displayed, it already contains a name. If the catalog is off, the entry window contains the filename last entered. If the catalog is on, the entry window contains the name of the file currently highlighted. You can use the name in the entry window or modify it with the alpha entry keys.

*See also:* Alpha entry mode, [ CATALOG ON OFF ] softkey, [ COPY ALL FILES ] softkeys, Disk specifiers, [ DEFAULT DISK ] softkey

## [COPY FROM CURVE FIT] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ]

Copy the curve fit table into the synthesis table.

**Caution** When you copy a curve fit table, the analyzer overwrites the current synthesis table without asking you to confirm the action. You cannot recover the previous synthesis table after you copy from curve fit.

**Caution** The analyzer does not copy engineering units into the synthesis table. Use [ GAIN FACTOR ] to simulate engineering units with synthesis.

**Note** When you curve fit to a trace with engineering units, the analyzer incorporates the engineering units into the gain of the curve fit model. Subsequent synthesis will give the same magnitude response. The analyzer does not copy engineering unit labels from the curve fit table.

*See also:* [ GAIN FACTOR ] softkey, Engineering units

## [COPY FROM SYNTHESIS] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]

Copy the synthesis table into the curve fit table. The synthesis table must be in pole zero format.

**Caution** When you copy a synthesis table, the analyzer overwrites the current curve fit table without asking you to confirm the action. You cannot recover the previous curve fit table after you copy from synthesis.

*See also:* [ CONVRT TO POLE ZERO ] softkey

## Correlation averaging

The average softkeys for correlation measurements allow you to do the following things:

- Choose from several types of averaging.
- Specify the number of averages.
- Select fast average mode —this lets the analyzer make averaged measurements without having to update the screen after every average.
- Specify how often you want the display updated.
- Turn average repeat on or off.
- Specify the percentage of overlap for an averaged measurement.
- Turn on overload reject to prevent overloads from corrupting an average in progress.

---

**Note** The analyzer does not autorange while averaging—so don't change the output of your test device during the averaging procedure. If an over-range condition occurs during averaging, an overload message appears but the analyzer does not abort the averaging procedure.

---

*See also:* [ OVERLAP PERCENT ] softkey, [ REPEAT ON OFF ] softkey (average), [ NUMBER AVERAGES ] softkey, [ UPDATE RATE ] softkey, [ AVERAGE TYPE ] softkey (FFT analysis), [ OVLD REJ ON OFF ] softkey, [ CHx AUTO RANGE ] softkey, [ FAST AVG ON OFF ] softkey

## Correlation frequency keys

For correlation analysis, the following softkeys are under the [ Freq ] hardkey:

- Record length.
- Resolution (lines).

*See also:* [ RECORD LENGTH ] softkey, [ RESOLUTN (LINES) ] softkey

## [CORRELATN ANALYSIS] softkey

Key Path: [ **Inst Mode** ]

Specify the correlation analysis instrument mode.

Correlation is a measure of the similarity between two signals. This is useful for extracting synchronous signals hidden by noise.

The following measurement data is available for swept sine measurements:

- Time record channel 1 or 2
- Auto correlation channel 1 or 2
- Cross correlation (2 ch only)
- Windowed time channel 1 or 2

For more information on correlation measurements, refer to the analyzer's *Concepts Guide*.

*See also:* [ WINDOWED TIME CHANNEL x ] softkey (correlation), [ CROSS CORRELATN ] softkey, [ AUTO CORR CHANNEL x ] softkey, [ TIME CHANNEL x ] softkey

## [COUPLED ON OFF] softkey

Key Path: [ **Marker** ]

Turn on and off marker coupling. Marker coupling means that the markers for both traces move together.

When you turn coupling on, the marker for the inactive trace moves to the same point as for the active trace.

---

**Note** Coupled markers move to the same X-axis bin, not necessarily the same X-axis value. Coupled markers will not move past the last active trace bin.

---

Marker coupling is quite useful. For example, if you display frequency response magnitude on the upper trace, and phase on the lower, you can use marker coupling to track both magnitude and phase at each X-axis position.

*See also:* Bins defined

## [COUPLING AC DC] softkey

Key Path: [ **Input** ] → [ CHANNEL x SETUP ]

Select ac or dc coupling for the input channel.

---

**Note**

With ac coupling, the input signal rolls off 3 dB at 1 Hz. So for very small spans at low frequencies, you should use dc coupling to avoid measurement error.

---

## [CP DC BINS ON OFF] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Window** ]

Specify whether the analyzer should use the dc bins in calculating composite power.

If dc bins is on, the analyzer uses the dc bins in the calculation. If dc bins is off, the analyzer excludes the dc bins from the calculation. The number of dc bins excluded depends on the window used.

*See also:* Bins defined, [ COMP PWR CHANNEL x ] softkey

## [CROSS CORRELATN] softkey

Key Path: [ **Meas Data** ]

Display the cross correlation.

Cross correlation displays the similarity between two signals as a function of the time shift between them. Cross correlation is calculated by multiplying one signal by a time-shifted version of the other signal and summing over all points. The result is plotted as a function of the time shift value.

Cross correlation is most useful for determining time delays of a common signal between two different paths.

For example, to determine the speed of sound you could place one microphone at a sound source and another microphone a known distance away. The cross correlation would show a peak at the time delay between the two microphones. It would also show peaks for each path.

The width of each peak is inversely proportional to the bandwidth of the signal. For example, random noise produces a very narrow peak.

The cross correlation computation depends on the type of averaging selected.

| | | |
|---|---|---|
| Average off | : | IFFT (FFT (time2) * conj (FFT (wtime1))) |
| rms | : | IFFT (sum (FFT (time2) * conj (FFT (wtime1)))) / N |
| rms exponential | : | IFFT (xavg (FFT (time2) * conj (FFT (wtime1)))) |
| Vector | : | IFFT (sum(FFT( time2)) * conj (sum(FFT (wtime1)))) / N |
| Vector exponential | : | IFFT (xavg(FFT(time2)) * conj (xavg(FFT (wtime1)))) |

| | | |
|---|---|---|
| where: timex | = | time for channel 1 or 2 |
| wtimex | = | time with weighting function applied |
| N | = | number of averages |
| xavg | = | (1/N) * new + ((N–1)/N) * old |

*See also:* [ **Window** ] hardkey, [ NUMBER AVERAGES ] softkey, [ TIME CHANNEL x ] softkey, [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey

## [CROSS SPECTRUM] softkey

Key Path: [ **Meas Data** ]

Display the most recent cross spectrum on the active trace. The cross spectrum compOutation depends on the type of averaging.

| | | |
|---|---|---|
| Averaging off, vector, or vector exponential | : | linspec2 * conj (linspec1) |
| rms | : | crtn2 * conj (crtn1) * sum (linspec2 * conj (linspec1)) / N |
| rms exponential | : | crtn2 * conj (crtn1) * xavg (linspec2 * conj (linspec1)) |
| Peak hold | : | cross spectrum not computed |

| | | |
|---|---|---|
| where: N | = | number of averages |
| crtn1 | = | correction for channel 1 |
| crtn2 | = | correction for channel 2 |
| linspec1 | = | linear spectrum channel 1 |
| linspec2 | = | linear spectrum channel 2 |
| xavg | = | g(1/N) * new + ((N-1)/N)* old |

*See also:* [ NUMBER AVERAGES ] softkey, [ CAL CONST ON OFF ] softkey, [ PEAK HOLD ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey, [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ AVERAGE ON OFF ] softkey

## [CURVE FIT REGISTER] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]

Specify in which data register the analyzer should store the curve fit FRF results.

The default curve fit register is D6.

**Caution** The data registers are cleared each time you turn the analyzer off. Save the curve fit register to a file before power-down or it will be lost.

## [CURVE FIT SETUP] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]

Brings up the fit setup menu.

These parameters control the behavior of curve fit. The default settings are those for full automation. The options are:

- Order max or fixed.
- Number of poles.
- Number of zeros.
- Weight auto or user.
- Weight register.
- Time delay.
- Frequency scale.

## [CURVE FIT] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ]

Access the curve fit utilities. The curve fit feature finds a mathematical model which closely approximates measured or synthesized frequency response data. The model is expressed as a pole zero table. Pole zero values are expressed in Hz.

The curve fit feature also automatically synthesizes the curve fit model into the selected curve fit data register. The analyzer displays this register in trace B as results become available. (If the display format is waterfall, the results are not displayed.)

For detailed information on synthesis, refer to the analyzer's *Concepts Guide*.

The following softkeys are available:

- [START FIT] starts the curve fit process.
- [ABORT FIT] stops the curve fit process.
- [CURVE FIT REGISTER] determines which data register receives the results.
- [EDIT TABLE] allows you to edit the entries in the curve fit table.
- [COPY FROM SYNTHESIS] copies the synthesis table into the curve fit table.
- [FIT REGION] specifies a portion of the trace to be used for the curve fit.
- [CURVE FIT SETUP] allows you to set up curve fit parameters.
- [TABLE ON OFF] turns on or off display of the curve fit table.

## [CWEIGHT() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Apply C-weight filtering to the operand. The argument must be frequency or octave domain data.

## [DASHED] softkey

See Line type softkeys.

## [DATA EDIT] softkey

Key Path: [ **Analys** ]

Access the data register editing capabilities. Data editing allows you to change the trace stored in a data register.

You define a line segment by specifying the [ START X ] and [ STOP X ] positions, then specifying the [ START Y ] and [ STOP Y ] values. The analyzer connects the two points with a straight line.

**Note** You must modify start Y or stop Y. If you do not change either Y-value, the analyzer does not change the data between the two points.

You can then move start X and stop X to define a new band.

*See also:* [ MODIFY STOP Y ] softkey, [ MODIFY START Y ] softkey, [ STOP X ] softkey, [ START X ] softkey, Data registers

## [DATA REG Dx] softkey

Key Path: [ **Source** ] → [ ARB SRC SETUP ]

Specify which data register should drive the source output for a source type of Arbitrary (D1-D8).

*See also:* [ ARBITRARY (D1-D8) ] softkey

## [DATA REGISTER] softkey (Meas Data)

Key Path: [ **Meas Data** ]
or: [ **Meas Data** ] → [ MORE ]

Access the [ Dx ] softkeys. Each [ Dx ] key displays the contents of one of the analyzer's eight data registers.

You can use [ RECALL TRACE ] to load any data register.

*See also:* Data registers, [ RECALL TRACE ] softkeys

### Data registers

The analyzer has eight data registers, D1 through D8. Each register holds a complete trace that you have saved from the current measurement or recalled from a disk. You can display the trace in a register directly or use it as an operand in a math function.

---

**Caution** The data registers are cleared each time you turn the analyzer off. Copy important traces to any disk (except the volatile RAM disk) before power-down or they will be lost.

---

*See also:* [ COPY FILE ] softkeys, [ DEFINE FUNCTION ] softkey, Operand menu

## [DATE MMDDYY] softkey

Key Path: [ **System Utility** ] → [ CLOCK SETUP ]

Display the current date at the top of the screen. The date is read from the analyzer's battery-backed clock.

After pressing this softkey, you can enter a new date with the number keys. The date must be entered in the format noted on the softkey label: the first two digits set the month, the second two digits set the day, the last two set the year. Here's an example:

August 3, 1990—Press [ DATE MMDDYY ] → [ **0** ] → [ **8** ] → [ **0** ] → [ **3** ] → [ **9** ] → [ **0** ] → [ ENTER ]

## [dB Magnitude] softkey

Key Path: [ **Trace Coord** ]

Define the Y-axis as magnitude displayed in decibels on a linear scale.

For linear units (volts), the Y-axis value is calculated as 20 times the log of (real part squared plus imaginary part squared).

For power units (volts squared), the Y-axis value is calculated as 10 times the log of (real part squared plus imaginary part squared).

You can specify a reference by pressing [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ].

*See also:* [ dB REF SETUP ] softkey

## [dB Ref Setup] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Specify the reference for the [ dB MAGNITUDE ] trace coordinate. The dB reference setting applies only for the current measurement data and the active trace.

The options are:

- dBV (dBEU).
- dBm.
- dBSPL.
- User specified.

The analyzer scales the dB magnitude trace based on the option you select. You can change the dB reference setup without modifying or losing measurement data.

The dB reference scaling is in addition to any engineering units that might already be applied to the measurement data.

*See also:* Engineering units, [ dBSPL (20 UPA) ] softkey, [ dBM ] softkey, [ dBV (DBEU) ] softkey, [ USER REFERENCE ] softkey, [ DB MAGNITUDE ] softkey

## [dBm Ref Impedance] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Specify the input impedance for [ dBM ]. The dBm unit is referenced to 1 milliwatt.

Specify a value that matches the impedance of the system under test. For example, the impedance of a telephone system is typically 600 ohms.

*See also:* [ dBM ] softkey

## [dBm] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Specify that dB magnitude is referenced to a power level of 1 mWatt (1 V ^ 2/kohm). This means that 0 dBm is equal to 1 mW, regardless of the impedance of the system.

This unit is valid only for data with units in volts or volts ^ 2. If engineering units are on, the engineering unit label should be "V."

Press [ dBm REF IMPEDANCE ] to specify the input impedance.

*See also:* [ ENG UNIT ON OFF ] softkey, [ ENG UNIT LABEL ] softkey, [ dBM REF IMPEDANCE ] softkey, [ DB MAGNITUDE ] softkey

## [dBSPL (20 uPa)] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Specify that dB magnitude is referenced to 20 uPa. This unit is valid only for data with engineering units of Pascals.

*See also:* Engineering units, [ DB MAGNITUDE ] softkey

## [dBV (dBEU)] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Specify that dB magnitude is referenced to 1V. If engineering units are on, dB is referenced to 1 EU. The analyzer performs no additional scaling before displaying the data.

*See also:* [ DB MAGNITUDE ] softkey, [ ENG UNIT ON OFF ] softkey

## [DEBUG] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ BASIC ] → [ INSTRUMNT BASIC ]

Locate errors in your HP Instrument BASIC program.

The Debug menu keeps [ RUN ] and [ CONTINUE ] from the main HP Instrument BASIC menu and adds the following softkeys:

- [ SINGLE STEP ] lets you execute your program one line at a time.
- [ LAST ERROR ] lets you examine the last error number and message generated by your program.
- [ EXAMINE VARIABLE ] lets you examine the current value of any program variable.
- [ RESET ] lets you reset HP Instrument BASIC to its default state.

## Decimal point [.] hardkey

This hardkey has two functions:

- When you are changing a numeric parameter, press this hardkey to enter a decimal point.
- When you are changing a text string, press this hardkey to insert a period (or decimal point) to the left of the cursor.

## [DEFAULT DISK] softkey

Key Path: [ **Disk Utility** ]
or: [ **Save/Recall** ] → [ DEFAULT DISK ]

Select a default disk. Whenever you request operations that require disk access —things like saving and renaming files—the analyzer performs these operations on the default disk.

You can override the default disk selection by including a disk specifier in any filename or device entry window. But if you select the disk you use most often as the default, you won't need to enter specifiers.

You can select one of the following as the default disk:

- Non-volatile RAM disk.
- Volatile RAM disk
- Internal disk.
- External HP-IB disk drive (analyzer must be set up as the system controller).

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important files to another disk before power-down or they will be lost.

*See also:* Controller Capability softkey group, [ EXTERNAL DISK ] softkey, [ INTERNAL DISK ] softkey, [ VOLATILE RAM DISK ] softkey, [ NON-VOL RAM DISK ] softkey, Disk specifiers

## [DEFAULT PENS] softkey

Key Path: [ **Plot/Print** ] → [ PLOT PEN SETUP ]

Return plotter pen assignments to the following preset values:

- [ TRACE A PEN ] = 2.
- [ TRACE B PEN ] = 3.
- [ MARKER A PEN ] = 5.
- [ MARKER B PEN ] = 6.
- [ ALPHA PEN ] = 4.
- [ GRID PEN ] = 1.

## [DEFINE CONSTANT] softkey

Key Path: [ **Analys** ]

The analyzer has five constant registers, K1 through K5. Each register holds a math constant that you define. The constant is displayed and defined in rectangular coordinates, A + jB.

To change the value of a particular constant or to display its current value, press the corresponding [ DEFINE Kx ] softkey.

Use the numeric entry keys to change the value of the specified constant. If the constant is complex, first enter the real part, then press [ + j ] and enter the imaginary part. If the imaginary part is negative, press [ +/– ] to change +j to –j.

You can accept the new value by pressing the [ ENTER ] softkey. Until you press [ ENTER ], you can reject the new value (and retain the old one) by pressing any hardkey or the [ CANCEL/RETURN ] softkey.

## [DEFINE FUNCTION] softkey

Key Path: [ **Analys** ]

Define math functions.

The analyzer has five function registers, F1 through F5. Each register holds a math function that you define. To change the definition of a function or to display its current definition, press the corresponding [ DEFINE Fx ] softkey.

---

**Note** To display the trace resulting from a function, select the corresponding [ Fx ] softkey under the [ **Meas Data** ] hardkey.

---

A math function is used to perform simple arithmetic or more complex math functions on some combination of the following: measurement data, stored trace data, constants, and other functions.

For information on units and math, refer to the analyzer's *Concepts Guide.*

You define a function using two alternating menus: an operand menu and an operator menu. The menus appear in an order that defines the function in standard algebraic notation.

When you change a function's definition, the old definition is in effect until you complete the new one by pressing the operator menu's [ ENTER ] softkey. Until you press [ ENTER ], you can abandon the new definition (and retain the old one) by pressing any hardkey or a [ CANCEL/RETURN ] softkey.

The [ **Back Space** ] hardkey deletes the last operand or operator in the new definition. Use it to correct mistakes in your entry.

All math operations are performed on linear data—even if the trace coord is logarithmic (log) magnitude. For log traces, math operations are performed *before* the measurement data is converted from linear to log values.

The following table lists the number of points used in math calculations and the number of points displayed. This applies only for the FFT analysis mode. The analyzer does no zero padding in math.

| Resolution | Baseband | | Zoom | |
|---|---|---|---|---|
| | Calculated | Displayed | Calculated | Displayed |
| 100 lines | 129 | 101 | 128 | 100 |
| 200 lines | 257 | 201 | 256 | 200 |
| 400 lines | 513 | 401 | 512 | 400 |
| 800 lines | 1025 | 801 | 1024 | 800 |

For baseband data, the analyzer displays the first part of the data. For example, with resolution of 200 lines, baseband, the analyzer displays the first 201 points and does not display the last 56 points.

For zoom data, the analyzer displays the middle part of the data. For example, with resolution of 200 lines, zoom, the analyzer does not display the first 28 points, displays the next 200 points, and does not display the last 28 points.

For more information, refer to the analyzer's *Concepts Guide.*

*See also:* [ FFT ANALYSIS ] softkey, Operation menu, Operator menu, Operator menu, Operand menu, [ **Meas Data** ] hardkey

## [DEFINE LOWER LIM] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ]

Define or alter the lower limit for the active trace.

You define the lower limit as a series of line segments using the following softkeys:

- [ MOVE MKR HORIZNTAL ]: Define the X-axis value of a segment endpoint.
- [ MOVE MKR VERTICAL ]: Define the Y-axis value of a segment endpoint.
- [ START SEGMENT ]: Press this softkey after you have defined the starting point of a segment.
- [ FINISH SEGMENT ]: Press this softkey after you have defined the ending point of a segment.
- [ MOVE ALL VERTICAL ]: Alter the amplitude value of all endpoints at once.
- [ DELETE SEGMENT ]: Delete the segment that is vertically aligned with the limit marker.
- [ DELETE ALL ]: Delete all segments at once.
- [ TRACE TO LIMIT ]: Convert the active trace into a limit line.

After you define a lower limit, it is maintained in a file. The amplitude and frequency values of the limit are maintained without units.

Limit files are cleared when you turn off the analyzer. If you do not want to lose the limits lines you have defined, use [ SAVE UPPER LIM ] and [ SAVE LOWER LIM ] to save the limits.

## [DEFINE UPPER LIM] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ]

Define or alter the upper limit for the active trace.

You define the upper limit as a series of line segments. Here's how you use the softkeys in this menu to define the segments:

- [ MOVE MKR HORIZNTAL ]: Define the X-axis value of a segment endpoint.
- [ MOVE MKR VERTICAL ]: Define the Y-axis value of a segment endpoint.
- [ START SEGMENT ]: Press this softkey after you have defined the starting point of a segment.
- [ FINISH SEGMENT ]: Press this softkey after you have defined the ending point of a segment.
- [ MOVE ALL VERTICAL ]: Alter the amplitude value of all endpoints at once.
- [ DELETE SEGMENT ]: Delete the segment that is vertically aligned with the limit marker.
- [ DELETE ALL ]: Delete all segments at once.
- [ TRACE TO LIMIT ]: Convert the active trace into a limit line.

After you define an upper limit, it is maintained in a file. The amplitude and frequency values of the limit are maintained without units.

Limit files are cleared when you turn off the analyzer. If you do not want to lose the limits lines you have defined, use [ SAVE UPPER LIM ] and [ SAVE LOWER LIM ] to save the limits.

## [DEFINE (? cm/s)] softkey

See [PLOT PEN SPEED] softkeys.

## [DEFINE Fx] softkey

See [DEFINE FUNCTION] softkey.

## [DELAY TIME] softkey (time markers)

Key Path: [ **Marker Fctn** ] → [ TIME PARAMTERS ]

Compute and display delay time—the time required for a step response to reach 50% of its steady-state level.

The analyzer uses only the data between the start time and stop time markers in the computation. The delay time is measured from the start time marker.

The analyzer also puts a horizontal line across the display at the steady-state level and displays the steady-state value in the mini-state.

*See also:* [ START TIME ] softkey, [ STOP TIME ] softkey

## [DELAY TIME] softkey (triggering)

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Trigger** ]

Specify the delay time for triggering.

Limits: 0 to 99,999 s Default: 0

The analyzer waits the specified amount of time after receiving a trigger before starting the measurement.

This is useful for starting an acoustics measurement at a later time. For example, if you go home at 5:00 and want to start a measurement at 10:00, you can set a delay time of 18,000 s and trigger the measurement before you go home. The analyzer waits 18,000 seconds (5 hours), then begins collecting data.

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

## [DELETE ALL FILES] softkey

Key Path: [ **Disk Utility** ]

Remove all files from one of the disks. The files are deleted from the default disk unless you change the disk specifier in the entry window.

*Hint:* To remove just one file from the disk, use the [ DELETE FILE ] softkey.

When you press [ DELETE ALL FILES ], you are asked to enter the disk specifier of the disk you want to clear. The specifier of the default disk is automatically placed in the entry window, but you can modify it with the alpha entry keys.

**Note** When you press the [ ENTER ] softkey to complete entry of a disk specifier, the disk is cleared without further asking. Be sure the name is correct before you press [ ENTER ].

**Note** You cannot remove a file if it is a LIF protected file or if the file is currently opened by an HP Instrument BASIC program. These files are indicated by a " * " or " > ", respectively, in the disk catalog.

*See also:* Alpha entry mode, [ DELETE FILE ] softkey, Disk specifiers, [ DEFAULT DISK ] softkey

## [DELETE ALL] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Delete an entire limit line.

This deletes the active trace's upper limit if you pressed [ DEFINE UPPER LIM ] to enter the menu. It deletes the active trace's lower limit if you pressed [ DEFINE LOWER LIM ] to enter the menu.

The analyzer asks you for confirmation before it deletes the limit.

*See also:* [ DEFINE LOWER LIM ] softkey, [ DEFINE UPPER LIM ] softkey

## [DELETE CHARACTER] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Delete the character under the text cursor when you are editing a program.

## [DELETE FILE] softkey

Key Path: [ **Disk Utility** ]

Remove a file from one of the disks. The file is deleted from the default disk unless you include a disk specifier in the filename entry window.

*Hint:* To remove all files from a disk at once, use the [ DELETE ALL FILES ] softkey.

It's often easier to delete files when the catalog is on. You can select the file you want to delete by turning the knob. Then when you press [ DELETE FILE ], the name of the selected file is automatically placed in the entry window.

When the catalog is off, the last-entered filename is placed in the entry window. You can modify the name in the entry window with the alpha entry keys.

---

**Note**

You cannot remove a file if it is a LIF protected file or if the file is currently opened by an HP Instrument BASIC program. These files are indicated by a " * " or " > ", respectively, in the disk catalog.

---

You can use "wild cards" in the entry box to delete more than one file. Here are some examples of how to use wild cards:

| | |
|---|---|
| A* | Delete all files starting with "A" and having no extension. |
| * .* | Delete all files. |
| * .DAT | Delete all files with the extension DAT. |

---

**Note**

When you press the [ ENTER ] softkey to complete entry of a filename, the file is deleted without further asking. Be sure the name is correct before you press [ ENTER ].

---

*See also:* Alpha entry mode, [ CATALOG ON OFF ] softkey, [ DELETE ALL FILES ] softkey, Disk specifiers, [ DEFAULT DISK ] softkey

## [DELETE LINE] softkey (Instrument BASIC)

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Delete the line containing the text cursor when you are editing a program.

The deleted line is placed in a one-line buffer. You can recall the deleted line into another part of your program with the [ RECALL LINE ] softkey.

*See also:* [ RECALL LINE ] softkey

## [DELETE SEGMENT] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Delete the upper or lower limit segment that is vertically aligned with the limit marker.

*See also:* [ DEFINE LOWER LIM ] softkey, [ DEFINE UPPER LIM ] softkey

## [DELETE TO LINE END] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Delete the character under the text cursor and all characters to the right of the cursor when you are editing a program.

## [DELETE VALUE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ EDIT TABLE ]
or: [ **Analys** ] → [ SYNTHESIS ] → [ EDIT TABLE ]

Delete the highlighted entry from the table.

The entry is placed onto a delete line stack. You can undelete the entry using the [ UNDELETE VALUE ] softkey. The analyzer clears the stack when you press the [ EDIT TABLE ] softkey or any hardkey.

The analyzer has separate stacks for poles, zeros, residues, numerators, and denominators. For example, you cannot delete an entry from the pole column and undelete it in the zeros column.

*See also:* [ UNDELETE LINE ] softkey

## [DELTA ORDER] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Freq ]

Specify the resolution for order domain data.

Limits: 0.0078125 to 1.0 Default value is 0.1
Steps: 0.0001

[ MAX ORDER ] divided by [ DELTA ORDER ] must be less than or equal to 400. For example, if [ MAX ORDER ] is 10, [ DELTA ORDER ] must be greater than or equal to .025 orders.

*See also:* [ MAX ORDER ] softkey

## [DESTIN DISK] softkey

See [COPY ALL FILES] softkeys.

## [DESTIN FILENAME]] softkey

See [COPY FILE]] softkeys.

## [DEVICE IS PLOT PRNT] softkey

Key Path: [ Plot/Print ]

Specify whether the output device is a plotter or printer. This determines the format the analyzer uses for the output.

If the output device is a plotter, you can plot the whole display or selected portions of the display. If the output device is a printer, you can only print the whole display.

Print information is sent as a bit-mapped graphic, so your printer must have raster-dump capabilities. Screen pixels are mapped one-to-one to printer pixels.

*See also:* [ PLOT DATA SELECT ] softkey

## [DFLT TITL ON OFF] softkey

Key Path: [ **Disp Format** ] → [ MORE ]

Toggle the title for the active trace between the default title and a label you create. ON means that the default title is displayed. OFF means that your defined title is displayed. The default title is the name of the measurement data displayed in the trace.

Press [ TRACE TITLE ] and use the alpha entry keys to enter a trace title or change the current trace title.

The title is displayed above the upper left corner of the trace box.

*See also:* [ **Meas Data** ] hardkey, Alpha entry mode, [ TRACE TITLE ] softkey

## [DIFF(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Perform a first-order approximation to a derivative.

If F1 = DIFF(D1), the value of F1 is defined as follows:

$$F1[i] = (D1[i] - D1[i-1]) / dx[i]$$

where F1[i] and D1[i] are the values of the ith data point of F1 and D1, respectively, and dx[i] is the width of the ith data point of D1.

## [DISK ADDRESS] softkey

Key Path: [ **Local/HP-IB** ]

Tell the analyzer what address is currently assigned to your external HP-IB disk drive. (See your disk drive's documentation if you don't know how to determine its HP-IB address.) An entry window is displayed so you can enter the address.

**Note**

The disk address is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

## Disk specifiers

The analyzer can use four different storage devices (all referred to as disks). When you press a softkey that accesses a disk function, you are asked to specify which disk the function should act on. Use the following disk specifiers:

- "INT:" specifies the internal disk.
- "RAM:" specifies the volatile RAM disk.
- "EXT:" specifies the external disk.
- "NVRAM:" specifies the non-volatile RAM disk.

The disk specifier must end with a colon (:).

When you press a softkey that asks you for a filename, you can prefix the filename with a disk specifier. This allows you to access a file on a disk other than the default disk. For example, enter "INT:MYCONFIG" to access a file named "MYCONFIG" that resides on the internal disk.

*See also:* [ VOLATILE RAM DISK ] softkey, [ NON-VOL RAM DISK ] softkey, [ EXTERNAL DISK ] softkey, [ INTERNAL DISK ] softkey

## [DISK TYPE LIF DOS] softkey

Key Path: [ **Disk Utility** ] → [ FORMAT DISK ]

Specify whether the disk should be formatted in LIF or MS-DOS format. (MS-DOS is a U.S. registered trademark of Microsoft Corporation.)

Operations on a DOS disk are slower than the same operations on a LIF disk. For best performance, set the [INTRLEAVE FACTOR] to 0.

---

**Note** The default format for volatile RAM when you turn on the analyzer is the non-volatile RAM format. For example, if the non-volatile RAM is LIF format, the analyzer will format RAM in LIF format.

---

The internal disk uses 3.5-inch flexible disks (double-sided, double-density or high-density); it does not read single-sided disks. The analyzer automatically distinguishes between the two types of disks.

The following table lists the formatted capacity of different LIF and MS-DOS disks.

| Format | Double density disk | High density disk |
|---|---|---|
| LIF | 630 kbytes | 1.3 Mbytes |
| MS-DOS | 737 kbytes | 1.5 Mbytes |

After the disk is formatted, you do not need to specify "LIF" or "DOS" in other file operations. The analyzer automatically determines the disk format.

## [DISK UNIT] softkey

Key Path: [ Local/HP-IB ]

Tell the analyzer what unit number is currently assigned to your external HP-IB disk drive. An entry window is displayed so you can enter the address.

**Note** The disk unit number is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

## [Disk Utility] hardkey

The softkeys under [ Disk Utility ] perform various file and mass storage device operations:

- Renaming files.
- Deleting files.
- Copying files.
- Formatting disks.
- Specifying the default disk.

**Note** To save and recall files, use the softkeys under [ Save/Recall ].

The analyzer displays an entry window and enters alpha entry mode when it's time to identify the file or disk you want to modify. Use the default filename displayed in the entry box or modify the name with the alpha entry keys. When the filename is correct, press [ ENTER ] to start the operation.

You can do two things to simplify disk and file management operations:

- Designate the disk you use most often as the default disk.
- Display the disk catalog.

To identify a file on the default disk, you only need to enter a filename. To identify a file on any other disk, you must enter a disk specifier and a filename.

When the catalog is displayed, you don't need to type the name of a file you want to modify. Instead, you can select the file with the knob **before** you bring up the filename entry window. The name of the file you select is automatically placed in the entry window.

*See also:* Disk specifiers, [ CATALOG ON OFF ] softkey, [ DEFAULT DISK ] softkey, Alpha entry mode, [ Save/Recall ] hardkey, [ DEFAULT DISK ] softkey, [ FORMAT DISK ] softkey, [ COPY FILE ] softkeys, [ DELETE FILE ] softkey, [ RENAME FILE ] softkeys

## [Disp Format] hardkey

Configure the analyzer's display. The analyzer provides the following display formats:

- Single.
- Upper/Lower.
- Front/Back.
- Waterfall.
- Measurement State.
- Input State.
- Bode Diagram.

Not all display formats are appropriate for all instrument modes. Those formats that are inappropriate for a particular mode are unavailable when that instrument mode is active.

You can reduce the amount of information on the screen using the following softkeys under [ Disp Format ] → [ MORE ].

- Grid On Off
- Blank Annotatn
- Blank Display
- Trace Title
- Dflt Titl On Off

## Display Group

The Display keys let you control what appears on the analyzer's two traces. Since only one trace is "active" at any given time, only one trace is the target of any adjustments you make using the display keys. Here's a brief summary of the Display keys and their significant functions:

- [ Meas Data ] determines the measurement data displayed on the active display.
- [ Trace Coord ] determines the Y-axis coordinates.
- [ Scale ] adjusts the position and size of the displayed data.
- [ Active Trace ] determines which trace is the target of changes made in the other display keys.
- [ Analys ] provides math functions and constants, limit lines, curve fit, synthesis, and data edit.
- [ Disp Format ] selects the number of traces displayed and adjusts their appearance.

**Note**

Parameters in the Display group do not affect the measurement. You can change any parameters in this group without changing or losing measurement data.

## [DISPLAY SETUP] softkey group

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ DISPLAY SETUP ]

Specify which part of the analyzer's screen should be used for HP Instrument BASIC programs. Program statements such as PRINT, MOVE, and DRAW require that some portion of the display be allocated for their use.

- [ OFF ] allocates no display area to your program.
- [ FULL ] allocates that portion of the display used by a full-height trace box. The full display is 29 text rows high and 58 columns wide. The lower left corner (for MOVE and DRAW) is (0,0). The upper right corner is (475,355).
- [ UPPER ] allocates that portion of the display used by the upper half-height trace box. The upper display is 14 text rows high and 58 columns wide. The lower left corner is (0,0). The upper right corner is (475,173).
- [ LOWER ] allocates that portion of the display used by the lower half-height trace box. The lower display is the same size as the upper display.
- [ CLEAR SCREEN ] clears the portion of the screen allocated to your HP Instrument BASIC program.

---

**Note** If you select either [ UPPER ] or [ LOWER ], the analyzer changes the display format to upper/lower.

---

*See also:* Trace boxes

### Displaying a related help topic

Many help screens contain underlined text that is linked to other topics. These "links" allow you to move quickly between related topics. To display a linked topic, turn the knob until the underlined text is highlighted, then press [ **4** ].

## [DO PRESET] softkey

Key Path: [ **Preset** ]

Return the analyzer to a known state. This known state provides a convenient starting point when you are setting up a new measurement.

The analyzer's preset state is described in the analyzer's *Operating Reference*. For quick access to the major preset values, perform a preset, change to the desired instrument mode, then display the measurement state.

| MARKER Group | | | |
|---|---|---|---|
| **[Marker] hardkey** | | **[Marker Fctn] hardkey, continued** | |
| Marker | On | Band Start Frequency | 0 kHz |
| Coupled | OFF | Band Stop Frequency | 20 kHz |
| X Entry | 0 Hz | Sideband Carrier Frequency | 23 kHz |
| Marker Value | ABS | Sideband Increment | 1 kHz |
| Peak Tracking | OFF | Number of Sidebands | 20 |
| **[Marker Fctn] hardkey** | | Start (Time Parameters) | 0 ms |
| Compute Results | Off | Stop (Time Parameters) | 750 us |
| Harmonic Fundamental Frequency | 10 kHz | Start (Gain/Phase) | 0 kHz |
| Number of Harmonics | 20 | Stop (Gain/Phase) | 20 kHz |
| Band Span Frequency | 20 kHz | Start (Freq & Damping) | 0 kHz |
| Band Center Frequency | 10 kHz | Stop (Freq & Damping) | 20 kHz |

| DISPLAY Group | | | |
|---|---|---|---|
| **[Meas Data] hardkey** | | **[ Trace Coord ] hardkey** | |
| (FFt analysis, order analysis) | | Trace Type | dB Magnitude |
| Trace A | Pwr Spec Channel 1 | Amplitude Peak RMS | RMS |
| Trace B | Time Channel 1 | Phase Deg/Rad | Deg |
| (Octave analysis) | | Y-axis Units | Volts ^ 2 |
| Trace A & B | Pwr Spec Channel 1 | X-Axis Lin/Log | Lin |
| (Swept Sine) | | **[Format] hardkey** | |
| Trace A | Frequency Response | Trace Format | Single |
| Trace B | Lin Spec Channel 2 | Grid | On |
| (Correlation) | | Default Title | On |
| Trace A | Auto Corr Channel 1 | Z-axis Range | 16 traces |
| Trace B | Time Channel 1 | Waterfall Trace Height | 39% |
| (Histogram) | | Waterfall Hidden Line | On |
| Trace A | Histogram Channel 1 | Baseline Suppress | 0% |
| Trace B | Unfilterd Time Ch 1 | **[Active Trace] hardkey** | |
| **[Scale] hardkey** | | Active Trace | A |
| Autoscale | Off | **[Analys] hardkey** | |
| Y Per Div | 10 dB | Limit Lines | Off |
| Reference Mode | Inp Range Tracking | | |

| SYSTEM Group | | | |
|---|---|---|---|
| **[Plot/Print] hardkey** | | **[Disk Utility] hardkey** | |
| Plot Speed | Fast (10 cm/s) | Disk Type | DOS |
| Trace A Pen Num | 2 | Interleave Factor | 0 |
| Trace B Pen Num | 3 | | |
| Marker A Pen Num | 5 | **[System Utility] hardkey** | |
| Marker B Pen Num | 6 | Auto Cal | On |
| Alpha Pen Number | 4 | Beeper | On |
| Grid Pen Number | 1 | | |
| Trace A/B Line Type | Solid | **[Local/HPIB] hardkey** | |
| Time Stamp | On | GPIB Echo | OFF |
| Page Eject | On | | |

**MEASUREMENT Group**

| [Frequency] hardkey (FFT analysis) | |
|---|---|
| Frequency Span | 102.4 kHz |
| Center Frequency | 51.2 kHz |
| Start Frequency | 0.0 Hz |
| Stop Frequency | 102.4 kHz |
| Entry Step Size | 2 kHz |
| Record Length | 3.9062 ms |
| Resolution | 400 lines |

| [Frequency] hardkey (Octave analysis) | |
|---|---|
| Start Frequency | 10 Hz |
| Stop Frequency | 16 kHz |
| Octave Resolution | 1/3 Octave |

| [Frequency] hardkey (Order analysis) | |
|---|---|
| Min rpm | 600 |
| Max rpm | 6000 |
| Max Order | 10 ord |
| Delta Order | 0.1 ord |
| Track | Off |
| Track 1 Order | 1 ord |
| Track 2 Order | 2 ord |
| Track 3 Order | 3 ord |
| Track 4 Order | 4 ord |
| Track 5 Order | 5 ord |

| [Frequency] hardkey (Swept Sine) | |
|---|---|
| Frequency Span | 51.149 kHz |
| Center Frequency | 25.6256 kHz |
| Start Frequency | 51.2 Hz |
| Stop Frequency | 51.2 kHz |
| Entry Step Size | 128 Hz |
| Sweep Lin/Log | Lin |
| Sweep Direction | Up |
| Sweep Auto/Man | Auto |
| Manual Freq | 51.2 Hz |
| Resolution | 101 Pnt/Swp |
| Auto Res | Off |
| Maximum % Change | 2.5% |
| Minimum Resolution | 401 Pnt/Swp |

| [Frequency] hardkey (Correlation) | |
|---|---|
| Record Length | 3.9062 ms |
| Resolution | 400 lines |

| [Frequency] hardkey (Histogram) | |
|---|---|
| Record Time | 3.9062 ms |
| Sample Time | 3.8147 us |
| Histogram Length | 1 rec |
| Histogram Bins | 512 |

| [Input] hardkey | |
|---|---|
| Range | Auto |
| Range | –51 dBVrms |
| Input Low | Float |
| Coupling | dc |
| Anti Alias Filter | On |
| A Weight Filter | Off |
| ICP Supply | Off |
| Eng Units | Off |

| [Window] hardkey (FFT analysis) | |
|---|---|
| Window Type | Flat Top |
| Force Width | 9.999 kS |
| Expo Decay | 9.999 kS |
| Ch 1 force/expo | FORCE |
| Ch 2 force/expo | EXPO |

| [Window] hardkey (Order analysis) | |
|---|---|
| Window Type | Uniform |
| CP dc Bin | On |

| [Window] hardkey (Correlation) | |
|---|---|
| Window Type | Zero Pad -T/4 |

| [Trigger] hardkey | |
|---|---|
| Trigger type | Free Run |
| Tach Pulses Per Rev | 1 |
| Trg Range | +/- 4 |
| Tach Level | 0 V |
| Holdoff Time | 0 s |
| Tach Slope | Pos |
| Trigger Level | 0 % |
| Trigger Slope | Pos |
| Channel 1 Delay | 0 s |
| Channel 2 Delay | 0 s |
| Arm Type | Automatic |
| Start rpm Usage | rpm increasing |
| Start rpm | 600 |
| rpm Step Size | 60 rpm |
| Time Step Size | 500 ms |
| Waterfall Steps (FFT analysis) | 15 |
| Waterfall Steps (Octave analysis) | 200 |
| Waterfall Steps (Order analysis) | 20 |
| Waterfall Steps (Correlation) | 15 |
| Waterfall Steps (Histogram) | 15 |

| MEASUREMENT Group, continued | | | |
|---|---|---|---|
| **[Inst Mode] hardkey** | | **[Average] hardkey (FFT analysis, Correlation)** | |
| Inst Mode | FFT, 1 Channel | Average | Off |
| Capture | Off | Number Averages | 10 |
| | | Average Type | rms |
| **[Source] hardkey (FFT, Correlation, Histogram** | | Fast Average | Off |
| Source | Off | Update Rate | 5 |
| Level | 0 Vpk | Repeat | Off |
| Source Type | Fixed sine | Overlap Percent | 0 % |
| Sine Frequency | 10.24 kHz | Overload Reject | Off |
| **[Source] hardkey (Octave analysis)** | | Preview Type | Off |
| Source | Off | Preview Time | 10 s |
| Level | 0 Vpk | **[Average] hardkey (Octave analysis)** | |
| Source Type | Pink Noise | Average Type | Exponential |
| Sine Frequency | 10.24 kHz | Hold Setup | Off |
| **[Source] hardkey (Order analysis)** | | Average Time | 125 ms |
| Source | Off | Confidence Level | 0.5 dB |
| Level | 0 Vpk | Impulse | Off |
| Source Type | Fixed Sine | Repeat | On |
| Sine Frequency | 10.24 kHz | **[Average] hardkey (Order analysis)** | |
| **[Source] hardkey (Swept Sine)** | | Average | Off |
| Level | 0 Vpk | Number Averages | 1 |
| Ramp Rate | 0 Vpk/s | Average Type | Time |
| Autolevel | Off | Repeat | Off |
| Ref Chan | Ch2 | **[Average] hardkey (Swept Sine)** | |
| Reference Level | 1 Vpk | Settle Time | 5 Cycles |
| Reference Tolerance | 2 dB | Integrate Time | 5 Cycles |
| Max Src Level | 2 Vpk | Fast Average | Off |
| Max Input Level | 2 Vpk | **[Average] hardkey (Swept Sine)** | |
| | | Fast Average | On |
| | | Repeat | On |

| Parameters not affected by Preset (stored in non-volatile RAM) | |
|---|---|
| **[Disk Utility] hardkey** | **[Plot/Print] hardkey** |
| Default Disk | Device Is Plot/Print |
| **[System Utility] hardkey** | **[Local/HP-IB] hardkey** |
| Time, Date | System Controller/Addressbl |
| Keyboard type | HPIB Addresses |
| Timestamp format | **[Input] hardkey** |
| **[Analys] hardkey** | Eng Unit Multiplier |
| Functions and Constants | Eng Unit Label |

The HP-IB command to perform a preset is SYST:PRES.

*See also:* [ **Inst Mode** ] hardkey, [ MEASURMNT STATE ] softkey

## Documentation

The following printed documentation is provided with the analyzer:

- The *Quick Start Guide.* This is an introduction to the HP 35665A analyzer. It contains some simple measurement tasks designed to get you comfortable with the analyzer.
- The *Operator's Guide.* This contains measurement tasks that demonstrate the functionality of the analyzer. It includes each of the measurement modes as well as limit lines, plotting/printing results, and save/recall.
- The *Concepts Guide.* This includes a conceptual overview of the analyzer and in-depth discussion of the major features.
- The *Operator's Reference.* This includes a brief overview of the front and rear panels and descriptions of each hardkey and softkey.
- *HP-IB Programming with the HP 35665A.* This covers remote operation of the analyzer over the HP-IB. It includes a conceptual overview, command descriptions and syntax, and example programs.
- *HP 35665A HP-IB Quick Reference Card.* This lists all HP-IB commands recognized by the analyzer. It also includes information about the HP-IB command syntax and the analyzer's status registers.
- *HP 35665A Installation and Verification Guide.* This includes installation instructions, specifications, and performance tests.
- *Standard Data Format Utilities User's Guide.* This describes a PC-based utility for sharing data between various analyzers.

These two documents are included with option 1C2, HP Instrument BASIC:

- *HP Instrument BASIC User's Handbook.* This contains global information about HP Instrument BASIC.
- *Using HP Instrument BASIC with the HP 35665A.* This shows you how to record and develop programs.

This document is included with option 0B3, service:

- *Service Guide.* This includes adjustments, circuit descriptions, replaceable parts, and troubleshooting information.

Other recommended sources of information are:

- *HP Dynamic Signals Demo Disc.* This compact disc contains captured signals from microphones and vibration transducers for 72 different types of signals. The disk is shipped with documentation to explain the signals and to offer appropriate measurement suggestions.
- Hewlett-Packard applications notes, available from your local HP Sales and Service Office. These include information on specific measurement applications.
- *Spectrum and Network Measurements*, Robert A. Witte (Prentice Hall, Englewood Cliffs, New Jersey, 1991). This book is a good overview of spectrum/network measurements.

## [DOTTED] softkey

See Line type softkeys.

## [Dx] softkeys

Key Path: [ **Meas Data** ] → [ DATA REGISTER ]

Display the contents of the corresponding data register.

You can use [ RECALL TRACE ] to load any data register.

*See also:* [ RECALL TRACE ] softkeys, Data registers

## [EDIT Dx] softkey

Key Path: [ **Analys** ] → [ DATA EDIT ]

Edit the contents of the specified data register.

*See also:* Data registers, [ DATA EDIT ] softkey

## [EDIT] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ]

View or edit your HP Instrument BASIC program. The analyzer enters HP Instrument BASIC edit mode and remains in this mode until you press [ END EDIT ].

Most hardkeys are redefined as alpha characters when the analyzer is in HP Instrument BASIC edit mode. Engraved letters, near the lower right corners of these keys, tell you which characters they will insert in your program.

The [ **Help** ], [ **Preset** ], number, decimal point, and [ **Back Space** ] hardkeys are not redefined, but the [ +/ – ] hardkey is. It inserts a minus (or dash) in your program rather than toggling a number between positive and negative values.

Use the knob to position the text cursor in your program. When you turn the knob clockwise, the cursor moves to the right of a line and then down to the next line. When you turn the knob counter-clockwise, the cursor moves to the left and then up.

**Caution** If you change or insert a program line, be sure to press [ ENTER ] before moving to another line with the knob; otherwise, the change will be lost.

Additional characters and editing function are available from the HP Instrument BASIC edit menu and its submenus.

*See also:* Knob, [ END EDIT ] softkey

## [EDIT TABLE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]
or: [ **Analys** ] → [ SYNTHESIS ]

Edit the curve-fit or synthesis table. You can add, delete, or edit the terms in the table. For curve fit, you can also fix the poles and zeros.

The table contains two columns of real and/or complex numbers. One column entry is highlighted. This highlighting acts as the editing cursor.

The knob moves the cursor up and down. When the cursor reaches the first blank line of the left column, it moves to the top line in the right column. Moving up past the top line in the right column brings the cursor back to the last line in the left column.

**Note**

If an entry window is displayed, wait a few seconds for the window to disappear, then use the knob to move the cursor in the table.

The table is annotated with pole-zero, pole-residue, or numerator-denominator column headings, and an order display next to each column heading. The maximum system order is 20.

For pole-zero and pole-residue tables, you can enter real or complex values. To enter a complex value, first type the real part, then press [ + j ] and type the imaginary part. The analyzer interprets the complex entry as a conjugate pair, and lists it in the table with a "+/–" notation.

**Note**

For poles and zeros, you must enter a positive imaginary value. For residues, you can use the [ +/ – ] hardkey to enter a negative imaginary value. For polynomial tables you can enter only real coefficients for each power of s.

**Note**

Laurent terms (s ^ 0, s ^ 1, etc.) in pole residue cannot be edited. You can delete Laurent terms by clearing the table.

*See also:* [ CLEAR TABLE ] softkey

## [ENABLE RECORDING] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ]

Begin recording front-panel keystrokes.

Keystroke recording allows you to create an HP Instrument BASIC program that mimics a series of keystrokes. It works by converting your keystrokes to equivalent HP-IB commands and then enclosing the commands in BASIC OUTPUT statements.

*Hint:* You can turn on GPIB Echo to display the commands in the upper left corner of the screen.

---

**Note** Not every keystroke generates an HP-IB command. For example, you must press [ **Freq** ], [ CENTER ], [ **1** ], [ **0** ], [ **kHz** ] before the command "FREQ:CENT 10000" is echoed to the screen.

---

When you have finished recording keystrokes, press [ **BASIC** ] to disable recording. You can view or edit the resulting program by pressing [ EDIT ]. You can execute the program by pressing [ RUN ].

*Hint:* Be sure to record a [ **Start** ] keystroke before you record a keystroke that requires good measurement data (such as [ MARKER - PEAK ]). This ensures that the measurement will be complete before your program uses the data.

The OUTPUT statements created by keystroke recording are entered into the current program. If the program buffer is empty, the analyzer first creates an ASSIGN statement and an END statement. OUTPUT statements are then inserted ahead of the END statement.

If the program buffer already contains a program, OUTPUT statements are inserted ahead of the program line containing the text cursor. You can position the text cursor by pressing [ EDIT ] and then turning the knob.

You can not record the following front panel operations:

- Redefinition of the analyzer's controller capabilities. HP-IB commands are not allowed to do this.
- Saving or recalling of HP Instrument BASIC programs. A program cannot be saved or recalled while it is running.
- Any other HP Instrument BASIC operation. These operations are all grouped under the [ **BASIC** ] hardkey, which disables keystroke recording.

The recorded version of a few front-panel operations may require additional programming—usually to synchronize program execution with the analyzer's measurement sequence. Here is an example:

During manual arming, any attempts to arm the analyzer before it is ready are ignored. When you operate the analyzer from the front panel, you can simply wait until the WAITING FOR ARM message is displayed and then press [ ARM ].

If you record this operation, you must add a routine that simulates your waiting for the message. The routine should check the RDY_FOR_ARM bit in one of the analyzer's registers and hold off the ARM command until the bit is set.

See your HP Instrument BASIC manual for more information about synchronization.

---

**Note**

For real-time octave, order, and FFT measurements, the analyzer may not be able to display results while an HP Instrument BASIC program is running. If you encounter this situation, you can insert a WAIT statement in the program. See the manual *Using HP Instrument BASIC with the HP 35665A* for more information and examples.

---

*See also:* [ GPIB ECHO ON OFF ] softkey

## [END EDIT] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Finish editing or viewing your program.

When you press [ END EDIT ] you return to the main HP Instrument BASIC menu. You can run the edited program immediately, but it is best to save your changes first.

---

**Caution** You must save an edited program or the changes will be lost when you turn the analyzer off.

---

*See also:* [ SAVE PROGRAM ] softkey

## [END LINE #] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ SECURE ]

Before you secure a program (protect it against viewing), you must specify the range of lines you want to secure. Press [ END LINE # ] to specify the last line in the range. An entry window is displayed so you can enter a new value.

After you have specified the first and last lines, press [ PERFORM SECURE ] to secure those lines and all lines that fall between them. When you edit or print a secured line, you will see an asterisk (*) rather than program statements after the line number.

*See also:* [ START LINE # ] softkey (Secure), [ SECURE ] softkey

## [ENG UNIT LABEL] softkey

Key Path: [ Input ] → [ CHANNEL x SETUP ]

Assign a name to the engineering units for the designated channel. You can enter up to 4 characters.

The default label is EU. When you turn on engineering units, the engineering unit label appears wherever "V" normally appears in the trace annotation.

*See also:* Engineering units

## [ENG UNIT MULTIPLIER] softkey

Key Path: [ Input ] → [ CHANNEL x SETUP ]

Specify the number of volts per engineering unit to be assigned for the designated channel. You can specify a number of volts per engineering unit or number of engineering units per volt. The default is 1 V/EU.

You can also use [ ENG UNIT AT MKR ] to specify the amplitude in EU at the current marker position.

*See also:* [ ENG UNIT AT MKR ] softkey, Engineering units

## [ENG UNIT ON OFF] softkey

Key Path: [ Input ] → [ CHANNEL x SETUP ]

Enable or disable the use of engineering units for the associated channel.

When engineering units is on, the analyzer does the following things:

- Uses your specified engineering unit label rather than the analyzer's internal label, V. The eng unit label appears anywhere that V normally appears in the trace annotation.
- Multiplies the amplitude by the eng unit multiplier.

**Note** You must turn on engineering units before starting a measurement. If you turn on engineering units after taking a measurement, the engineering units are not applied to the current data.

*See also:* [ ENG UNIT MULTIPLIER ] softkey, [ ENG UNIT LABEL ] softkey, [ ENG UNIT AT MKR ] softkey, Engineering units

## Engineering units

The analyzer can interpret the input signal as engineering units. An "engineering unit" is an arbitrary unit to which you can assign any voltage value. The default engineering unit is EU.

To use engineering units, you must enter an EU value (using the [ ENG UNIT MULTIPLIER ] softkey). The analyzer multiplies the input by this value to obtain the desired EU. You must also enter a descriptive label (using the [ ENG UNIT LABEL ] softkey). Finally, you must turn on engineering units by pressing [ ENG UNIT ON OFF ].

For example, if a transducer is calibrated at 10 mV/g, you can enter "g" as the EU label and enter 10 mv as the EU multiplier. The analyzer will then display 1 g for each 10 mV measured for the channel.

By changing the engineering units, you can get the analyzer to show results in non-voltage units, such as mils, inches per second, or g's. This is useful for rotating machinery or vibration measurements.

Engineering units are useful because they allow you to effectively convert a transducer's output voltage to any numerical value—and to assign a label to these units as well. However, the transducer must be a linear device. Engineering units are valid only when the relationship between the engineering unit and the transducer's output voltage is linear.

*See also:* [ ENG UNIT ON OFF ] softkey, [ ENG UNIT LABEL ] softkey, [ ENG UNIT MULTIPLIER ] softkey

## [ENG UNIT AT MKR] softkey

Key Path: [ **Input** ] → [ CHANNEL x SETUP ]

Specify the number of engineering units at the current marker Y-axis position, using the current display units. The analyzer divides the value you enter by the amplitude at the marker to calculate the engineering unit multiplier.

For example, assume you are calibrating a transducer and have introduced a 1 g calibration signal at the transducer, which is connected to channel 1. To set the engineering units, display the channel 1 power spectrum, press [ MARKER TO PEAK ] → [ **Input** ] → [ ENG UNIT AT MKR ] → [ 1 ] → [ dBEUrms ].

*See also:* [ ENG UNIT MULTIPLIER ] softkey, Engineering units

## [ENTER] softkey (BASIC)

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Accept the changes you've made while editing a line of your program. If the editor detects no syntax errors, the line is accepted.

**Caution** If you move the text cursor off of the line before you press [ ENTER ], the changes you've made are lost.

If the editor is in insert line mode when you press [ ENTER ], it creates a blank line below the current line and moves the text cursor to that new line. If the editor is not in insert line mode when you press [ ENTER ], it just moves the text cursor to the next line of the program.

## [ENTRY STEP SIZE] softkey

Key Path: [ **Freq** ]

Define the effect of the knob and arrow keys on the value of the following frequency parameters:

- [ CENTER ].
- [ START ].
- [ STOP ].

Limits: 15.625 mHz to 10.24 kHz
128 Hz (Swept sine)

Default: 2 kHz (FFT)

[ ENTRY STEP SIZE ] defines the following things:

- The smallest frequency change possible when you turn the knob slowly.
- The frequency change that results when you press an arrow key once.

*See also:* Arrow keys, Knob

## [EQUAL CONFID] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ Avg ]

Specify equal confidence averaging for an octave measurement.

For equal confidence the analyzer varies the average time for each band so that the relative confidence in the measurement is equal across bands.

There is a 68% probability that the results will be within +/– the specified confidence level of the true mean value, and a 96% probability that the results will be within twice the specified confidence level of the true mean value.

For example, if you specify a confidence level of 2 dB, there is 68% confidence that the results will be within 2 dB of the true mean value, and 96% confidence that the results will be within 4 dB of the true mean value.

You can specify the confidence level to be .25, .5, 1, or 2 dB.

---

**Note**

Before an equal confidence measurement is settled, the instantaneous spectrum is displayed. Averaging proceeds after the settling time has elapsed. This behavior is especially noticeable for the lower frequency bands, where the average times are longer than at higher frequencies.

---

*See also:* [ CONFIDNCE LEVEL ] softkey, [ OCTAVE ANALYSIS ] softkey

## [EXAMINE VARIABLE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ DEBUG ]

Display the contents of a program variable.

---

**Note** Your program must be paused, stopped, or in single-step mode before you can examine a variable.

---

When you press [ EXAMINE VARIABLE ], the analyzer asks you to enter a variable name. You enter a name using the alpha entry keys.

You can examine array variables in one of two ways. Display the entire array by entering <array_name>(*) in the entry window. Display a single element of the array by entering <array_name>(<element_number>).

The analyzer uses up to 10 lines (of 40 characters each) to display variables. Those containing more than 400 characters are truncated.

*See also:* Alpha entry mode

## [EXP(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the natural antilog (e^x) of the operand.

The natural antilog (e^x) of a complex number a + jb is defined as

$$e\hat{\ }(a+jb) = e\hat{\ }a * \cos b + j * e\hat{\ }a * \sin b.$$

## [EXPO DECAY] softkey

Key Path: [ Window ]

Specify the exponential window's time constant.

Limits: 3.8147 us to 9.99 Ms Default: 9.999 ks

This is the rate at which the signal is attenuated for the exponential window. Generally, the time constant should be set to one-fourth of the time record for the window to be effective.

*See also:* Time record, [ CHANNEL x FORCE EXPO ] softkey

## [EXPONENTL] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ Avg ]

Specify exponential averaging for an octave measurement.

Unlike linear averaging, exponential averaging weights new data more than old data. This is useful for tracking data that changes over time.

The analyzer uses the time constant, [ AVERAGE TIME ], to smooth the data. A time constant of 0.125 seconds corresponds to an IEC 651 sound level meter "fast" characteristic; 1.0 seconds corresponds to the "slow" characteristic.

The measurement continues until you stop it.

---

**Note** Before an exponential measurement is settled, the instantaneous spectrum is displayed. Exponential averaging proceeds after the settling time has elapsed. This behavior is especially noticeable for long (1 s) time constants.

---

*See also:* [ AVERAGE TIME ] softkey, [ OCTAVE ANALYSIS ] softkey

## [EXTERNAL DISK] softkey

Key Path: [ **Disk Utility** ] → [ DEFAULT DISK ]
or: [ **Save/Recall** ] → [ DEFAULT DISK ]

Select an external HP-IB disk as the default disk.

You must have connected the HP-IB disk drive and entered its address under [ Local/HP-IB ] → [ PERIPHERL ADDRESSES ] → [ DISK ADDRESS ]. The analyzer must be set as the [ SYSTEM CONTROLLER ].

*See also:* Controller Capability softkey group, [ DEFAULT DISK ] softkey

## External keyboard user interface

When the analyzer is not in alpha entry mode, you can operate the analyzer using the external keyboard rather than the front panel.

- The numeric keys 0 through 9, the up arrow and down arrow keys, the Back Space key, and the Enter key do the same thing from the keyboard as from the front panel.
- F1 through F10 correspond to the softkeys. F1 is the top softkey; F10 is the bottom softkey.
- F12 corresponds to the [ **Help** ] hardkey.
- Right arrow and left arrow keys correspond to turning the knob clockwise and counter-clockwise.
- Pressing Alt, CTRL, and DEL simultaneously corresponds to the [ **Preset** ] hardkey.
- Print Screen corresponds to pressing [ **Plot/Print** ] and [ START PLOT/PRNT ].
- The alpha keys A through Z correspond to the hardkeys on the analyzer's front panel. You can use either upper case or lower case alpha characters.

The following tables list the keyboard and front panel equivalent keys, first alphabetically by front panel key, then alphabetically by keyboard key.

This table lists the front panel hardkeys and the equivalent keyboard alpha keys.

| Front Panel | Keyboard | Front Panel | Keyboard |
|---|---|---|---|
| Active Trace | D | Marker Value | Z |
| Analys | E | Meas Data | A |
| Avg | O | Pause/Cont | N |
| Disk Utility | Q | Plot/Print | T |
| Disp Format | F | Save/Recall | P |
| Down arrow (↓) | Y | Scale | C |
| Freq | H | Source | K |
| BASIC | S | Start | M |
| Input | J | System Utility | R |
| Inst Mode | G | Trace Coord | B |
| Local/HP-IB | U | Trigger | L |
| Marker | V | Up arrow (↑) | X |
| Marker Fctn | W | Window | I |

This table lists the keyboard alpha keys and the equivalent front panel hardkeys.

| Keyboard | Front Panel | Keyboard | Front Panel |
|---|---|---|---|
| A | Meas Data | N | Pause/Cont |
| B | Trace Coord | O | Avg |
| C | Scale | P | Save/Recall |
| D | Active Trace | Q | Disk Utility |
| E | Analys | R | System Utility |
| F | Disp Format | S | BASIC |
| G | Inst Mode | T | Plot/Print |
| H | Freq | U | Local/HP-IB |
| I | Window | V | Marker |
| J | Input | W | Marker Fctn |
| K | Source | X | Up arrow (↑) |
| L | Trigger | Y | Down arrow (↓) |
| M | Start | Z | Marker Value |

*See also:* Alpha entry mode

## [EXTERNAL TRIGGER] softkey

Key Path: [ Trigger ]

Select external triggering. This means that the analyzer will trigger when the signal applied to the external trigger input connector goes from logic-low to logic-high (positive slope) or from logic-high to logic-low (negative slope).

For octave or order measurements, you specify TTL high or low level for the external trigger rather than slope.

The external trigger connector is on the rear panel of the analyzer.

Unlike input triggering and source triggering, external triggering requires a digital signal at standard TTL levels.

**Note** For octave measurements, you may not be able to use external triggering to capture a transient signal. After receiving the trigger, the analyzer does not display a spectrum until after the settling time. If the transient occurs during the settling time, the analyzer misses it.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ LEVEL HIGH LOW ] softkey, [ SLOPE POS NEG ] softkey

## [FAIL BEEP ON OFF] softkey

Key Path: [ Analys ] → [ LIMIT TEST ]

Enable and disable the limit-fail beeper for the active trace.

The limit-fail beeper emits an audible tone when all of the following conditions are true:

- [ FAIL BEEP ON/OFF ] is ON.
- [ BEEPER ON/OFF ] is ON.
- [ TEST EVAL ON/OFF ] is ON.
- The trace falls outside its current limits.

*See also:* [ TEST EVAL ON OFF ] softkey, [ BEEPER ON OFF ] softkey

## [FAST AVG ON OFF] softkey

Key Path: [ Avg ]

Turn on or off the fast average mode. When fast average is on, the analyzer updates the display once for each N averages, where N is the specified update rate. This may increase measurement speed.

For example, if you specify an update rate of 5, the analyzer updates the display once every 5 averages.

For swept sine measurements (option 1D2), this key specifies whether the analyzer updates the display at each point (Fast Avg Off) or waits until the sweep is complete (Fast Avg On).

For histogram measurements, this key specified whether the analyzer displays intermediate results (Fast Avg Off) or waits until the measurement is complete (Fast Avg On).

*See also:* [ UPDATE RATE ] softkey

## [FAST (50 cm/s)] softkey

See [ PLOT PEN SPEED ] softkeys.

## [FAULT LOG] softkey

Key Path: [ System Utility ]

Display the hardware fault log on the screen.

If any hardware failures occur in your analyzer, they are listed in the fault log. Contact your local HP sales and service office for further information or have a qualified service technician refer to the analyzer's *Service Guide*.

You can clear entries in the fault log by pressing [ CLEAR FAULT LOG ].

## [FFT ANALYSIS] softkey

Key Path: [ Inst Mode ]

Specify the FFT analysis instrument mode.

In the FFT analysis mode, the analyzer uses digital signal processing to sample the input signal and convert it to the frequency domain. A wide variety of measurement results are available from an FFT measurement.

| 2 channel | 1 channel |
|---|---|
| Power spectrums ch 1 & 2 | Power spectrum ch 1 |
| Linear spectrums ch 1 & 2 | Linear spectrum ch 1 |
| Time ch 1 & 2 | Time ch 1 |
| Frequency response | Windowed time ch 1 |
| Coherence | |
| Cross spectrum | |
| Orbit | |
| Windowed time ch 1 & 2 | |

The time domain data is uncalibrated and unaveraged.

For more information on measurement data, see the analyzer's *Concepts Guide.*

*See also:* [ ORBIT ] softkey, [ WINDOWED TIME CH x ] softkey, [ WINDOWED TIME CH x ] softkey, [ CROSS SPECTRUM ] softkey, [ COHERENCE ] softkey, [ FREQUENCY RESPONSE ] softkey (FFT analysis), [ TIME CHANNEL x ] softkey, [ LIN SPEC CHANNEL x ] softkey (FFT analysis), [ PWR SPEC CHANNEL x ] softkey, [ TIME CHANNEL x ] softkey, [ LIN SPEC CHANNEL x ] softkey (FFT analysis), [ PWR SPEC CHANNEL x ] softkey, [ 2 CHANNEL ] softkey, [ 1 CHANNEL ] softkey

## FFT averaging

The average softkeys for FFT analysis allow you to do the following things:

- Choose from several types of averaging.
- Specify the number of averages.
- Select fast average mode—this lets the analyzer make averaged measurements without having to update the screen after every average.
- Specify how often you want the display updated.
- Turn average repeat on or off.
- Specify the percentage of overlap you want the analyzer to use when making an averaged measurement.
- Turn on overload reject to prevent overloads from corrupting an average in progress.
- Preview each time record collected by the analyzer and decide whether or not to include the time record in the measurement.

**Note**

The analyzer does not autorange while averaging—so don't change the output of your test device during the averaging procedure. If an over-range condition occurs during averaging, an overload message appears but the analyzer does not abort the averaging procedure.

*See also:* [ OVERLAP PERCENT ] softkey, [ REPEAT ON OFF ] softkey (average), [ NUMBER AVERAGES ] softkey, [ UPDATE RATE ] softkey, [ AVERAGE TYPE ] softkey (FFT analysis), [ OVLD REJ ON OFF ] softkey, [ CHx AUTO RANGE ] softkey, Time record, [ MANUAL PREVIEW ] softkey, [ FAST AVG ON OFF ] softkey

## FFT frequency keys

For FFT analysis, the following softkeys are under the [ **Freq** ] hardkey:

- Span
- Center
- Start
- Stop
- Zero start
- Full span
- Entry step size
- Record length
- Resolution (lines)

*See also:* [ SPAN ] softkey (frequency), [ CENTER ] softkey (frequency), [ START ] softkey (frequency), [ STOP ] softkey (frequency), [ ZERO START ] softkey, [ FULL SPAN ] softkey (frequency), [ ENTRY STEP SIZE ] softkey, [ RECORD LENGTH ] softkey, [ RESOLUTN (LINES) ] softkey

## [FFT(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Perform a Fast Fourier Transform of the operand. If the size of the argument data block is not a power of two, the analyzer pads the data with zeros to the nearest power of two.

When you perform an FFT on time data collected using a Hanning or Flat Top window, the result will differ in phase from a linear spectrum of the same time data. The analyzer corrects the linear spectrum for phase error introduced by the window; the math FFT operation does not correct for phase error.

The analyzer cannot compute the FFT for frequency data with more than 800 lines of resolution. For other domains, the number of data points must not exceed 2048.

If the argument's X-axis units are anything other than frequency or time, the analyzer performs the FFT but does not change the units.

*See also:* [ LIN SPEC CHANNEL x ] softkey (FFT analysis), [ FLAT TOP ] softkey, [ HANNING ] softkey

## [FINISH SEGMENT] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Anchor a line segment's ending point at the position of the limit marker.

Limits are defined as a series of line segments. Press [ START SEGMENT ] to anchor a segment's starting point. Use [ MOVE MKR HORIZNTAL ] and [ MOVE MKR VERTICAL ] to position the limit marker.

When you press [ FINISH SEGMENT ] to anchor an ending point, the analyzer automatically anchors the starting point of a new segment at the same position. This makes it easier for you to build continuous limit lines.

You can abandon the automatically generated starting point. Just press [ START SEGMENT ] after you reposition the limit marker.

*See also:* [ START SEGMENT ] softkey, [ MOVE MKR VERTICAL ] softkey, [ MOVE MKR HORIZNTAL ] softkey

## [FIT REGION] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]

Specify what portion of trace A should be used by the curve fitter.

You can specify that the curve fitter use the full span or identify a portion of the span to be used.

---

**Note** X-axis scaling has no effect on the curve fit analysis region.

---

*See also:* [ USER SPAN ] softkey, [ FULL SPAN ] softkey

## [FIX VALUE TOGGLE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ EDIT TABLE ]

Fix or unfix the highlighted pole or zero for a curve fit table.

When a value is "fixed," the curve fitter assumes it is accurate and finds a model which includes the fixed poles and zeros. If poles or zeros are known to exist at the origin of the s-plane, fixing them usually improves the accuracy of the fit.

Fixed values are identified by the label "fxd" at the right side of the line in the table

Terms in the curve fit table which are not fixed are discarded at the end of a new curve fit and have no effect on the curve fitter.

## [FIXED SINE] softkey

Key Path: [ **Source** ]

Select the fixed sine waveform. Use the numeric entry keys to specify the frequency.

| | | |
|---|---|---|
| Limits: | 0 Hz to 115 kHz | Default: 10.24 kHz |
| Steps: | 15.625 mHz | |

Press the [ LEVEL ] softkey to specify the sine wave amplitude.

## [FLAT TOP] softkey

Key Path: [ **Window** ]

Select the Flat Top window for both input channels. The Flat Top window has better amplitude accuracy, but poorer frequency resolution than the Hanning window. This is the default window type for FFT measurements.

The Flat Top window is useful when you must measure the amplitude of a particular frequency component with great accuracy—for example, when using a fixed-sine source. This window should not be used for burst or chirp source types or other strictly periodic signals.

The Flat Top window is sometimes called a sinusoidal window.

For more information on the Flat Top window and its applications, see the analyzer's *Concepts Guide.*

*See also:* [ HANNING ] softkey

## Fonts

Fonts provide different ways to display the same character. Here's how the fonts are used in the analyzer:

- Plain font: This is used for most help text, most softkey labels, and for annotation of the active trace.
- Ghosted font (dotted): This is used for annotation of the inactive trace and for inactive softkey labels.
- Highlighted font (inverse video): This is used to indicate the active option for softkeys that toggle, the active numeric entry softkey in a menu, and the active link in help text.
- Underlined font: This is used to indicate inactive links in help text.

## [FORCE EXPO] softkey

Key Path: [ **Window** ]

Select the force and exponential window combination specified by the [ CHANNEL 1 FORCE EXPO ] and [ CHANNEL 2 FORCE EXPO ] softkeys.

---

**Note** When you specify the force window, the analyzer applies both the force and exponential weighting functions for that channel.

---

To measure frequency response with a hammer test, connect the hammer to channel 1 with a force window and the response transducer to channel 2 with an exponential window. Set the force width so it flattens most of the noise after the hammer hit but doesn't attenuate the hammer hit itself.

For more information on the force and exponential windows and their applications, see the analyzer's *Concepts Guide.*

*See also:* [ FORCE WIDTH ] softkey

## [FORCE WIDTH] softkey

Key Path: [ **Window** ]

Specify the force window's width.

Limits: 3.8147 us to 9.99 Ms    Default: 9.999 ks

The force window passes the first part of the time record (specified by the force width) and sets the last part to the average value of the time record's remaining data.

The width must be less than the time record for the window to be effective.

*See also:* Time record, [ CHANNEL x FORCE EXPO ] softkey

## [FORMAT DISK] softkey

Key Path: [ **Disk Utility** ]

Define some formatting parameters and format a disk using the following softkeys:

- [ DISK TYPE LIF DOS ]: Lets you specify the disk format.
- [ RAM DISK SIZE ]: Lets you specify the size for a RAM disk.
- [ INTRLEAVE FACTOR ] : Lets you define the spacing between sectors (only used for flexible disks).
- [ PERFORM FORMAT ]: Starts formatting the disk *after* asking you for the disk specifier.

## [FREE RUN TRIGGER] softkey

Key Path: [ **Trigger** ]

Select free run triggering. This means that the analyzer will process time records (input data) as quickly as possible, without waiting for any kind of triggering signal. The analyzer makes measurements continuously (some analyzers call this continuous triggering).

Free run triggering is useful when you need to take data continuously. It is also useful when you don't need to synchronize your measurements with a particular event or with an external device.

*Hint:* If you want to take data continuously and the analyzer is not doing so, make sure you've selected both free run trigger and automatic arming.

For information on limit testing over HP-IB, see the analyzer's *HP-Programming with the HP 35665A* manual.

For order measurements or octave measurements (options 1D0 or 1D1), you can specify a delay for free run triggering. When you press [ **Start** ], the analyzer waits the specified delay time before triggering the measurement.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ AUTOMATIC ARM ] softkey, [ DELAY TIME ] softkey (triggering)

## [FRENCH] softkey

See [ KEYBOARD SETUP ] softkeys.

## [FREQ & DAMPING] softkey

Key Path: [ **Marker Fctn** ]

Calculate and display the resonant frequency and the damping ratio.

The analyzer uses a 1 degree of freedom curve fitter on data between the start and stop markers. For accurate results, the marker band should cover at least the 3 dB bandwidth.

Frequency and damping are valid only for frequency response data.

*See also:* [ STOP FREQUENCY ] softkey, [ START FREQUENCY ] softkey

## [Freq] hardkey

Set the band of frequencies to be analyzed.

The softkeys under the [ Freq ] hardkey vary depending on the instrument mode selected. The analyzer "remembers" a set of frequency settings for each instrument mode.

See the following topics for the softkeys for each instrument mode:

- FFT frequency keys
- Swept sine frequency keys
- Octave analysis frequency keys
- Order analysis frequency keys
- Correlation analysis frequency keys
- Histogram/time frequency keys

*See also:* [ Inst Mode ] hardkey, FFT frequency keys, Swept sine frequency keys, Octave analysis frequency keys, Order analysis frequency keys, Correlation frequency keys, Histogram/Time frequency keys

## [FREQ LABEL] softkey

Key Path: [ Trace Coord ] → [ X UNITS ] → [ User X Setup ]

Specify a name for the user-defined X-axis frequency domain units. The name can be up to 5 characters long.

*See also:* [ USER X UNIT ] softkey

## [FREQUENCY RESPONSE] softkey (FFT analysis)

Key Path: [ **Meas Data** ]

Display the most recent frequency response function on the active trace.

Frequency response shows how a system (a "network") responds to a particular input. The network might be electrical (a filter, for example) or mechanical (a model airplane in a wind tunnel).

Frequency response is only available for two-channel measurements. The frequency response computation varies depending on the type of averaging active.

| | | |
|---|---|---|
| Average off, rms, or rms exponential | : | (cross spectrum) / (power spectrum ch 1) |
| Vector or vector exponential | : | (linear spectrum ch 2) / (linear spectrum ch 1) |
| Peak hold | : | no frequency response computed |

*See also:* [ LIN SPEC CHANNEL x ] softkey (FFT analysis), [ PWR SPEC CHANNEL x ] softkey, [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey, [ CROSS SPECTRUM ] softkey, [ PEAK HOLD ] softkey

## [FREQUENCY RESPONSE] softkey (swept sine)

(Available only with option 1D2, Swept Sine)

Key Path: [ **Meas Data** ]

Display the most recent frequency response function on the active trace. This trace is updated at each sweep point.

For swept sine measurements, the analyzer calculates frequency response by dividing channel 2 linear spectrum by the channel 1 linear spectrum.

*See also:* [ SWEPT SINE ] softkey

## [FREQUENCY SCALE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]
or: [ **Analys** ] → [ SYNTHESIS ] → [ SYNTHESIS SETUP ]

Enter the frequency scaling to be used by the curve fitter or synthesis.

Limits: 1x10^-6 to 1x10^6 Default: 1.0

The analyzer scales the frequency axis (the X-axis) by f/(frequency scale), where f is frequency in Hz.

If you want the frequency axis to be in radians, enter a frequency scale of $1/(2\pi)$. Then you can make table entries in terms of radians (even though the unit keys still say mHz, Hz, and kHz). The frequency axis is always labeled Hz; however, the X-axis cursor should now be interpreted as radians.

## [FRONT BACK] softkey

Key Path: [ **Disp Format** ]

Display both traces using one full-height trace box.

The active trace is drawn with a solid line, the inactive trace with a dotted line. Annotation for the active trace is in the plain font; annotation for the inactive trace is in a ghosted font.

**Note** If you select either [ UPPER ] or [ LOWER ] under the [ **BASIC** ] → [ DISPLAY SETUP ] key, the analyzer changes the display format from front/back to upper/lower.

*See also:* [ **Active Trace** ] hardkey, Fonts, Trace boxes

## [FULL OCTAVE] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ Freq ]

Specify a full octave band measurement.

Full octave analysis is the measurement of a frequency spectrum by the use of 12 constant percentage bandwidth filters one octave wide and spaced at one octave intervals.

The analyzer displays a total RMS power band and up to 12 frequency bands. The center frequency of each band is twice the center frequency of the previous band.

---

**Note** Markers return the ANSI Standard preferred frequencies.

---

You can specify the start and stop frequencies by pressing the [ START ] and [ STOP ] softkeys. When you change one of these frequencies, the analyzer changes the other frequency if the specified band if more than 12 octaves.

For full octave measurements, the maximum stop frequency is 16 kHz for 1 channel and 8 kHz for 2 channels. The minimum start frequency is 80 mHz.

The exact center frequencies are determined by starting at 1000 Hz (band 10) and multiplying by 2.0 to get higher bands or dividing by 2.0 to get lower bands.

---

**Note** Markers return the ANSI Standard preferred frequencies.

---

*See also:* [ STOP ] softkey (octave frequency), [ START ] softkey (octave frequency)

## [FULL SCALE] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Display all the measured data, scaled to fit the display area. This applies only for the axis you are currently scaling.

If you have scaled either axis using axes scale markers, this is how you return to the full scale display.

*See also:* [ AXES SCAL MARKERS ] softkey

## [FULL] softkey (BASIC display)

See [ DISPLAY SETUP ] softkey group.

## [FULL SPAN] softkey (curve fit)

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ FIT REGION ]

Specify that the curve fitter use the full data span from trace A.

---

**Note** When you set the curve fit analysis region to full span, the analyzer displays "Trace A" as the start and stop frequencies in the mini-state. This means that the analyzer will use the full span of Trace A.

---

**Note** X-axis scaling has no effect on the curve fit analysis region.

---

## [FULL SPAN] softkey (frequency)

Key Path: [ **Freq** ]

Have the analyzer look at all frequencies from 0 Hz to its upper limit—102.4 kHz for one-channel measurements, 51.2 kHz for two-channel measurements. This softkey also anchors the start frequency.

*See also:* [ START FREQUENCY ] softkey

## [FUNDAMNTL FREQUENCY] softkey

Key Path: [ **Marker Fctn** ] → [ HARMONIC MARKER ]

Specify the fundamental frequency of the harmonic series you want to look at. The analyzer needs the fundamental frequency to find the appropriate harmonics and to make the harmonic marker calculations.

*See also:* [ HARMONIC MARKER ] softkey

## [Fx] softkeys

Key Path: [ **Meas Data** ] → [ MATH FUNCTION ]

Display the result of the corresponding user-defined function.

**Note** A function must be defined before it can be displayed. Functions are defined under the [ **Analys** ] hardkey.

## [GAIN FACTOR] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ] → [ SYNTHESIS SETUP ]

Specify the desired gain of a synthesized frequency response function.

Limits: 1e–38 to 1e+38 and not = 0 Default: 1.0

Gain is entered as a unitless number. The gain value is displayed in the lower right corner of the table.

## [GAIN PHAS MARGINS] softkey

Key Path: [ **Marker Fctn** ]

Turn on gain and phase margin markers. These allow you to specify a start and stop frequency, then compute and display gain and phase margins and crossovers. Gain and phase margin are valid only for frequency response data.

*See also:* [ COMPUTE MARGINS ] softkey, [ STOP FREQUENCY ] softkey, [ START FREQUENCY ] softkey

## [GERMAN] softkey

See [ KEYBOARD SETUP ] softkeys.

## [GOTO LINE] softkeys

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Move the text cursor directly to a particular line of the program you are editing. You can specify the line either by its number or its label.

Use the number keys to specify a line number. Use the hardkeys with engraved letters, the underscore ( _ ) softkey, and the [ UPPERCASE/lowercase ] softkey to specify a label. Then when you press [ ENTER ], the text cursor moves to the specified line.

If you enter a line number that doesn't exist, the cursor moves to the closest line. If you enter a label that doesn't exist, the cursor remains on the current line.

*Hint:* To go to the end of the program, enter a line number greater than that of the last line (for example, 99,999).

## [GPIB ECHO ON OFF] softkey

Key Path: [ **Local/HP-IB** ]

Enable and disable the echo (display) of HP-IB command mnemonics to the analyzer's screen. (HP-IB is Hewlett-Packard's implementation of GPIB—the General Purpose Interface Bus.) The HP-IB mnemonics are used to operate the analyzer from the HP-IB.

With echo turned on, you can operate the analyzer from the front panel and it will display the command mnemonics you must send over the bus to achieve the same results. Mnemonics are displayed on the third line in the upper-left corner of the screen.

Not every keystroke generates an HP-IB command. For example, you must press the sequence
[ **Freq** ] → [ CENTER ] → [ **1** ] → [ **0** ] → [ **kHz** ]
before the command "FREQ:CENT 10000" is echoed to the screen.

---

**Note**

When echo is on, the analyzer also displays valid commands sent to the analyzer over the HP-IB. This is useful when debugging HP Instrument BASIC programs.

---

## [GRID ON OFF] softkey

Key Path: [ **Disp Format** ] → [ MORE ]

Turn on or off the overlay grid (graticule) for the active trace.

---

**Note** If you turn off a trace grid, it will not appear on an external printer/plotter.

---

## [GRID PEN] softkey

Key Path: [ **Plot/Print** ] → [ PLOT PEN SETUP ]

Specify which plotter pen should be used for plotting trace grids.

## [GRID] softkey

See [ PLOT DATA SELECT ] softkey.

## [HANNING] softkey

Key Path: [ **Window** ]

Select the Hanning window for both input channels. The Hanning window attenuates the input signal at both ends of the time record to zero. This forces the signal to appear periodic. The Hanning window offers better frequency resolution, but poorer amplitude accuracy than the Flat Top window.

The Hanning window is the most commonly-used window, and is particularly useful for random noise measurements. This window should not be used for burst or chirp source types or other strictly periodic signals.

The Hanning window is sometimes called the Hann window or random window.

For more information on the Hanning window and its applications, see the analyzer's *Concepts Guide.*

*See also:* [ FLAT TOP ] softkey

## Hardkeys

There are five groups of hardkeys on the analyzer's front panel:

- DISPLAY.
- MEASUREMENT.
- SYSTEM.
- MARKER.
- Numeric entry.

The keys in these groups are referred to as hardkeys because the function assigned to each key never changes (except during alpha entry and program editing). In contrast, the function assigned to each softkey can change.

A "hardkey label" is printed directly on each hardkey. The label tells you which function is assigned to that key. In the help text, hardkeys are represented by enclosing hardkey labels in brackets (for example, "The [ **Help** ] hardkey is used to..."). The hardkey label is mixed upper case and lower case.

An engraved letter appears at the lower-right corner of most hardkeys. This letter tells you which alpha character will be inserted to the left of the text cursor when you press a hardkey during alpha entry or program editing.

*See also:* Alpha entry mode

## Hardware test softkeys

Key Path: [ **System Utility** ]

Enable special setups during self tests and service tests.

You should only use these softkeys as directed in your *HP 35665A Installation and Verification Guide* or *Service Guide.*

## [HARMONIC MARKER] softkey

Key Path: [ **Marker Fctn** ]

Turn on and set up harmonic markers. This marker shows the harmonics for a particular fundamental frequency. From the harmonic marker menu you can do the following things:

- Enter the fundamental frequency.
- Specify the number of harmonic markers you want displayed.
- Turn off computation.
- Display total harmonic distortion (THD).
- Display harmonic power.

Harmonic markers are available only for frequency domain or order domain data.

*See also:* [ HARMONIC POWER ] softkey, [ THD ] softkey, [ COMPUTE OFF ] softkey, [ NUMBER OF HARMONICS ] softkey, [ FUNDAMNTL FREQUENCY ] softkey

## [HARMONIC POWER] softkey

Key Path: [ **Marker Fctn** ] → [ HARMONIC MARKER ]

Compute and display the harmonic power (absolute) for the current fundamental frequency. The value is displayed in the lower left corner of the trace box.

The analyzer calculates harmonic power by measuring the absolute value of the identified harmonics of the fundamental frequency. Noise and other signals at other points along the frequency spectrum are not taken into account (unless they happen to occur at a harmonic frequency).

The harmonic power results reflect the harmonics in the current frequency span. The number of harmonics you specify is the maximum number the analyzer uses in the calculation. For example, if you press [ NUMBER OF HARMONICS ] and enter 10, the harmonic power calculation does not include all ten harmonics if some of these harmonics are outside the current span.

If the trace coordinate is dB magnitude, the analyzer displays harmonic power in dBVrms. For other trace coordinates, the analyzer displays harmonic power in Vrms ^ 2.

*See also:* [ **Trace Coord** ] hardkey, [ NUMBER OF HARMONICS ] softkey, [ FUNDAMNTL FREQUENCY ] softkey

## [Help] hardkey

| To do this: | Press this key: |
|---|---|
| Turn help on | [ Help ] |
| Turn help off | [ 0 ] |
| Get help on a key | [ <key> ] |
| Jump to a topic | [ 4 ] |
| Return to previous topic | [ 7 ] |
| Go to index | [ 1 ] |
| Display next page | [ ↓] |
| Display previous page | [ ↑] |
| Select help topic or link | Turn the knob |
| Print the current screen | [ 8 ] |

Online help is a special operating mode available in the HP 35665A. You enter this mode by pressing [Help]. You exit by pressing [0].

There are two distinct methods you can use to access information while using online help:

- PRESS ANY KEY for information on that key.
- SELECT A TOPIC from the online help index.

PRESSING A HARDKEY OR SOFTKEY—When the analyzer is in the online help mode, you can press any hardkey or softkey to display information on that key. Menus remain active so you can get help on any softkey, but the analyzer setup doesn't change when you press keys.

SELECTING AN INDEX ENTRY—You can display the help index by pressing [1]. It contains an alphabetical listing of all help topics (including key descriptions). Turn the knob to select a topic, then press [4] to display it. Use the up and down arrow keys to move backward and forward one page in the index.

Most topics listed in the index describe the hardkeys and softkeys, but some are of a more general nature. These more general topics are only available through the index or links.

Some index entries provide cross-references to the available help topics. These entries end with "(XREF)." The name of an XREF entry does not match the name of the topic it displays.

The basic functions you use to move around in help are assigned to the number keys. A legend at the BOTTOM OF THE SCREEN shows you which function is assigned to each number key. The following topics describe the basic functions:

- Quitting online help.
- Paging through help screens.
- Displaying a related help topic.
- Returning to a previous help topic.

The print function—assigned to [ 8 ]—allows you to print topics one screen at a time. But before you can use this function, you must designate the analyzer as the system controller and enter the printer's HP-IB address under the [ PRINTER ADDRESS ] softkey.

*See also:* [ PRINTER ADDRESS ] softkey, Controller Capability softkey group, Returning to a previous help topic, Displaying a related help topic, Paging through help screens, Quitting online help

## [HIDN LINE ON OFF] softkey

Key Path: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Turn on or off hidden line removal on the waterfall display.

When hidden line removal is off, the analyzer displays all of every trace. This can clutter the display if you are displaying many traces.

When hidden line removal is on, the analyzer does not display portions of traces that lie behind previous traces.

*See also:* [ WATERFALL ] softkey

## Histogram averaging

The analyzer does not allow averaging for histogram measurements. The average softkeys for histogram measurements allow you to do the following things:

- Select fast average mode—this specifies whether the analyzer should display intermediate results or wait until the histogram length is complete.
- Turn average repeat on or off. This specifies whether the analyzer should take one histogram length and stop or continue taking measurements.

*See also:* [ HISTOGRAM LENGTH ] softkey, [ HISTOGRAM LENGTH ] softkey, [ FAST AVG ON OFF ] softkey, [ REPEAT ON OFF ] softkey (histogram)

## [HISTOGRAM BINS] softkey

Key Path: [ **Freq** ]

Specify the X-axis resolution for the histogram measurement displays.

Limits: 4 to 1024 in powers of 2 Default: 512

*Hint:* For an optimal histogram measurement, set the number of bins (in points) equal to the square root of the [ HISTOGRAM LENGTH ].

The analyzer's X-axis displays from (–1.42 times input range) to (+1.42 times input range) in volts. The resolution is determined by dividing that value by the [ HISTOGRAM BINS ].

For example, if the input range is +3.9858 Vpk, the analyzer displays from –5.66V to +5.66V, a total of 11.32V. If you specified 512 histogram bins, each point represents (11.32V / 512), or 22.1 mV.

*See also:* [ HISTOGRAM LENGTH ] softkey

## [HISTOGRAM CHANNEL x] softkey

Key Path: [ **Meas Data** ]

Display the number of samples versus amplitude (in volts peak). The Y-axis displays the number of samples at each amplitude.

The following parameters affect the histogram measurement:

- Histogram bins.
- Input range.
- Histogram length.
- Sample time or record length.

The analyzer bypasses the anti-alias filters and digital filters for histogram measurements.

*See also:* [ HISTOGRAM LENGTH ] softkey, [ CHANNEL x RANGE ] softkey, [ HISTOGRAM BINS ] softkey, [ SAMPLE TIME ] softkey

## [HISTOGRAM LENGTH] softkey

Key Path: [ **Freq** ]

Specify how long you want a histogram measurement to be. You can specify a number of points, seconds, or records (a record is 1024 points).

Limits: 1 to 2.8e14 points — Default: 1 record (1024 points)

*Hint:* For an optimal histogram measurement, set the histogram length (in points) equal to [ HISTOGRAM BINS ] squared.

The analyzer collects data for either the specified number of points, records, or time. If repeat is on, the analyzer clears the data and starts another measurement as soon as the specified [ HISTOGRAM LENGTH ] is complete.

---

**Note** If you specify a [ HISTOGRAM LENGTH ] that is not an integral multiple of time records, the analyzer collects enough data to complete the last time record. However, it only uses the specified [ HISTOGRAM LENGTH ] for the histogram computations.

---

*See also:* [ HISTOGRAM BINS ] softkey, [ REPEAT ON OFF ] softkey (histogram)

## Histogram/Time frequency keys

For histogram analysis, the following softkeys are under the [ **Freq** ] hardkey:

- Record time.
- Sample time.
- Histogram length.
- Histogram bins.

*See also:* [ RECORD TIME ] softkey, [ SAMPLE TIME ] softkey, [ HISTOGRAM LENGTH ] softkey, [ HISTOGRAM BINS ] softkey

## [HISTOGRAM/TIME] softkey

Key Path: [ **Inst Mode** ]

Specify the histogram/time instrument mode.

The histogram measurement shows how the amplitude of the input signal is distributed between its maximum and minimum values. Some of its uses are determining the statistical properties of noise and monitoring the performance of electromechanical positioning systems.

Histogram measurements are only armed and triggered once. The measurement runs for the specified histogram length and stops. If repeat is on, the analyzer then clears the data and performs another histogram over the specified histogram length.

The accuracy of the histogram is dependent on the following parameters:

- Histogram bins.
- Sample time.
- Histogram length.

The following results are available from a histogram measurement:

- Histogram.
- Probability Density Function.
- Cumulative Density Function.
- Unfiltered Time.

For more information on histogram measurements, refer to the analyzer's *Concepts Guide.*

*See also:* [ UNFILTERD TIME CH x ] softkey, [ HISTOGRAM LENGTH ] softkey, [ SAMPLE TIME ] softkey, [ HISTOGRAM BINS ] softkey, [ CDF CHANNEL x ] softkey, [ PDF CHANNEL x ] softkey, [ HISTOGRAM CHANNEL x ] softkey

## [HOLD BOTTOM] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Hold the bottom marker for Y-axis scaling. When you turn the knob or enter a value from the numeric keyboard, the top marker moves.

*See also:* [ AXES SCAL MARKERS ] softkey

## [HOLD CENTER] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Hold the center marker for axis scaling. When you turn the knob or enter a value from the numeric keyboard, the right and left or top and bottom markers move toward or away from each other (the width changes). The center value remains unchanged.

*See also:* [ AXES SCAL MARKERS ] softkey

## [HOLD LEFT] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Hold the left marker for X-axis Y-axis scaling. When you turn the knob or enter a value from the numeric keyboard, the right marker moves.

*See also:* [ AXES SCAL MARKERS ] softkey

## [HOLD RIGHT] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Hold the right marker for X-axis Y-axis scaling. When you turn the knob or enter a value from the numeric keyboard, the left marker moves.

*See also:* [ AXES SCAL MARKERS ] softkey

## [HOLD SCALE] softkey

Key Path: [ Scale ] → [ AXES SCAL MARKERS ]

Hold the axis scale constant. Turning the knob moves the markers but does not change the scale. You must use [ SCALE AT MARKERS ] to change the scale.

The way the markers move depends on the current "hold" selection (right, top, center, left, bottom, or width).

*See also:* [ HOLD WDTH (SCROLL) ] softkey, [ HOLD LEFT ] softkey, [ HOLD TOP ] softkey, [ HOLD CENTER ] softkey, [ HOLD RIGHT ] softkey, [ HOLD BOTTOM ] softkey, [ SCALE AT MARKERS ] softkey

## [HOLD SETUP] softkeys

Key Path: [ Avg ]

Turn on or off average hold for octave measurements. When you select maximum or minimum, the analyzer displays the maximum or minimum averaged spectrum value for each band. This applies for linear, exponential, and equal confidence octave average types. It does not affect peak hold.

The following softkeys are in the menu:

- Off — turn off the average hold feature.
- Maximum — hold the maximum averaged spectrum value.
- Minimum — hold the minimum averaged spectrum value. This is useful for estimating background noise.

**Note** The main difference between hold maximum and peak hold is that Peak Hold displays the absolute maximum within a band, while Hold Maximum displays the maximum averaged value.

**Note** When you select maximum or minimum hold, the analyzer effectively sets the number of waterfall steps to 1. If you pause a measurement with a waterfall displayed, the analyzer displays only 1 trace.

*See also:* [ WATERFALL STEPS ] softkey, [ PEAK HOLD ] softkey (octave), [ EQUAL CONFID ] softkey, [ EXPONENTL ] softkey, [ STABLE ] softkey

## [HOLD TOP] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Hold the top marker for Y-axis scaling. When you turn the knob or enter a value from the numeric keyboard, the bottom marker moves.

*See also:* [ AXES SCAL MARKERS ] softkey

## [HOLD WDTH (SCROLL)] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Hold the marker width for axis scaling. When you turn the knob or enter a value from the numeric keyboard, the center value changes. The distance between the right and left or top and bottom markers remains unchanged.

*See also:* [ AXES SCAL MARKERS ] softkey

## [HOLDOFF TIME] softkey

Key Path: [ **Trigger** ] → [ TACHOMETR SETUP ]
or: [ **Input** ] → [ TACHOMETR SETUP ]

Specify a "tachometer delay" in seconds.

Limits: 0 s to 52.224 ms    Default: 0 s

The analyzer waits this amount of time after receiving a valid tach transition before it will accept another tachometer input. This allows multiple tach transitions to occur within any one tach edge, "cleaning up" the tach edge.

## HP-IB controllers

When you connect devices using the HP-IB, one device must coordinate activity on the bus. The coordinating device is called the "controller." The analyzer can act as a controller.

Sometimes, you may have more than one device on the bus that can function as a controller. Only one of these devices can coordinate bus activity at any given time. The device that is currently coordinating bus activity is called the "active controller."

One device on the bus must be designated as the "system controller." The system controller can always take control of the bus—even if it is not currently the active controller. The analyzer is designated as the system controller if you press [ SYSTEM CONTROLLR ].

The analyzer cannot function as the system controller when [ ADDRESSBL ONLY ] is selected, but it *can* function as the active controller. The current active controller must simply pass control to the analyzer.

## HP-IB overview

HP-IB, the Hewlett-Packard interface bus, allows you to build an integrated test system from individual devices (instruments and computers). If a device complies with the IEEE 488.1 standard, HP-IB cables can link it into a system. This analyzer is such a device.

Each device is assigned a unique HP-IB address. This allows one device, referred to as the controller, to coordinate the activities of all other devices on the bus. The controller can issue an instruction to a particular device by prefacing the instruction with that device's address.

## [HP-IB TRIGGER] softkey

Key Path: [ Trigger ]

Select HP-IB triggering. This lets you synchronize a measurement to a trigger command issued via the HP-IB. To use the HP-IB trigger, make sure the analyzer's HP-IB connector—located on the rear panel—is connected to the controller that issues the trigger command

Once the analyzer is armed, triggering occurs via one of three HP-IB commands:

- Group Execute Trigger (GET)
- *TRG
- TRIG:IMM

After the analyzer is triggered, additional HP-IB trigger commands are ignored until the measurement is complete and the analyzer is re-armed. The controller can detect these conditions by reading the analyzer's status registers. To learn more about HP-IB triggering, see *HP-IB Programming with the HP 35665A*.

**Note** HP-IB triggering is not available with Order Analysis mode (Option 1D0).

## HP Instrument BASIC edit menu

The HP Instrument BASIC edit menu and its submenus provide access to special characters and editing functions when the analyzer is in the HP Instrument BASIC edit mode.

[ ENTER ] accepts any changes you have made to the current line. [ END EDIT ] exits the edit mode and displays the INSTRUMNT BASIC menu.

Three softkeys—[ INSERT LINE ], [ DELETE LINE ], and [ RECALL LINE ]—allow you to reorganize your program one line at a time. Another line-oriented softkey—[ GOTO LINE ]—lets you move the text cursor quickly to a particular line number or program label.

There are two character-oriented softkeys. [ INSERT SPACE ] inserts a space character to the left of the text cursor. [ DELETE CHARACTER ] deletes the character under the text cursor.

The [ TYPING UTILITIES ] softkey gives you access to additional characters, HP Instrument BASIC keywords, and a case-shifting function.

## [HZ (SEC)] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ]

Specify Hz for frequency domain X-axis units and seconds for time domain X-axis units.

## [HZ/ORDER RATIO] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ Order Setup ]

Specify the speed of rotation in Hz/order or rpm/order. The analyzer uses this value as the first order when the X-axis unit is order.

*See also:* [ ORDER (REV) ] softkey

## [ICP SUPLY ON OFF] softkey

Key Path: [ **Input** ] → [ CHANNEL x SETUP ]

Enable or disable the ICP supply on the corresponding input channel. This connects the internal 4 mA current source to the input connector. The nominal voltage output is 24 V dc (open circuit).

To avoid measurement distortion and maximize the analyzer's dynamic range, use ac coupling when the ICP supply is on.

*See also:* [ COUPLING AC DC ] softkey

## [IMAG() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the imaginary part of the operand.

The imaginary part of a complex number "a + jb" is "b."

## [IMAGINARY PART] softkey

Key Path: [ **Trace Coord** ] → [ MORE: NYQ REAL IMAG ]

Display the imaginary part of the measurement results on the active trace.

Here are some characteristics of the imaginary part trace:

- If there's no imaginary data, the waveform is a flat line, showing zero magnitude.
- For complex data, the imaginary trace represents the imaginary part of the complex FFT data.
- For time waveforms, the imaginary trace represents the imaginary part of the Hilbert transform of the real part. For example, a 2 volt peak sine wave input in zoom mode appears as a frequency-shifted 2 volt peak sine in the real part trace, and as a frequency- and phase-shifted 2 volt peak sine wave in the imaginary part trace.

## [IMPULSE] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Avg** ]

Compute and display the IEC 651 impulse characteristic in the overall power band (far right band in the display).

For linear averaging, the analyzer calculates the value of the impulse output over the average time. For other average types, the analyzer calculates the instantaneous value of the impulse vector. The bandwidth of the impulse detector is dc to the value listed in the table below.

Turning on the impulse detector limits the maximum center band frequency and the broadband frequency as listed in the following table:

| | **Full Octave** | | **1/3 Octave** | | **1/12 Octave** | |
|---|---|---|---|---|---|---|
| | Center | Broad | Center | Broad | Center | Broad |
| 1 channel | 8.0 kHz | 25.6 kHz | 16.0 kHz | 25.6 kHz | 11.313 kHz | 12.8 kHz |
| 2 channel | 4.0 kHz | 12.8 kHz | 8.0 kHz | 12.8 kHz | 5.657 kHz | 6.4 kHz |

*See also:* [ STOP ] softkey (octave frequency), [ AVERAGE TIME ] softkey

## Inactive softkeys

Some softkeys are inactive for particular analyzer setups. For example, the [ COHERENCE ] measurement data softkey is inactive during 1-channel measurements. This is because the coherence computation requires data from two channels.

The analyzer uses a ghosted font to indicate that a softkey is inactive.

*See also:* Fonts

## [INCREMENT] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ RENUMBER ]

Before you renumber a program, press [ INCREMENT ] to specify the increment between the renumbered lines. An entry window is displayed so you can enter a new value.

After you have specified the starting line number and the increment between line numbers, press [ PERFORM RENUMBER ] to renumber your program.

*See also:* [ START LINE # ] softkey (Renumber), [ RENUMBER ] softkey, [ PERFORM RENUMBER ] softkey

## [INP RANGE TRACKING] softkey

Key Path: [ **Scale** ]

Turn input range tracking on or off for the active trace. In this mode, the analyzer references the scale to the input range according to the trace coordinate you've selected.

- For linear magnitude traces, the bottom reference always stays at zero. The [ Y PER DIV ] is adjusted so the top of the scale is greater than or equal to the current input range.
- For logarithmic magnitude traces, the top reference always stays at the current input range.
- For real and imaginary traces, the center reference always stays at zero. The [ Y PER DIV ] is adjusted so the top of the scale is greater than or equal to the current input range.
- Phase traces do not use input range tracking.

Input range tracking is turned off during an autoscale procedure or when you change the [ Y PER DIV ] for real, imaginary, or linear magnitude traces.

Input range tracking is not available when you display frequency response, coherence, or math functions.

*See also:* [ Y AUTO SCAL ONCE ] softkey, [ TOP REFERENCE ] softkey, [ CENTER REFERENCE ] softkey, [ Y PER DIV (DECADES) ] softkey, [ Y PER DIV (DECADES) ] softkey, [ BOTTOM REFERENCE ] softkey, [ **Trace Coord** ] hardkey

## [Input] hardkey

Select an appropriate input configuration.

The softkeys under the [ **Input** ] hardkey allow you to do the following things for each input channel:

- Set the range, either manually or automatically (the default is automatically).
- Specify the grounding mode.
- Specify ac or dc coupling.
- Turn the antialias filter on or off.
- Turn the A-weight filter on or off.
- Turn the ICP power supply on or off.
- Specify engineering units label and multiplier.

If you overload the current input range, the "OV1" or "OV2" status indicators at the top of the analyzer's screen become bold.

*See also:* [ ENG UNIT MULTIPLIER ] softkey, [ ENG UNIT LABEL ] softkey, Engineering units, [ ICP SUPLY ON OFF ] softkey, [ A WT FLTR ON OFF ] softkey, [ ANTIALIAS ON OFF ] softkey, [ COUPLING AC DC ] softkey, [ INPUT LOW FLOAT GND ] softkey, [ CHx AUTO RANGE ] softkey, [ CHANNEL x RANGE ] softkey

## [INPUT LOW FLOAT GND] softkey

Key Path: [ **Input** ] → [ CHANNEL x SETUP ]

Select a pseudo-floating or grounded input mode for the input channel's low side (the shell of the BNC connector).

The pseudo-floating input mode has a 1 Mohm resistance from the shell of the BNC connector to the analyzer's chassis ground—that's why it's called a "pseudo-floating" input, since the input connector's low side is not completely isolated from the chassis ground.

The grounded input mode has a 55 ohm resistance from the shell of the BNC connector to the analyzer's chassis ground.

Both pseudo-floating and grounded input modes have a 1 Mohm resistance (shunted by less than 100 pF) from the center conductor to the shell of the BNC input connector.

## [INPUT STATE] softkey

Key Path: [ **Disp Format** ]

Display the analyzer's current input configuration—how you've set up the input channels and tachometer input. Use this display and one of the plot or print softkeys to document the input setup for a particular measurement.

You can also use this display while you are setting up a measurement. The analyzer updates the display when you change input settings.

---

**Note**

The input state is displayed until you select another option under [ **Disp Format** ].

If you select either [ UPPER ] or [ LOWER ] under the [ **BASIC** ] → [ DISPLAY SETUP ] key, the analyzer changes the display format to upper/lower.

---

*See also:* [ TACHOMETR SETUP ] softkey (Trigger), [ CHANNEL x SETUP ] softkey

## [INSERT KEYWORD] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ] →
[ TYPING UTILITIES ]

Insert complete keywords before the text cursor when you are editing a program.

Here's how you insert a keyword:

1. Press [ INSERT KEYWORD ].
2. Press the hardkey whose engraved letter corresponds to the first character of the keyword you want.
3. Locate the keyword in the resulting menu. (If more than nine keywords begin with the same character, you may need to press a [ MORE ] softkey to locate the keyword you want.
4. Insert the keyword in your program by pressing the corresponding softkey.

**Note** Use the [ CANCEL ] softkey to return to the Typing Utilities menu without inserting a keyword.

## [INSERT LINE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Enable and disable insert line mode when you are editing an HP Instrument BASIC program.

When the editor enters insert line mode, it creates a blank line above the current line (the one containing the text cursor) and moves the cursor to that line. When the editor exits insert line mode, it deletes the current line and moves the text cursor to the next line.

*Hint:* To save the contents of the current line, press [ ENTER ] before you exit insert line mode.

When the editor is in insert line mode, it adds a new line after the current line each time you press [ ENTER ] (assuming the current line contains no syntax errors). This continues until you exit insert line mode—either by pressing [ INSERT LINE ] or by moving the text cursor to another line with the knob.

## [INSERT SPACE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ BASIC ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Insert a space before the cursor in the program you are editing.

## Insert special characters softkeys

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ BASIC ] → [ INSTRUMNT BASIC ] → [ EDIT ] → [ TYPING UTILITIES ]

Each of these softkeys gives you access to a special character during program editing. When you press one of these softkeys, the characters listed after "INSERT" are displayed in a menu. You can then insert one of these characters before the text cursor by pressing the corresponding softkey.

**Note** The [ CANCEL/RETURN ] softkey allows you to return to the Typing Utilities menu without inserting a special character.

## [Inst Mode] hardkey

Specify the type of measurement being made and whether signals applied to the front panel input connectors or previously captured signals are being measured.

The instrument modes available are:

- FFT analysis.
- Octave analysis (with option 1D1).
- Order analysis (with option 1D0).
- Swept sine (with option 1D2).
- Correlation analysis.
- Histogram/Time.
- Time capture.
- 1 channel.
- 2 channel.

Instrument mode is a major selection that changes the "personality" of the analyzer. This means that other parameters and menus change when you change instrument mode.

*See also:* [ 2 CHANNEL ] softkey, [ 1 CHANNEL ] softkey, [ CAPTURE ON OFF ] softkey, [ HISTOGRAM/TIME ] softkey, [ CORRELATN ANALYSIS ] softkey, [ SWEPT SINE ] softkey, [ ORDER ANALYSIS ] softkey, [ OCTAVE ANALYSIS ] softkey, [ FFT ANALYSIS ] softkey

## [INSTRUMNT BASIC] softkey

(Available only with opt. 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ]

Access the softkeys for editing, selecting, printing, debugging, and labeling programs.

*See also:* [ LABEL PROGRAM ] softkey, [ DEBUG ] softkey, [ PRINT PROGRAM ] softkey, [ SELECT PROGRAM ] softkey, [ EDIT ] softkey

## [INTEG() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Perform a first-order approximation to a running integral.

If F1 = INTEG(D1), the value of F1 is defined as follows:

$$F1[i] = (D1[i] * dx[i]) + (D1[i-1] * dx[i-1]) + (D1[i-2] * dx[i-2]) + \dots$$

where F1[i] and D1[i] are the values of the ith data point of F1 and D1, respectively, and dx[i] is the width of the ith data point of D1.

In other words, the ith point in F1 is the sum of all points in D1, up to and including the ith point, with each point multiplied by its width.

One application for integration is converting time domain data from acceleration to velocity. (For frequency domain data, use the "/jOMEGA" operation.)

*See also:* [ /jOMEGA( ] softkey

## [INTEGRATE TIME] softkey (swept sine)

(Available only with option 1D2, Swept Sine)

Key Path: [ Avg ]

Specify the integrate time for each swept sine measurement point. Integrate time is the amount of time that each point is measured.

Limits: 1 to 234 cycles — Default: 5 cycles
or: 250 us to 32,768 s

The integration filter's effective bandwidth is inversely proportional to the integration time (bandwidth = 1 / integrate time). Increasing integrate time effectively narrows the bandwidth at each measurement point. The result is greater harmonic rejection and increased signal-to-noise ratios but longer measurement times.

If you set the integrate time in cycles, the integration scale is proportional. The integrate time will be longer at lower frequencies; at higher frequencies the same number of cycles occurs in a shorter time.

If you set the integrate time in seconds, the analyzer tries to use a constant integration, with the following exceptions.

The analyzer integrates over an integer multiple of cycles at the measurement frequency. At low frequencies, if the integrate time is less than 1 complete cycle, the analyzer takes a complete cycle.

The integrate time is limited to 3200/filter span, where filter span is the equivalent FFT frequency span. As the sweep goes to higher frequencies, the integrate time may decrease. The following table lists the maximum integrate time for each frequency span.

| Equivalent span | Max integrate time | Equivalent span | Max integrate time |
|---|---|---|---|
| 51,200 Hz | .0625 s | 50 Hz | 64 s |
| 25,600 Hz | .125 s | 25 Hz | 128 s |
| 12,800 Hz | .250 s | 12.5 Hz | 256 s |
| 6,400 Hz | .500 s | 6.25 Hz | 512 s |
| 3,200 Hz | 1 s | 3.125 Hz | 1024 s |
| 1,600 Hz | 2 s | 1.5625 Hz | 2048 s |
| 800 Hz | 4 s | 781.25 mHz | 4096 s |
| 400 Hz | 8 s | 390.625 mHz | 8192 s |
| 200 Hz | 16 s | 195.3125 mHz | 16384 s |
| 100 Hz | 32 s | 97.65625 mHz | 32768 s |

*See also:* [ SWEPT SINE ] softkey

## [INTERNAL DISK] softkey

Key Path: [ **Disk Utility** ] → [ DEFAULT DISK ]
or: [ **Save/Recall** ] → [ DEFAULT DISK ]

Select the analyzer's internal disk as the default disk.

The internal disk uses 3.5-inch flexible disks (double-sided, double-density or high-density) for storage. You must format each flexible disk before you use it.

*See also:* [ FORMAT DISK ] softkey, [ DEFAULT DISK ] softkey

## [INTRLEAVE FACTOR] softkey

Key Path: [ **Disk Utility** ] → [ FORMAT DISK ]

Define the sector numbering on the flexible disks you will format in the internal disk drive or an external disk drive.

Limits: 0 to 255 Default: 0

**Note** If you enter a 0, the analyzer will use interleave factors of 1 for LIF and 3 for DOS.

Save and recall operations are more efficient (faster) when you select the proper interleave factor. The default interleave factors of 1 for LIF and 3 for DOS are most efficient.

If you enter a value too large for the disk you are formatting, the analyzer uses the largest possible value.

*See also:* [ FORMAT DISK ] softkey

## [INVERSE FFT() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Perform an Inverse Fast Fourier Transform. If the size of the argument data block is not a power of two, the analyzer pads the data with zeros to the nearest power of two.

When you perform the IFFT on a linear spectrum collected using the Hanning or Flat Top window, the result will differ from the original time data. In this case, exchanging the left and right halves of the IFFT result will produce the original windowed time data.

The analyzer cannot compute the FFT for frequency data with more than 800 lines of resolution. For other domains, the number of data points must not exceed 2048.

If the argument's X-axis units are anything other than frequency or time, the analyzer performs the FFT but does not change the units.

*See also:* [ LIN SPEC CHANNEL x ] softkey (FFT analysis), [ FLAT TOP ] softkey, [ HANNING ] softkey

## [ITALIAN] softkey

See [ KEYBOARD SETUP ] softkeys.

## [KEYBOARD SETUP] softkeys

Key Path: [ **System Utility** ]

Specify what language keyboard you have attached to the analyzer. The analyzer accepts the following keyboards (the default is U.S. English):

- French.
- German.
- Italian.
- Spanish.
- Swedish/Finnish.
- U.K. English.
- U.S. English.

**Note** Configuring your analyzer to use a different keyboard **does not** localize the analyzer's help facility or screen annotation; it only ensures that the analyzer recognizes the proper keys for that particular keyboard.

For details on using an external keyboard, refer to the *Using I-BASIC with the HP 35665A* manual.

## Knob

The *knob* is an RPG (rotary pulse generator) that controls three things: movement of the on-screen marker, continuous entry of numeric values, and movement of the cursor in the help mode.

Usually, the knob simply moves the marker for the active trace. Turn the knob clockwise and the marker moves to the right. Turn counter-clockwise and the marker moves left. The faster you turn the knob, the faster the marker moves.

After you press a softkey that requires a numeric entry, the knob becomes dedicated to numeric entry. Turn the knob clockwise and the analyzer steps through larger numeric entries. Turn counter-clockwise and the analyzer steps through increasingly smaller entries.

Although the analyzer uses a default step size to control the "sensitivity" of the knob—that is, the interval between each numeric entry as you turn the knob—you can select your own "step size" for frequency entries. Press [ **Freq** ] and [ ENTRY STEP SIZE ]. Then use the numeric keypad to enter your own step size.

When numeric entry is active, an entry window appears at the top of the screen with the currently-selected numeric value. This window remains on screen for several seconds to give you a chance to enter a numeric value. If you don't make an entry, the window disappears after several seconds. If you use the knob (or the numeric entry keypad) to make an entry, this window remains on the screen. After you complete your entry, the window soon disappears and the knob returns to marker movement.

When you are using help, the knob scrolls through index entries and links in help text. Turn the knob clockwise to move down through the index or links; turn the knob counter-clockwise to move up.

*See also:* [ ENTRY STEP SIZE ] softkey

## [LABEL PROGRAM] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ]

Change the softkey label for the active HP Instrument BASIC program. This changes the [ RUN PROGRAM x ] softkeys and the [ PROGRAM x ] softkeys under [ SELECT PROGRAM ].

You are asked to enter the new label. The entry window already contains the current label, but you can modify it with the alpha entry keys.

*See also:* Alpha entry mode, [ PROGRAM x ] softkey, [ RUN PROGRAM x ] softkey

## [LAST ERROR] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ DEBUG ]

Redisplay the last error message generated by your program.

## [LEVEL HIGH LOW] softkey

(Available only with opt. 1D0, Computer Order Tracking, or opt. 1D1, Real Time Octave)

Key Path: [ **Trigger** ]

Specify whether a high or low TTL signal should trigger the analyzer for octave or order measurements. This applies for external triggering only.

**Note** The external trigger input floats to TTL high. If nothing is connected to the trigger input, the analyzer triggers immediately when you set [ LEVEL HIGH LOW ] to high.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ EXTERNAL TRIGGER ] softkey

## [LEVEL] softkey (source)

Key Path: [ **Source** ]

Specify an output level for the analyzer's source—this level applies to all waveforms. You can specify peak volts, true rms volts, peak dBV, or rms dBV. If you don't specify a new output level, the output levels remain at the level you set previously.

Limits: 0 Vpk to 5 Vpk Default: 0 Vpk
Steps: 200 uVpk

For random noise or periodic chirp the level you set is the total wideband level (in other words, the summation of these waveforms measured at full span). If you're using smaller frequency spans, not all of this energy will appear in the measurement because some of the waveform's power will be outside the selected span.

Unlike most source parameters, the source level is global for all instrument modes (except swept sine and order analysis). This means that if you specify a source level, then change the instrument mode, the source level remains the same.

The analyzer also keeps track of the units you specified for the level. For example, if you set the level in V rms for random noise, the analyzer maintains the rms level when you change to a different source output type. If you set the level in V peak, the analyzer maintains the peak level.

Because the ratio of peak-to-rms values is different for different source output types, the peak value changes when the analyzer maintains the rms value. The source output level is limited to +/– 5 V peak. If the new rms value would require a peak value outside this range, the analyzer sets the rms value to the maximum possible.

For example, the peak-to-rms ratio for random noise is approximately 4.4. The ratio for fixed sine is 1.414. If you set a source level of 1 V rms for random noise and then change the output type to fixed sine, the analyzer maintains the 1 V rms level. The peak voltage required for 1 V rms is 4.4 V for random noise and 1.414 V for fixed sine.

*See also:* [ **Inst Mode** ] hardkey, [ PERIODIC CHIRP ] softkey, [ RANDOM NOISE ] softkey

## [LEVEL] softkey (swept sine source)

Key Path: [ **Source** ]

Specify an output level for the analyzer's source in swept sine mode. You can specify peak volts, true rms volts, peak dBV, or rms dBV. If you don't specify a new output level, the output levels remain at the level you set previously.

*See also:* [ SWEPT SINE ] softkey

## [LEVEL] softkey (tachometer setup)

Key Path: [ **Trigger** ] → [ TACHOMETR SETUP ]
or: [ **Input** ] → [ TACHOMETR SETUP ]

Specify the tachometer trigger level.

Limits: Range setting (+/–4 V or +/–20 V) Default: 0

Choose a level (within the specified range) at which the signal is fairly clean and does not have multiple transitions through the specified level for any one tach edge.

**Note** The actual trigger level may vary slightly from the entered level. For this reason, you can enter levels between +/– 4.7 V for the lower range setting and +/– 25 V for the upper range setting.

*See also:* [ TRG RANGE +/- 20 4 ] softkey

## [LEVEL] softkey (trigger setup)

Key Path: [ **Trigger** ] → [ TRIGGER SETUP ]

Set the trigger level as a percentage of the current input range (do not confuse the input range with the vertical scale). When the trigger signal crosses this level, the analyzer makes a measurement.

Limits: –100% to +100% Default: 0%

**Note** The trigger level applies to channel 1 triggering and channel 2 triggering only. Free run, external, source, and HP-IB triggers are independent of the level setting.

The percentage of input range is in terms of *linear units*, not logarithmic units. For example, if your current input range is –5 dBVrms, you must first find the equivalent value in linear units (such as V, not dBV or dBVrms). The equivalent of –5 dBVrms is 795.27 mV. Then find the percentage of this value that approximates the trigger level you want to use. If you want the trigger to occur at 400 mV, set a trigger level of 50% (400 is 50% of 795.27).

You can also use input range tracking to see how the trigger level percentage relates to the input signal.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ INP RANGE TRACKING ] softkey, [ CHANNEL x RANGE ] softkey

## [LIMIT TEST] softkey

Key Path: [ **Analys** ]

Access the softkeys you need to define limits (also called limit lines) and to test trace data against those limits.

- [ LINES ON/OFF ] enables and disables display of the limits.
- [ TEST EVAL ON/OFF ] enables and disables evaluation of trace data against the limits.
- [ FAIL BEEP ON/OFF ] specifies whether the analyzer should beep when a limit test is failed.
- [ DEFINE UPPER LIMIT ] and [ DEFINE LOWER LIMIT ] let you define limits interactively from the front panel.

Each limit is defined as a series of line segments and maintained in a file. (These segments need not be joined at their endpoints.)

If you recall limit lines, be sure to set up the same Y-axis units and X-axis units that you used to create the limit lines. The analyzer does not store unit labels with the limit table. For example, an X-axis value of 1.2 kHz is stored as "1200" and a Y-axis value of –35 dBVrms is stored as "–35." If you use different X-axis or Y-axis units, limit testing will not work.

*Hint:* You can create a limit from a trace. Just display the trace you want to use, then press [ TRACE TO LIMIT ].

For information on limit testing over HP-IB, see the analyzer's *HP-Programming with the HP 35665A* manual.

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**Note** Limit testing is not available for order track measurement data.

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## [LIMIT x LINE TYPE] softkeys

Key Path: [ **Plot/Print** ] → [ PLOT LINE SETUP ] → [ LIMIT A LINE TYPE ]
or: [ **Plot/Print** ] → [ PLOT LINE SETUP ] → [ LIMIT B LINE TYPE ]

Specify the line pattern that will be used to plot the limit line for each of the analyzer's two traces.

Line type changes apply only to trace A if you pressed [ LIMIT A LINE TYPE ] to display these softkeys, or to trace B if you pressed [ LIMIT B LINE TYPE ].

*See also:* Line type softkeys

## [LIN SPEC CHANNEL x] softkey (FFT analysis)

Key Path: [ **Meas Data** ]

Display the linear spectrum for the specified channel. The linear spectrum computation depends on the type of averaging active.

| | | |
|---|---|---|
| Averaging off, rms averaging, rms exponential, or peak hold | : | crtn * fft (windowed time) |
| Vector averaging | : | sum (crtn * fft (wtime))/N |
| Vector exponential averaging | : | (1/N) * (crtn * fft (wtime)) + ((N-1)/N) * linspec |

| | | |
|---|---|---|
| where: N | = | number of averages |
| wtime | = | windowed time |
| crtn | = | correction for channel x |
| linspec | = | linear spectrum channel x |

*See also:* [ RMS EXPONENTL ] softkey, [ CAL CONST ON OFF ] softkey, [ NUMBER AVERAGES ] softkey, [ WINDOWED TIME CH x ] softkey, [ VECTOR EXPONENTL ] softkey, [ PEAK HOLD ] softkey, [ VECTOR ] softkey, [ RMS ] softkey

## [LIN SPEC CHANNEL x] softkey (swept sine)

(Available only with option 1D2, Swept Sine)

Key Path: [ **Meas Data** ]

Display the most recent swept linear spectrum for the specified channel. The trace is updated at each new sweep point.

## Line type softkeys

Specify the line pattern that will be used to plot each of the analyzer's two traces.

- [ SOLID ] specifies a solid line.
- [ DOTTED ] specifies a dotted line.
- [ DASHED ] specifies a dashed line.
- [ USER DEFINED ] activate the user line type (if supported by your plotter or printer).
- [ USER LINE TYPE ] allows you to enter the encoded value for a particular line type. See your printer or plotter documentation for information on the lines types available and the codes.

Line type changes apply only to trace A if you pressed [ TRACE A LINE TYPE ] to display these softkeys. They apply only to trace B if you pressed [ TRACE B LINE TYPE ].

## [LINEAR MAGNITUDE] softkey

Key Path: [ **Trace Coord** ]

Display the magnitude of the active trace on a linear Y-axis scale. The Y-axis value is the square root of (real part squared plus imaginary part squared).

*See also:* [ **Active Trace** ] hardkey

## [LINEAR] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Avg** ]

Specify linear averaging for an octave measurement.

For linear averaging the analyzer performs a linear integration over time of the magnitude squared power in each measurement band. Specify the integration time by pressing [ AVERAGE TIME ]

See [ REPEAT ON OFF ] for information on how that parameter affects linear averaging.

*See also:* [ REPEAT ON OFF ] softkey (octave), [ AVERAGE TIME ] softkey, [ OCTAVE ANALYSIS ] softkey

## [LINES ON OFF] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ]

Enable and disable the display of limit lines for the active trace.

The analyzer can evaluate a trace against the current limits even when limit lines are not displayed. Just toggle [ TEST EVAL ON OFF ] to ON.

*See also:* [ TEST EVAL ON OFF ] softkey

## [LN() softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the natural logarithm (base e) of the operand.

The natural logarithm (base e) of a complex number a + jb is

ln(sqrt(a^2+b^2)) + j* arctan(b/a).

The imaginary part of the result is the phase of the original complex number. When computing the logarithm of a block of complex data, the analyzer uses the unwrapped phase in radians.

*See also:* [ UNWRAPPED PHASE ] softkey

## [Local/HP-IB] hardkey

Press the [ Local/HP-IB ] hardkey for one of the following reasons:

- To gain access to softkeys that define the analyzer's HP-IB parameters.
- To return the analyzer to local control when it is being operated from the HP-IB.
- To abort a running HP Instrument BASIC program.

The softkeys grouped under this hardkey allow you to do the following things:

- Abort HP-IB operations initiated by the analyzer.
- Specify the analyzer's controller capabilities.
- Set the analyzer's address.
- Tell the analyzer what addresses you are using for attached printer, plotter, and disk drive.
- Specify whether HP-IB mnemonics should be echoed to the display when equivalent keys are pressed.
- Interrupt a controller that is operating the analyzer from the HP-IB.

When you operate the analyzer from the HP-IB, all hardkeys on the analyzer's front panel—except for [ Local/HP-IB ]—are disabled. You can press [ Local/HP-IB ] to suspend remote (HP-IB) operation and reenable local (front-panel) operation.

---

**Note**

If the analyzer has received the Local Lockout (LLO) command via the HP-IB, *all* hardkeys are disabled. In this case, you can not reenable front-panel operation from the front panel. The analyzer must receive the Go To Local (GTL) command via the HP-IB.

---

The analyzer cancels any pending *OPC command or query when you suspend remote operation.

See the *HP-IB Programming with the HP 35665A* manual for more information about remote operation of the analyzer.

*See also:* [ HPIB ECHO ON OFF ] softkey, [ DISK ADDRESS ] softkey, [ PLOTTER ADDRESS ] softkey, [ PRINTER ADDRESS ] softkey, [ ANALYZER ADDRESS ] softkey, Controller Capability softkey group, [ ABORT HP-IB ] softkey

## [LOG MAGNITUDE] softkey

Key Path: [ **Trace Coord** ]

Display the magnitude of the active trace on a logarithmic Y-axis scale. The Y-axis value is calculated using the following equation:

Y = square root (i ^ 2 + r ^ 2)

where r is the real part and i is the imaginary part.

*See also:* [ **Active Trace** ] hardkey

## [LOWER] softkey (BASIC display)

See [ DISPLAY SETUP ] softkey group.

## [MAG(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the magnitude of the operand.

The magnitude of a complex number a + jb is given by sqrt (a ^ 2 + b ^ 2). In polar form, the magnitude of me ^ jp is simply m.

## [MANUAL ARM] softkey

Key Path: [ **Trigger** ]
or: [ **Trigger** ] → [ ARM SETUP ]

Select manual trigger arming. This means the analyzer cannot make a measurement until you manually arm the trigger by pressing the [ ARM ] softkey. Once you arm the trigger, the analyzer will make a measurement if the trigger conditions are met.

To make additional measurements, you'll have to press [ ARM ] each time.

---

**Note** For averaged measurements, you must arm each average.

---

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

## [MANUAL FREQ] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Set manual frequency for a swept sine measurement. This is the actual frequency of measurement; it must fall between the start and stop frequencies.

You may make a numeric entry after pressing this key, or perform a manual sweep by pressing the arrow keys in the numeric entry key group. The amount of increment or decrement is determined by the resolution you set up.

This key is only used for manual sweep. A numeric entry made while this key is inactive will be used the next time you select manual sweep.

*See also:* [ RESOLUTN ] softkey, [ STOP ] softkey (swept sine frequency), [ START ] softkey (swept sine frequency), [ SWEEP AUTO MAN ] softkey

## [MANUAL PREVIEW] softkey

Key Path: [ Avg ] → [ PREVIEW SETUP ]

Turn on the manual preview feature.

When manual preview is on, you can decide which data should be included in the measurement results.

After each time record is collected, it is displayed. You must either accept or reject the time record for both channels by pressing [ REJECT TIME REC ] or [ ACCEPT TIME REC ]. The analyzer waits until you respond.

*See also:* [ ACCEPT TIME REC ] softkey, [ REJECT TIME REC ] softkey

## [Marker Fctn] hardkey

Select from the following specialized marker functions:

- Harmonic markers.
- Band markers.
- Sideband markers.
- Waterfall markers.
- Time markers.
- Gain and phase margins and crossovers.
- Resonant frequency and damping.
- Supplemental information.

*See also:* [ SUPLMENTL INFO ] softkey, [ FREQ & DAMPING ] softkey, [ GAIN PHAS MARGINS ] softkey, [ TIME PARAMTERS ] softkey, [ WATERFALL MARKERS ] softkey, [ SIDEBAND MARKER ] softkey, [ BAND MARKER ] softkey, [ HARMONIC MARKER ] softkey

## [MARKER FCTN OFF] softkey

Key Path: [ **Marker Fctn** ]

Turn off any marker function that is on.

*See also:* [ **Marker Fctn** ] hardkey

## Marker Group

This group includes the [ **Marker** ] and [ **Marker Fctn** ] hardkeys and the knob.

The marker keys call up menus that let you control the location and movement of the on-screen marker. These controls affect only the markers for the currently-active trace.

*See also:* [ **Marker Fctn** ] hardkey, Knob, [ **Marker** ] hardkey

## [Marker] hardkey

Select markers.

The marker appears as a small diamond.

This marker can be absolute or relative. The absolute marker (or main marker) values reflect the absolute X-axis and Y-axis values. By changing to relative, you can set a marker reference (indicated by a small square) and use the relative marker to find relative values between two points.

You can also search for peaks or move the marker to a specific X-axis location.

The analyzer displays marker readouts just above each trace box.

*See also:* [ MARKER X ENTRY ] softkey, Marker search keys, [ MKR VALUE ABS REL ] softkey, Marker readout

## [MARKER ON OFF] softkey

Key Path: [ **Marker** ]

Turn the marker on and off.

Each trace has its own marker. To turn on a marker for a particular trace, first make sure the trace is active (use the [ **Active Trace** ] hardkey). The marker options you select apply only to the marker on the active trace.

*See also:* [ **Active Trace** ] hardkey

## Marker readout

The analyzer displays marker values in the line above the trace box. For absolute markers, the labels are "X" and "Y." For relative markers, the values are "Xr" and "Yr."

For very small or very large values, the annotation is in scientific notation. The prefixes are defined under "Suffix menus."

For the far left band in octave displays, the X marker field reads T, I, B, P, or U:

- T indicates band-limited total power.
- I indicates broadband impulse power.
- B indicates broadband total power.
- P indicates broadband peak power.
- U indicates undefined. This indicates data read in from a different analyzer.

*See also:* Suffix menus

## Marker search keys

Four softkeys allow you to search for peaks on the active trace:

- [ MARKER TO PEAK ]: Finds the highest peak once.
- [ NEXT PEAK RIGHT ]: Finds the closest peak to right of marker.
- [ NEXT PEAK LEFT ]: Finds the closest peak to left of marker.
- [ PEAK TRK ON/OFF ]: Finds the highest peak each time the trace updates.

A peak is a local maximum on a trace. The slope of a trace is positive to the left of a peak and negative to the right. In addition, the slope on one side of a peak must not change for at least one vertical division (one-half division if the display format is upper/lower).

## [MARKER TO PEAK] softkey

Key Path: [ **Marker** ]

Move the marker to the largest amplitude on the displayed X-axis portion of the trace. (The marker will find Y-axis values that are above or below the displayed values, but will not find a Y-axis value of infinity).

This moves the marker to the peak only for the active trace (but the marker on the inactive trace will also move if marker coupling is on). Once moved, the marker remains at the new X-axis location until you do one of the following things:

- Turn the knob (with no entry window displayed).
- Press another marker-search key.
- Enter a new X-axis location (using [ MARKER X ENTRY ]).

The analyzer will not move the marker to a peak at 0 Hz.

---

**Note** If you turn on peak tracking, the analyzer automatically moves the marker to the peak each time the active trace updates.

---

*See also:* [ COUPLED ON OFF ] softkey, [ PEAK TRK ON OFF ] softkey

## [Marker Value] hardkey

Use the current value of the marker readout for the active numeric entry softkey. The analyzer uses the real value (not complex) in the current coordinate system.

The marker has an X-axis value and a Y-axis value. The analyzer tries to match the units for the parameter. For example, if you are displaying a frequency response and press [ **Freq** ] → [ STOP ] → [ **Marker Value** ], the analyzer uses the X-axis marker value. The units for stop frequency are Hz, the X-axis value for a frequency response display.

If the parameter has no units, the analyzer uses the Y-axis marker value. If the units do not match, the analyzer displays an error message and does not use the marker value for the numeric entry.

*See also:* [ REAL PART ] softkey, [ **Trace Coord** ] hardkey, [ NUMERIC ENTRY ] softkeys

## [MARKER X ENTRY] softkey

Key Path: [ **Marker** ]

Move the marker to a specific location. Press [ X ENTRY ] and enter the X-axis coordinate using the numeric keypad.

## [MARKER REFERENCE] softkey

See [ PLOT DATA SELECT ] softkey.

## [MATCH X SCALE] softkey

Key Path: [ **Scale** ]

Set the X-axis scale for the active trace to match the X-axis scale for the inactive trace.

This is a convenient way to set the same scaling for both traces.

**Note**

You cannot scale octave data to match data from other instrument modes. The analyzer will display nominally the same frequency span for both traces, but the scaling will not be the same because of the total-power band at the right side of the octave display.

## [MATCH Y SCALE] softkey

Key Path: [ **Scale** ]

Set the Y-axis scale for the active trace to match the Y-axis scale for the inactive trace. The analyzer changes the scale only if the coordinate systems are compatible.

This is a convenient way to set the same scaling for both traces.

## [MATH FUNCTION] softkey

Key Path: [ **Meas Data** ]
or: [ **Meas Data** ] → [ MORE ]

Access the [ Fx ] softkeys. Each [ Fx ] key displays the result of a function you have defined.

A function must be defined before it can be displayed. Functions are defined under the [ **Analys** ] hardkey.

If you display a math function that cannot be executed, the analyzer displays the grid with no data. For example, if you're in 1 channel mode, the function F1 = FreqResp will be displayed as an empty grid. (Frequency response is a 2-channel measurement.)

*See also:* [ DEFINE FUNCTION ] softkey

## [MAX INPUT LEVEL] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ **Source** ] → [ AUTOLEVEL SETUP ]

Specify a maximum input level for the non-reference channel when autolevel is on. The analyzer adjusts the source output so that the amplitude at the measurement frequency does not exceed this level.

Limit: 486 uVpk to 31.6 Vpk | Default: 2 Vpk

*See also:* [ AUTOLEVEL ON OFF ] softkey, [ REF CHAN CH1 CH2 ] softkey

## [MAX ORDER] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Freq ]

Specify how many orders you want displayed.

Limits: 3.125 to 200 Default: 10

[ MAX ORDER ] divided by [ DELTA ORDER ] must be less than or equal to 200. [ MAX ORDER ] is further limited by the following equation:

$$\text{(Max Order X Max rpm)/60} \quad \begin{array}{l} \leq 25.6 \text{ kHz (1 channel)} \\ \leq 12.8 \text{ kHz (2 channel)} \end{array}$$

For post-processing of time capture data:

$$\text{(Max Order X Max rpm)/60} \quad \begin{array}{l} \leq 102.4 \text{ kHz (1 channel)} \\ \leq 51.2 \text{ kHz (2 channel)} \end{array}$$

*See also:* [ DELTA ORDER ] softkey

## [MAX RPM] softkey (Capture Setup)

Key Path: [ Inst Mode ] → [ CAPTURE SETUP ] → [ TACHOMETR SETUP ]

Specify the upper limit of the rotation speed range you want to monitor for time capture.

Limits: 5 to 491,519 Default: 6,000

**Note** If the instrument mode is order analysis, the analyzer ignores this setting and uses the [ MAX RPM ] specified under the [ Freq ] key.

## [MAX RPM] softkey (Freq)

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Freq ]

Specify the upper limit of the rotation speed range you want to monitor for order measurements with rpm step arming.

Limits: 5 to 491,519 Default: 6,000

[ MAX RPM ] is further limited by this equation:

(Max Order X Max rpm)/60 $\leq$ 25.6 kHz (1 channel)
$\leq$ 12.8 kHz (2 channel)

For post-processing of time capture data:

(Max Order X Max rpm)/60 $\leq$ 102.4 kHz (1 channel)
$\leq$ 51.2 kHz (2 channel)

For rpm increasing measurements, the measurement starts at [ MIN RPM ] and stops [ MAX RPM ]. For rpm decreasing measurements, the measurement starts at [ MAX RPM ] and continues to [ MIN RPM ].

*See also:* [ RPM DECREASING ] softkey (order analysis), [ RPM INCREASING ] softkey (order analysis), [ RPM STEP ARM ] softkey (order measurements), [ ORDER ANALYSIS ] softkey, [ MIN RPM ] softkey

## [MAX SRC LEVEL] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Source ] → [ AUTOLEVEL SETUP ]

Specify the maximum source output level. When autolevel is on, the source output will not go above this level.

Limits: 254 uVpk to 5 Vpk Default: 2 Vpk

The source level may also be limited by the [ MAX INPUT LEVEL ].

*Hint:* To determine if the source level has been limited, display the [ LIN SPEC ] for channel 1. If it appears "flattened," the analyzer has probably limited the source level.

*See also:* [ MAX INPUT LEVEL ] softkey, [ AUTOLEVEL ON OFF ] softkey

## [MAXIMUM % CHANGE] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ] → [ RESOLUTN SETUP ]

Specify the maximum percent change for the swept sine autoresolution feature.

Limits: .391% to 100% Default: 2.5%

[ MAXIMUM % CHANGE ] refers to the difference in frequency response at adjacent measurement points. The analyzer compares the [ MAXIMUM % CHANGE ] to the magnitude and phase change between two consecutive points. The next frequency step size is proportional to the entered [ MAXIMUM % CHANGE ] and inversely proportional to the detected magnitude change.

Decreasing the percent change provides better resolution when changes occur, but results in a slower measurement. A larger percent change does not slow down the measurement as much, but it also does not improve the resolution as much.

*See also:* [ AUTO RES ON OFF ] softkey, [ SWEPT SINE ] softkey

## [MAXIMUM] softkey (hold setup)

See [ HOLD SETUP ] softkeys.

## [Meas Data] hardkey

Specify what measurement data you want displayed in the active trace. The measurement data available varies for different instrument modes.

The following table lists the data available for each instrument mode. Math Function, Data Register, Waterfall Register, and Capture are also available for each measurement.

| Instrument Mode | Measurement Data |
|---|---|
| FFT Analysis | Linear spectrum channel 1 or 2<br>Power spectrum channel 1 or 2<br>Time record channel 1 or 2<br>Frequency response (2 channel only)<br>Coherence (2 channel only)<br>Cross spectrum (2 channel only)<br>Orbit (2 channel only)<br>Windowed time channel 1 or 2 |
| Octave Analysis | Power spectrum channel 1 or 2 |
| Order Analysis<br>Track off | Power spectrum channel 1 or 2<br>Time record channel 1 or 2<br>Orbit (2 channel only)<br>rpm profile |
| Track on | Composite power channel 1 or 2<br>Order track channel 1 or 2<br>rpm profile |
| Swept Sine | Linear spectrum channel 1 or 2<br>Time record last point ch 1 or 2<br>Frequency response<br>Cross spectrum<br>Normalized variance channel 1 or 2 |
| Correlation Analysis | Time record channel 1 or 2<br>Auto correlation channel 1 or 2<br>Cross correlation (2 channel only)<br>Windowed time channel 1 or 2 |
| Histogram/Time | Histogram channel 1 or 2<br>PDF channel 1 or 2<br>CDF channel 1 or 2<br>Unfiltered time record chan 1 or 2 |

## Measurement Group

The Measurement keys let you control the analyzer's input configuration, measurement range, and measurement resolution. Here's a brief summary of the Measurement keys and their significant functions:

- [ **Inst Mode** ] specifies the kind of measurement you want to make.
- [ **Freq** ] determines the frequency range measured.
- [ **Window** ] specifies the windowing function applied to the input signal.
- [ **Input** ] sets the current input range and coupling.
- [ **Source** ] controls the analyzer's source output.
- [ **Trigger** ] provides trigger choices and manual arming.
- [ **Start** ] initiates a new measurement.
- [ **Pause/Cont** ] stops the analyzer in the middle of a measurement. Pressing [ **Pause/Cont** ] again continues the measurement where it left off.
- [ **Avg** ] provides averaging choices.

### [MEASURMNT STATE] softkey

Key Path: [ **Disp Format** ]

Display the analyzer's current configuration—how you've set up the analyzer. Use this display and one of the plot or print softkeys to document the instrument setup for a particular measurement.

**Note**

The measurement state does not include the input settings. Press [ INPUT STATE ] to display that information.

You can also use this display while you are setting up a measurement. The analyzer updates the display when you change parameter settings.

**Note**

The measurement state is displayed until you select another option under [ **Disp Format** ].

If you select either [ UPPER ] or [ LOWER ] under the [ **BASIC** ] → [ DISPLAY SETUP ] key, the analyzer changes the display format to upper/lower.

*See also:* [ INPUT STATE ] softkey

## [MEMORY SIZE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ]

Allocate stack space (in bytes of volatile RAM) for your program.

Limits: 1200 bytes to 3 megabytes Default: 0
Step: 2 bytes

Stack space is the portion of memory used for temporary storage of program variables that are not stored in COM. It provides the program's "working space."

The analyzer allocates all other memory for program use as it is needed—at run time, when you recall a program, or when you edit a program.

Stack space is set automatically when you recall a program or press [ AUTO MEMORY ]. However, the automatically generated stack space is not appropriate for some programs. Here are two examples:

- Programs that call subprograms recursively usually require more stack space.
- Programs that have many subprograms but don't "nest" them deeply when running usually require less stack space.

---

**Note** If you see the message "ERROR 2 Memory overflow" while your program is running, you need to allocate more stack space or increase the memory available by removing such things as time capture data and waterfall registers. The keys are under [ **System Utility** ] → [ MEMORY USAGE ].

---

*See also:* [ VOLATILE RAM DISK ] softkey, [ AUTO MEMORY ] softkey

## [MEMORY USAGE] softkey

Key Path: [ **System Utility** ]

Display a chart showing how much memory is available and how much is used by the following things:

- Time capture buffer.
- Waterfall display.
- Waterfall registers.
- HP Instrument BASIC programs.
- Volatile RAM disk.

The softkeys in the menu allow you to clear any of the items in this list from memory. Press the associated [ REMOVE ] key, then [ CONFIRM REMOVE ].

---

**Note** If you remove the RAM disk, you must use [ FORMAT DISK ] to recreate the volatile RAM disk.

---

*See also:* [ CAPTURE LENGTH ] softkey, [ VOLATILE RAM DISK ] softkey, [ **BASIC** ] hardkey, [ WATERFALL REGISTER ] softkey, [ WATERFALL ] softkey, [ FORMAT DISK ] softkey

### Menu definition

The term "menu" simply refers to softkey labels that are displayed concurrently. For example, when you press the [ **Display Format** ] hardkey, the following softkey labels appear:

[ SINGLE ]
[ UPPER/LOWER ]
[ FRONT/BACK ]
[ WATERFALL ]
[ MEASURMNT STATE ]
[ INPUT STATE ]
[ WATERFALL ACT TRACE ]
[ WATERFALL SETUP ]
[ BODE DIAGRAM ]
[ MORE ]

These labels are referred to collectively as the Display Format menu.

## [MIN RPM] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Freq ]

Specify the lower limit of the rotation speed range you want to monitor for order measurements with rpm step arming.

Limits: 5 to 491,519 rpm Default: 600
Min rpm must be less than [ MAX RPM ], which is limited by this equation:

$$(\text{Max Order X Max rpm})/60 \le 25.6 \text{ kHz (1 channel)}$$
$$\le 12.8 \text{ kHz (2 channel)}$$

For rpm increasing measurements, the measurement starts at [ MIN RPM ] and continues to [ MAX RPM ]. For rpm decreasing measurements, the measurement starts at [ MAX RPM ] and stops at [ MIN RPM ].

*See also:* [ RPM DECREASING ] softkey (order analysis), [ RPM INCREASING ] softkey (order analysis), [ RPM STEP ARM ] softkey (order measurements), [ ORDER ANALYSIS ] softkey, [ MAX RPM ] softkey (Freq)

## [MINIMUM RESOLUTN] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ] → [ RESOLUTN SETUP ]

Specify the minimum resolution for the swept sine autoresolution algorithm. The analyzer will not adjust the resolution any finer than this setting.

Limits: 3 to 801 points/sweep Default: 401 points/sweep
(You can enter values outside this range; the analyzer checks the values at run time and adjusts them to within the limits.)

You can specify a number of points per sweep, percent of the frequency span, or a specific frequency step.

*See also:* [ AUTO RES ON OFF ] softkey, [ SWEPT SINE ] softkey

## [MINIMUM] softkey (hold setup)

See [ HOLD SETUP ] softkeys.

## [MKR VALUE ABS REL] softkey

Key Path: [ **Marker** ]

Toggle the marker between absolute and relative.

When the absolute marker is absolute, the X-axis and Y-axis values at the marker position.

When the marker is relative, the X-axis and Y-axis values indicated are those relative to the position of the marker reference (indicated by a small square), not absolute values. The marker labels change from X and Y to Xr and Yr.

To move the marker reference to a specific (absolute location), use the [ REFERENCE X ENTRY ] and [ REFERENCE Y ENTRY ] softkeys under [ REFERENCE SETUP ]. To move the marker reference to the position of the main marker, press [ REFERENCE TO MARKER ].

## [MODIFY START Y] softkey

Key Path: [ **Analys** ] → [ DATA EDIT ] → [ EDIT D1 - D8 ]

Change the start vertical axis value for data edit. The analyzer draws a straight line connecting the point defined by [ START X ] and start Y with the point defined by [ STOP X ] and stop Y.

---

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [EXP] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[1] [5] [EXP] [+/−] [3] [ENTER]

---

*See also:* [ STOP X ] softkey, [ MODIFY STOP Y ] softkey, [ START X ] softkey, [ DATA EDIT ] softkey

## [MODIFY STOP Y] softkey

Key Path: [ Analys ] → [ DATA EDIT ] → [ EDIT D1 - D8 ]

Change the stop vertical axis value for data edit. The analyzer draws a straight line connecting the point defined by [ START X ] and start Y with the point defined by [ STOP X ] and stop Y.

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [EXP] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[1] [5] [EXP] [+/–] [3] [ENTER]

*See also:* [ STOP X ] softkey, [ MODIFY START Y ] softkey, [ START X ] softkey, [ DATA EDIT ] softkey

## [MORE] softkey

Display the second page of options for a menu.

When there are more than 10 options in a menu, the options are split into two pages. Use [ MORE ] to display the second page, then use [ RETURN ] to display the first page.

## [MORE: NYQ REAL IMAG] softkey

Display the second page of trace coordinate options.

The options include real part, imaginary part, and Nyquist diagram.

*See also:* [ NYQUIST DIAGRAM ] softkey, [ IMAGINARY PART ] softkey, [ REAL PART ] softkey

## [MOVE ALL VERTICAL] softkey

Key Path: [ **Analys** ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Specify that you want to move an entire limit line up or down.

The value of [ MOVE ALL VERTICAL ] specifies an amplitude offset for every segment in the limit. The offset is referenced to the limit's original position.

You can change the current value by turning the knob, pressing an arrow key, or entering a new value with a number key.

**Note** Unlike other numeric entries, the entry window stays open until you press another key. Any changes you make in the value are implemented immediately.

## [MOVE MKR HORIZNTAL] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Specify that you want to move the limit marker horizontally. The limit marker's horizontal position defines the X-axis value of a segment endpoint.

It's easiest to position the limit marker by turning the knob. You can also position the limit marker by entering a discrete value with the number keys.

When you are ready to anchor a segment endpoint at the position of the limit marker, just press [ START SEGMENT ] or [ FINISH SEGMENT ].

**Note** Unlike other numeric entries, the entry window stays open until you press [ FINISH SEGMENT ] or [ CANCEL/RETURN ]. While you move the marker, the analyzer displays the segment, but the segment is not saved until you press [ FINISH SEGMENT ].

## [MOVE MKR VERTICAL] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Specify that you want to move the limit marker vertically. The limit marker's vertical position defines the Y-axis value of a segment endpoint.

It's easiest to position the limit marker by turning the knob. You can also position the limit marker by entering a discrete value for [ MOVE MKR VERTICAL ] with the number keys.

When you are ready to anchor a segment endpoint at the position of the limit marker, just press [ START SEGMENT ] or [ FINISH SEGMENT ].

**Note** Unlike other numeric entries, the entry window stays open until you press [ FINISH SEGMENT ] or [ CANCEL/RETURN ]. While you move the marker, the analyzer displays the segment, but the segment is not saved until you press [ FINISH SEGMENT ].

## [NEW FILENAME] softkey

See [ RENAME FILE ] softkeys.

## [NEXT PEAK LEFT] softkey

Key Path: [ **Marker** ]

Move the marker left to the next local maximum in the displayed data. (Unlike [ MARKER TO PEAK ], next peak will not find Y-axis values that are off the display.)

The marker moves to the next left peak only on the trace that's active (but the marker on the inactive trace will also move if marker coupling is on).

A peak is a local maximum on a trace. The slope of a trace is positive to the left of a peak and negative to the right. In addition, the sign of the slope on either side of a peak must not change for at least one vertical division (one-third division for octave displays, or 1/10 division for log Y-axis).

The "next left peak" must be at least one display point to the left of the current marker location. If the peak search algorithm doesn't find a peak, the marker doesn't move.

*Hint:* Decrease the value of [ Y PER DIV ] to increase the number of peaks found.

Use any of the marker-search keys with relative marker to quickly measure differences between two signals.

*See also:* [ MARKER TO PEAK ] softkey, [ MKR VALUE ABS REL ] softkey, Marker search keys, [ Y PER DIV (DECADES) ] softkey, [ COUPLED ON OFF ] softkey

## [NEXT PEAK RIGHT] softkey

Key Path: [ **Marker** ]

Move the marker right to the next local maximum in the displayed data. (Unlike [ MARKER TO PEAK ], next peak will not find Y-axis values that are off the display.)

The marker moves to the next right peak only on the trace that's active (but the marker on the inactive trace will also move if marker coupling is on).

A peak is a local maximum on a trace. The slope of a trace is positive to the left of a peak and negative to the right. In addition, the sign of the slope on either side of a peak must not change for at least one vertical division (one-third division for octave displays, or 1/10 division for log Y-axis).

The "next right peak" must be at least one display point to the left of the current marker location. If the peak search algorithm doesn't find a peak, the marker doesn't move.

*Hint:* Decrease the value of [ Y PER DIV ] to increase the number of peaks found.

Use any of the marker-search keys with relative marker to quickly measure differences between two signals.

*See also:* [ MARKER TO PEAK ] softkey, [ MKR VALUE ABS REL ] softkey, Marker search keys, [ Y PER DIV (DECADES) ] softkey, [ COUPLED ON OFF ] softkey

## [NON-VOL RAM DISK] softkey

Key Path: [ **Disk Utility** ] → [ DEFAULT DISK ]
or: [ **Save/Recall** ] → [ DEFAULT DISK ]

Select the analyzer's battery-backed RAM as the default disk.

The contents of the non-volatile RAM disk are retained when you turn the analyzer off. They will be available when you turn it back on.

The non-volatile RAM disk is initialized at the factory with approximately 31.0 Kbytes of storage space (LIF format). If you change the format from LIF to DOS, the size is approximately 29.7 Kbytes.

You cannot change the size of the non-volatile RAM disk for a given format (LIF or DOS). All format options reformat the disk to the same size.

*See also:* [ DEFAULT DISK ] softkey

## [NORM VAR CHANNEL x] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ **Meas Data** ]

Display the normalized variance for the specified channel.

Variance is an indicator of how much noise power remains in the signal after a desired number of integration cycles have been completed. Variance values equal to 1 indicate the noise component has been successfully averaged out of the signal. Variance values less than 1 indicate the level of noise power left in the signal after the integration process.

To improve variance, increase the number of integration cycles. This improves the signal-to-noise ratio.

## [NUMBER AVERAGES] softkey

Key Path: [ **Avg** ]

Specify the number of averages the analyzer should perform for each measurement.

Limits: 1 to 9,999,999 Default: 10

For exponential averaging, the number of averages you select determines the weighting of old versus new data, not the total number of averages calculated. As the number of averages increases, new data is weighted less.

*See also:* [ RMS EXPONENTL ] softkey

## [NUMBER OF HARMONICS] softkey

Key Path: [ **Marker Fctn** ] → [ HARMONIC MARKER ]

Specify the maximum number of harmonics you want the analyzer to identify with the harmonic marker.

Limits: 0 to 400 Default: 20

The actual number of harmonics identified depends on the fundamental frequency and the analyzer's bandwidth. Higher fundamental frequencies have fewer harmonics displayed, because it takes fewer harmonics to reach the top end of the analyzer's frequency range.

The analyzer displays the harmonics for the fundamental frequency that you specified most recently. To change the fundamental frequency, use the [ FUNDAMNTL FREQUENCY ] softkey.

*See also:* [ FUNDAMNTL FREQUENCY ] softkey, [ HARMONIC MARKER ] softkey

## [NUMBER OF POLES] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]

Specify the number of poles (a conjugate pair is considered 2 poles).

Limits: 0 to 20 Default: 20

The actual number of poles used depends on whether you specify order max or order fixed. If you specify order fixed, the curve fitter finds a system with the number of poles you have specified. If you specify order max, the curve fitter attempts to find the optimum number of poles, without exceeding the number you have specified.

The number of poles can be different than the number of zeros.

## [NUMBER OF SIDEBANDS] softkey

Key Path: [ **Marker Fctn** ] → [ SIDEBAND MARKER ]

Specify the number of sidebands you want the analyzer to identify with the sideband marker.

Limits: 0 to 200 Default: 20

The actual number of sidebands identified depends on the carrier frequency and the analyzer's bandwidth.

The analyzer displays the sidebands spaced at the sideband increment from the carrier frequency that you specified most recently. To change the carrier frequency, use the [ CARRIER FREQ ] softkey.

*See also:* [ CARRIER FREQ ] softkey, [ SIDEBAND MARKER ] softkey

## [NUMBER OF ZEROS] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]

Specify the number of zeros (a conjugate pair is considered 2 zeros).

Limits: 0 to 20 Default: 20

The actual number of zeros used depends on whether you specify order max or order fixed. If you specify order fixed, the curve fitter finds a system with the number of zeros you have specified. If you specify order max, the curve fitter attempts to find the optimum number of zeros, without exceeding the number you have specified.

The number of zeros can be different than the number of poles.

## Numeric entry softkeys

Some softkeys let you change numeric parameters. If a menu contains just one such softkey, the key is active when you enter the menu. If a menu contains two or more of these softkeys, only one of them is active when you enter the menu.

**Note** The analyzer indicates that a numeric entry softkey is active by highlighting the whole softkey label.

The active numeric entry softkey is ready to accept a new value at any time. You don't need to press it before entering a new value with the number keys or stepping the old value with the arrow keys.

When you start entering a new value with the number keys, the softkey's entry window is displayed at the top of the screen. The window remains on the screen until you either complete or abort the entry. You complete an entry by pressing the [ ENTER ] softkey or a suffix softkey. You abort an entry by pressing [ CANCEL/RETURN ].

When you step the value of a numeric entry softkey with the arrow keys, the entry window is displayed for a couple of seconds so you can see the new value.

You *do* need to press a numeric entry key, even the active one, if you want to change its value by turning the knob. The knob is normally used to move the marker, and can only be used for numeric entry if an entry window is displayed.

When you press a numeric entry key, its entry window is displayed at the top of the screen for a couple of seconds. If you start turning the knob while the window is still up, the window remains up until you stop. You can watch the value change as you turn the knob.

**Note** Changes made with the arrow keys and the knob take effect immediately.

*See also:* Suffix menus, Knob

## [NYQUIST DIAGRAM] softkey

Key Path: [ **Trace Coord** ] → [ MORE: NYQ REAL IMAG ]

Display a Nyquist diagram, with the real part on the X-axis versus the imaginary part on the Y-axis.

Markers read the real and imaginary parts as well as the implied frequency or time position. Markers hold their frequency (or time) position when you change between Nyquist and other coordinate types.

## Octave analysis frequency keys

For octave analysis, the following softkeys are under the [ **Freq** ] hardkey:

- Start.
- Stop.
- Full octave.
- 1/3 octave.
- 1/12 octave.

*See also:* [ START ] softkey (octave frequency), [ STOP ] softkey (octave frequency), [ FULL OCTAVE ] softkey, [ 1/3 OCTAVE ] softkey, [ 1/12 OCTAVE ] softkey

## [OCTAVE ANALYSIS] softkey

(Available only with option 1D1, Real Time Octave)

Key Path: [ Inst Mode ]

Specify the octave analysis instrument mode.

Octave measurements compute power in bands using banks of filters covering 12 octaves. The bandwidth of each of these filters is either one full octave, 1/3 octave, or 1/12 octave (set under the [ Freq ] hardkey).

The analyzer meets the ANSI 1986 specification for 1/3 octave filters.

The display for octave measurements shows one band for each filter band. The far right band shows one of five things, indicated by a letter just below the band:

- T indicates band-limited total power.
- I indicates broadband impulse power.
- B indicates broadband total power.
- P indicates broadband peak power.
- U indicates undefined. This indicates data read in from a different analyzer.

"Broadband" means the power in the frequency span from 0 Hz to the frequency listed in the following table:

| | Frequency | |
|---|---|---|
| | 1 channel | 2 channel |
| Full Octave | 25.6 kHz | 12.8 kHz |
| 1/3 Octave | 25.6 kHz | 12.8 kHz |
| 1/12 Octave | | |
| Impulse on | 12.8 kHz | 6.4 kHz |
| Peak Hold on | 6.4 kHz | 3.2 kHz |

"Band-limited" means the power in the displayed octave bands. For example, if the display is 1/3 octave from 10 Hz to 16 kHz, the bandwidth of total power contains only those bands.

If the input channel A-weight filter is on, it is applied for the total power band. If a math function A-, B-, or C-weight is applied to the data, the weighting function also applied to the total power band.

For more information on octave analysis, refer to the analyzer's *Concepts Guide.*

*See also:* [ PEAK HOLD ] softkey (octave), [ IMPULSE ] softkey, [ DEFINE FUNCTION ] softkey, [ Freq ] hardkey, [ 1/12 OCTAVE ] softkey, [ 1/3 OCTAVE ] softkey, [ FULL OCTAVE ] softkey

## Octave averaging

The average softkeys for octave measurements allow you to do the following things:

- Choose from four types of averaging:
  - Linear.
  - Exponential.
  - Equal confidence.
  - Peak hold.
- Specify maximum, minimum, or no average hold.
- Specify an average time.
- Specify the confidence level for equal confidence averaging.
- Turn on or off the impulse display.
- Turn average repeat on or off.

*See also:* [ REPEAT ON OFF ] softkey (octave), [ IMPULSE ] softkey, [ CONFIDNCE LEVEL ] softkey, [ AVERAGE TIME ] softkey, [ HOLD SETUP ] softkeys, [ EXPONENTL ] softkey, [ EQUAL CONFID ] softkey, [ STABLE ] softkey, [ PEAK HOLD ] softkey (octave)

## [OFF] softkey (BASIC display)

See [ DISPLAY SETUP ] softkey group.

## [OFF] softkey (hold setup)

See [ HOLD SETUP ] softkeys.

## Operand menu

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ]

Specify the data to be used as the argument in a function.

- [ MEAS DATA ] allows you to select measurement results as an operand. The results available vary depending on the instrument mode.
- [ DATA REG (D1-D8) ], [ CONSTANT (K1-K5) ], and [ FUNCTION (F1-F5) ] allow you to select the contents of a particular register as an operand. (You cannot use a larger-numbered function in the definition of a smaller-numbered function. For example, you cannot use F2 in defining F1.)
- [ OPERATION ] allows you to specify what operation should be performed on the argument.
- [ ( ] specifies the order in which operations should be performed. The close parenthesis, [ ) ], is available in the operator menu.
- [ CANCEL/RETURN ] abandons the function definition you are creating and retains the one that already exists.

*See also:* [ **Inst Mode** ] hardkey

## Operation menu

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ]

Specify which operations should be performed on the operand (argument) following the operation. The analyzer puts the operation and an opening parenthesis,"(", in the definition. The following operations are available:

| | |
|---|---|
| ■ Conj | Complex conjugate. |
| ■ Mag | Magnitude. |
| ■ Real | Real part. |
| ■ Imag | Imaginary part. |
| ■ Sqrt | Complex square root. |
| ■ FFT | Fast Fourier Transform. |
| ■ Inverse FFT | Inverse Fast Fourier Transform. |
| ■ PSD | Scale a spectrum to display power spectral density. |
| ■ Ln | Complex natural logarithm (base e). |
| ■ Exp | Complex natural antilog (e ^ x). |
| ■ * jomega | Multiply by jw. |
| ■ /jomega | Divide by jw. |
| ■ Aweight | A-weight filtering. |
| ■ Bweight | B-weight filtering. |
| ■ Cweight | C-weight filtering. |
| ■ Diff | Differentiate. |
| ■ Integ | Integrate. |

## Operator menu

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → operand

Specify which arithmetic operations a function will perform. The following operators are available: addition [ + ], subtraction [ - ], multiplication [ * ], and division [ / ].

**Note** The analyzer does some limited tracking of units in trace math operations.

Use the closing parenthesis softkey, [ ) ], in conjunction with the opening parenthesis, [ ( ], softkey (in the Operand menu) to specify the order in which operations should be performed.

Use [ ENTER ] to complete a new function definition. If you have used fewer closing parentheses than opening parentheses, [ ENTER ] adds enough to create a balance.

Use [ CANCEL/RETURN ] to abandon the function definition you are creating and retain the one that already exists.

## [OPTIONS SETUP] softkey

Key Path: [ **System Utility** ]

Display the options available and installed in the analyzer.

If you have ordered and received an upgrade from Hewlett-Packard, you can install the software by inserting the disk and following the instructions included with the upgrade kit.

## [ORBIT] softkey

Key Path: [ **Meas Data** ] → [ MORE ]

Display an orbit diagram. This is a lissajous figure of channel 2 time versus channel 1 time.

**Note** Orbit displays are not averaged or corrected.

This display is useful for balancing and understanding rotor dynamics.

*See also:* [ CAL CONST ON OFF ] softkey

## [ORDER (REV)] softkey

Key Path: [ Trace Coord ] → [ X UNITS ]

Specify orders for frequency domain X-axis units and revolutions for time domain X-axis units. You can specify the speed of rotation by pressing [ HZ/ORDER RATIO ] under [ ORDER SETUP ].

---

**Note** The analyzer uses the same speed of rotation for all traces. For a waterfall display, the speed of rotation may actually be different for each trace. Keep this in mind when you interpret the results.

---

*See also:* [ HZ/ORDER RATIO ] softkey

## Order analysis frequency keys

For order analysis, the following softkeys are under the [ Freq ] hardkey:

- Min rpm.
- Max rpm.
- Max order.
- Delta order.
- Track on off.
- Track x order.

*See also:* [ MIN RPM ] softkey, [ MAX RPM ] softkey (Freq), [ MAX ORDER ] softkey, [ DELTA ORDER ] softkey, [ TRACK ON OFF ] softkey, [ TRACK x ORDER ] softkey

## [ORDER ANALYSIS] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Inst Mode** ]

Specify the order analysis instrument mode.

Order analysis is useful for vibration analysis of rotating machinery. The X-axis is calibrated in orders rather than Hz. One order represents one revolution of the rotating device.

The HP 35665A computed order tracking eliminates the need for external signal-conditioning equipment, such as ratio synthesizers and tracking filters.

The measurement data available for order analysis measurements is listed in the following table.

| Track Off | Track On |
|---|---|
| Power spectrums ch 1 & 2 | Composite power ch 1 & 2 |
| Time ch 1 & 2 | Order track ch 1 & 2 |
| Orbit | rpm profile |

An order tracking spectrum is a measure of the total power in any order (harmonic of shaft rotation frequency) as a function of RPM. It is useful for determining how a particular order of rotation excites the system throughout its operating range.

The computed order tracking algorithm resamples the incoming signal, resulting in extremely stable and repeatable order measurements that were not possible using analog ratio synthesis and filtering. The tachometer input provides a powerful and flexible triggering facility which virtually removes the need for external signal-shaping circuitry.

For more information on order analysis, refer to the analyzer's *Concepts Guide.*

*See also:* [ COMP PWR CHANNEL x ] softkey, [ ORDER TRK CHANNEL x ] softkey, [ RPM PROFILE ] softkey, [ ORBIT ] softkey, [ TIME CHANNEL x ] softkey (order meas), [ PWR SPEC CHANNEL x ] softkey (octave), [ TRACK ON OFF ] softkey, [ TRACK ON OFF ] softkey

## [ORDER AT MKR] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ Order Setup ]

Specify the number of orders represented by the marker X-axis value.

## Order averaging

The average softkeys for order analysis allow you to do the following things:

- Turn averaging on or off.
- Specify a number of averages.
- Choose between time and time exponential averaging.
- Turn average repeat on or off.

**Note**

When average is on for order analysis, only the time data is averaged. The power spectrum is not averaged; it represents the instantaneous spectrum at the time of the last average.

If you want to display the averaged spectrum, define a math function to be "FFT(TIME1)" and select that function from the Meas Data softkeys.

*See also:* [ DEFINE FUNCTION ] softkey, [ REPEAT ON OFF ] softkey (average), [ TIME EXPONENTL ] softkey, [ TIME ] softkey (average, order measurement), [ NUMBER AVERAGES ] softkey, [ AVERAGE ON OFF ] softkey

## [ORDER MAX FIXED] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]

Specify whether the curve fitter should use fixed or max order.

If you specify fixed order, the curve-fit routine finds the specified numbers of poles and zeros. Use fixed order if you know the system order.

If you specify max order, the curve fitter estimates the optimum number of poles and zeros for the transfer function to be fitted. It finds the lowest order fit possible, using the specified number of poles and zeros as a maximum. Use max order if you do not know the system order.

*Hint:* If max order does not yield satisfactory results, use fixed order and try higher or lower system orders. You can control numerator and denominator orders separately.

*See also:* [ NUMBER OF ZEROS ] softkey, [ NUMBER OF POLES ] softkey

## [ORDER SETUP] softkey

Key Path: [ Trace Coord ] → [ X UNITS ]

Specify the rotation speed for order X-axis units by selecting one of the following keys:

- Hz/order ratio.
- Trace rpm.
- Order at marker.

*See also:* [ ORDER (REV) ] softkey, [ ORDER AT MKR ] softkey, NOT ALTER THIS FILE MANUALLY!! It should only be altered by, [ TRACE RPM ] softkey, [ HZ/ORDER RATIO ] softkey

## [ORDER TRK CHANNEL x] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Meas Data ] → [ MORE ]

Display one of five order tracking spectrums for the specified channel.

An order tracking spectrum is a measure of the total power in any order (harmonic of shaft rotation frequency) as a function of RPM. It is useful for determining how a particular order of rotation excites the system throughout its operating range.

**Note** This data is only available if track is on.

*See also:* [ TRACK ON OFF ] softkey

## [ORIGINAL FILENAME] softkey

See [ RENAME FILE ] softkeys.

## [OUTPUT FILENAME] softkey

Key Path: [ Plot/Print ]

Enter an output filename using the alpha entry menu. The analyzer plots or prints to this file when you specify output to a file.

You can enter up to 18 characters. When you start to plot to a file, the analyzer checks for a valid file name. Valid file names are different for DOS than for LIF.

DOS file names can be up to 8 characters with a 3-character extension (for example, PLOTFILE.HPG). If you entered too many characters, the analyzer truncates your entry to make it valid and performs the plot. If you enter file name longer than 8 characters, only the first 8 characters are used. Likewise, if you enter an extension longer than 3 characters, only the first 3 characters are used.

LIF file names can be up to 6 characters with a 3-characters extension (for example, PLFILE.HPG). If you enter too many characters, the analyzer displays an error message and does not perform the plot.

The analyzer will also increment file names if you use a number as the last character of the file name or the last character before the extension--for example, "PLOT1" or "PLOT1.HPG." The analyzer will automatically put the name "PLOT2" (or "PLOT2.HPG") in the entry box the next time you save something. This feature only works if the catalog is off.

*See also:* [ OUTPUT TO HPIB FILE ] softkey

## [OUTPUT TO HPIB FILE] softkey

Key Path: [ Plot/Print ]

Specify whether you want to print or plot directly to the HP-IB device or to a file on the default disk.

You specify the file name by pressing [ OUTPUT FILENAME ].

The file will be formatted for the output device specified by the [ DEVICE IS PLOT PRNT ] softkey.

*See also:* [ OUTPUT FILENAME ] softkey, [ DEVICE IS PLOT PRNT ] softkey

## [OVERLAP PERCENT] softkey

Key Path: [ **Avg** ]

Specify the percentage of overlap you want the analyzer to use when making an averaged measurement.

Limits: 0 to 99% Default: 0%
Steps: 1%

Overlap only works when the measurement is in real time.

The amount of overlap possible varies with the frequency span. For wide spans (with short time records), little or no overlap is possible—the time record is small compared to the time it takes the analyzer to process the time record. For narrow spans (with long time records), considerable overlap is possible—the time record is long compared to the time it takes the analyzer to process the time record.

If the analyzer indicates that the current measurement is in real time and the specified overlap percentage cannot be achieved, the REAL-TIME status message is removed (if you're averaging and this occurs, no attempt is made to re-enter real time until you start the average again—if averaging is off, real time processing resumes as soon as possible).

To learn more about overlap processing, see the analyzer's *Concepts Guide.*

*See also:* Real-time bandwidth, [ SPAN ] softkey (frequency)

## [OVERSHOOT] softkey

Key Path: [ **Marker Fctn** ] → [ TIME PARAMTERS ]

Compute and display overshoot—the maximum value by which the step response exceeds its steady-state level. The analyzer uses only the data between the start time and stop time markers in the computation.

The analyzer also puts a horizontal line across the display at the steady-state level and displays the steady-state value in the mini-state.

*See also:* [ START TIME ] softkey, [ STOP TIME ] softkey

## [OVERWRITE FILE] softkey

Key Path: [ **Save/Recall** ] → [ SAVE DATA ] → [ INTO FILE ]
or: [ **Plot/Print** ] → [ START PLOT/PRINT ]

Save information or print/plot data to an existing file.

**Caution** Existing information in the file will be lost if you press this key.

## [OVLD REJ ON OFF] softkey

Key Path: [ **Avg** ]

Turn overload reject on or off. The input channels must be set to a fixed range for overload reject.

When overload reject is off, all time records are included in the measurement. If any time records are overloaded, measurement accuracy may decrease.

When overload reject is turned on, data from overloaded input channels is not included in the measurement results.

When overload reject is on, an averaged measurement rejects the time record taken from an overloaded input channel and the time record that was taken concurrently for the other channel. The measurement continues until the analyzer has accepted a number of time records equal to the specified number of averages.

The analyzer will not autorange during an averaged measurement if overload reject is on.

Overload reject is not available for time capture.

*See also:* [ CHx FIXED RANGE ] softkey, [ CAPTURE ON OFF ] softkey, [ NUMBER AVERAGES ] softkey, Time record

## [P1 P2 SETUP] softkeys

Key Path: [ **Plot/Print** ] → [ MORE SETUP ]

Specify where on the page you want the plot to appear. You can use the plotter's default P1 and P2 settings or specify your own settings. P1 is the lower left corner of the plot, and P2 is the upper right corner of the plot. Refer to your plotter documentation for appropriate P1 and P2 values.

- [ USER P1P2 ON OFF ] specifies whether the plotter uses its default settings (OFF) or the settings defined by the other four keys in this menu (ON).
- [ USER P1 X ] defines the horizontal value for the lower left corner of the plot.
- [ USER P1 Y ] defines the vertical value for the lower left corner of the plot.
- [ USER P2 X ] defines the horizontal value for the upper right corner of the plot.
- [ USER P2 Y ] defines the vertical value for the upper right corner of the plot.

## [PAGE EJCT ON OFF] softkey

Key Path: [ **Plot/Print** ]

Enable and disable your plotter's page-eject feature or your printer's form feed feature. The state you select is used for all plotting and printing operations initiated by the analyzer.

**Note** Check your plotter's documentation to be sure that it supports the requested page-eject state.

## Paging through help screens

To display the next page of a multi-page help topic, press the down arrow key. To display the previous page, press the up arrow key. A message in the lower-right corner of the screen shows you the current page number.

## [Pause/Cont] hardkey

Stop the analyzer in the middle of a measurement. The analyzer displays the measurement as completed so far. Press [ **Pause-Cont** ] once more to continue the measurement—the analyzer begins where it left off. If you want to clear the data and start the measurement over again, press [ **Start** ].

---

**Note** Pause/continue behaves differently for swept sine, histogram, octave, and order measurements.

---

If you're using rms or vector averaging (stable averaging, not exponential averaging), pressing [ **Pause-Cont** ] after the averages are completed causes the analyzer to take another group of averages. The additional averages are added to the cumulative average results. Pressing [ **Pause-Cont** ] before the averages are completed simply pauses the measurement.

If you're using exponential averaging (rms or vector) or peak hold averaging, pressing [ **Pause-Cont** ] pauses the measurement. Pressing [ **Pause-Cont** ] once more continues the measurement.

---

**Note** If a calibration occurs while a measurement is paused, the analyzer will start a new measurement when you press [ **Pause/Cont** ].

---

*See also:* [ **Pause/Cont** ] hardkey (octave and order), [ **Pause/Cont** ] hardkey (octave and order), [ CALIBRATN ] softkey, [ **Pause/Cont** ] hardkey (histogram), [ **Pause/Cont** ] hardkey (swept sine)

## [Pause/Cont] hardkey (histogram)

If you pause a histogram measurement before it is complete, the measurement stops. The analyzer does not display incomplete intermediate results.

If you continue a paused histogram measurement, it begins where it was paused and continues to the end of the histogram length.

If you press [ **Pause/Cont** ] after a histogram measurement is complete, the analyzer collects a new time record and updates the unfiltered time measurement data. The histogram data does not incorporate the new time record.

*See also:* [ HISTOGRAM LENGTH ] softkey, [ UNFILTERD TIME CH x ] softkey

## [Pause/Cont] hardkey (octave and order)

For octave and order measurements, pressing the [ Pause/Cont ] hardkey always clears all measurement data from the analyzer's buffers and starts a new measurement.

## [Pause/Cont] hardkey (swept sine)

If you continue a paused, incomplete swept sine measurement, the analyzer begins at the point where you paused the measurement and finishes the sweep.

*See also:* [ TIME CHANNEL x ] softkey

## [PDF CHANNEL x] softkey

Key Path: [ **Meas Data** ]

Display the Probability Density Function for the specified channel. This is the histogram normalized to unit area, or the probability that a specific level occurred. It is computed by dividing the histogram by (number of samples times delta V). The resulting units are 1/V.

*See also:* [ HISTOGRAM CHANNEL x ] softkey

## [PEAK HOLD] softkey

Key Path: [ **Avg** ] → [ AVERAGE TYPE ]

Select the peak hold function. The analyzer takes N time records, where N is the number of averages you specify. The analyzer compares each data point in the measured frequency span with the previous values. Only the largest value for each frequency point is saved.

If you press [ **Pause/Cont** ] after the measurement is complete, the analyzer compares another N time records with the existing data. If you press [ **Start** ], the analyzer clears the data and takes N time records.

Technically, peak-hold averaging is not really a type of averaging, since the results are not mathematically averaged. But it's still considered a type of averaging because it combines the results of several measurements into one final measurement result.

With the peak-hold function, the analyzer mathematically compares each data point to its previous peak value. If the data point is larger than its last peak value, the new value is used.

---

**Note**

The results of peak hold averaging are seen only in power spectrum displays. All other available measurement data displays only the latest processed time record, not averaged data.

The following measurement data is not available with peak hold averaging:

- Frequency Response
- Coherence
- Cross Spectrum

---

*See also:* [ NUMBER AVERAGES ] softkey, [ PWR SPEC CHANNEL x ] softkey

## [PEAK HOLD] softkey (octave)

Key Path: [ Avg ] → [ AVERAGE TYPE ]

Select the peak hold function for an octave measurement. Peak hold averaging is intended for non-coherent signals only.

The analyzer holds the absolute peak power in each displayed octave band. The overall power band (far right band in the display) displays broadband peak power; it has a bandwidth of dc to the value listed in the table below.

Peak hold limits the maximum center band frequency and the broadband peak frequency as listed in the following table:

| | Full Octave | | 1/3 Octave | | 1/12 Octave | |
|---|---|---|---|---|---|---|
| | Center | Broad | Center | Broad | Center | Broad |
| 1 channel | 8.0 kHz | 25.6 kHz | 16.0 kHz | 25.6 kHz | 5.657 kHz | 6.4 kHz |
| 2 channel | 4.0 kHz | 12.8 kHz | 8.0 kHz | 12.8 kHz | 2.828 kHz | 3.2 kHz |

peak detector rise times = 1/(2.56 * broadband peak frequency)

See [ REPEAT ON OFF ] for information on how that parameter affects peak hold averaging.

**Note**

When you select [ PEAK HOLD ], the analyzer effectively sets the number of waterfall steps to 1. If you pause a measurement with a waterfall displayed, the analyzer displays only 1 trace.

*See also:* [ REPEAT ON OFF ] softkey (octave), [ WATERFALL STEPS ] softkey

## [PEAK TRK ON OFF] softkey

Key Path: [ **Marker** ]

Turn on or off peak tracking for the active trace. When peak tracking is on, the analyzer continuously moves the marker to the peak value on the trace.

You can turn on peak tracking for Trace A, Trace B, or both traces. If you turn on peak tracking for both traces, each marker follows the peak for its respective trace (unless marker coupling is on).

Because marker coupling takes priority over peak tracking, the marker will not track the peak value for the inactive trace if both marker coupling and peak tracking are turned on.

*See also:* [ COUPLED ON OFF ] softkey

## [PERFORM FORMAT] softkey

Key Path: [ **Disk Utility** ] → [ FORMAT DISK ]

Format a disk. After you identify the disk, it is formatted using the current values of [ INTRLEAVE FACTOR ] and, for RAM disks, [ RAM DISK SIZE ].

---

**Note** The analyzer's internal disk drive can only format double-sided, double-density or high-density flexible disks.

---

When you press [ PERFORM FORMAT ], you are asked to enter the disk specifier for the disk you want to format. The entry window already contains the specifier for the default disk, but you can modify it with the alpha entry keys. Remember that the disk specifier must end with a colon (:) unless you are specifying a volume name.

---

**Caution** When you format a disk or RAM, the analyzer erases all data from that device. Before you perform the format, save any important data to another device.

---

---

**Note** You cannot remove a file if it is a LIF protected file or if the file is currently opened by an HP Instrument BASIC program. These files are indicated by a " * " or " ", respectively, in the disk catalog.

---

You can append a volume name to the disk specifier when you format a disk. Just position the cursor after the colon and enter a name of six characters or less. For example, "INT:MYDISK."

*Hint:* Use a unique volume name for each flexible disk to help you keep track of your data. The name will be displayed in the upper-left corner of the catalog.

*See also:* [ CATALOG ON OFF ] softkey, Volume name, Alpha entry mode, Disk specifiers, [ RAM DISK SIZE ] softkey, [ INTRLEAVE FACTOR ] softkey

## [PERFORM RENUMBER] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ RENUMBER ]

Renumber the lines of your program.

The number of the first line will be the value specified in [ START LINE # ]. The increment between lines will be the value specified in [ INCREMENT ].

*See also:* [ START LINE # ] softkey (Renumber), [ INCREMENT ] softkey

## [PERFORM SCRATCH] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ SCRATCH ]

Scratch (delete) your program and/or its variables. The selection you made in the scratch options softkey group determines what will be deleted.

*See also:* [ SCRATCH OPTIONS ] softkey group

## [PERFORM SECURE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ SECURE ]

Secure the portion of your program specified by [ START LINE # ] and [ END LINE # ].

Secured lines cannot be viewed in the HP Instrument BASIC editor or printed with [ PRINT PROGRAM ]. An asterisk (*) replaces program statements on secured program lines.

**Caution** Secured program lines can not be unsecured. Be sure to keep an unsecured version of the program for your own records.

*See also:* [ SECURE ] softkey, [ END LINE # ] softkey, [ START LINE # ] softkey (Secure)

## [PERFORM COPY ALL] softkey

See [ COPY ALL FILES ] softkeys.

## [PERFORM FILE COPY] softkey

See [ COPY FILE ] softkeys.

## [PERFORM RENAME] softkey

See [ RENAME FILE ] softkeys.

## [PERIODIC CHIRP] softkey

Key Path: [ **Source** ]

Select the periodic chirp waveform. Periodic chirp is a fast sine sweep across the current frequency span that repeats with the same period as the time record.

The effect of the periodic chirp is similar to the random noise waveform, but its spectrum is much flatter than a noise spectrum. The chirp waveform is the same in every time record, so averaging may not be required.

Because the chirp output is periodic, it's best to use the Uniform window when making measurements using this waveform.

*See also:* [ BURST CHIRP ] softkey, [ UNIFORM ] softkey

## [PHASE DEG RAD] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Specify whether phase is displayed in units of degrees or radians. The default is degrees.

## [PHASE] softkey

Key Path: [ **Trace Coord** ]

Display wrapped phase on the active trace.

Wrapped phase means that all phase is shifted to between −180 degrees and +180 degrees. If the actual phase is outside this range, it is increased or decreased by a multiple of 360 degrees to put it between −180 and +180 degrees.

For example, +400 degrees is displayed as +40 degrees (400 − 360 = 40), and −190 degrees is displayed as +170 degrees (−190 + 360 = 170).

To display actual phase (not shifted), press [ UNWRAPPED PHASE ].

*See also:* [ UNWRAPPED PHASE ] softkey

## [PINK NOISE] softkey

Key Path: [ **Source** ]

Select the pink noise waveform. Pink noise is similar to random noise, except that the spectral density is inversely proportional to frequency. This means that the amplitude rolls off at 3 dB/octave.

Pink noise is used for octave measurements. Because the octave bands are wider at higher frequencies but the pink noise density is proportionately lower, the result is a constant amount of energy per octave band. In other words, an octave spectrum of pink noise looks flat.

A typical use for pink noise is microphone calibration.

*See also:* [ OCTAVE ANALYSIS ] softkey, [ RANDOM NOISE ] softkey

## [PLOT DATA SELECT] softkey

Key Path: [ Plot/Print ]

Specify which portion of the display you want to plot. You can plot the following items:

- [ ALL ] — everything displayed except the status line and softkey menu.
- [ TRACE ] — only the active trace.
- [ TRACE MARKER ] — the main marker for the active trace.
- [ MARKER REFERENCE ] — the marker reference for the active trace.
- [ GRID ] — the graticule for the active trace.

**Note**

Your selections from this menu apply only for a plotter. If your output device is a printer, you can only print the whole display.

You can specify different plotter pens for each of these items. Use the softkeys under [ PLOT PEN SETUP ].

*See also:* [ MKR VALUE ABS REL ] softkey, [ MKR VALUE ABS REL ] softkey, [ PLOT PEN SETUP ] softkey

## [PLOT LINE SETUP] softkey

Key Path: [ Plot/Print ]

Specify the line pattern that will be used to plot the traces and limit lines.

*See also:* Line type softkeys, [ TRACE x LINE TYPE ] softkeys, [ LIMIT x LINE TYPE ] softkeys

## [PLOT PEN SETUP] softkey

Key Path: [ Plot/Print ]

Assign plotter pens for various items on the analyzer's screen using the following softkeys:

- [ TRACE A PEN ]: Used for trace A and all of its trace-specific annotation.
- [ TRACE B PEN ]: Used for trace B and all of its trace-specific annotation.
- [ MARKER A PEN ]: Used for trace A's markers, marker functions, and limit lines.
- [ MARKER B PEN ]: Used for trace B's markers, marker functions, and limit lines.
- [ ALPHA PEN ]: Used for information that is not trace-specific.
- [ GRID PEN ]: Used for the grids.

One softkey—[ DEFAULT PENS ]—returns the other softkeys in this menu to their preset values.

*See also:* [ DEFAULT PENS ] softkey

## [PLOT PEN SPEED] softkeys

Key Path: [ Plot/Print ] → [ DEFINE PLOT ] → [ PLOT SPEED ]

Specify the plotting speed for all plotting operations initiated by the analyzer.

Two softkeys provide the most commonly selected plotting speeds:

- [ SLOW (10 cm/s) ].
- [ FAST (50 cm/s) ].

Another softkey lets you request additional plotting speeds that may be supported by your plotter. Press [ DEFINE (? cm/s) ] to enter a new speed (units are cm/s).

## [Plot/Print] hardkey

The softkeys under the [ Plot/Print ] hardkey control the plotting and printing of screen contents.

---

**Note** You must select the [ SYSTEM CONTROLLR ] softkey (under [ Local/HP-IB ]) before plotting or printing. Also, [ PLOTTER ADDRESS ] and [ PRINTER ADDRESS ] must be correct.

---

The softkeys in this menu allow you to do the following things:

- Start and abort plotting or printing.
- Specify which portions of the analyzer's screen should be plotted.
- Specify whether you're plotting over HP-IB or to a file.
- Specify whether the output goes to a printer or a plotter.
- Set up the pens and plotting speed.
- Turn time stamp on or off.

Plots are scaled according to the established limits on the plotter. The analyzer can't redefine these limits; you must change them on the plotter.

Print information is sent as a bit-mapped graphic, so your printer must have raster-dump capabilities. Screen pixels are mapped one-to-one to printer pixels.

The softkeys grouped under [ Plot/Print ] allow you to plot or print the following things:

- Traces.
- Curve fit/synthesis tables.
- The instrument state.
- The disk catalog.
- Output from an HP Instrument BASIC program.
- Fault or test log (performance tests).

These softkeys do not allow you to plot or print HP Instrument BASIC programs or Help screens. To print a program, press the [ PRINT PROGRAM ] softkey (in the BASIC menu). To print a displayed Help screen, press [ 8 ] when the Help screen is displayed.

*See also:* [ Help ] hardkey, [ PRINT PROGRAM ] softkey, [ TIMESTAMP SETUP ] softkey, [ PLOT PEN SPEED ] softkeys, [ PLOT PEN SETUP ] softkey, [ DEVICE IS PLOT PRNT ] softkey, [ OUTPUT TO HPIB FILE ] softkey, [ PLOT DATA SELECT ] softkey, [ ABORT PLOT/PRNT ] softkey, [ START PLOT PRNT ] softkey, [ PRINTER ADDRESS ] softkey, [ PLOTTER ADDRESS ] softkey, Controller Capability softkey group

## [PLOTTER ADDRESS] softkey

Key Path: [ Local/HP-IB ]

Tell the analyzer what address is currently assigned to your HP-IB plotter. (See your plotter's documentation if you don't know how to determine its HP-IB address.) An entry window is displayed so you can enter the address.

**Note** The plotter address is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

When you plot screen contents, the analyzer looks for a plotter at the address specified with this softkey. If there isn't a plotter at the specified address, the plot is aborted.

## [Preset] hardkey

The two softkeys in the preset menu allow you to return the analyzer to a known state. [ DO PRESET ] uses all default settings. [ RECALL AUTOSTATE ] uses settings you have saved to an autostate file.

**Note** If you do not want to load the autostate or auto-basic program when you turn on the analyzer, hold down the [ Preset ] key while you turn on the analyzer.

This also prevents the analyzer from performing a calibration.

The HP-IB command to perform a preset is SYST:PRES.

*See also:* [ SINGLE CAL ] softkey, [ SAVE AUTOSTATE ] softkey, [ SAVE PROGRAM ] softkey, [ RECALL AUTOSTATE ] softkey, [ DO PRESET ] softkey, [ SAVE AUTOSTATE ] softkey

## [PREVIEW OFF] softkey

Key Path: [ Avg ] → [ PREVIEW SETUP ]

Turn off manual preview and timed preview. When preview is off, the analyzer includes all time records in the measurement (except as limited by overload reject).

*See also:* [ OVLD REJ ON OFF ] softkey, [ TIMED PREVIEW ] softkey, [ MANUAL PREVIEW ] softkey

## [PREVIEW SETUP] softkey

Key Path: [ Avg ]

Set up manual preview and timed preview parameters.

When manual or timed preview is active, the analyzer displays each time record. The message "WAITING FOR ACCEPT/REJECT" appears in the measurement status area.

This menu also contains the softkeys for accepting or rejecting a time record during preview.

*See also:* [ ACCEPT TIME REC ] softkey, [ REJECT TIME REC ] softkey, [ TIMED PREVIEW ] softkey, [ MANUAL PREVIEW ] softkey

## [PRINT PROGRAM] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ BASIC ] → [ INSTRUMNT BASIC ]

Print (list) your HP Instrument BASIC program. The following things must be true in order for your program to print:

- The analyzer must be the system controller.
- The printer must be turned on, attached to the analyzer's HP-IB connector, and set to the address specified under the [ PRINTER ADDRESS ] softkey.

*See also:* [ PRINTER ADDRESS ] softkey, Controller Capability softkey group

## [PRINTER ADDRESS] softkey

Key Path: [ Local/HP-IB ]

Tell the analyzer what address is currently assigned to your HP-IB printer. (See your printer's documentation if you don't know how to determine its HP-IB address.) An entry window is displayed so you can enter the address.

**Note** The printer address is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

When you print screen contents, the analyzer looks for a printer at the address specified with this softkey. If there isn't a printer at the specified address, the print is aborted.

## [PROGRAM X] softkey (Option 1C2)

See [ SELECT PROGRAM ] softkey.

## [PSD() softkey

Key Path: [ Analys ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Scale the argument spectrum to give power spectral density. The argument must be a power spectrum from the FFT analysis mode or the octave analysis mode.

After the PSD scaling operation as been performed on a spectrum, any marker function applied to the result will access the scaled data. Similarly, any subsequent math operation will act on the scaled data.

## [PWR SPEC CHANNEL x] softkey

Key Path: [ **Meas Data** ]

Display the most recent channel 1 or channel 2 power spectrum. The power spectrum computation depends on the type of averaging active.

| | | |
|---|---|---|
| Averaging off, vector, or vector exponential | : | crtn * linspec * conj (linspec) |
| rms | : | crtn * sum (linspec * conj (linspec)) / N |
| rms exponential | : | crtn * xavg (linspec * conjuc (linspec)) |
| Peak hold | : | crtn * max (pspec |

| | | |
|---|---|---|
| where: N | = | number of averages |
| crtn | = | correction for channel x |
| linspec | = | linear spectrum channel x |
| pspec | = | power spectrum channel x |
| xavg | = | g(1/N) * new + ((N-1)/N)* old |

*See also:* [ CAL CONST ON OFF ] softkey, [ NUMBER AVERAGES ] softkey, [ PEAK HOLD ] softkey, [ RMS EXPONENTL ] softkey, [ RMS ] softkey, [ VECTOR EXPONENTL ] softkey, [ VECTOR ] softkey, [ AVERAGE ON OFF ] softkey

## [PWR SPEC CHANNEL x] softkey (octave)

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Meas Data** ]

Display power spectrum results for an octave measurement.

For octave measurements the analyzer uses proportionally spaced filters an octave, 1/3 octave, or 1/12 octave apart. The measurement data displayed is the sum of the power in each filter band.

*See also:* [ OCTAVE ANALYSIS ] softkey

## [PWR SPEC CHANNEL x] softkey (order)

(Available only with option 1D1, Real Time Octave)

Key Path: [ **Meas Data** ]

Display power spectrum results for an order measurement.

When average is on for order analysis, only the time data is averaged. The power spectrum is not averaged; it represents the instantaneous spectrum at the time of the last average.

If you want to display the averaged spectrum, define a math function to be "FFT(TIME1)" and select that function from the Meas Data softkeys.

*See also:* [ DEFINE FUNCTION ] softkey, [ ORDER ANALYSIS ] softkey

## Quitting online help

To quit (exit) the online help system, press [ **0** ]. When you quit help, the analyzer restores the menu that was displayed just before you entered help. Other instrument parameters are unchanged.

## [RAM DISK SIZE] softkey

Key Path: [ **Disk Utility** ] → [ FORMAT DISK ]

Specify the size for the RAM disk you are formatting in 1024 byte increments.

Each time you turn the analyzer on, a 64 kilobyte volatile RAM disk is created. If you need more storage space, you must specify a larger RAM disk size and reformat the disk.

*See also:* [ FORMAT DISK ] softkey

## [RAMP RATE] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ **Source** ]

Specify how fast the source amplitude can change when you start, stop, pause, and continue a swept sine measurement. The source also ramps to a different level if you change the source level during a swept sine measurement or if the autolevel algorithm changes the level.

---

**Note** If you enter a ramp rate of 0 V/S, the analyzer changes the source level instantaneously rather than ramping to the new level.

---

When you start a swept sine measurement, the source ramps on at the correct frequency. When you stop a measurement, the source ramps off.

If you change to a different instrument mode while the source is still on, the source immediately shuts off without ramping.

*See also:* [ **Inst Mode** ] hardkey, [ LEVEL ] softkey (swept sine source), [ SWEPT SINE ] softkey

## [RANDOM NOISE] softkey

Key Path: [ **Source** ]

Select the random noise waveform. Random noise yields a fast, linear estimate of the system under test. Because it is not periodic in the time record, random noise requires windowing (usually the Hanning window).

For FFT analysis, correlation analysis, and histogram/time measurements, the bandwidth of the random noise is set so that most of the energy in the source signal is within the measured span.

For octave analysis, the bandwidth of the random noise is based on the stop frequency as follows:

| Stop frequency | Bandwidth |
|---|---|
| Full octave | stop frequency * 3.2 |
| 1/3 octave | stop frequency * 1.6 |
| 1/12 octave | stop frequency * 1.13 |

For order analysis, the random noise bandwidth is the FFT frequency span closest to the result of the following equation:

Max rpm x Max order / 60

*See also:* [ SPAN ] softkey (frequency), [ ORDER ANALYSIS ] softkey, [ STOP ] softkey (octave frequency), [ OCTAVE ANALYSIS ] softkey, [ HISTOGRAM/TIME ] softkey, [ CORRELATN ANALYSIS ] softkey, [ FFT ANALYSIS ] softkey, Time record, [ HANNING ] softkey

## [RCL FIT TABLE] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Replace the current curve fit table with a saved curve fit table.

For instructions on recalling, see "Recalling information."

## [RCL SYNTH TABLE] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Replace the current synthesis table with a saved synthesis table.

For instructions on recalling, see "Recalling information."

## [RE-SAVE PROGRAM] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Save an edited HP Instrument BASIC program. You can not use [ SAVE PROGRAM ] for this purpose, because it doesn't allow you to overwrite an existing program (in this case, the last-saved version of the program you are editing).

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important programs to another disk before power-down or they will be lost.

---

For instructions on saving, see "Saving information."

*See also:* [ SAVE PROGRAM ] softkey

## [REAL PART] softkey

Key Path: [ **Trace Coord** ] → [ MORE: NYQ REAL IMAG ]

Display the real part of the measurement results on the active trace.

## [REAL(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the real part of the operand.

The real part of a complex number "a + jb" is "a."

## Real-time bandwidth

Real-time bandwidth is a specification used to characterize the performance of an FFT analyzer. The real-time bandwidth is the frequency span at which the FFT processing time equals the time record length—this means all input data is included in the average (in other words, there is no gap between the end of one time record and the beginning of the next).

However, if you increase the span past the real-time bandwidth, the record length becomes shorter than the FFT processing time. Time records are no longer contiguous, and some data is missed. Therefore, you can overlap records only when measuring below the real-time bandwidth, because the time record length must be longer than the FFT processing time to achieve any overlap.

The actual real-time bandwidth achieved varies with the amount of processing time the analyzer needs. As with overlap processing, this depends on the current frequency span, the type of average selected, and how busy the analyzer is servicing the HP-IB and marker functions and key presses. The typical real-time bandwidth for the HP 35665A (with fast average on) is 6.4 kHz for two channels and 12.8 kHz for one channel.

## [RECALL AUTOSTATE] softkey

Key Path: [ **Save/Recall** ]
or: [ **Preset** ]

Recall the instrument state from the saved auto state file.

The analyzer looks for the file AUTO_ST, first on the internal disk, then in non-volatile memory.

The instrument state does not include traces, limit lines, math functions, math constants, or data registers.

*See also:* [ SAVE AUTOSTATE ] softkey, [ NON-VOL RAM DISK ] softkey, [ INTERNAL DISK ] softkey

## [RECALL CAPTURE] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Replace the current time capture buffer contents with a saved time capture file.

For instructions on recalling, see "Recalling information."

## [RECALL DATA] softkey

Key Path: [ Save/Recall ]

Display softkeys for recalling the following types of data:

- Individual trace.
- Time capture buffer contents.
- Waterfall buffer contents.

For instructions on recalling, see "Recalling information."

*See also:* [ RECALL WATERFALL ] softkey, [ RECALL CAPTURE ] softkey, [ RECALL TRACE ] softkeys

## [RECALL LINE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ BASIC ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Recall the last line you deleted when you are editing a program.

A line is always recalled with its original line number. You must change this number if you want the recalled line to remain at its new location when you press [ ENTER ]. The new line number must fall between the line numbers of adjacent program lines.

*Hint:* If you press [ INSERT LINE ] before [ RECALL LINE ], you will be able to see the line numbers of both adjacent lines.

*See also:* [ INSERT LINE ] softkey

## [RECALL LOWER LIM] softkey

Key Path: [ Save/Recall ] → [ RECALL MORE ]

Recall a limit line into the lower limit register of the active trace.

**Caution** If you recall limit lines, be sure to set up the same Y-axis units and X-axis frequency span that you used to create the limit lines. If you use different X-axis or Y-axis values, limit testing will not work.

For instructions on recalling, see "Recalling information."

## [RECALL MATH] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Recall a complete set of math definitions—all functions and constants—from one of the disks.

For instructions on saving, see "Recalling information."

## [RECALL PROGRAM] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Load an HP Instrument BASIC program into the analyzer.

For instructions on recalling, see "Recalling information."

## [RECALL STATE] softkey

Key Path: [ **Save/Recall** ]

Replace the current instrument state with a saved state.

**Note**

If you recall an instrument state from an earlier version of HP 35665A firmware, parameters not included in the earlier version are set to their default states.

For instructions on recalling, see "Recalling information."

## [RECALL TRACE] softkeys

Key Path: [ **Save/Recall** ]

Load a saved trace without its original scaling information into one of the analyzer's data registers.

You can display a recalled trace by selecting the corresponding data register under the [ Meas Data ] hardkey. When you display a trace recalled with [ RCL TRACE ], it is displayed using the current scaling of the corresponding data register.

For instructions on recalling, see "Recalling information."

## [RCL TRACE AND SCALE] softkeys

Key Path: [**Save/Recall**]

Load a saved trace and its original scaling information into one of the analyzer's data registers.

You can display a recalled trace by selecting the corresponding data register under the [ Meas Data ] hardkey. When you display a trace recalled with [ RCL TRACE AND SCALE ], it is displayed with its original scaling.

For instructions on recalling, see "Recalling information."

**Note** To display the recalled trace, you must select the corresponding data register under the [ **Meas Data** ] hardkey.

For instructions on recalling, see "Recalling information."

*See also:* [ **Meas Data** ] hardkey

## [RECALL UPPER LIM] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Recall a limit line into the upper limit register of the active trace.

**Caution** If you recall limit lines, be sure to set up the same Y-axis units and X-axis frequency span that you used to create the limit lines. If you use different X-axis or Y-axis values, limit testing will not work.

For instructions on recalling, see "Recalling information."

## [RECALL WATERFALL] softkey

Key Path: [ **Save/Recall** ] → [ RECALL MORE ]

Recall a saved waterfall into a waterfall register.

The analyzer keeps track of the order of additional disks by appending a number to the file name for each disk. For example, if you enter the filename "WFALL," the analyzer labels additional disks "WFALL1," "WFALL2," and so on. When you recall a split file, the analyzer tells you which disk to insert next.

For instructions on recalling, see "Recalling information."

## Recalling information

The analyzer displays an entry window and enters alpha entry mode when it's time to identify the file you want to recall. Use the default filename displayed in the entry window or modify the name with the alpha entry keys. When the filename is correct, press [ENTER] to start the recall operation.

You can do two things to simplify recall operations:

- Designate the disk you use most often as the default disk.
- Display the disk catalog.

You only need to enter a filename to identify a file on the default disk. You must enter a disk specifier and a filename to identify a file on any other disk.

The analyzer can recall files from one of four disks:

- Non-volatile RAM disk (NVRAM).
- Volatile RAM disk (RAM).
- Internal disk (INT).

External HP-IB disk drive (EXT).

When the catalog is displayed, you don't need to type the name of a file you want to overwrite. Instead, you can just select the file with the knob before bringing up the filename entry window. The name of the file you select is automatically placed in the entry window.

*See also:* Alpha entry mode, [ EXTERNAL DISK ] softkey, [ INTERNAL DISK ] softkey, [ VOLATILE RAM DISK ] softkey, [ NON-VOL RAM DISK ] softkey, [ CATALOG ON OFF ] softkey, Disk specifiers, [ DEFAULT DISK ] softkey

## [RECORD LENGTH] softkey

Key Path: [ Freq ]

Specify the time record length in seconds.

Limits: 1.9531 ms to 8192 s (2 chan) Default: 7.8125 ms
976.56 us to 4096 s (1 chan) 3.9062 ms
(limits depend on the instrument mode, resolution, and span selected)

When you change the record length, the frequency span changes to (resolution / record length). If start is anchored, the center and stop frequencies change accordingly. If center is anchored, the start and stop frequencies change accordingly. When you change the frequency span, the record length changes to (resolution / span).

The number of points in each record is related to the resolution as follows:

| Resolution | Number of pointsper record |
|---|---|
| 100 | 256 |
| 200 | 512 |
| 400 | 1024 |
| 800 | 2048 |

For correlation measurements, record length and resolution are independent—changing one does not change the other.

For correlation measurements, the record length, T, represents the length of the raw time record collected. This record length, T, is used in the correlation weighting functions -T/4 to T/4, 0 to T/2, and -T/2 to T/2.

*See also:* [ RESOLUTN (LINES) ] softkey, [ ZERO PAD 0, T/2 ] softkey, [ UNIFORM -T/2, T/2 ] softkey, [ ZERO PAD -T/4, T/4 ] softkey, [ CORRELATN ANALYSIS ] softkey, [ SPAN ] softkey (frequency), Time record

## [RECORD TIME] softkey

Key Path: [ Freq ]

Specify the time record length in seconds for a histogram measurement.

| | | |
|---|---|---|
| Limits: | 7.8125 ms to 4096 s (2 chan) | Default: 7.8125 ms |
| | 3.906 ms to 2048 s (1 chan) | 3.906 ms |

(limits depend on the instrument mode and span selected)

This is another way of setting the [ SAMPLE TIME ] for a histogram measurement. The [ SAMPLE TIME ] and [ RECORD TIME ] are related as shown in the following equation:

Record Time = Sample Time x 1024

*See also:* [ SAMPLE TIME ] softkey, Time record

## [REF CHAN CH1 CH2] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Source ] → [ AUTOLEVEL SETUP ]

Specify a reference channel for the autolevel facility. The analyzer uses the [ REFERENCE LEVEL ] and [ REFERENCE TOLERANCE ] values for the reference channel, and the [ MAX INPUT LEVEL ] for the non-reference channel.

*See also:* [ MAX INPUT LEVEL ] softkey, [ REFERENCE TOLERANCE ] softkey, [ REFERENCE LEVEL ] softkey, [ AUTOLEVEL ON OFF ] softkey

## [REFERENCE LEVEL] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Source ] → [ AUTOLEVEL SETUP ]

Specify the amplitude which the analyzer will try to maintain for the input reference channel when autolevel is on.

| | | |
|---|---|---|
| Limits: | 486 uVpk to 31.6 Vpk | Default: 1 Vpk |

When the amplitude varies more than the specified [ REFERENCE TOLERANCE ], the source output level changes to compensate.

*See also:* [ REFERENCE TOLERANCE ] softkey, [ AUTOLEVEL ON OFF ] softkey, [ REF CHAN CH1 CH2 ] softkey

## [REFERENCE SETUP] softkey

Key Path: [ **Marker** ]

Specify that you want to move the marker reference. You can set the marker reference to any X-axis or Y-axis value; unlike the absolute or relative markers, the marker reference is not restricted to displayed values.

- [ REFERENCE TO MARKER ] moves the marker reference to the main marker.
- [ REFERENCE X ENTRY ] moves the marker reference to a specific X-axis value
- [ REFERENCE Y ENTRY ] moves the marker reference to a specific Y-axis value

## [REFERENCE TOLERANCE] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ **Source** ] → [ AUTOLEVEL SETUP ]

Specify the amount that the input reference channel amplitude can change before the source output level is adjusted when autolevel is on.

Limits: 0.1 dB to 20 dB Default: 2 dB

*See also:* [ AUTOLEVEL ON OFF ] softkey, [ REF CHAN CH1 CH2 ] softkey

## [REFERENCE TO MARKER] softkey

See [ REFERENCE SETUP ] softkey.

## [REFERENCE X ENTRY] softkey

See [ REFERENCE SETUP ] softkey.

## [REFERENCE Y ENTRY] softkey

See [ REFERENCE SETUP ] softkey.

## [REJECT TIME REC] softkey

Key Path: [ **Avg** ] → [ PREVIEW SETUP ]

Do not include the last time record in the measurement data.

When manual preview or timed preview is on, you can decide which data should be included in the measurement results.

After each time record is collected, it is displayed. You must either accept or reject the time record for both channels. That is, you cannot accept the time record for one channel and reject it for the other channel.

If you reject the time record, the analyzer does not return to the previous display; rather, it leaves the rejected time record displayed until you change the display, take another time record, or restart the measurement.

*See also:* [ TIMED PREVIEW ] softkey, [ MANUAL PREVIEW ] softkey

## [REMOVE CAPTURE] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]
or: [ **System Utility** ] → [ MEMORY USAGE ]

Deallocate the memory reserved for time capture.

The analyzer asks you for confirmation before it deallocates the memory.

## [REMOVE PROGRAMS] softkey

See [ MEMORY USAGE ] softkey.

## [REMOVE RAM DISK] softkey

See [ MEMORY USAGE ] softkey.

## [REMOVE WATERFALL] softkey

See [ MEMORY USAGE ] softkey.

## [REMOVE WTRFL REGS] softkey

See [ MEMORY USAGE ] softkey.

## [RENAME FILE] softkeys

Key Path: [ **Disk Utility** ]

Rename a file using the following softkeys:

- [ ORIGINAL FILENAME ] asks you for the file's current name.
- [ NEW FILENAME ] asks you for the file's new name.
- [ PERFORM RENAME ] renames a file based on your entries in the two filename entry windows.

When you press [ PERFORM RENAME ], the analyzer renames a file on the default disk. To rename a file on one of the other disks, you must enter that disk's specifier in both filename entry windows.

A name is automatically entered into each filename entry window. If the catalog is off, each entry window contains the filename last entered. If the catalog is on, each entry window contains the name of the file currently highlighted. You can use the name in the entry window or modify it with the alpha entry keys.

*See also:* Alpha entry mode, [ CATALOG ON OFF ] softkey, Disk specifiers, [ DEFAULT DISK ] softkey

## [RENUMBER] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ]

Allows you to do three things:

- Specify the first line number of a renumbered program.
- Specify the increment between renumbered lines.
- Renumber a program based on the specified first line number and increment.

*See also:* [ PERFORM RENUMBER ] softkey, [ INCREMENT ] softkey, [ START LINE # ] softkey (Renumber)

## [REPEAT ON OFF] softkey (average)

Key Path: [ Avg ]

Turn average repeat on or off.

When repeat is on, the analyzer takes N averages (N is the specified number of averages), then clears the data and takes another N averages. The analyzer continues taking measurements until you turn repeat off, turn averaging off, or press [ Pause/Cont ].

This is useful for observing signals that change slowly over time. You can average enough to reduce the noise and still compare the signal over time. The best way to observe this is to set up the analyzer for a waterfall display and set the average parameters like this:

- Average On
- Fast Avg On
- Update Rate = Number Averages

The analyzer takes N averages and displays the results as the first line in the waterfall. Then it takes another N averages and displays the results as the second line in the waterfall, and so forth.

You can also turn repeat on to get a set of averages at each arm in manual arm, time step arm, or rpm step arm mode.

*See also:* [ RPM STEP ARM ] softkey, [ TIME STEP ARM ] softkey, [ MANUAL ARM ] softkey, [ NUMBER AVERAGES ] softkey, [ UPDATE RATE ] softkey, [ FAST AVG ON OFF ] softkey, [ AVERAGE ON OFF ] softkey, [ WATERFALL ] softkey, [ AVERAGE ON OFF ] softkey, [ NUMBER AVERAGES ] softkey

## [REPEAT ON OFF] softkey (histogram)

Key Path: [ Avg ]

When repeat is on, the analyzer performs a histogram over the specified histogram length, then clears the data and performs another histogram over the specified histogram length. The analyzer continues taking measurements until you turn repeat off or press [ Pause/Cont ].

This is useful for observing signals that change slowly over time. You can include enough samples to reduce the noise and still compare the signal over time. The best way to observe this is to set up the analyzer for a waterfall display and turn on fast average.

*See also:* [ FAST AVG ON OFF ] softkey, [ WATERFALL ] softkey, [ HISTOGRAM LENGTH ] softkey

## [REPEAT ON OFF] softkey (octave)

Key Path: [ **Avg** ]

The effect of this key varies depending on the type of averaging and triggering used.

Exponential or equal confidence averaging are not affected by repeat on off.

For linear averaging with external or HP-IB trigger, repeat works like this:

- If repeat is on, the analyzer waits for an external or HP-IB trigger and then repeatedly outputs linear averages after each average time, with no dead time between averages.
- If repeat is off, the analyzer waits for a trigger, computes and displays one linear average, and then waits for another trigger. The analyzer continues to wait for new triggers until you pause the measurement. This mode allows you to collect a waterfall of externally triggered linear averages into one waterfall for later post-processing. The filters settle between each average

For peak hold averaging with external or HP-IB trigger, repeat works like this:

- If repeat is on, the analyzer waits for a trigger and then captures the peak amplitude until you pause the measurement.
- If repeat is off, the analyzer waits for a trigger and captures peak amplitude information for a time equal to the average time.

  In this mode, average time can be thought of as peak hold integration time. After this time has elapsed, the analyzer waits for another trigger. After the next trigger, the analyzer compares the new peaks to the existing held peaks and holds the greater of the two. You must press [ **Start** ] to reset the peak hold display.

  Note that if the peak hold average time is not long enough, some of the lower peak hold bands will never be updated since they have not settled. Peaks are held for each band as they become settled.

For linear averaging with free run trigger, repeat works like this:

- If repeat is on, the analyzer waits for start and then repeatedly outputs linear averages after each linear average integration time.
- If repeat is off, the analyzer, waits for start, then computes and displays one linear average.

For peak hold averaging with free run trigger, repeat works like this:

- If repeat is on, the analyzer waits for start and then captures the peak amplitude until the measurement is paused.
- If repeat is off, the analyzer waits for start and captures peak amplitude information for a time equal to the average time. In this mode, average time can be thought of as peak hold integration time. Note that if the peak hold average time is not long enough, then some of the lower peak hold bands will never be updated since they have not settled. Peaks are held for each band as they become settled.

*See also:* [ AVERAGE TIME ] softkey, [ AVERAGE TIME ] softkey, [ AVERAGE TIME ] softkey

## [REPEAT ON OFF] softkey (source)

Key Path: [ **Source** ] → [ ARB SRC SETUP ]

Turn repeat on or off for the arbitrary source output.

When repeat is on, the analyzer outputs data to the source connector continuously, without interruption.

When repeat is off, the source behavior is affected by trigger mode. In free run trigger mode, source output is continuous, just as it is with repeat on. For any other trigger mode, the source begins its output only when a trigger occurs and shuts off after all the data in the register has been output. This happens each time a trigger occurs.

The timing of the source output is slightly different in different trigger modes. In source trigger mode, the output begins at trigger time. In external trigger, HP-IB trigger, or input trigger modes, the output will be delayed slightly (less than 30 usec).

*See also:* [ ARBITRARY (D1-D8) ] softkey

## [RESET] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ DEBUG ]

Reset your program.

When you reset a program, all HP-IB interfaces it has used are reset and all open files are closed. You can not continue a program that has been reset. If you use [ SINGLE STEP ] after [ RESET ], execution begins at the first line of the program.

**Note** [ RESET ] does not affect your program's variables or HP Instrument BASIC's display area.

*See also:* [ SINGLE STEP ] softkey

## [RESOLUTN (LINES)] softkey

Key Path: [ Freq ]

Specify the resolution for an FFT or correlation measurement. You can select 100, 200, 400, or 800. The default is 400.

If you specify lower resolution (smaller number), it takes less time for the analyzer to collect and process the data. Specify fewer lines for faster measurements, or more lines for better frequency resolution.

When you change the resolution, the analyzer changes the record length rather than the span.

See "Bins defined" for a table showing the relationship between number of lines and the number of points for an FFT measurement.

The following table shows the relationship between the number of points and resolution for different weighting functions in the correlation mode.

| Resolution | 0 to T/2 (real) | -T/2 to T/2 (real) | -T/4 to T/4 (real) |
|---|---|---|---|
| 100 | 128 | 256 | 128 |
| 200 | 256 | 512 | 256 |
| 400 | 512 | 1024 | 512 |
| 800 | 1024 | 2048 | 1024 |

*See also:* [ SPAN ] softkey (frequency), [ RECORD LENGTH ] softkey, Bins defined

## [RESOLUTN SETUP] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Enter the following resolution information for a swept sine measurement:

- Specify the resolution.
- Turn autoresolution on or off.
- Specify the maximum percent change.
- Specify the minimum resolution.

*See also:* [ MINIMUM RESOLUTN ] softkey, [ MAXIMUM % CHANGE ] softkey, [ AUTO RES ON OFF ] softkey, [ RESOLUTN ] softkey

## [RESOLUTN] softkey

(Available only with opt. 1D2, Swept Sine)

Key Path: [ Freq ] → [ RESOLUTN SETUP ]

Set the resolution of the frequency points used in a swept sine measurement.

Limits: 15.625 mHz to SPAN (or 3 to 801 points/sweep)    Default: 101 points/sweep

For a linear sweep, you may set the resolution in number of frequency points per sweep, percent of the frequency span, or a specific frequency step size (Hz). For a log sweep, you may set the resolution in number of frequency points per sweep, percent of the frequency span, number of frequency points per decade, or number of frequency points per octave.

After the sweep is complete, the analyzer redistributes the data (if necessary) to 401 points or 801 points, interpolating between actual measurement points. This is the data that is displayed and saved. The analyzer does this so that you can perform math on swept sine data.

*See also:* [ SPAN ] softkey (swept sine frequency), [ SWEEP LIN LOG ] softkey, [ SWEEP LIN LOG ] softkey, [ SWEPT SINE ] softkey

## Returning to a previous help topic

The analyzer remembers the last 20 topics displayed. To return to a previous topic, press [ 7 ] one or more times. This function is especially useful if you have displayed a related topic—by pressing [ 4 ]—and want to return to the original topic.

*See also:* Displaying a related help topic

## [RISE TIME] softkey

Key Path: [ **Marker Fctn** ] → [ TIME PARAMTERS ]

Compute and display the rise time—the time required for a step response to rise from 10% to 90% of its steady-state level. The analyzer uses only the data between the start time and stop time markers in the computation.

The analyzer uses the lowest steady-state value and approximate highest steady-state value between start time and stop time. The start time should be at least 5 bins before the transition for the computation to be accurate.

The analyzer also puts a horizontal line across the display at the highest steady-state level and displays the steady-state value in the mini-state.

*See also:* [ START TIME ] softkey, [ STOP TIME ] softkey

## [RMS EXPONENTL] softkey

Key Path: [ **Avg** ] → [ AVERAGE TYPE ]

Select exponential rms (power) averaging. Unlike linear (normal) averaging, exponential averaging weights new data more than old data. This is useful for tracking data that changes over time.

For exponential averaging, the number of averages you specify determines the weighting of old versus new data, not the total number of averages calculated. If you increase the [ NUMBER AVERAGES ], new data is weighted less.

With exponential averaging, it's especially important to set the number of averages carefully—if there are too few averages in the measurement, the averaging does not smooth out variances. But if there are too many averages, the analyzer may not track subtle changes occurring within the data.

To calculate the exponential average, the analyzer uses this formula:

$$[(1/N)* (new)]+[((N-1)/N)* (old)],$$

where N is a weighting factor (the [ NUMBER AVERAGES ] you've specified).

When you start an exponential average, N equals 1 for the first analysis, N equals 2 for the second analysis, and so on—until N equals the [ NUMBER AVERAGES ] you've specified. This reduces the variance quickly during the startup of an exponential average.

Once you start a measurement using exponential averaging, the measurement continues indefinitely. To stop it, press [ **Pause/Cont** ]. This is different than linear averaging—linear averaging stops automatically after the specified number of averages are completed.

Until the measurement reaches the specified number of averages, there is no difference between rms exponential averaging and rms averaging.

---

**Note**

The results of rms exponential averaging are displayed only for the following measurement data (and math functions using these data types):
- Power spectrum.
- Frequency response.
- Cross spectrum.

Linear spectrum and time measurement data show only the last processed time record, not averaged data.

---

*See also:* [ RMS ] softkey, [ NUMBER AVERAGES ] softkey [ PWR SPEC CHANNEL x ] softkey, [ FREQUENCY RESPONSE ] softkey (FFT analysis), [ CROSS SPECTRUM ] softkey

## [RMS] softkey

Key Path: [ Avg ] → [ AVERAGE TYPE ]

Select rms (power) averaging. This is the default average type. The analyzer averages N time records, where N is the number of averages you specify.

If you press [ Pause/Cont ] to continue the measurement after the measurement is complete, the analyzer averages another N time records with the existing data. If you press [ Start ], the analyzer clears the data and averages a new N time records.

Remember that rms averaging does not eliminate noise, but simply produces an approximation of the actual noise level. Increasing the number of rms averages provides a better statistical approximation of the noise, but does not actually reduce the noise.

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**Note**

The results of rms averaging are displayed only for the following measurement data (and math functions using these data types):
- Power spectrum.
- Frequency response.
- Cross spectrum.

Linear spectrum and time measurement data show only the last processed time record, not averaged data.

---

*See also:* [ NUMBER AVERAGES ] softkey, [ PWR SPEC CHANNEL x ] softkey,
[ FREQUENCY RESPONSE ] softkey (FFT analysis), [ CROSS SPECTRUM ] softkey

## [RMS SQRT (PWR)] softkey

Key Path: [ Marker Fctn ] → [ BAND MARKER ]

Compute and display the square root of band power. Band power is the total power within the specified frequency band. The value is displayed in the lower left corner of the trace box.

If the trace coordinate is dB magnitude, the analyzer displays band power in dBVrms. For other trace coordinates, the analyzer displays band power in Vrms.

*See also:* [ Trace Coord ] hardkey, [ BAND SPAN ] softkey

## [RPM (SEC)] softkey

Key Path: [ Trace Coord ] → [ X UNITS ]

Specify rpm for frequency domain X-axis units and seconds for time domain X-axis units. One Hz is equal to 60 rpm.

## [RPM DECREASING] softkey (order analysis)

Key Path: [ **Trigger** ] → [ ARM SETUP ]

For time step arming the first arm occurs when the tachometer input rpm value reaches a value less than [ START RPM ].

For rpm step arming the first arm occurs when the tachometer input rpm value passes through the [ MAX RPM ] value (or integral multiples of [ RPM STEP SIZE ] below [ MAX RPM ]) in a negative (rpm decreasing) direction.

*See also:* [ TIME STEP ARM ] softkey (order measurements), [ RPM STEP ARM ] softkey (order measurements), [ MAX RPM ] softkey (Freq), [ START RPM ] softkey

## [RPM INCREASING] softkey (order analysis)

Key Path: [ **Trigger** ] → [ ARM SETUP ]

For time step arming the first arm occurs when the tachometer input rpm value reaches a value greater than [ START RPM ].

For rpm step arming the first arm occurs when the tachometer input rpm value passes through the [ MIN RPM ] value (or integral multiples of [ RPM STEP SIZE ] above [ MIN RPM ]) in a positive (rpm increasing) direction.

*See also:* [ TIME STEP ARM ] softkey (order measurements), [ RPM STEP ARM ] softkey (order measurements), [ MIN RPM ] softkey, [ START RPM ] softkey

## [RPM PROFILE] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Meas Data** ] → [ MORE ]

Display the time history of RPM.

If order track is on, the display has RPM on the vertical axis and time on the horizontal axis. If order track is off, the display has RPM on the vertical axis and counts on the horizontal axis.

*See also:* [ TRACK ON OFF ] softkey

## [RPM STEP ARM] softkey

Key Path: [ **Trigger** ]
or: [ **Trigger** ] → [ ARM SETUP ]

Select rpm step arming. (See separate help topic for rpm step arming with order analysis.) Arming works like this:

- The first arm occurs when the tachometer input rpm value passes through the [ START RPM ] value in a positive direction for [ RPM INCREASING ] or in a negative direction for [ RPM DECREASING ].
- Subsequent steps occur at intervals of [ RPM STEP SIZE ].
- The number of steps is equal to the [ WATERFALL STEPS ] value with the following exception:

The analyzer sets a "stop rpm" based on one of the following equations:

for rpm increasing
stop = start rpm + (rpm step size x waterfall steps)

for rpm decreasing
stop = start rpm - (rpm step size x waterfall steps)

If the tach input sweep rate is too fast for the analyzer to make measurements at "rpm step size" intervals, the analyzer cannot obtain all the rpm steps. The analyzer stops at the calculated "stop rpm" and displays the message "WATERFALL COMPLETE."

If this happens, you can either slow down the tach ramp rate, increase the rpm step size, or use time capture to ensure that each step is measured.

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

*See also:* [ RPM STEP ARM ] softkey (order measurements), [ START RPM ] softkey, [ START RPM USAGE ] softkeys, [ RPM STEP SIZE ] softkey, [ WATERFALL STEPS ] softkey, [ CAPTURE SETUP ] softkey

## [RPM STEP ARM] softkey (order measurements)

Key Path: [ **Trigger** ]

Select rpm step arming for an order measurement.

- The first arm occurs when the tachometer input rpm value passes through the [ MIN RPM ] value in a positive ([ RPM INCREASING ]) direction or the [ MAX RPM ] value in a negative ([ RPM DECREASING ]) direction.
- Subsequent steps occur at intervals of [ RPM STEP SIZE ].
- The number of steps is:
  ((Max rpm – Min rpm)/rpm step size) + 1
  The analyzer sets [ WATERFALL STEPS ] to this value, and you cannot change it. The actual number of steps may be further limited by the ramp speed of the tach input.

The analyzer sets a "stop rpm" based on one of the following equations:

for rpm increasing
stop = start rpm + (rpm step size x waterfall steps)

for rpm decreasing
stop = start rpm - (rpm step size x waterfall steps)

If the tach input sweep rate is too fast for the analyzer to make measurements at "rpm step size" intervals, the analyzer cannot obtain all the rpm steps. The analyzer stops at the calculated "stop rpm" and displays the message "WATERFALL COMPLETE."

If this happens, you can either slow down the tach ramp rate, increase the rpm step size, or use time capture to ensure that each step is measured.

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

*See also:* [ CAPTURE SETUP ] softkey, [ RPM STEP SIZE ] softkey, [ MAX RPM ] softkey (Freq), [ MIN RPM ] softkey, [ RPM INCREASING ] softkey (order analysis), [ RPM DECREASING ] softkey (order analysis), [ WATERFALL STEPS ] softkey

## [RPM STEP SIZE] softkey

Key Path: [ **Trigger** ] → [ ARM SETUP ]

Specify the rpm step size for rpm step arming.

Limits: 1 to 500,000 rpm    Default: varies depending on instrument mode

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

*See also:* [ RPM STEP ARM ] softkey

## [RPM DECREASING] softkey

See [ START RPM USAGE ] softkeys.

## [RPM INCREASING] softkey

See [ START RPM USAGE ] softkeys.

## [RUN PROGRAM] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ]

Begin execution of the current HP Instrument BASIC program. After all variables not in COM are initialized, execution begins with the first statement.

To pause a running program, press [ **BASIC** ].

To stop a running program, press [ **Local/HP-IB** ].

---

**Note** If the program is paused, you can resume execution by pressing the [ CONTINUE ] softkey.

---

*See also:* [ CONTINUE ] softkey (BASIC), Stopping a program

## [RUN PROGRAM X] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ]
or: [ **BASIC** ] → [ SELECT PROGRAM ]

Begin execution of the specified program. After all variables not in COM are initialized, execution begins with the first statement.

---

**Note** HP Instrument BASIC allows you to automatically load and run a designated program when you turn on the analyzer. See [ SAVE PROGRAM ] for instructions.

---

To pause a running program, press [ **BASIC** ].

To stop a running program, press [ **Local/HP-IB** ].

If you have changed the labels for programs, the softkeys list the program labels rather than the program numbers.

---

**Note** If the program is paused, you can resume execution by pressing the [ CONTINUE ] softkey.

*Hint:* The softkey labels disappear when you press this softkey while in help mode. You can press [BASIC] to display the softkey labels.

*See also:* [ SAVE PROGRAM ] softkey, [ CONTINUE ] softkey (BASIC), [ LABEL PROGRAM ] softkey

## [S/N VERSION] softkey

Key Path: [ **System Utility** ]

Display your analyzer's serial number and firmware version.

This is useful if you need to know the serial number and the rear panel of your analyzer is not easily accessible.

## [SAMPLE TIME] softkey

Key Path: [ Freq ]

Specify the sample time for a histogram measurement. Sample time is the time between points in the display.

| | | |
|---|---|---|
| Limits: | 7.6294 us to 4 s (2 ch) | Default: 7.6294 us |
| | 3.8147 us to 2 s (1 ch) | 3.8147 us |

This is another way of setting the [ RECORD TIME ] for a histogram measurement. The [ SAMPLE TIME ] and [ RECORD TIME ] are related as shown in the following equation:

Sample Time = Record Time / 1024

---

**Note** Time capture taken in the histogram mode uses the full frequency span rather than the specified [ SAMPLE TIME ].

---

*See also:* [ RECORD TIME ] softkey

## [SAVE AND DISP DATA] softkey

Key Path: [ Marker Fctn ] → [ WATERFALL MARKERS ]

Save the selected waterfall trace or slice to the specified data register and display the data in the upper trace box.

*See also:* [ SELECT SAVE REGISTER ] softkey, [ SLICE SELECT ] softkey, [ TRACE SELECT ] softkey

## [SAVE AUTOSTATE] softkey

Key Path: [ **Save/Recall** ] → [ MORE ]

Save the current instrument state to the auto state file. When you turn on the analyzer, the analyzer uses the instrument state from this file.

**Note** If you do not want to load the autostate program when you turn on the analyzer, hold down the [ **Preset** ] key while you turn on the analyzer.

The analyzer does not ask you to enter a file name for the auto state file. The auto state is always saved to the same file (NVRAM:AUTO_ST). (You can copy the file to an internal disk. When you recall the autostate, the analyzer looks for the file AUTO_ST first on the internal disk, then in non-volatile memory.)

The instrument state does not include traces, limit lines, math functions, math constants, or data registers.

*See also:* [ INTERNAL DISK ] softkey, [ NON-VOL RAM DISK ] softkey

## [SAVE CAPTURE] softkey

Key Path: [ **Save/Recall** ] → [ SAVE DATA ]

Save the contents of the time capture buffer.

If the buffer is too large to fit on one disk, the analyzer displays a message telling you it must split the file and instructs you to press [ CONTINUE SAVE ]. The analyzer fills the first disk, then prompts you to insert another disk and press [ CONTINUE SAVE ] again until the entire buffer has been saved.

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important time capture data to another disk before power-down or it will be lost.

For instructions on saving, see "Saving information."

## [SAVE CHx CAL TRACE] softkey

Key Path: [ **System Utility** ] → [ CALIBRATN ]

Save the calibration trace for the specified channel to a data register.

*See also:* Data registers

## [SAVE DATA] softkeys

Key Path: [ **Save/Recall** ]

Display softkeys for saving the following types of data:

- Individual trace.
- Time capture buffer contents.
- Waterfall buffer contents for the active trace.

For instructions on saving, see "Saving information."

*See also:* [ SAVE WATERFALL ] softkey, [ SAVE CAPTURE ] softkey, [ SAVE TRACE ] softkeys

## [SAVE FIT TABLE] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Save the curve fit table.

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important tables to another disk before power-down or it will be lost.

---

For instructions on saving, see "Saving information."

## [SAVE LOWER LIM] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Save the lower limit line of the active trace to one of the disks.

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important limit files to another disk before power-down or they will be lost.

---

For instructions on saving, see "Saving information."

## [SAVE MATH] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Save a complete set of math definitions—all functions and constants—to one of the disks.

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important math files to another disk before power-down or they will be lost.

---

For instructions on saving, see "Saving information."

## [SAVE PROGRAM] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Save the selected HP Instrument BASIC program.

HP Instrument BASIC allows you to automatically load one or more programs and run a designated program when you turn on the analyzer. To make an autoloading program, save it to the non-volatile RAM disk or to a floppy disk in the internal drive with one of the following names:

- AUTO_BAS
- AUTO_BA1
- AUTO_BA2
- AUTO_BA3
- AUTO_BA4
- AUTO_BA5

At power-up, the analyzer searches the internal disk drive and then the non-volatile RAM disk for files with these special names. It searches for files in the order listed above, but it does not search for AUTO_BA1 if AUTO_BAS is found.

If AUTO_BAS is found, it is loaded into the first program buffer and executed after all other programs have been loaded. If AUTO_BA1 through AUTO_BA5 are found, they are loaded into the first through fifth program buffers, but they are not executed.

If you do not want to load any AUTO_BA* program, you can hold down [ **Preset** ] while you turn on the analyzer.

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important programs to another disk before power-down or they will be lost.

---

For instructions on saving, see "Saving information."

*See also:* [ RE-SAVE PROGRAM ] softkey

## [SAVE SNTH TABLE] softkey

Key Path: [ **Save/Recall** ] → [ SAVE MORE ]

Save the synthesis table.

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important tables to another disk before power-down or it will be lost.

---

For instructions on saving, see "Saving information."

## [SAVE STATE] softkey

Key Path: [ **Save/Recall** ]

Save the current instrument state to one of the disks.

The instrument state does not include traces, limit lines, math functions, math constants, or data registers.

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important state files to another disk before power-down or they will be lost.

For instructions on saving, see "Saving information."

## [SAVE TO DATA REG] softkey

Key Path: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

Save the selected waterfall trace or slice to the specified data register.

*See also:* [ SELECT SAVE REGISTER ] softkey, [ SLICE SELECT ] softkey, [ TRACE SELECT ] softkey

## [SAVE TRACE] softkey

Key Path: [ **Save/Recall** ] → [ SAVE DATA ]

Save the active trace to one of the following places:

[ INTO Dx ] lets you save into data register x.

[ INTO FILE ] lets you save to the default disk (or to any disk if you include a disk specifier).

The analyzer saves only the active trace and its trace title. If you want to save other measurement data, you must first display it in the active trace, then save the trace.

**Caution** The volatile RAM disk and all data registers are cleared each time you turn the analyzer off. Copy important trace files to another disk before power-down or they will be lost.

For instructions on saving, see "Saving information."

*See also:* [ DEFAULT DISK ] softkey, Disk specifiers, Data registers

## [SAVE UPPER LIM] softkey

Key Path: [ Save/Recall ] → [ SAVE MORE ]

Save the upper limit line of the active trace to one of the disks.

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important limit files to another disk before power-down or they will be lost.

For instructions on saving, see "Saving information."

## [SAVE WATERFALL] softkey

Key Path: [ Save/Recall ] → [ SAVE DATA ]

Save the waterfall of the measurement data displayed in the active trace. You can save the waterfall to one of two places:

[ INTO FILE ] lets you save to the default disk (or any disk if you include a disk specifier).

[ INTO Wx ] lets you save into the specified waterfall register.

The analyzer saves only the measurement data for the currently active trace. It does not save the complete set of measurement results. For example, if the active trace displays coherence and you have set [ WATERFALL STEPS ] to 10, the analyzer saves the last 10 coherence traces.

[ WATERFALL STEPS ] must be greater than 1, or the analyzer displays a message and does not save the waterfall.

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important waterfall data to another disk before power-down or it will be lost.

If the buffer is too large to fit on one disk, the analyzer displays a message telling you it must split the file and instructs you to press [ CONTINUE SAVE ]. The analyzer fills the first disk, then prompts you to insert another disk and press [ CONTINUE SAVE ] again until the entire buffer has been saved.

For instructions on saving, see "Saving information."

*See also:* [ WATERFALL REGISTER ] softkey, Disk specifiers, [ DEFAULT DISK ] softkey, [ WATERFALL STEPS ] softkey

## [Save/Recall] hardkey

The softkeys under [ Save/Recall ] are used to load traces into the analyzer's data registers and to save and recall the following kinds of files:

- Individual trace.
- Instrument state.
- Limit definition.
- Math definition.
- HP Instrument BASIC program.
- Time capture buffer contents.
- Waterfall buffer contents for the active trace.
- Curve fit table.
- Synthesis table.

---

**Note**

When you save to a file, the analyzer displays a message when the save is complete.

When you save to a data register, RAM, or non-volatile RAM, the operation speed does not allow the message to be displayed. When the softkey menu changes, the save is complete.

---

For instructions on saving, see "Saving information."

---

**Note**

To rename, copy, or delete files, use the softkeys grouped under [ Disk Utility ].

---

*See also:* [ NON-VOL RAM DISK ] softkey, [ VOLATILE RAM DISK ] softkey, Data registers, [ SAVE SNTH TABLE ] softkey, [ SAVE FIT TABLE ] softkey, [ SAVE WATERFALL ] softkey, [ SAVE CAPTURE ] softkey, [ SAVE PROGRAM ] softkey, [ SAVE MATH ] softkey, [ SAVE UPPER LIM ] softkey, [ SAVE STATE ] softkey, [ SAVE TRACE ] softkeys

## Saving Information

When you save information to a file, the analyzer displays an entry window and enters alpha entry mode. Use the default filename displayed in the entry window or modify the name with the alpha entry keys. When the filename is correct, press [ENTER] to start the save operation.

The analyzer assigns the following extensions to the default file names.

- DAT traces, capture file, waterfalls
- STA states
- LIM upper and lower limits
- MTH math function and constant definitions
- FIT curve fit tables
- SYN synthesis tables

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important files to another disk before power-down or they will be lost.

You can do two things to simplify save operations:

- Designate the disk you use most often as the default disk.
- Display the disk catalog.

You only need to enter a filename to identify a file on the default disk. You must enter a disk specifier and a filename to identify a file on any other disk.

The analyzer can save files to one of four disks:

- Non-volatile RAM disk (NVRAM).
- Volatile RAM disk (RAM).
- Internal disk (INT).
- External HP-IB disk drive (EXT).

When the catalog is displayed, you don't need to type the name of a file you want to overwrite. Instead, you can just select the file with the knob before bringing up the filename entry window. The name of the file you select is automatically placed in the entry window.

The analyzer will also increment file names if you use a number as the last character of the file name or the last character before the extension--for example, "TRACE1" or "TRACE1.DAT." The analyzer will automatically put the name "TRACE2" (or "TRACE2.DAT") in the entry box the next time you save something. This feature only works if the catalog is off.

If the buffer contents will not fit on one disk, the analyzer splits the file and asks you to insert another disk when the current disk is full. Press [ CONTINUE SAVE ] to save the next portion of the buffer on the new disk.

---

**Note** [ CONTINUE SAVE ] only works for flexible disks in the internal or external disk drives. It does not work for non-volatile RAM, volatile RAM, or fixed external disks.

---

When you try to save to an existing file, the analyzer displays an error message and a new softkey menu. You must press [ OVERWRITE FILE ] to overwrite the file or [ CANCEL/RETURN ] to enter a new file name.

*See also:* [ OVERWRIT FILE ] softkey, [ CONTINUE SAVE ] softkey, Alpha entry mode, [ EXTERNAL DISK ] softkey, [ INTERNAL DISK ] softkey, [ VOLATILE RAM DISK ] softkey, [ NON-VOL RAM DISK ] softkey, [ CATALOG ON OFF ] softkey, Disk specifiers, [ DEFAULT DISK ] softkey

## [SCALE AT MARKERS] softkey

Key Path: [ **Scale** ] → [ AXES SCAL MARKERS ]

Change the display to show only that part of the trace between the axes scale markers. When you move the markers, the data displayed changes. The way the markers move depends on the current "hold" selection ([ HOLD RIGHT ], [ HOLD TOP ], [ HOLD CENTER ], [ HOLD LEFT ], [ HOLD BOTTOM ], [ HOLD WDTH (SCROLL) ]).

For example, assume you press [ SCALE AT MARKERS ], then press [ HOLD WDTH (SCROLL) ]. When you turn the knob, the display scrolls through the data.

*See also:* [ HOLD WDTH (SCROLL) ] softkey, [ HOLD BOTTOM ] softkey, [ HOLD LEFT ] softkey, [ HOLD CENTER ] softkey, [ HOLD TOP ] softkey, [ HOLD RIGHT ] softkey, [ AXES SCAL MARKERS ] softkey

## [Scale] hardkey

Choose an appropriate scale and units for the active trace.

The options available in the menu are:

- Y-axis autoscale.
- Y-axis top reference.
- Y-axis center reference.
- Y-axis bottom reference.
- Y-axis input range tracking.
- Y-axis per division.
- Match the X-axis scale to the other trace.
- Match the Y-axis scale to the other trace.
- Axes scale markers.

**Note** The arrow keys and the knob are especially useful in the Scale menu, since they let you quickly change the vertical scaling.

For very small or very large values, the Y-axis scale annotation is in scientific notation. The prefixes are defined under "Suffix menus."

*See also:* Suffix menus, [ MATCH Y SCALE ] softkey, [ MATCH X SCALE ] softkey, Knob, [ AXES SCAL MARKERS ] softkey, [ Y PER DIV (DECADES) ] softkey, [ INP RANGE TRACKING ] softkey, [ BOTTOM REFERENCE ] softkey, [ CENTER REFERENCE ] softkey, [ TOP REFERENCE ] softkey, [ Y AUTO SCAL ONCE ] softkey, Arrow keys

## [SCRATCH OPTIONS] softkey group (Option 1C2)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ SCRATCH ]

Press one of the softkeys in this group to specify what will be deleted when you press [ PERFORM SCRATCH ].

Each softkey specifies some combination of your HP Instrument BASIC program and its variables:

- [ SCRATCH ] specifies the program and all of its variables except those in COM.
- [ SCRATCH C ] specifies all program variables — including those in COM — but not the program itself.
- [ SCRATCH A ] specifies the program and all of its variables including those in COM.

*See also:* [ PERFORM SCRATCH ] softkey

## [SCRATCH] softkey (Option 1C2)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ]

Allows you to do two things:

- Select which combination of your HP Instrument BASIC program and its variables you want to delete.
- Delete the selected combination.

*See also:* [ PERFORM SCRATCH ] softkey, [ SCRATCH OPTIONS ] softkey group

## [SCRATCH A] softkey

See [ SCRATCH OPTIONS ] softkey group.

## [SCRATCH C] softkey (Option 1C2)

See [ SCRATCH OPTIONS ] softkey group.

## [SCREEN SAVER DELAY] softkey

Key Path: [ **Disp Format** ] → [ MORE ] → [ SCREEN SAVER ]

Change the time delay in minutes for the screen saver:

- Limits: integers 1 through 120
- Default: 15

**Note** The delay time is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

## [SCREEN SAVER ON/OFF] softkey

Key Path: [ **Disp Format** ] → [ MORE ] → [ SCREEN SAVER ]

Turn the screen saver on or off.

**Note** The On/Off setting is saved in non-volatile memory, so it is retained when you turn the analyzer off and on.

## [SCREEN SAVER] softkey

Key Path: [ **Disp Format** ] → [ MORE ]

Access the softkeys for setting up the screen saver:

- Screen Saver On/Off
- Screen Saver Delay

The screen saver blanks the display after a user-specified time if a front panel key or an external keyboard key has not been pressed.

The display can be turned back on by pressing a front panel key or an external keyboard key.

## [SCROLL DOWN] softkey

Key Path: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

More traces may be stored in a waterfall than are currently displayed. This key displays a group of traces above (newer than) the currently displayed traces.

## [SCROLL UP] softkey

Key Path: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

More traces may be stored in a waterfall than are currently displayed. This key displays a group of traces below (older than) the currently displayed traces.

## [SECURE] softkey (Option 1C2)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ]

Allows you to do two things:

- Specify a range of lines in your program that you want to secure.
- Secure (protect against viewing) the specified range of lines.

---

**Caution** Secured program lines can not be unsecured. Be sure to keep an unsecured version of the program for your own records.

---

*See also:* [ PERFORM SECURE ] softkey, [ START LINE # ] softkey (Secure)

## [SELECT PROGRAM] softkey (Option 1C2)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ]

Specify which of the 5 HP Instrument BASIC programs you want to run. You can select from programs 1 through 5. If you have changed the labels for programs, the softkeys list the program labels rather than the program numbers.

*See also:* [ LABEL PROGRAM ] softkey

## [SELECT SAVE REGISTER] softkey

Key Path: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

Specify the data register for saving waterfall traces or slices.

*See also:* [ SLICE SELECT ] softkey, [ TRACE SELECT ] softkey

## [SETTLE TIME] softkey (Option 1D2)

Key Path: [ **Avg** ]

Specify the settling time for a swept sine measurement.

Settling time is the delay between changing the source frequency and starting the measurement at each point. This allows the transient response of the device under test to die out before data collection begins.

You can enter the settling time in seconds or as a number of cycles.

*See also:* [ SWEPT SINE ] softkey

## [SETTLING TIME] softkey

Key Path: [ **Marker Fctn** ] → [ TIME PARAMTERS ]

Compute and display settling time—the time required for a step response to reach steady-state level and stay within +/– 5% of the difference between the initial and steady-state levels.

For example, for a step response from 0V to 1V would accept a steady-state band of .95V to 1.05V (1 +/- .05(1-0)). A step response from .5V to 1V would accept a steady-state band of .975V to 1.025V (1 +/- .05(1-.5)).

The analyzer uses only the data between the start time and stop time markers in the computation. The settling time is measured from the start time marker.

The analyzer also puts a horizontal line across the display at the steady-state level and displays the steady-state value in the mini-state.

*See also:* [ START TIME ] softkey, [ STOP TIME ] softkey

## [SIDEBAND INCREMENT] softkey

Key Path: [ **Marker Fctn** ] → [ SIDEBAND MARKER ]

Specify the frequency increment (difference) between sidebands and the carrier frequency.

*See also:* [ SIDEBAND MARKER ] softkey, [ CARRIER FREQ ] softkey

## [SIDEBAND MARKER] softkey

Key Path: [ **Marker Fctn** ]

Turn on the sideband marker. This marker shows the sidebands (and sideband power) for a particular carrier frequency. From the sideband marker menu you can do the following things:

- Specify the carrier frequency.
- Specify the sideband increment.
- Specify the number of sidebands.
- Turn off computation.
- Display sideband power.

*See also:* [ SIDEBAND POWER ] softkey, [ COMPUTE OFF ] softkey, [ NUMBER OF SIDEBANDS ] softkey, [ SIDEBAND INCREMENT ] softkey, [ CARRIER FREQ ] softkey

## [SIDEBAND POWER] softkey

Key Path: [ **Marker Fctn** ] → [ SIDEBAND MARKER ]

Compute and display the sideband power. The sideband power value represents the rms summation of all marked sidebands. The value is displayed in the lower left corner of the trace box.

If the trace coordinate is dB magnitude, the analyzer displays sideband power in dBVrms. For other trace coordinates, the analyzer displays sideband power in Vrms ^ 2.

*See also:* [ **Trace Coord** ] hardkey, [ SIDEBAND MARKER ] softkey

## [SINGLE CAL] softkey

Key Path: [ **System Utility** ] → [ CALIBRATN ]

Calibrate the analyzer one time. Calibration starts as soon as you press the key, interrupting any measurement in progress.

**Note** If you do a calibration while a measurement is paused, the analyzer will start a new measurement when you press [ **Pause/Cont** ].

Calibration is done for all amplitude ranges and all frequencies regardless of instrument setup.

During calibration a small ac voltage (around 2 mV) appears at the source output connector.

**Note** Enable the analyzer's autocalibration function if you want calibrations to occur automatically.

*See also:* [ **Pause/Cont** ] hardkey, [ AUTO CAL ON OFF ] softkey

## [SINGLE] softkey

Key Path: [ **Disp Format** ]

Display only the currently active trace using a single, full-height trace box. All trace annotation applies to the active trace.

**Note** If you select either [ UPPER ] or [ LOWER ] under the [ **BASIC** ] → [ DISPLAY SETUP ] key, the analyzer changes the display format from single to upper/lower.

*See also:* Trace boxes

## [SINGLE STEP] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ DEBUG ]

Execute one line of your program.

The first time you press [ SINGLE STEP ], the analyzer performs a pre-run operation and then displays the first line to be executed. On subsequent presses, the analyzer executes the displayed line and then displays the next line to be executed. (Program lines are displayed at the top of the screen.)

If your program is paused, single-stepping begins with the line following the last-executed line. If your program has been stopped or reset, single-stepping begins with the first line.

**Note** If you change (edit) a paused program, it is reset automatically.

You can use [ EXAMINE VARIABLE ] to see what has happened after each line is executed.

*See also:* [ EXAMINE VARIABLE ] softkey

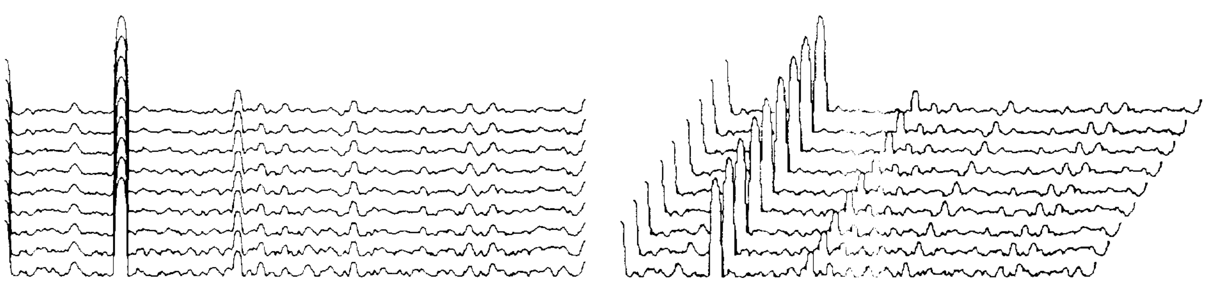
## [SKEW ANGLE] softkey

Key Path: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Specify the offset angle (in degrees) for skewed waterfall display.

Limits: 0 to 45 degrees Default: 30

The skew angle determines how much each trace is offset from the previous trace, as shown in the illustration. The display on the left has no skew (0 degrees). The display on the right has a skew of 30 degrees.



If you specify 0, the effect is the same as turning skew off--each trace begins at the left edge of the trace box and ends at the right edge.

*See also:* [ SKEW ON OFF ] softkey

## [SKEW ON OFF] softkey

Key Path: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Turn skewed waterfall display on or off.

When skew is off, each trace begins at the left edge of the trace box and ends at the right edge.

When skew is on, the beginning of each trace added to the display is offset to the right from the previous trace. Specify the offset by pressing [ SKEW ANGLE ]. The end of each trace is offset to the left so that each trace is completely displayed. The skewed display is especially useful for octave displays.

*See also:* [ SKEW ANGLE ] softkey

## [SLICE SELECT] softkey

Key Path: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

Turn on the slice select marker. Use the numeric keys or the knob to identify the slice you want to save.

A slice is a vertical line through the collection of waterfall traces at the same X-axis value. The number of points in the slice is equal to the number of traces in the waterfall buffer. Each point is the amplitude for the corresponding trace.

The slice is limited to 2048 points. If there are more than 2048 traces in the waterfall, the slice begins with the selected trace and ends 2048 traces later.

You can save the selected slice to a data register by pressing [ SAVE TO DATA REG ]. To view the slice, press [ SAVE AND DISP DATA ]. This saves the slice to the data register and displays the data register on trace A.

---

**Note** You must pause a running measurement before you can use the slice select marker.

---

*See also:* [ SAVE AND DISP DATA ] softkey, [ SAVE TO DATA REG ] softkey, [ TRACE SELECT ] softkey

## [SLOPE POS NEG] softkey

Key Path: [ **Trigger** ] → [ TRIGGER SETUP ]
or: [ **Trigger** ] → [ TACHOMETR SETUP ]
or: [ **Input** ] → [ TACHOMETR SETUP

Select triggering on a rising (positive) or falling (negative) trigger signal.

---

**Note** The slope setting applies to channel 1 triggering, channel 2 triggering, and external triggering only. Free run, source, and HP-IB triggers operate independently of the slope setting.

---

For more information on triggering, see the analyzer's *Concepts Guide.*

## [SLOW (10 cm/s)] softkey

See [ PLOT PEN SPEED ] softkeys.

## Softkeys

The analyzer has ten softkeys arranged in a column to the right of the screen. They are referred to as softkeys because the function assigned to each key can change. In contrast, the function assigned to each hardkey never changes.

For example, when you press the [ **Source** ] hardkey, the first softkey is used to turn the analyzer's source on and off. But when you press the [ **Plot/Print** ] hardkey, the first softkey is used to initiate a plot of the analyzer's screen.

A softkey's current meaning is determined by its "softkey label." The label is displayed on the screen, to the left of the softkey. In the help text, softkeys are represented by enclosing softkey labels in brackets (for example, "The [ CROSS SPECTRUM ] softkey is used to..."). Softkey labels are all upper case.

Special types of softkeys include the following: those that can toggle between two states, those that are part of a bracketed group, and those that are inactive for some analyzer setups.

*See also:* Softkeys in bracketed groups, Softkeys that toggle, [ INACTIVE ] softkeys

## Softkeys in bracketed groups

Some softkeys are grouped together with a bracket.

The keys in such a group select options that are mutually exclusive—at any given time, only one of the options can be active. The analyzer indicates which option is active by drawing a box around that option's softkey label.

## Softkeys that toggle

Some softkeys control analyzer functions that have only two states (for example, on and off). Each time you press one of these keys, the associated function toggles (switches) from one state to the other.

Here is an example of a toggling softkey:

[ X-AXIS LIN **LOG** ]

The analyzer indicates which state is active by highlighting the corresponding text on the softkey label. In the example above, log X-axis is active. If you were to press this example softkey, the state would toggle to linear X-axis.

## [SOLID] softkey

See Line type softkeys.

## [Source] hardkey

Select a source waveform appropriate for the type of measurement you want to make, turn the source on or off, or set the output level for each waveform.

For FFT analysis, correlation analysis, and histogram/time, the analyzer provides these source output types:

- Random noise.
- Burst random.
- Periodic chirp.
- Burst chirp.
- Pink noise.
- Fixed sine.
- Arbitrary data register D1-D8 (with Option 1D4).

For octave and order measurements, the analyzer provides these source output types:

- Random noise.
- Pink noise.
- Fixed sine.

For swept sine measurements, fixed sine is the only output type available. The menu includes:

- Ramp rate
- Autoleveling parameters.

**Caution** When you turn on the analyzer's power (and when you turn off power), a brief pulse may appear at the source output connector. Do not cycle power if you have sensitive test devices connected to the analyzer's source.

The analyzer remembers a separate set of source parameters for each instrument mode. The exceptions are source on/off and source level. The source always shuts off when you change instrument modes, but its level remains unchanged.

The source output impedance is less than 5Ω, so you do not need to terminate the analyzer's source.

*See also:* [ SOURCE ON OFF ] softkey, [ LEVEL ] softkey (source), [ SOURCE ON OFF ] softkey, [ **Inst Mode** ] hardkey, [ AUTOLEVEL ON OFF ] softkey, [ RAMP RATE ] softkey, [ FIXED SINE ] softkey, [ PINK NOISE ] softkey, [ RANDOM NOISE ] softkey, [ ARBITRARY (D1-D8) ] softkey, [ FIXED SINE ] softkey, [ PINK NOISE ] softkey, [ BURST CHIRP ] softkey, [ PERIODIC CHIRP ] softkey, [ BURST RANDOM ] softkey, [ RANDOM NOISE ] softkey, [ LEVEL ] softkey (source)

## [SOURCE ON OFF] softkey

Key Path: [ **Source** ]

Turn the analyzer's source on or off. When you first turn on the analyzer (or press [ **Preset** ]), the source selected will be fixed sine, and it will be turned off.

The source will also be turned off whenever you change instrument modes, unless the new mode is swept sine. The source is always on in swept sine mode. This means that if you turn on the source, then change the instrument mode, the source remains on. The analyzer does not remember a different source on/off state for each instrument mode.

**Note**

If you turn off the source and turn it on again, the output level will automatically return to the level you set previously—even if you've selected a different source waveform.

**Note**

When you start a measurement with capture on, the analyzer turns off the source. The highlight of the [SOURCE ON OFF] key does not change. The source status is indicated by the SRC status indicator above the trace. When the measurement is complete, the analyzer returns the source to its original on/off state.

*See also:* [ CAPTURE ON OFF ] softkey, [ **Inst Mode** ] hardkey

## [SOURCE TRIGGER] softkey

Key Path: [ Trigger ]

Select internal triggering from the analyzer's source.

For source triggering, you can specify pre- or post-trigger delay, but not trigger level or slope.

Source triggering is used with waveforms that are periodic (periodic chirp and fixed sine). For periodic chirp, triggering occurs at the beginning of each time record. For fixed sine, triggering occurs at a consistent (but not predictable) point within the time record.

If you use the fixed sine waveform as the source trigger signal (and the span starts at zero), you should set the fixed sine frequency as a multiple of the frequency span/400. This ensures that the sine wave is periodic within that particular time record—otherwise, the analyzer won't trigger at the same point on the sine wave during subsequent time records (a problem if you're making phase measurements). If the span does not start at zero (zoomed measurements), you should make sure the center frequency is also a multiple of the frequency span/400.

There are fewer restrictions when using the periodic chirp with sine source triggering, but if the span does not start at zero (zoomed measurements), make sure the center frequency is a multiple of the frequency span/400.

The analyzer triggers regularly with random noise, but there is no relationship between the trigger and any particular component of the random noise signal.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ CHANNEL x DELAY ] softkey, [ FIXED SINE ] softkey, [ PERIODIC CHIRP ] softkey

## [SOURCE DISK] softkey

See [ COPY ALL FILES] softkeys.

## [SOURCE FILENAME] softkey

See [ COPY FILE ] softkeys.

## [SPAN] softkey (frequency)

Key Path: [ Freq ]

Specify the frequency bandwidth to be measured. Use the numeric keypad to enter this value. You can enter any value, but the analyzer will automatically switch to the nearest acceptable value. You can also use the arrow keys in the numeric entry group or the knob to step through available values for the frequency span

The following frequency spans are available:

| | | |
|---|---|---|
| 102,400 Hz * | 800 Hz | 6.25 Hz |
| 51,200 Hz | 400 Hz | 3.125 Hz |
| 25,600 Hz | 200 Hz | 1.5625 Hz |
| 12,800 Hz | 100 Hz | .78125 Hz |
| 6,400 Hz | 50 Hz | .390625 Hz |
| 3,200 Hz | 25 Hz | .1953125 Hz |
| 1,600 Hz | 12.5 Hz | .09765625 Hz ** |

* For 1-channel measurements only.
** For 2-channel measurements only.

The span doesn't change when you change the start frequency. This is convenient, because it lets you look at different places in the frequency spectrum while still maintaining the same bandwidth.

When you change the frequency span, the length of the time record changes also—the exact length of the time record (measured in seconds) is resolution/span. And conversely, when you change the time record length, the frequency span changes. The time record length and the frequency span are simply different ways of expressing the same information.

The analyzer's frequency resolution depends on the span you select. To summarize:

- Frequency resolution = Span / Resolution
- Frequency resolution = 1 / (time record length)
- Frequency span = Resolution / (time record length)
- Time record length = Resolution / Span

*See also:* [ RESOLUTN (LINES) ] softkey, [ RECORD LENGTH ] softkey, Time record, Knob, Arrow keys

## [SPAN] softkey (swept sine frequency)

(Available only with option 1D2, Swept Sine)

Key Path: [ **Freq** ]

Specify the width of the band of frequencies to be analyzed for a swept sine measurement.

Limits: 15.625 mHz to 51.149 kHz Default: 51.149 kHz

For log sweep, you can also enter the span in decades or octaves.

If you enter a span that is too large, the analyzer uses the largest span possible for the current start frequency or center frequency (whichever is anchored).

*See also:* [ CENTER ] softkey (swept sine frequency), [ START ] softkey (swept sine frequency), [ SWEPT SINE ] softkey

## [SPANISH] softkey

See [ KEYBOARD SETUP ] softkeys.

## [SQRT(] softkey

Key Path: [ **Analys** ] → [ DEFINE FUNCTION ] → [ DEFINE Fx ] → [ OPERATION ]

Compute the square root of the operand.

The square root of a complex number "a + jb" is given by the formula:

sqrt((a+sqrt(a^2+b^2))/2) +/-j* sqrt((a-sqrt(a^2+b^2))/2)
where the sign of the imaginary part is the same as the sign of b. In polar form, the square root of me^jp is sqrt(m)* e^j(p/2).

## [START CAPTURE] softkey

Key Path: [ Inst Mode ] → [ CAPTURE SETUP ]

Begin collecting data from the inputs and store it in the time capture buffer. If memory was not previously allocated for the time capture buffer, it is allocated now.

**Note**

The analyzer always captures an integral number of 1024point records. All references to "records" for time capture are for a 1024point record.

If there is not enough memory for the specified time length, the analyzer allocates as much memory as possible and displays an error message.

When the capture is complete, the analyzer toggles [ CAPTURE ON/OFF ] to ON.

**Note**

Triggering occurs only once for time capture acquisition. Once the capture starts, it continues until the specified capture length has been reached.

**Note**

If [ TACH DATA ON OFF ] is on, the analyzer does not allow time for the digital filters to settle before capturing data.

For FFT analysis, Correlation analysis, and Histogram analysis, you may want to set the analysis region start time to at least 68 points to eliminate the settling time from the measurement data. (The analyzer allows the digital filters to settle for 68 points.)

*See also:* [ ANALYSIS REGION ] softkeys, [ TACH DATA ON OFF ] softkey, [ CAPTURE ON OFF ] softkey, [ ALLOCATE CAPTURE ] softkey

## [START FIT] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]

Start the curve fit process.

The analyzer performs the following actions:

- Places the pole zero results in the curve fit table when the fit is complete.
- Turns off the table (if it is displayed) and returns to the display format.
- Stores the synthesized frequency response of the curve fit model in the specified curve fit data register.
- Displays the specified data register in trace B if the display format is upper/lower or front/back.
- Places the weighting function used for the fit in the selected weight register.

Use [ ABORT FIT ] to stop a curve fit in progress.

Before starting the curve fit, be sure that you have done the following things:

- Display frequency response data in trace A.
- Display coherence data in trace B, if you want the curve fit to use the measured coherence.
- Set fixed terms or cleared the curve fit table to remove unwanted fixed terms.
- Completed the setup under [CURVE FIT SETUP].

When you start the curve fit, the analyzer displays intermediate results in trace B. When the curve fit is complete, the analyzer displays the frequency response of the curve fit model.

The analyzer uses coherence in a curve fit if trace A contains frequency response data and trace B contains coherence data obtained with four or more averages. Overlap processing will increase the number of averages required. If coherence is not displayed in trace B, the analyzer calculates and uses a pseudo-coherence instead.

For swept sine data, the analyzer always uses the calculated pseudo-coherence. For synthesized traces, the analyzer uses no coherence—coherence is assumed to be 1.0 for all data points.

*See also:* [ CURVE FIT SETUP ] softkey, [ FIX VALUE TOGGLE ] softkey, [ WEIGHT REGISTER ] softkey, [ CURVE FIT REGISTER ] softkey, [ COHERENCE ] softkey, [ FREQUENCY RESPONSE ] softkey (FFT analysis), [ OVERLAP PERCENT ] softkey

## [START FREQUENCY] softkey

Key Path: [ **Marker Fctn** ] → [ GAIN PHAS MARGINS ]
or: [ **Marker Fctn** ] → [ FREQ & DAMPING ]

Move the start marker to a specified location. Use the numeric entry keys or the knob to specify the location. The default is the measurement start frequency.

The analyzer uses only the data between the start and stop markers for computations.

## [Start] hardkey

Begin a measurement.

If the analyzer is already making a measurement, press [ **Start** ] to start the measurement over again.

If the analyzer is paused, press [ **Pause-Cont** ] to continue the measurement.

**Note** When you start a measurement with capture on, the analyzer turns off the source. When the measurement is complete, the analyzer returns the source to its original on/off state.

[ **Start** ] clears all measurement data from the analyzer's buffers; [ **Pause-Cont** ] does not clear the buffers.

*Hint:* If you want to see several measurements in a waterfall display, see the instructions under the [ REPEAT ON/OFF ] key (under [ **Avg** ]).

If you're in manual arm mode, pressing [ **Start** ] does not arm the trigger (you'll have to press [ ARM ] in the trigger menu to do that).

Pressing [ **Start** ] does not provide a trigger signal. If you want to select a trigger signal, press [ **Trigger** ] and select an appropriate trigger option.

*See also:* [ CAPTURE ON OFF ] softkey, [ REPEAT ON OFF ] softkey (average), [ **Pause/Cont** ] hardkey, [ MANUAL ARM ] softkey

## [START LINE #] softkey (Renumber)

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ RENUMBER ]

Before you renumber a program, press [ START LINE # ] to specify the new line number for the first line. An entry window is displayed so you can enter a new value.

---

**Note** Renumbering acts on the entire program. [ START LINE # ] is used for the first program line after renumbering. It does not specify where renumbering should begin in the original program.

---

After you have specified the starting line number and the increment between line numbers, press [ PERFORM RENUMBER ] to renumber your program.

*See also:* [ PERFORM RENUMBER ] softkey, [ INCREMENT ] softkey, [ RENUMBER ] softkey

## [START LINE #] softkey (Secure)

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ UTILITIES ] → [ SECURE ]

Before you secure a program (protect it against viewing), you must specify the range of lines you want to secure. Press [ START LINE # ] to specify the first line in the range. An entry window is displayed so you can enter a new value.

After you have specified the first and last lines, press [ PERFORM SECURE ] to secure those lines and all lines that fall between them. When you edit or print a secured line, you will see an asterisk (*) rather than program statements after the line number.

*See also:* [ SECURE ] softkey, [ END LINE # ] softkey

## [START PLOT PRNT] softkey

Key Path: [ **Plot/Print** ]

Begin plotting or printing. Be sure all the plot/print parameters and your printer or plotter are set up correctly before you press this key.

## [START RPM OFF] softkey (order analysis)

Key Path: [ **Trigger** ] → [ ARM SETUP ]

When you select [ START RPM OFF ] with time step arming the first arm occurs when you press [ START ].

For rpm step arming, selecting [ START RPM OFF ] has the same effect as selecting [ RPM INCREASING ].

*See also:* [ RPM STEP ARM ] softkey (order measurements), [ RPM INCREASING ] softkey (order analysis), [ WATERFALL STEPS ] softkey, [ TIME STEP ARM ] softkey (order measurements)

## [START RPM] softkey

Key Path: [ **Trigger** ] → [ ARM SETUP ]

Specify the rpm start value for rpm step arming. For [ RPM DECREASING ], this specifies the highest rpm. For [ RPM INCREASING ], it specifies the lowest rpm.

Limits: 5 to 491,520 rpm Default: 600 rpm

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

*See also:* [ RPM STEP ARM ] softkey

## [START RPM] softkey (order analysis)

Key Path: [ **Trigger** ] → [ ARM SETUP ]

Specify the rpm start value for time step arming.

Limits: 5 to 491,520 rpm Default: 600 rpm

This key works with [ START RPM OFF ], [ RPM INCREASING ], and [ RPM DECREASING ] as follows:

- For [ START RPM OFF ], the first arm occurs as soon as you start the measurement.
- For [ RPM INCREASING ], the first arm occurs when the tachometer input rpm value reaches a value greater than [ START RPM ].
- For [ RPM DECREASING ], the first arm occurs when the tachometer input rpm value reaches a value less than [ START RPM ].

Subsequent steps occur at time intervals [ TIME STEP SIZE ] after the first arm. The number of steps is determined by the [ WATERFALL STEPS ] setting.

This key has no effect for automatic arming or rpm step arming.

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

## [START RPM USAGE] softkeys

Key Path: [ **Trigger** ] → [ ARM SETUP ]

The two softkeys in this group, [ RPM INCREASING ] and [ RPM DECREASING ] work with rpm step arming.

If you select [ RPM INCREASING ], the first arm occurs when the tachometer input rpm value passes through the [ START RPM ] value in a positive direction.

If you select [ RPM DECREASING ], the first arm occurs when the tachometer input rpm value passes through the [ START RPM ] value in a negative direction.

Subsequent arms occur at rpm intervals [ RPM STEP SIZE ] measured from this point.

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

## [START SEGMENT] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Anchor a line segment's starting point at the position of the limit marker.

Limits are defined as a series of line segments. Press [ FINISH SEGMENT ] to anchor a segment's ending point. Use [ MOVE MKR HORIZNTAL ] and [ MOVE MKR VERTICAL ] to position the limit marker.

## [START] softkey (curve fit frequency)

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ FIT REGION ]

Specify the start frequency for the portion of the trace to be used by the curve fitter.

**Note** If the start frequency you specify is outside the data boundary, the analyzer uses the first point in the data on point A.

## [START] softkey (frequency)

Key Path: [ Freq ]

Specify the start frequency of the frequency band you want analyzed.

| | | |
|---|---|---|
| Limits: | 0 Hz to 57.5 kHz (2 channel) | Default: 0 Hz |
| | 0 Hz to 115 kHz (1 channel) | (FFT measurement) |

(limits depend on the instrument mode and span selected)

Selecting a start frequency does not change the frequency span. The size of the span remains at its previous setting.

This also anchors the start frequency. If you change the span frequency or record length, the start frequency remains constant and the center and stop frequencies change.

The analyzer does not display any frequency data less than 0 Hz. Therefore, if you specify a start value of less than zero, you won't see anything displayed to the left of 0 Hz.

**Caution** Although the analyzer will display data up to 115 kHz, the range from 102.4 kHz to 115 kHz is not calibrated and is significantly affected by the antialias filter.

*See also:* [ RECORD LENGTH ] softkey, [ SPAN ] softkey (frequency)

## [START] softkey (octave frequency)

(Available only with option 1D1, Real Time Octave)

Key Path: [ Freq ]

Specify the start frequency or lowest band number of the frequency band you want analyzed.

| | | |
|---|---|---|
| Limits: | 80 mHz to 10 kHz (2 chan) | Default: 10 Hz |
| | 80 mHz to 20 kHz (1 channel) | 10 Hz |

(for 1/3 octave; limits vary for full and 1/12 octave)

You can display up to 12 octaves. When you specify a start frequency, the analyzer changes the stop frequency if the specified band includes more than 12 octaves.

*See also:* [ STOP ] softkey (octave frequency)

## [START] softkey (swept sine frequency)

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Specify the start (lowest) frequency to be analyzed for a swept sine measurement.

Limits: 15.625 mHz to (51.2 kHz – 15.625 mHz)
Default: 51.2 Hz

The start frequency becomes the new anchor for span; center and stop will change to appropriate values.

*See also:* [ SWEPT SINE ] softkey

## [START SYNTHESIS] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ]

Create a frequency-response curve based on the current synthesis table. When finished, the analyzer stores the synthesized frequency response in the specified synthesis data register and displays that data register in the active trace.

The synthesis calculation uses s=jf in H(s), where f is frequency in Hz. The analyzer interprets table pole zero entries as being in Hz.

The synthesis uses the current measurement frequency span, set under the [ **Freq** ] hardkey.

Synthesis requires the analyzer to be in either FFT analysis or swept sine instrument mode.

In the FFT analysis instrument mode, synthesis produces the same number of frequency bins as a measurement. This allows you to perform math between synthesis and measurement results.

The following table lists the number of bins created by synthesis. Synthesis creates the number of bins listed in the left columns under baseband and zoom, then zero pads the rest of the bins for the total number of bins listed in the right columns under baseband and zoom.

| Resolution | Baseband | | Zoom | |
|---|---|---|---|---|
| | Created | Total | Created | Total |
| 100 lines | 101 | 129 | 100 | 128 |
| 200 lines | 201 | 257 | 200 | 256 |
| 400 lines | 401 | 513 | 400 | 512 |
| 800 lines | 801 | 1025 | 800 | 1024 |

If you specify a log X-axis for synthesis, the synthesis produces true log data spacing.

In the swept sine instrument mode, synthesis results are compatible with measurement results for math if the two results have the same number of bins. Swept sine data has either 401 or 801 bins. Measurement data can have 101, 201, 401, or 801 bins, depending on the resolution specified.

*See also:* [ RESOLUTN (LINES) ] softkey, Bins defined, [ X-AXIS LIN LOG ] softkey (synthesis), [ **Inst Mode** ] hardkey, [ SYNTHESIS REGISTER ] softkey

## [START TIME] softkey

Key Path: [ **Marker Fctn** ] → [ TIME PARAMTERS ]

Move the start time marker to the specified location. Use the numeric entry keys or the knob to specify the location.

*See also:* [ TIME PARAMTERS ] softkey

## [START X] softkey

Key Path: [ **Analys** ] → [ DATA EDIT ] → [ EDIT D1 - D8 ]

Define the horizontal axis location of the left band marker for data edit.

---

**Note** You cannot set Start X to a value greater than Stop X.

---

*See also:* [ DATA EDIT ] softkey

## [START RPM OFF] softkey

See [ START RPM USAGE ] softkeys.

## [STOP FREQUENCY] softkey

Key Path: [ **Marker Fctn** ] → [ GAIN PHAS MARGINS ]
or: [ **Marker Fctn** ] → [ FREQ & DAMPING ]

Move the stop marker to a specified location. Use the numeric entry keys or the knob to specify the location. The default is the measurement stop frequency.

The analyzer uses only the data between the start and stop markers for computations.

## [STOP] softkey (curve fit frequency)

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ FIT REGION ]

Specify the stop frequency for the portion of the trace to be used by the curve fitter.

---

**Note** If the stop frequency you specify is outside the data boundary, the analyzer uses the last point in the data on point A.

---

## [STOP] softkey (frequency)

Key Path: [ **Freq** ]

Set the stop frequency to the specified value. The analyzer sets the stop frequency using the closest span that includes the frequency band described by the start and stop frequencies. This is because the analyzer has fixed frequency spans.

| | | |
|---|---|---|
| Limits: | 195.31 mHz to 51.2 kHz (2 ch) | Default: 51.2 kHz |
| | 195.31 mHz to 115 kHz (1 ch) | 102.4 kHz |

(limits depend on the instrument mode and span selected)

For example, if the start frequency is 0 Hz and you enter a stop frequency of 5 kHz, the analyzer sets the stop frequency to 6.4 kHz. The 6.4 kHz span is the smallest span that includes 0 Hz and 5 kHz.

The start frequency remains constant (and selected as the new anchor for span); center frequency, frequency span, and record length change to appropriate values.

---

**Caution** Although the analyzer will display data up to 115 kHz, the range from 102.4 kHz to 115 kHz is not calibrated and is significantly affected by the antialias filter.

---

*See also:* [ START ] softkey (frequency), [ SPAN ] softkey (frequency)

## [STOP] softkey (octave frequency)

(Available only with option 1D1, Real Time Octave)

Key Path: [ Freq ]

Specify the stop frequency of the frequency band you want analyzed.

| | | |
|---|---|---|
| Limits: | 125 Hz to 16 kHz (2 channel) | Default: 16 kHz |
| | 125 Hz to 31.5 kHz (1 channel) | 16 kHz |

(for 1/3 octave; limits vary for full and 1/12 octave)

You can display up to 12 octaves. When you specify a stop frequency, the analyzer changes the start frequency if the specified band includes more than 12 octaves.

*See also:* [ START ] softkey (octave frequency)

## [STOP] softkey (swept sine frequency)

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Specify the stop (highest) frequency to be analyzed for a swept sine measurement.

Limits: 31.25 mHz to 51.2 kHz — Default: 51.2 kHz

The start frequency will be held constant (and selected as the new anchor for span); center and span will change to appropriate values.

*See also:* [ SWEPT SINE ] softkey

## [STOP TIME CHANNEL x] softkey

Key Path: [ Inst Mode ] → [ CAPTURE SETUP ]

Specify where in the time capture buffer data a measurement should stop processing data. You can specify a stop time for each channel individually. The stop time is referenced to the beginning of the capture buffer. If the data is triggered, the times are referenced to the trigger point.

## [STOP TIME] softkey

Key Path: [ Marker Fctn ] → [ TIME PARAMTERS ]

Move the stop time marker to the specified location. Use the numeric entry keys or the knob to specify the location.

*See also:* [ TIME PARAMTERS ] softkey

## [STOP X] softkey

Key Path: [ **Analys** ] → [ DATA EDIT ] → [ EDIT D1 - D8 ]

Define the horizontal axis location of the right band marker for data edit.

**Note** You cannot set stop X to a value less than start X.

*See also:* [ DATA EDIT ] softkey

## Stopping a program

You can press one of three hardkeys to stop an HP Instrument BASIC program that is running. Each key stops program execution in a different way:

- Press [ **BASIC** ] to PAUSE the program.
- Press [ **Local/HP-IB** ] to STOP the program.
- Press [ **Preset** ] → [ DO PRESET ] to STOP the program and preset the analyzer.

**Note** Programs also pause when they encounter a a PAUSE statement.

When you pause a program, execution stops after completing the current statement. You can resume execution of a paused program by pressing [ CONTINUE ]. You can restart the program from the first line by pressing [ RUN ].

When you stop a program, execution stops immediately, all HP-IB interfaces are reset, and any open files are closed. You cannot resume execution from the point at which it was stopped, but you can restart the program from the first line by pressing [ RUN ].

An HP Instrument BASIC program works by sending HP-IB commands to the analyzer. Generally, the analyzer can't execute these commands as fast as they are sent, so they accumulate in the HP-IB input buffer.

If you pause or stop a program, commands in the buffer will continue to execute.

## [STRT TIME CHANNEL x] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Specify where in the time capture buffer data a measurement should begin processing data. You can specify a start time for each channel individually. The start time is referenced to the beginning of the capture buffer. If the data is triggered, the times are referenced to the trigger point.

If you use a different frequency span than was used to capture the data, the digital filter step response corrupts part of the first time record. To correct for this, set the start time to:

(capture span / playback span) * 0.1 record

This delay allows the digital filter to settle before analyzing the data.

*See also:* [ SPAN ] softkey (frequency), [ CAPTURE HEADER ] softkey

### Suffix menus

For many numeric entries there are suffix softkeys that allow you to choose units for the entry. For some entries, the suffix menu includes units with prefixes, such as "kHz" or "ms." For example, you could enter 123 ms either as ".123 s" or "123 ms."

Other entries must be made in engineering notation, such as "100e–3" (100 x 10 ^ 3). For example, you could enter a Y Per Div of 12.5 mdB as "125 EXP +/– 2" or ".0125."

Some values are shown in scientific notation, such as "10.3 kHz." The prefixes for scientific notation are listed in the following table:

| Letter | Prefix | Multiple | Letter | Prefix | Multiple |
|---|---|---|---|---|---|
| a | atto | 10^–18 | k | kilo | 10^3 |
| f | femto | 10^–15 | M | mega | 10^6 |
| p | pico | 10^–12 | G | giga | 10^9 |
| n | nano | 10^–9 | T | tera | 10^12 |
| u | micro | 10^–6 | P | peta | 10^15 |
| m | milli | 10^–3 | E | exa | 10^18 |

*See also:* [ NUMERIC ENTRY ] softkeys

## [SUPLMENTL INFO] softkey

Display the following information about the data in the active trace (for all displays except waterfall):

- The Z-axis label for the trace. This is the value that would be displayed for a waterfall display. It may be the number of averages, the time from when the measurement started, the "count" (number of time records since the measurement started), or rpm.
- What type of weighting was applied to the data—none, A-weight, B-weight, or C-weight.

  The analyzer has a hardware A-weight filter for each channel. There are also A-weighting, B-weighting, and C-weighting operations available in math functions. (The supplemental marker field does not distinguish between hardware and math function A-weight filtering.)

---

**Note**

If you display a slice of the total power band from an octave measurement, the supplemental info displays a frequency value rather than "total power." The frequency listed is the next band above the measurement stop frequency.

---

*See also:* [ DEFINE FUNCTION ] softkey, [ A WT FLTR ON OFF ] softkey, [ WATERFALL ] softkey

## [SWEDISH] softkey

See [ KEYBOARD SETUP] softkeys.

## [SWEEP AUTO MAN] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Toggle between auto and manual sweep modes.

In auto sweep mode the sweep is internally controlled by the analyzer, using your measurement setup.

In manual sweep mode you control the sweep by changing manual frequency in this menu. It is easiest to change the frequency by rotating the knob, but you can also use the numeric entry key group. Manual frequency cannot exceed the sweep's start and stop frequencies.

**Note** The analyzer displays and saves only the most recent measurement for each frequency point (bin).

If a measurement is in progress at the time that you select manual sweep mode, the analyzer sets the manual frequency to the current sweep point.

If you start a measurement after selecting manual sweep mode, the analyzer uses the previously set manual frequency. If the previous manual frequency is less than the start frequency or greater than the stop frequency, the analyzer sets the manual frequency to the start or stop frequency, depending on which is closest to the previously set value.

To use the knob or the arrow keys to change the frequency, you must first press [ MANUAL FREQ ]. This causes the entry window for manual frequency to remain until you change to auto sweep or press another key requiring numeric entry.

*See also:* Bins defined, [ MANUAL FREQ ] softkey, [ MANUAL FREQ ] softkey, Arrow keys, Knob

## [SWEEP LIN LOG] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Select either linear or logarithmic spacing between measurement frequencies for a swept sine measurement.

In the linear sweep mode, the frequency step size is constant throughout the sweep.

In the log sweep mode, the frequency domain measurements are made at logarithmically (or proportionately) spaced frequency points. The ratio of consecutive step sizes is held constant, rather than the frequency step size.

*See also:* [ SWEPT SINE ] softkey

## [SWEEP UP DOWN] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ Freq ]

Specify the direction of a swept sine measurement.

Sweep Up selects a sweep that begins at the start frequency, sweeps to the stop frequency, and ends.

Sweep Down selects a sweep that begins at the stop frequency, sweeps to the start frequency, and ends.

While a measurement is in progress, the current sweep point is marked with a marker and the current sweep frequency is shown on the screen centered above the trace box.

*See also:* [ SWEPT SINE ] softkey

## Swept sine averaging

The average softkeys for swept sine measurements allow you to do the following things:

- Specify settle time—the delay between changing the source frequency and starting the measurement at each point.
- Specify integrate time—the amount of time that each point is measured.
- Select fast average mode —this lets the analyzer make averaged measurements without having to update the screen after every average.

*See also:* [ FAST AVG ON OFF ] softkey, [ INTEGRATE TIME ] softkey (swept sine), [ SETTLE TIME ] softkey

## Swept sine frequency keys

For swept sine analysis, the following softkeys are under the [ Freq ] hardkey:

- Span.
- Center.
- Start.
- Stop.
- Entry step size.
- Sweep lin/log.
- Sweep up/down.
- Sweep auto/man.
- Manual freq.
- Resolutn setup.

*See also:* [ SPAN ] softkey (swept sine frequency), [ CENTER ] softkey (swept sine frequency), [ START ] softkey (swept sine frequency), [ STOP ] softkey (swept sine frequency), [ ENTRY STEP SIZE ] softkey, [ SWEEP LIN LOG ] softkey, [ SWEEP UP DOWN ] softkey, [ SWEEP AUTO MAN ] softkey, [ MANUAL FREQ ] softkey, [ RESOLUTN SETUP ] softkey

## [SWEPT SINE] softkey

(Available only with option 1D2, Swept Sine)

Key Path: [ **Inst Mode** ]

Specify the swept sine instrument mode.

In a swept sine measurement, the sine source "sweeps" through a specified range of frequencies—actually, this sweep is a series of very small discrete steps. You can vary the speed of the sweep, its resolution (how many steps are used to form one sweep), and the direction of the sweep. You can also specify that a sweep have linear-spaced or logarithmic-spaced steps.

At each discrete frequency point during the sweep, the analyzer measures and displays the relative magnitudes and phase of the DUT's sinusoidal responses.

Swept sine measurements provide extremely good signal-to-noise ratios and can characterize nonlinear systems. Input autoranging during the measurement process increases dynamic range to a maximum of 120 dB.

The following measurement data is available for swept sine measurements:

- Linear spectrum channel 1 or 2
- Time record last point ch 1 or 2
- Frequency response
- Cross spectrum
- Normalized variance channel 1 or 2

For more information on swept sine measurements, refer to the analyzer's *Concepts Guide.*

*See also:* [ NORM VAR CHANNEL x ] softkey, [ CROSS CORRELATN ] softkey, [ FREQUENCY RESPONSE ] softkey (swept sine), [ TIME CHANNEL x ] softkey (swept sine), [ LIN SPEC CHANNEL x ] softkey (swept sine)

## [SYNTHESIS REGISTER] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ]

Specify in which data register the analyzer should store the synthesis results.

The default synthesis register is D8.

*See also:* Data registers

## Synthesis Setup Softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ]

Access the softkeys for specifying the following synthesis parameters:

- Gain factor.
- Time delay.
- Frequency scale.
- X-axis lin log.

*See also:* [ X-AXIS LIN LOG ] softkey (synthesis), [ FREQUENCY SCALE ] softkey, [ TIME DELAY ] softkey, [ GAIN FACTOR ] softkey

## [SYNTHESIS] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ]

Access the synthesis utilities.

Synthesis allows you to create a frequency response trace based on the transfer function of a system. To perform synthesis, you enter parameters from your transfer function into the analyzer's synthesis table. Parameters can be represented in pole-zero, pole-residue, or polynomial forms.

For detailed information on synthesis, refer to the analyzer's *Concepts Guide*.

The following softkeys are available:

- Start Synthesis starts the synthesis process.
- Synthesis Register determines which data register receives the results.
- Edit Table allows you to edit the entries in the synthesis table.
- Copy from Curve Fit copies the curve fit table into the synthesis table.
- Convert Table allows you to convert the synthesis table between pole zero, pole residue, and polynomial formats.
- Synthesis Setup allows you to set up synthesis parameters.
- Table On Off turns on or off display of the curve fit table.

*See also:* [ TABLE ON OFF ] softkey, [ SYNTHESIS SETUP ] softkey, [ CONVERT TABLE ] softkey, [ COPY FROM CURVE FIT ] softkey, [ EDIT TABLE ] softkey, [ SYNTHESIS REGISTER ] softkey, [ START SYNTHESIS ] softkey, [ CONVRT TO POLYNMIAL ] softkey, [ CONVRT TO POLE RESD ] softkey, [ CONVRT TO POLE ZERO ] softkey

## System Group

The System keys let you control how the analyzer communicates with the external devices, the HP-IB controller, and external measurement programs. Here's a brief summary of the System keys and their significant functions:

- [ Help ] provides information about specific analyzer controls and functions.
- [ Save/Recall ] lets you save and recall stored traces, instrument states, limits, math operations, and HP Instrument BASIC programs
- [ Disk Utility ] provides useful utilities to let you format, delete, and examine files stored on the currently-selected mass storage device (including the analyzer's internal RAM disks and flexible disk drive or external disks).
- [ System Utility ] lets you perform a calibration procedure and set the analyzer's internal clock.
- [ BASIC ] lets you create (and run) HP Instrument BASIC programs *if your analyzer is equipped with the HP Instrument BASIC option (1C2).*
- [ Plot/Print ] controls selection and configuration of an external plotter or printer.
- [ Local/HP-IB ] provides HP-IB options when the analyzer is under local (front panel) control.
- [ Preset ] returns most of the analyzer settings to their default positions.

### [System Utility] hardkey

[ System Utility ] groups infrequently used softkeys under one hardkey. The softkeys allow you to do the following things:

- Calibrate the analyzer.
- Turn the beeper on and off.
- Set the battery-backed clock's time and date.
- Display the analyzer's options configuration and install new options.
- Display the analyzer's memory usage and remove items from memory.
- Indicate if you are using a different language keyboard.
- Display the analyzer's serial number.
- Enable special hardware setups during performance tests. Run these test only as directed in the analyzer's *Installation and Verification Guide* or the *Service Guide.*

*See also:* [ KEYBOARD SETUP ] softkeys, Hardware test softkeys, [ S/N VERSION ] softkey, [ MEMORY USAGE ] softkey, [ OPTIONS SETUP ] softkey, [ CLOCK SETUP ] softkey, [ BEEPER ON OFF ] softkey, [ CALIBRATN ] softkey

## [SYSTEM CONTROLLR] softkey

See Controller capability softkey group.

## [TABLE ON OFF] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ]
or: [ **Analys** ] → [ SYNTHESIS ]

Turn on or off the curve fit or synthesis data table.

When table is on, the screen displays the two-column table for curve fit or synthesis. When table is off, the screen displays the normal traces.

The analyzer updates the table only at the end of a curve fit; it does not display intermediate results in the table.

## [TACH DATA ON OFF] softkey

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Specify whether or not you want the capture buffer to include the tachometer input signal.

If the instrument mode is order analysis, the analyzer automatically includes the tachometer signal even if you turn tach data off.

---

**Note** You must set up the tachometer parameters *before* capturing the data.

---

*See also:* [ TACHOMETR SETUP ] softkey (Trigger), [ TACHOMETR SETUP ] softkey (Trigger)

## [TACH PULS PER REV] softkey

Key Path: [ **Trigger** ] → [ TACHOMETR SETUP ]
or: [ **Input** ] → [ TACHOMETR SETUP ]

Specify the number of tachometer pulses that occur in one revolution of the shaft.

Limits: 0.5 to 2048 Default: 1

## [TACHOMETR SETUP] softkey (Capture Setup)

Key Path: [ **Inst Mode** ] → [ CAPTURE SETUP ]

Turn tachometer data on or off.

You can also specify the maximum RPM from this menu.

**Note** If the instrument mode is order analysis, the analyzer ignores these settings and uses the max rpm specified under the [ **Freq** ] key.

*See also:* [ MAX RPM ] softkey (Freq), [ TACH DATA ON OFF ] softkey

## [TACHOMETR SETUP] softkey (Trigger)

Key Path: [ **Trigger** ]
or: [ **Input** ]

Set up the following tachometer parameters:

- Tach pulses per revolution.
- Range high low.
- Level.
- Hold off.
- Slope.

*See also:* [ SLOPE POS NEG ] softkey, [ HOLDOFF TIME ] softkey, [ LEVEL ] softkey (tachometer setup), [ TRG RANGE +/- 20 4 ] softkey, [ TACH PULS PER REV ] softkey

## [TEST EVAL ON OFF] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ]

Enable and disable testing of the active trace against its current limits.

A trace fails a limit test if any of its points fall outside the current limits. Results of the test are displayed in the lower-left corner of the trace box.

If you want limit lines to be displayed during the test, toggle [ LINES ON /OFF ] to ON.

*See also:* [ LIMIT TEST ] softkey, [ LINES ON OFF ] softkey

## [THD] softkey

Key Path: [ **Marker Fctn** ] → [ HARMONIC MARKER ]

Compute and display the total harmonic distortion (THD) for the current fundamental frequency and number of harmonics. The value is displayed in the lower left corner of the trace box.

The analyzer displays THD as a percentage of the amplitude at the fundamental frequency.

The analyzer calculates THD by comparing the energy of the fundamental to the energy of the harmonics. Noise and other signals at other points along the frequency spectrum are not taken into account (unless they happen to occur at the fundamental frequency or at the harmonics).

The THD results reflect the harmonics found in the current frequency span. The number of harmonics you specify is the maximum number the analyzer uses in the THD calculation. For example, if you press [ NUMBER OF HARMONICS ] and enter 10, the THD calculation does not include all ten harmonics if some of these harmonics are outside the current span.

*See also:* [ NUMBER OF HARMONICS ] softkey, [ FUNDAMNTL FREQUENCY ] softkey

## [TIME CHANNEL x] softkey

Key Path: [ **Meas Data** ]

Display the most recent channel 1 or channel 2 time record on the active trace. Look at time records when you want to verify the presence of an input signal, or when setting input ranges manually.

If averaging is on, the analyzer displays the most recent time record added to the average. The analyzer does not show an averaged time waveform, since all averaging is done after the time data has been transformed to the frequency domain.

Time record displays are not corrected. Therefore, amplitude measurements made while viewing time record displays may not be accurate. For accurate amplitude measurements, use measurements that display data in the frequency domain.

*See also:* [ CAL CONST ON OFF ] softkey, Time record

## [TIME CHANNEL x] softkey (order meas)

Key Path: [ **Meas Data** ]

Display channel 1 or channel 2 time on the active trace. If average is on, averaged time is displayed.

## [TIME CHANNEL x] softkey (swept sine)

Key Path: [ **Meas Data** ]

Display the baseband time record from the last sweep point. The trace is updated at each new sweep point.

The data displayed is the actual time data used for the integration, determined by the integrate time and the frequency span. If there are less than 1024 points, the last part of the time record is truncated to zero.

*See also:* [ SPAN ] softkey (swept sine frequency), [ INTEGRATE TIME ] softkey (swept sine)

## [TIME DELAY] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]
or: [ **Analys** ] → [ SYNTHESIS ]→ [ SYNTHESIS SETUP ]

Enter time delay values.

Limits: – 100 s to + 100 s Default: 0.0 s

If the system you wish to fit has a time delay or transport delay, enter the value before starting the curve fit process to obtain an accurate fit.

The purpose is to remove phase ramps from the frequency response before fitting. A phase ramp cannot be modeled by a pole or zero, and must be handled separately.

At the beginning of a curve fit process, trace A data is internally multiplied by e ^ (sT) to cancel delay. "T" is the entered time delay.

In synthesis, e ^ (–sT) is multiplied into the synthesis to simulate the addition of time delay. "T" is the entered time delay.

## [TIME EXPONENTL] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Avg** ] → [ AVERAGE TYPE ]

Select time exponential averaging for an order measurement. The analyzer updates the display after each new average.

Unlike linear (normal) averaging, exponential averaging weights new data more than old data. This is useful for tracking data that changes over time.

When using exponential averaging, the number of averages you select determines the weighting of old versus new data—not the total number of averages calculated. As the number of averages increases, new data is weighted less.

With exponential averaging, it's especially important to set the number of averages carefully—if there are too few averages in the measurement, the averaging will not smooth out variances. But if there are too many averages, the analyzer may not track subtle changes occurring within the data.

To calculate the exponential average, the analyzer uses this formula:

$$[(1/N)* (new)] + [((N-1)/N)* (old)],$$

where N is a weighting factor (the number of averages you've specified).

When starting an exponential average, the analyzer sets N equal to 1 for the first analysis, then sets N equal to 2 for the second analysis, and so on—until N equals the number of averages you've specified. Until the measurement reaches the specified number of averages, there is no difference between time exponential averaging and time averaging.

Once you start a measurement using exponential averaging, the measurement continues indefinitely. To stop it, press [ **Pause/Cont** ].

*See also:* [ TIME ] softkey (average, order measurement), [ NUMBER AVERAGES ] softkey

## [TIME HHMM] softkey

Key Path: [ **System Utility** ] → [ CLOCK SETUP ]

Display the current time at the top of the screen. The time is read from the analyzer's battery-backed clock.

After pressing this softkey, you can enter a new time with the number keys. The time must be entered in a 24-hour format: the first two digits set the hour, the second two digits set the minute. Here are a couple of examples:

8:05 am—Press [ TIME HHMM ] → [ **0** ] → [ **8** ] → [ **0** ] → [ **5** ] → [ ENTER ]

3:42 pm—Press [ TIME HHMM ] → [ **1** ] → [ **5** ] → [ **4** ] → [ **2** ] → [ ENTER ]

## [TIME LABEL] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ User X Setup ]

Specify a name for the user-defined X-axis time domain units. The name can be up to 5 characters long.

*See also:* [ USER X UNIT ] softkey

## [TIME PARAMTERS] softkey

Key Path: [ **Marker Fctn** ]

Turn on and set up time markers.

You can specify a start and stop time, then compute and display the following time domain values for the specified time:

- Overshoot.
- Rise time.
- Settling time.
- Delay time.

The analyzer also puts a horizontal line across the display at the steady-state level and displays the steady-state value in the mini-state.

*See also:* [ DELAY TIME ] softkey (time markers), [ SETTLING TIME ] softkey, [ RISE TIME ] softkey, [ OVERSHOOT ] softkey, [ STOP TIME ] softkey, [ START TIME ] softkey

## Time record

A *time record* is the sample of input data required for one FFT operation—essentially, the basic building block for all FFT analyzers. The time record length is measured in seconds (or microseconds or milliseconds) and changes with the size of the frequency span.

For some instrument modes you can specify the record length as well as a frequency span.

*See also:* [ SPAN ] softkey (frequency), [ RECORD LENGTH ] softkey

## [TIME] softkey (average, order measurement)

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Avg ] → [ AVERAGE TYPE ]

Select time averaging for an order measurement. The analyzer averages N time records, where N is the specified number of averages. The averaged time record is not displayed until after the average is complete. As you increase the number of averages, the display update rate decreases.

**Note** When you select time averaging, the analyzer effectively sets the number of waterfall steps to 1. If you pause a measurement with a waterfall displayed, the analyzer displays only 1 trace.

*See also:* Time record, [ NUMBER AVERAGES ] softkey, [ WATERFALL STEPS ] softkey

## [TIME] softkey (preview)

Key Path: [ Avg ] → [ PREVIEW SETUP ]

Specify how long the analyzer should wait for a response before automatically including the time record in the measurement results. This only applies when the analyzer is the timed preview mode.

Limits: 0.1 to 3600 s    Default: 10 s

*See also:* [ TIMED PREVIEW ] softkey

## [TIME STEP ARM] softkey

Key Path: [ Trigger ]
or: [ Trigger ] → [ ARM SETUP ]

Select time step arming. This means that the analyzer waits for all hardware to settle and the elapsed time value to reach the next step (last value plus the specified time step size). Then the analyzer starts a measurement as soon as trigger conditions are met.

Subsequent arms occur at equal intervals (specified by [ TIME STEP SIZE ]) referenced to the start time. The analyzer performs the number of arms specified by [ WATERFALL STEPS ], then stops, with the following exception:

The analyzer sets a "stop rpm" based on one of the following equations:

for rpm increasing
stop = start rpm + (time step size x waterfall steps)

for rpm decreasing
stop = start rpm - (time step size x waterfall steps)

If the tach input sweep rate is too fast for the analyzer to make measurements at "time step size" intervals, the analyzer cannot obtain all the time steps. The analyzer stops at the calculated "stop rpm" and displays the message "WATERFALL COMPLETE."

If this happens, you can either slow down the tach ramp rate, increase the time step size, or use time capture to ensure that each step is measured.

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

*See also:* [ WATERFALL STEPS ] softkey, [ START RPM USAGE ] softkeys, [ TIME STEP SIZE ] softkey

## [TIME STEP ARM] softkey (order measurements)

Key Path: [ Trigger ]
or: [ Trigger ] → [ ARM SETUP ]

Select time step arming for an order measurement.

Time step arming works with [ START RPM OFF ], [ RPM INCREASING ], and [ RPM DECREASING ] like this:

- For [ START RPM OFF ], the first arm occurs as soon as you start the measurement.
- For [ RPM INCREASING ], the first arm occurs when the tachometer input rpm value reaches a value greater than [ START RPM ].
- For [ RPM DECREASING ], the first arm occurs when the tachometer input rpm value reaches a value less than [ START RPM ].

Subsequent steps occur at time intervals [ TIME STEP SIZE ] after the first arm. The number of steps is determined by the [ WATERFALL STEPS ] setting with the following exception:

The analyzer sets a "stop rpm" based on one of the following equations:

for rpm increasing
stop = start rpm + (time step size x waterfall steps)

for rpm decreasing
stop = start rpm - (time step size x waterfall steps)

If the tach input sweep rate is too fast for the analyzer to make measurements at "time step size" intervals, the analyzer cannot obtain all the time steps. The analyzer stops at the calculated "stop rpm" and displays the message "WATERFALL COMPLETE."

If this happens, you can either slow down the tach ramp rate, increase the time step size, or use time capture to ensure that each step is measured.

For more information on arming and triggering, see the analyzer's *Concepts Guide.*

*See also:* [ CAPTURE SETUP ] softkey, [ WATERFALL STEPS ] softkey, [ TIME STEP SIZE ] softkey, [ START RPM ] softkey, [ START RPM ] softkey, [ START RPM OFF ] softkeys (order analysis), [ RPM DECREASING ] softkey (order analysis), [ RPM INCREASING ] softkey (order analysis)

## [TIME STEP SIZE] softkey

Key Path: [ **Trigger** ] → [ ARM SETUP ]

Specify the time step size for time step arming.

Limits: 0 to 500 ks Default: 0.5 s

For more information on arming and triggering, see the analyzer's *Concepts Guide*.

*See also:* [ START RPM USAGE ] softkeys, [ TIME STEP ARM ] softkey

## [TIME STMP ON OFF] softkey

Key Path: [ **Plot/Print** ] → [ CLOCK SETUP ] → [ TIMESTAMP SETUP ]

Turn time stamp on or off for plotting and printing.

When time stamp is turned on, the analyzer plots the date and time the displayed data was taken along with the screen data you specify under [ PLOT DATA SELECT ].

Specify the format for the time stamp information using the softkeys under [ **System Utility** ] → [ CLOCK SETUP ] → [ TIMESTAMP SETUP ].

*See also:* [ TIMESTAMP SETUP ] softkey

## [TIMED PREVIEW] softkey

Key Path: [ **Avg** ] → [ PREVIEW SETUP ]

When timed preview is on, you can decide which data should be included in the measurement results. After each time record is collected, it is displayed. You must either accept or reject the time record for both channels by pressing [ REJECT TIME REC ] or [ ACCEPT TIME REC ].

Unlike manual preview, the analyzer waits only a specified amount of time. If you do not respond, the data is automatically accepted.

*See also:* [ TIME ] softkey (preview), [ ACCEPT TIME REC ] softkey, [ REJECT TIME REC ] softkey

## [TIMESTAMP SETUP] softkey

Key Path: [ System Utility ] → [ CLOCK SETUP ]

Specify the date and time format for the time stamp feature. The analyzer uses this format wherever time and date are displayed.

The date and time are saved in battery-backup memory. They are saved even when the analyzer is turned off.

You can specify that the analyzer include the time stamp information when print or plot the display.

*See also:* [ TIME STMP ON OFF ] softkey

## [TITLE LINE X] softkeys

Key Path: [ Plot/Print ] → [ MORE SETUP ]

Specify plot and print output title lines.

The title lines allow you to place two lines of arbitrary text at the top of the plot or print output. Each line can be up to 31 characters long. You can use these lines for information about the data displayed.

If you enter text for either line, the mini-state disappears and the new title is displayed. If you want the two top lines to be blank, enter a space for either line.

## [TOP REFERENCE] softkey

Key Path: [ **Scale** ]

Select a reference value for the top of the scale. Then use the numeric keypad and appropriate softkeys to enter this value. When you change the [ Y PER DIV ] value, the top of the scale remains fixed and the bottom changes.

The ratio between the reference value and the [ Y PER DIV ] value cannot be greater than 1e15.

---

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [ EXP ] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[ **1** ] [ **5** ] [ EXP ] [ +/− ] [ **3** ] [ ENTER ]

---

*See also:* [ Y PER DIV (DECADES) ] softkey

## [TRACE A MKR PEN] softkey

Key Path: [ **Plot/Print** ] → [ PLOT PEN SETUP ]

Specify which plotter pen should be used for plotting trace A's markers.

The marker A pen is also used to plot the X- and Y-axis coordinates of trace A markers (when you use the [ TRACE MARKER ] and [ MARKER REFERENCE ] softkeys under [ PLOT DATA SELECT ]), and to plot limit lines, limit test results, and marker function results..

*See also:* [ PLOT DATA SELECT ] softkey

## [TRACE A PEN] softkey

Key Path: [ **Plot/Print** ] → [ PLOT PEN SETUP ]

Specify which plotter pen should be used for plotting trace A and all of its trace-specific annotation.

Trace-specific annotation includes the following items:

- Trace title.
- Marker readout.
- X-axis annotation.
- Y-axis annotation.

## [TRACE B MKR PEN] softkey

Key Path: [ Plot/Print ] → [ PLOT PEN SETUP ]

Specify which plotter pen should be used for plotting trace B's markers.

The marker B pen is also used to plot the X- and Y-axis [ TRACE MARKER ] and [ MARKER REFERENCE ] softkeys under [ PLOT DATA SELECT ]), and to plot limit lines, limit test results, and marker function results..

*See also:* [ PLOT DATA SELECT ] softkey

## [TRACE B PEN] softkey

Key Path: [ Plot/Print ] → [ PLOT PEN SETUP ]

Specify which plotter pen should be used for plotting trace B and all of its trace-specific annotation.

Trace-specific annotation includes the following items:

- Trace title.
- Marker readout.
- X-axis annotation.
- Y-axis annotation.

### Trace boxes

A trace box is a bounded area of the screen that is used to display trace data. There are three trace box sizes: full-height, half-height, and those used for waterfall displays.

A full-height trace box is used for the single and front/back trace formats. The grid for this box is ten divisions high and ten divisions wide.

**Note** When you use the front/back trace format, the vertical dimension of the full-height box is slightly compressed to make room for the second trace's annotation.

Two half-height trace boxes are used for the upper/lower trace format. The grids for these boxes are still ten divisions high and ten divisions wide. However, the spacing between vertical grids is smaller than for a single trace box.

For waterfall displays, the lower trace box is about 3/4 height and the upper trace about 1/4 height. The grid for the upper box is ten divisions high and ten divisions wide. There is no grid in the lower (waterfall) trace box.

## [Trace Coord] hardkey

Select Y-axis trace coordinates for the active trace. These are different ways of looking at measurement data displayed on the active trace. Looking at the data in different ways can reveal much more information.

These are the trace coordinates in the analyzer:

- Linear magnitude.
- Log magnitude.
- dB magnitude.
- Phase.
- Unwrapped phase.
- Real part of the data.
- Imaginary part of the data.
- Nyquist diagram.

The softkey menu also lets you specify:

- X-axis units.
- Y-axis units.
- X-axis linear/log scale.

*See also:* [ Y UNITS ] softkey, [ X UNITS ] softkey, [ X-AXIS LIN LOG ] softkey (trace coord), [ NYQUIST DIAGRAM ] softkey, [ IMAGINARY PART ] softkey, [ REAL PART ] softkey, [ UNWRAPPED PHASE ] softkey, [ PHASE ] softkey, [ DB MAGNITUDE ] softkey, [ LOG MAGNITUDE ] softkey, [ LINEAR MAGNITUDE ] softkey

## [TRACE HEIGHT] softkey

Key Path: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Specify the height of each trace displayed in the waterfall display area as a percentage of trace box height.

Limits: 1 to 100 percent — Default: 39 percent

The top (most recent) trace in the waterfall uses the top "trace height" percent of the trace box. The base of the top trace is indicated by a line at the left edge of the display. The bases of the other traces displayed are spread evenly in the rest of the trace box.

For example, if you specify a trace height of 50 percent, each trace will be half the height of the trace box. If you display two traces, the traces will each take half of the trace box with no overlap. If you display more than two traces, the traces will overlap.

**Note** If you set the trace height less than 29% or greater than 75%, some of the waterfall annotation is not displayed.

*See also:* Trace boxes, [ WATERFALL ] softkey

## [TRACE RPM] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ Order Setup ]

Set the first order to the rpm value for the displayed trace.

This key is only valid with rpm step arming.

*See also:* [ RPM STEP ARM ] softkey

## [TRACE SELECT] softkey

Key Path: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

Turn on the trace select marker. Use the numeric entry keys or the knob to choose the waterfall trace of interest.

You can save the selected trace to a data register by pressing [ SAVE TO DATA REG ]. If you want to view the trace, press [ SAVE AND DISP DATA ]. This saves the trace to the data register and displays the data register on trace A.

The trace you select is also used as the starting point for slice select.

---

**Note** You must pause a running measurement before you can use the trace select marker.

---

*See also:* [ SAVE AND DISP DATA ] softkey, [ SAVE TO DATA REG ] softkey, [ SLICE SELECT ] softkey

## [TRACE] softkey

See [ PLOT DATA SELECT ] softkey.

## [TRACE TITLE] softkey

Key Path: [ **Disp Format** ] → [ MORE ]

Assign a title for the active trace. Use the numeric keypad and the alpha keys to enter an appropriate name (up to 13 characters long). The title appears above the upper left corner of the trace box. Entering a trace title is useful for labeling results to be plotted.

---

**Note** You can enter more than 13 characters for the trace title, but the analyzer truncates the title to 13 characters.

---

When you enter a trace title, the [ DFLT TITL ON OFF ] key toggles to highlight OFF. To display the default trace title, press [ DFLT TITL ON OFF ] to highlight ON.

*See also:* [ DFLT TITL ON OFF ] softkey, Alpha entry mode

## [TRACE TO LIMIT] softkey

Key Path: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE LOWER LIM ]
or: [ **Analys** ] → [ LIMIT TEST ] → [ DEFINE UPPER LIM ]

Convert the active trace into a limit line.

You can edit the converted trace just as you would a limit line, using the keys under [ DEFINE UPPER LIMIT ] or [ DEFINE LOWER LIMIT ].

**Note**

When you convert an octave trace to a limit line, the limit line does not look like the octave trace. The analyzer connects the value at the center frequency of each octave band, rather than drawing a bar for each band.

## [TRACE X LINE TYPE] softkeys

Key Path: [ **Plot/Print** ] → [ TRACE A LINE TYPE ]
or: [ **Plot/Print** ] → [ PLOT LINE SETUP ] → [ TRACE A LINE TYPE ]
or: [ **Plot/Print** ] → [ TRACE B LINE TYPE ]
or: [ **Plot/Print** ] → [ PLOT LINE SETUP ] → [ TRACE B LINE TYPE ]

Specify the line pattern that will be used to plot each of the analyzer's two traces.

Line type changes apply only to trace A if you pressed [ TRACE A LINE TYPE ] to display these softkeys, or to trace B if you pressed [ TRACE B LINE TYPE ].

*See also:* Line type softkeys

## [TRACE MARKER] softkey

See [ PLOT DATA SELECT ] softkey.

## [TRACK ON OFF] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Freq** ]

Toggle between order track and order spectrum measurements. When track is on, the analyzer makes order track measurements. When track is off, the analyzer makes order spectrum measurements.

## [TRACK POINTS] softkey (order analysis)

Key Path: [ Trigger ] → [ ARM SETUP ]

Limits: 1 to 32,768 — Default: varies depending on instrument mode and memory availability

The behavior of this key in order analysis depends on the arming mode and whether track is on or off.

- In general, this key specifies the capacity of the waterfall—the total number of traces that are stored in the waterfall buffer.
- If track is on, this key specifies the number of points in the measurement.
- For time step arming, this key specifies the number of steps in the arming sequence.
- For rpm step arming, you cannot change the value for [ TRACK POINTS ]. The analyzer automatically sets [ TRACK POINTS] to the value:
  ((Max rpm – Min rpm)/rpm step size) + 1.

---

**Caution** When you start a new measurement, all current data in the waterfall buffer is lost.

---

*See also:* [ TRACK ON OFF ] softkey, [ RPM STEP SIZE ] softkey, [ MIN RPM ] softkey, [ MAX RPM ] softkey (Freq), [ RPM STEP ARM ] softkey (order measurements), [ TIME STEP ARM ] softkey (order measurements), Waterfall buffer

## [TRACK X ORDER] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ Freq ]

Specify the orders you want to track.

Limits: Delta Order to Max Order — Default: 1,2,3,4,5
Steps: .0001

For example, if you want to track orders 3, 6, 8.5, 11, and 15, set Track 1 Order to 3, Track 2 Order to 6, Track 3 Order to 8.5, Track 4 Order to 11, and Track 5 Order to 15.

*See also:* [ DELTA ORDER ] softkey, [ MAX ORDER ] softkey

## [TRACK X] softkey

(Available only with opt. 1D0, Computed Order Tracking)

Key Path: [ **Meas Data** ] → [ MORE ] → [ ORDER TRK CHANNEL X ]

Specify which of the five order tracks you want to display for the channel.

## [TRG RANGE +/- 20 4] softkey

Key Path: [ **Trigger** ] → [ TACHOMETR SETUP ]
or: [ **Input** ] → [ TACHOMETR SETUP ]

Toggle the tachometer input range between +/– 20 volts and +/– 4 volts.

You can set the actual level within the range by pressing [ LEVEL ] and entering a value.

*See also:* [ LEVEL ] softkey (tachometer setup)

## [Trigger] hardkey

Specify a trigger signal appropriate for the type of measurement you want to make:

- Free run.
- External.
- Channel 1.
- Channel 2.
- Source.
- HP-IB.

You can use triggering with all instrument modes except swept sine (option 1D2). Not all types of triggering are available for each instrument mode.

This menu also contains softkeys for setting up the following parameters:

- Tachometer parameters.
- Trigger parameters.
- Arm parameters.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ ARM SETUP ] softkey, [ TRIGGER SETUP ] softkey, [ TACHOMETR SETUP ] softkey (Trigger), [ HP-IB TRIGGER ] softkey, [ SOURCE TRIGGER ] softkey, [ CHANNEL x TRIGGER ] softkey, [ CHANNEL x TRIGGER ] softkey, [ EXTERNAL TRIGGER ] softkey, [ FREE RUN TRIGGER ] softkey

## [TRIGGER SETUP] softkey

Key Path: [ Trigger ]

Specify the following trigger conditions:

- Level.
- Slope.
- Delay.

For more information on triggering, see the analyzer's *Concepts Guide.*

*See also:* [ SLOPE POS NEG ] softkey, [ LEVEL ] softkey (trigger setup), [ CHANNEL x DELAY ] softkey

## [TYPING UTILITIES] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ BASIC ] → [ INSTRUMNT BASIC ] → [ EDIT ]

Lets you do the following things when you are editing a program:

- Insert special characters.
- Insert keywords.
- Shift the case of alpha characters.

The Typing Utilities menu also repeats the [ ENTER ], [ INSERT SPACE ], and [ DELETE CHARACTER ] softkeys, which are all available in the main editing menu.

**Note** The [ CANCEL/RETURN ] softkey in the Typing Utilities menu just returns you to the main editing menu. It has no effect on the current line of your program.

*See also:* [ DELETE CHARACTER ] softkey, [ INSERT SPACE ] softkey, [ ENTER ] softkey (BASIC), [ UPPERCASE LOWERCASE ] softkey, [ INSERT KEYWORD ] softkey, [ INSERT SPECIAL CHARACTERS ] softkeys

## [U.K. ENGLISH] softkey

See [ KEYBOARD SETUP ] softkeys.

## [U.S. ENGLISH] softkey

See [ KEYBOARD SETUP ] softkeys.

## [UNDELETE VALUE] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ EDIT TABLE ]
or: [ **Analys** ] → [ SYNTHESIS ] → [ EDIT TABLE ]

Take the top entry off of the delete value stack and insert it just above the highlighted position in the table.

Entries come off the stack in the reverse order that they were added to the stack. For example, if you delete entries 1, 2, and 3 (in that order) and then press [ UNDELETE VALUE ], the first entry is 3, then 2, then 1.

The analyzer has separate stacks for poles, zeros, residues, numerators, and denominators. For example, you cannot delete an entry from the pole column and undelete it in the zeros column.

If the stack is empty this key does nothing.

*See also:* [ DELETE VALUE ] softkey

## [UNFILTERD TIME CH x] softkey

Key Path: [ **Meas Data** ]

Display the unfiltered time record for the specified channel.

Unfiltered time is a time-domain trace that shows the input time record without anti-alias filtering, bandwidth-limiting filtering, or averaging. Otherwise, unfiltered time channel data is similar to time channel data available with the analyzer's other instrument modes. You may have to adjust the frequency span (by specifying the time record length) to avoid visual distortion of the time trace.

---

**Note** The analyzer displays the first time record for the histogram measurement. The unfiltered time display is not updated as the analyzer collects additional time records.

---

*See also:* Time record

## [UNIFORM -T/2, T/2] softkey

Key Path: [ Window ]

Specify the uniform weighting function for a correlation measurement. This weighting function has a value of 1 for all points in the time record.

Be sure to use the correct window for your data. Use the uniform window for transient and exactly periodic signals only. Use the zero pad windows for all other signals. If you use the uniform window with a slightly non-periodic signal, you can see a tapering of the correlation results.

For example, look at the autocorrelation of a 10.1 kHz sine wave with a 3.9 us record length. Compare what you see with the uniform window to the zero pad -T/4 to T/4 window. The zero pad window gives the correct results.

*See also:* [ CORRELATN ANALYSIS ] softkey

## [UNIFORM] softkey

Key Path: [ Window ]

Select the Uniform window for both input channels. The Uniform window's rectangular shape does not attenuate any portion of the time record—it weights all parts of the time record equally. This is the default window for order measurements.

Because the Uniform window does not force the signal to appear periodic in the time record, it is generally used only with functions that are already periodic within a time record, such as transients and bursts. For sinewaves that are exactly periodic within a time record, the Uniform window measures the amplitude exactly (to within hardware specifications).

The Uniform window is sometimes called a transient or box car window.

For more information on the Uniform window and its applications, see the analyzer's *Concepts Guide.*

## [UNWRAPPED PHASE] softkey

Key Path: [ **Trace Coord** ]

Display unwrapped phase on the active trace.

Unwrapped phase means that the actual phase referenced to the lowest measured frequency is displayed; it is not shifted to between –180 and +180 degrees.

To display wrapped phase, press [ PHASE ].

*See also:* [ PHASE ] softkey

## [UPDATE RATE] softkey

Key Path: [ **Avg** ]

Specify how often you want the display to update when fast average is turned on.

Limits: 1 to 99,999 Default: 5

For example, if you enter 5, the analyzer will update the display once every 5 averages.

*See also:* [ FAST AVG ON OFF ] softkey

## [UPPER LOWER] softkey

Key Path: [ **Disp Format** ]

Display both traces using two half-height trace boxes. Trace A is displayed in the upper box and trace B in the lower box.

The annotation for each trace box applies for the trace displayed in the box. The annotation for the active trace is in a plain font; the annotation for the inactive trace is in a ghosted font.

*See also:* [ **Active Trace** ] hardkey, Fonts, Trace boxes

## [UPPER] softkey (BASIC display)

See [ DISPLAY SETUP ] softkey group.

## [UPPERCASE LOWERCASE] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ] → [ EDIT ] →
[ TYPING UTILITIES ]

Toggle between uppercase (A-Z) and lowercase (a-z) alpha characters for editing HP Instrument BASIC programs.

## [USER FREQ FACTOR] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ User X Setup ]

Specify the conversion factor for frequency domain user-defined X-axis units. When you select user-defined X-axis units, the analyzer divides the X-axis values in Hz by the conversion factor to obtain X-axis values in user-defined units.

For example, if you want X-axis units of cpm (cycles per minute), specify a factor of 0.01667. The analyzer divides the Hz value by .01667 to convert it to cpm. A value of 10 Hz is interpreted as 600 cpm.

*See also:* [ USER X UNIT ] softkey

## [USER LABEL] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Enter the label for [ USER REFERENCE ]. The analyzer attaches a prefix of "dB" to the name. For example, if you enter a label of "g", the Y-axis unit label will be "dBg."

*See also:* [ USER REFERENCE ] softkey

## [USER REF LEVEL] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Specify the dB reference level for [ USER REFERENCE ].

*See also:* [ USER REFERENCE ] softkey

## [USER REFERENCE] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ] → [ dB REFERENCE ]

Specify that dB magnitude is referenced to a level you enter by pressing [ USER REF LEVEL ]. You can also specify a name for the units by pressing [ USER LABEL ].

*See also:* [ USER LABEL ] softkey, [ USER REF LEVEL ] softkey, [ DB MAGNITUDE ] softkey

## [USER SPAN] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ FIT REGION ]

Specify that the curve fitter use only the portion of the trace defined by [ START ] and [ STOP ].

*See also:* [ STOP ] softkey (curve fit frequency), [ START ] softkey (curve fit frequency)

## [USER TIME FACTOR] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ User X Setup ]

Specify the conversion factor for time domain user-defined X-axis units. When you select user-defined X-axis units, the analyzer multiplies the X-axis values in seconds by the conversion factor to obtain X-axis values in user-defined units.

For example, if you specified a label of feet and enter a time factor of 25, the analyzer multiplies the seconds by 25. A value of 100 ms is interpreted as 2.5 ft.

*See also:* [ USER X UNIT ] softkey

## [USER X AT MKR] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ] → [ User X Setup ]

Specify the number of user-defined X-axis units at the current marker position. The analyzer uses the marker value and the number you enter to calculate the user frequency factor or user time factor.

*See also:* [ USER TIME FACTOR ] softkey, [ USER FREQ FACTOR ] softkey, [ X UNITS ] softkey

## [USER X SETUP] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ]

Set up the following parameters for user X-axis units:

- Frequency multiplier.
- Time multiplier.
- User value at marker.
- Label for frequency data.
- Label for time data.

*See also:* [ USER TIME FACTOR ] softkey, [ USER FREQ FACTOR ] softkey, [ TIME LABEL ] softkey, [ FREQ LABEL ] softkey, [ USER X AT MKR ] softkey, [ USER X UNIT ] softkey

## [USER X UNIT] softkey

Key Path: [ **Trace Coord** ] → [ X UNITS ]

Specify user-defined units for the X-axis. You can enter a name for the units and a multiplier by pressing [ USER X SETUP ] and selecting from the softkeys in that menu.

*See also:* [ USER X SETUP ] softkey

## [USER DEFINED] softkey

See Line type softkeys.

## [USER LINE TYPE] softkey

See Line type softkeys.

## [USER P1P2 ON OFF] softkey

See [ P1 P2 SETUP ] softkeys.

## [USER P1 X] softkey

See [ P1 P2 SETUP ] softkeys.

## [USER P1 Y] softkey

See [ P1 P2 SETUP ] softkeys.

## [USER P2 X] softkey

See [ P1 P2 SETUP ] softkeys.

## [USER P2 Y] softkey

See [ P1 P2 SETUP ] softkeys.

## [UTILITIES] softkey

(Available only with option 1C2, HP Instrument BASIC)

Key Path: [ **BASIC** ] → [ INSTRUMNT BASIC ]

The softkeys under [ UTILITIES ] let you do the following things for your HP Instrument BASIC program:

- Allocate a specific amount of memory for the program's stack.
- Let the analyzer automatically allocate the amount of stack space it determines the program needs.
- Scratch (delete) the program and its variables.
- Renumber its lines.
- Secure some or all of its lines.

*See also:* [ AUTO MEMORY ] softkey, [ MEMORY SIZE ] softkey, [ SECURE ] softkey, [ RENUMBER ] softkey, [ SCRATCH ] softkey

## [V/RTHZ] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Display the trace in volts divided by the square root of equivalent filter bandwidth (square root power spectral density). This is useful for wideband, continuous signals.

## [V ^ 2/HZ (PSD)] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Display the trace in volts squared divided by the equivalent filter bandwidth. This provides power normalized to a 1 Hz bandwidth, or power spectral density (PSD). This is useful for wideband, continuous signals.

## [V ^ 2S/HZ (ESD)] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Display the trace in volts squared seconds divided by the equivalent filter bandwidth. This provides energy normalized to a 1 Hz bandwidth, or energy spectral density (ESD). This is useful for wideband, transient signals.

## [VECTOR EXPONENTL] softkey

Key Path: [ **Avg** ]

Select exponential vector averaging. You'll need to provide a trigger signal—from the analyzer's source or from an external signal.

Unlike linear (normal) averaging, exponential averaging weights new data more than old data. This is useful for tracking data that changes over time.

When using exponential averaging, the number of averages you select determines the weighting of old versus new data—not the total number of averages calculated. As the number of averages increases, new data is weighted less.

With exponential averaging, it's especially important to set the number of averages carefully—if there are too few averages in the measurement, the averaging will not smooth out variances. But if there are too many averages, the analyzer may not track subtle changes occurring within the data.

To calculate the exponential average, the analyzer uses this formula:

$$[(1/N)*\ (new)] + [((N-1)/N)*\ (old)],$$

where N is a weighting factor (the number of averages you've specified).

When starting an exponential average, the analyzer sets N equal to 1 for the first analysis, then sets N equal to 2 for the second analysis, and so on—until N equals the number of averages you've specified.

Once you start a measurement using exponential averaging, the measurement continues indefinitely. To stop it, press [ **Pause/Cont** ]. This is different than linear averaging—linear averaging stops automatically after the specified number of averages are completed.

Until the measurement reaches the specified number of averages, there is no difference between vector exponential averaging and vector averaging.

The results of vector exponential averaging affect only frequency domain measurement results. Vector exponential averaging does not affect time domain measurement data or the results of math functions on time domain data.

*See also:* [ VECTOR ] softkey, [ NUMBER AVERAGES ] softkey

## [VECTOR] softkey

Key Path: [ Avg ]

Select vector averaging.

With vector-averaging, the analyzer averages complex values, point-by-point, in the frequency domain. This lowers noise because the real and imaginary components of the random signals are not in phase and therefore cancel each other—increasingly so with each average. Frequency components that are periodic do not cancel and therefore do not diminish with successive averages.

For mechanical applications, vector averaging is often used during vibration measurements to resolve low-level frequency components from background noise.

The results of vector averaging affect only frequency domain measurement results. Vector averaging does not affect time domain measurement data or the results of math functions on time domain data.

Vector averaging produces results similar to time averaging (time averaging means that the analyzer averages all time records first, then performs a single FFT on an averaged time record). Vector averaging accomplishes the same thing as time averaging, since the averaged linear spectrum derived from a series of vector-averaged linear spectra is equivalent to a single linear spectrum of time-averaged time records.

Although measurements made with vector averaging have better signal-to-noise ratios than rms averaging, there are some restrictions:

- The input signal must be periodic. In other words, the frequency components you want to measure must repeat with each time record. If these components are not periodic (not in phase with the start of each new time record), their real and imaginary values will cancel and the analyzer will not resolve these components.
- If you select vector averaging, you'll need to provide a trigger signal—from the analyzer's source or from an external signal. Of course, the analyzer will still make a measurement with continuous triggering (no trigger signal), but the amplitude of periodic signals will diminish with each successive average (since even periodic components have random phase with continuous triggering).

## [VOLATILE RAM DISK] softkey

Key Path: [ **Disk Utility** ] → [ DEFAULT DISK ]
or: [ **Save/Recall** ] → [ DEFAULT DISK ]

Select the analyzer's volatile RAM as the default disk.

---

**Caution** The volatile RAM disk is cleared each time you turn the analyzer off. Copy important files to another disk before power-down or they will be lost.

---

Each time you turn the analyzer on, a 64 Kbyte volatile RAM disk is created. If you need more storage space, you must specify a different [ RAM DISK SIZE ] and reformat the disk.

File operations are much faster on the volatile RAM disk than on the internal disk. This makes the volatile RAM disk very useful for HP Instrument BASIC programs.

*See also:* [ RAM DISK SIZE ] softkey, [ DEFAULT DISK ] softkey

## [VOLTS] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Display the trace in volts. This is useful for narrow band signals.

## [VOLTS ^ 2] softkey

Key Path: [ **Trace Coord** ] → [ Y UNITS ]

Display the trace in volts squared. This is useful for narrow band signals.

## Volume name

Volume names allow you to uniquely identify each of your flexible disks. The volume names are displayed in the upper-left corner of the disk catalog.

A volume name can be up to six characters long. You assign it to a disk before formatting. Just append the name to the disk specifier in the [ PERFORM FORMAT ] entry window.

*See also:* [ CATALOG ON OFF ] softkey

## [WATERFALL ACT TRACE] softkey

Key Path: [ **Disp Format** ]

Change the display format to waterfall. Display the measurement data for the active trace in the waterfall trace and make trace B active.

This provides quick access to a waterfall display of the current measurement data.

*See also:* [ **Meas Data** ] hardkey, [ WATERFALL ] softkey

### Waterfall buffer

The analyzer temporarily stores traces in a waterfall buffer in RAM. The number of traces stored is determined by the [ WATERFALL STEPS ] softkey.

The amount of memory available limits the size of the waterfall buffer. You can clear other things from memory by pressing the softkeys under [ MEMORY USAGE ]. This makes more memory available for the waterfall buffer.

The waterfall buffer is cleared when you start a new measurement, preset the analyzer, or turn off the analyzer.

**Note** The waterfall buffer is not the same thing as the waterfall registers. The analyzer automatically stores traces in the waterfall buffer. You must save data to the waterfall registers by pressing the [SAVE WATERFALL] softkey.

*See also:* [ SAVE WATERFALL ] softkey, [ WATERFALL REGISTER ] softkey, [ WATERFALL STEPS ] softkey, [ MEMORY USAGE ] softkey, [ **Preset** ] hardkey

## [WATERFALL MARKERS] softkey

Key Path: [ **Marker Fctn** ]

Turn on and set up waterfall markers.

Waterfall markers are valid only for waterfall displays and when trace B is the active trace.

From the waterfall markers menu, you can do the following things:

- Scroll up or scroll down in the waterfall trace buffer.
- Select a trace or slice from the waterfall.
- Display a trace or slice in the upper trace.
- Save a trace or slice to a data register.
- Specify the data register for saving a trace or slice.
- Save and display a trace.
- Set up the waterfall display.

*See also:* [ SELECT SAVE REGISTER ] softkey, [ SAVE AND DISP DATA ] softkey, [ WATERFALL SETUP ] softkey, [ SAVE TO DATA REG ] softkey, [ SAVE AND DISP DATA ] softkey, [ WATERFALL ] softkey, Data registers, [ SLICE SELECT ] softkey, [ TRACE SELECT ] softkey, [ SCROLL DOWN ] softkey, [ SCROLL UP ] softkey

## [WATERFALL REGISTER] softkey

Key Path: [ **Meas Data** ]
or: [ **Meas Data** ] → [ MORE ]

Access the [ Wx ] softkeys. Each [ Wx ] key displays the contents of one of the analyzer's eight waterfall registers.

You can use [ RECALL WATERFALL ] to load any waterfall register.

*See also:* [ RECALL WATERFALL ] softkey, [ Wx ] softkeys

## [WATERFALL SETUP] softkey

Key Path: [ **Disp Format** ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ]

Access the softkeys for setting up the following waterfall display characteristics:

- Specify the Z-axis range.
- Specify the trace height.
- Turn hidden lines on or off.
- Suppress the baseline.
- Turn skew on or off.
- Specify the skew angle.

**Note** You specify the number of traces stored for a waterfall by pressing [ WATERFALL STEPS ] under [ **Trigger** ] → [ ARM SETUP ].

*See also:* [ SKEW ANGLE ] softkey, [ SKEW ON OFF ] softkey, [ WATERFALL STEPS ] softkey, [ BASELINE SUPPRESS ] softkey, [ HIDN LINE ON OFF ] softkey, [ TRACE HEIGHT ] softkey, [ MAX TRACES DISPLAYED ] softkey, [ WATERFALL ] softkey

## [WATERFALL] softkey

Key Path: [ **Disp Format** ]

Select the waterfall display format. You can display measurement data from any measurement (except swept sine or order track) in a waterfall display. You cannot display data registers in a waterfall display.

This format provides a small upper trace box and a larger lower trace box. The lower trace box displays trace B in a waterfall or map. The traces are scrolled down the display (the newest trace is at the top). The upper trace box displays trace A.

---

**Note** You specify the number of traces stored for a waterfall by pressing [ WATERFALL STEPS ] under [ **Trigger** ] → [ ARM SETUP ].

---

Trace A and trace B are independent in a waterfall display. You can assign any available measurement data to either trace. This is different from some other analyzers that assign the same measurement data for both traces.

The softkeys controlling the behavior of the waterfall display are accessed by pressing [ WATERFALL SETUP ].

Special waterfall markers are available under the [ **Marker Fctn** ] hardkey. You can use these markers to select a trace or slice from the lower trace box to be displayed in the upper trace box.

---

**Note** The waterfall display format is not available for swept sine measurements or order track mode in order measurements. If you select either of these instrument modes when the current display selection is waterfall, the display format changes to single.

---

**Note** If you select either [ UPPER ] or [ LOWER ] under the [ **BASIC** ] → [ DISPLAY SETUP ] key, the analyzer changes the display format from waterfall to upper/lower.

---

*See also:* [ TRACK ON OFF ] softkey, Data registers, [ WATERFALL STEPS ] softkey, [ SWEPT SINE ] softkey, [ WATERFALL MARKERS ] softkey, [ WATERFALL SETUP ] softkey, [ **Meas Data** ] hardkey, Trace boxes

## [WATERFALL STEPS] softkey

Key Path: [ **Trigger** ] → [ ARM SETUP ]
or: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Limits: 1 to 32,768 Default: varies depending on instrument mode and memory availability

The behavior of this key depends on the arming mode and the instrument mode. (See separate help topics for waterfall steps with octave analysis and order analysis.)

- In general, this key specifies the capacity of the waterfall—the total number of traces that are stored in the waterfall buffer.
- For rpm step or time step arming, this key specifies the maximum number of steps in the arming sequence.

The number of traces the analyzer can store depends on the amount of memory available and the size of the data. For example, octave traces take much less memory than frequency response traces. If the analyzer cannot store the number of traces you specify, it sets the value to the highest possible number and displays a message.

---

**Caution** When you start a new measurement, all current data in the waterfall buffer is lost.

---

*See also:* [ WATERFALL STEPS ] softkey (octave analysis), [ WATERFALL STEPS ] softkey (order analysis), Waterfall buffer, [ RPM STEP ARM ] softkey, [ TIME STEP ARM ] softkey

## [WATERFALL STEPS] softkey (octave analysis))

Key Path: [ **Trigger** ] → [ ARM SETUP ]
or: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Limits: 1 to 32,768

Default: varies depending on instrument mode and memory availability

The behavior of this key in octave analysis depends on the arming mode and the type of averaging.

- In general, this key specifies the capacity of the waterfall—the total number of traces that are stored in the waterfall buffer.
- For rpm step or time step arming, this key specifies the maximum number of steps in the arming sequence.
- For octave measurements, when you select [ MAXIMUM ] or [ MINIMUM ] hold or [ PEAK HOLD ], the analyzer effectively sets the number of waterfall steps to 1. The analyzer stores only the most recent trace in the waterfall buffer. If you pause a measurement with a waterfall displayed, the analyzer displays only 1 trace.

**Caution** When you start a new measurement, all current data in the waterfall buffer is lost.

*See also:* [ PEAK HOLD ] softkey (octave), [ HOLD SETUP ] softkeys, [ RPM STEP ARM ] softkey, [ TIME STEP ARM ] softkey, Waterfall buffer

## [WATERFALL STEPS] softkey (order analysis)

Key Path: [ **Trigger** ] → [ ARM SETUP ]
or: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

In the order analysis mode, the [ WATERFALL STEPS ] softkey behaves like the [ TRACK POINTS ] softkey.

*See also:* [ TRACK POINTS ] softkey

## [WEIGHT AUTO USER] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]

Specify which portions of the input frequency response should be emphasized during the curve fit.

The weighting function is a real function of frequency whose values vary between 0 and 1, where 1 represents maximum emphasis.

If you select auto weight, the curve fitter will automatically generate a weighting function and store this in the selected weight register when it has finished. Usually the auto weighting function only needs to emphasize small portions of the frequency response to obtain a good fit.

If you select user weight, the curve fitter uses whatever weighting function is stored in the specified weight register. The analyzer does not generate and store a new weighting function. You can edit the weighting function using the [ DATA EDIT ] softkeys.

*See also:* [ WEIGHT REGISTER ] softkey, [ WEIGHT REGISTER ] softkey

## [WEIGHT REGISTER] softkey

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ CURVE FIT ] → [ CURVE FIT SETUP ]

Specify which data register should be used for the curve fitter's weighting function.

If you selected auto weight, the curve fitter generates a weighting function and stores it in the selected data register.

If you selected user weight, the curve fitter uses the data stored in the selected data register as the weighting function for further curve fit operations. The analyzer does not generate and store a new weighting function.

The default weight register is D7.

You can save user or auto weighting functions on disk by saving the data register containing the function.

## [Window] hardkey

Select the type of input window you want.

A "window" is a time-domain weighting function applied to the input signal—essentially, a way to filter out signals that are not periodic (and therefore spurious) within the input time record. Depending on the window, the analyzer attenuates certain parts of the input time record, to prevent "leakage"—a smearing of energy across the frequency spectrum, caused by transforming signals that are not periodic within the time record.

You can display windowed time data in FFT analysis and correlation analysis instrument modes.

The window functions available for each instrument mode are:

- FFT Analysis:
  - Hanning.
  - Flat Top.
  - Uniform.
  - Force Expo.
  - Channel 1 Forc Expo.
  - Channel 2 Forc Expo.
  - Force Width.
  - Expo Decay.
- Order Analysis:
  - Hanning.
  - Flat Top.
  - Uniform.
- Correlation Analysis (weighting functions):
  - Zero Pad -T/4, T/4.
  - Zero Pad 0, T/2.
  - Uniform -T/2, T/2.
- Octave Analysis, Swept Sine, or Histogram:
  - No windowing.

*See also:* [ UNIFORM -T/2, T/2 ] softkey, [ ZERO PAD 0, T/2 ] softkey, [ ZERO PAD -T/4, T/4 ] softkey, [ EXPO DECAY ] softkey, [ FORCE WIDTH ] softkey, [ CHANNEL x FORCE EXPO ] softkey, [ CHANNEL x FORCE EXPO ] softkey, [ FORCE EXPO ] softkey, [ UNIFORM ] softkey, [ FLAT TOP ] softkey, [ HANNING ] softkey, [ UNIFORM ] softkey, [ FLAT TOP ] softkey, [ HANNING ] softkey, Time record

## [WINDOWED TIME CH x] softkey

Key Path: [ **Meas Data** ] → [ MORE ]

Display the most recent time record after the currently active window function has been applied.

This is most useful for directly observing the effects of force and exponential windows.

*See also:* [ **Window** ] hardkey, Time record

## [WINDOWED TIME CH x] softkey (correlation)

Key Path: [ **Meas Data** ]

Display the most recent time record after the currently active window function has been applied.

This is most useful for correlation with transient signals. Be sure that you set trigger delay so that the signal appears in the windowed time data.

For example, if you are triggering without a trigger delay and using the zero pad –T/4 to T/4 window, the windowing process will clear the first quarter of the time record. This deletes your signal, and it will not show up in the windowed time. You can correct this by using a pretrigger delay of at least a quarter of the time record.

Be sure to use the correct window for your data. Use the uniform window for transient and exactly periodic signals only. Use the zero pad windows for all other signals. If you use the uniform window with a slightly non-periodic signal, you can see a tapering of the correlation results.

For example, look at the autocorrelation of a 10.1 kHz sine wave with a 3.9 us record length. Compare what you see with the uniform window to the zero pad -T/4 to T/4 window. The zero pad window gives the correct results.

*See also:* [ UNIFORM -T/2, T/2 ] softkey, [ ZERO PAD -T/4, T/4 ] softkey, [ CHANNEL x DELAY ] softkey, [ **Window** ] hardkey, Time record

## [Wx] softkeys

Key Path: [ **Meas Data** ] → [ WATERFALL REGISTER ]

Display the contents of the corresponding waterfall register.

You can use [ RECALL WATERFALL ] to load any waterfall register.

**Note**

If you display a waterfall register in a non-waterfall trace box, only the first trace in the waterfall is displayed.

*See also:* Trace boxes, [ RECALL WATERFALL ] softkey, [ Wx ] softkeys

## [X UNITS] softkey

Key Path: [ **Trace Coord** ]

Specify the following units attributes for the X-axis:

- Hz (Seconds)
- rpm (Seconds)
- Orders (Revolutions)
- User defined

You can specify X-axis units for all measurement data in the FFT analysis, swept sine, and correlation analysis instrument modes, and for time data in the histogram/time instrument mode. You cannot specify X-axis units for measurement data in the octave analysis or order analysis instrument modes.

The units you specify apply only for the active trace, independent of instrument mode.

For example, if you specify rpm for power spectrum data, linear spectra will also use rpm for the X-axis. If you specify rpm for time data in the FFT analysis instrument mode, time data in the correlation analysis mode will also use rpm for the X-axis.

To specify X-axis units for a data register, waterfall register, or math function, you must first display the register in the active trace, then specify the X-axis units.

*See also:* [ USER X UNIT ] softkey, [ RPM (SEC) ] softkey, [ ORDER (REV) ] softkey, [ HZ (SEC) ] softkey

## [X-AXIS LIN LOG] softkey (synthesis)

(Available only with option 1D3, Curve Fit/Synthesis)

Key Path: [ **Analys** ] → [ SYNTHESIS ] → [ SYNTHESIS SETUP ]

Specify whether the synthesis computation produce linear or logarithmic X-axis data spacing.

For example, linear X-axis data spacing is based on start frequency and delta frequency. Logarithmic X-axis data spacing is based on start frequency and the ratio between adjacent frequency points.

---

**Note** This is not the same as specifying the X-axis display scale to lin or log.

---

## [X-AXIS LIN LOG] softkey (trace coord)

Key Path: [ **Trace Coord** ]

Specify a linear or a logarithmic scale for the X-axis.

This parameter affects only how the data is displayed. For the same span and resolution, frequency resolution for both linear and log scales is identical—both have a the same number of points per display. The logarithmic scale simply displays these points on a logarithmic X-axis.

For baseband measurements (spans that start at 0 Hz) the logarithmic scale shows the actual start frequency (the first bin) of the current span—not the nominal value of 0 Hz. So if you're looking at a 51.2 kHz frequency span, the first frequency shown on the logarithmic scale is 128 Hz (the analyzer does not show a value at 0 Hz since the log of 0 is minus infinity).

*See also:* Bins defined

## [Y PER DIV (DECADES)] softkey

Key Path: [ Scale ]

For linear Y-axis, specify the number of units per vertical scale division. For a log Y-axis, specify the number of decades displayed.

When you select a new scale spacing, the currently-active reference (top reference, center reference, or bottom reference) is held the same and the rest of the scale adjusted around this level. The reference softkey with a box around it is the currently-active reference.

**Note**

When you enter a value for the Y-axis, you cannot enter units. The analyzer uses the currently-displayed Y-axis units.

You can use the [ EXP ] key to enter units in engineering notation. For example, to enter 15 mV, press the following key sequence:

[ 1 ] [ 5 ] [ EXP ] [ +/− ] [ 3 ] [ ENTER ]

*See also:* [ LOG MAGNITUDE ] softkey, [ LINEAR MAGNITUDE ] softkey, [ BOTTOM REFERENCE ] softkey, [ CENTER REFERENCE ] softkey, [ TOP REFERENCE ] softkey

## [Y UNITS] softkey

Key Path: [ Trace Coord ]

Specify the following units attributes for the vertical axis:

- Peak or rms amplitude.
- Degree or radian phase.
- Volts.
- Volts ^ 2.
- V/rtHz.
- V ^ 2/Hz.
- V ^ 2S/Hz.
- a reference for dB magnitude.

*See also:* [ dB REF SETUP ] softkey, [ V ^ 2S/Hz (ESD) ] softkey, [ V ^ 2/Hz (PSD) ] softkey, [ V/rtHz ] softkey, [ VOLTS ^ 2 ] softkey, [ VOLTS ] softkey, [ AMPLITUDE PEAK RMS ] softkey, [ PHASE DEG RAD ] softkey

## [Z AXIS RANGE] softkey

Key Path: [ **Disp Format** ] → [ WATERFALL SETUP ]
or: [ **Marker Fctn** ] → [ WATERFALL MARKERS ] → [ WATERFALL SETUP ]

Specify the range of complete traces you want displayed on the waterfall.

Limits and default vary depending on the data displayed.

You specify the range in one of the following units, depending on the type of data displayed:

- Number of counts
- Number of averages
- Seconds
- rpm

---

**Note** If you specify a counts or averages, the analyzer displays one more than that number. You are specifying a range, not a number of traces. For example, if you specify "15 counts" the analyzer actually displays 16 traces.

---

*See also:* [ WATERFALL ] softkey

## [ZERO PAD -T/4, T/4] softkey

Key Path: [ **Window** ]

Specify the –T/4 to T/4 weighting function for a correlation measurement. ("T" refers to the time record length.) This weighting function has a value of 0 for the first quarter and last quarter of the time record and a value of 1 for the second quarter and third quarter.

Use this weighting function for periodic signals with positive delays (lags) and negative delays (leads) from channel 1 to channel 2.

For information on how this weighting function affects computation, see autocorrelation and cross correlation.

For more information on correlation weighting functions, refer to the analyzer's *Concepts Guide*.

*See also:* [ RECORD LENGTH ] softkey, [ CROSS CORRELATN ] softkey, [ AUTO CORR CHANNEL x ] softkey, [ CORRELATN ANALYSIS ] softkey

## [ZERO PAD 0, T/2] softkey

Key Path: [ **Window** ]

Specify the 0 to T/2 weighting function for a correlation measurement. ("T" refers to the time record length.) This weighting function has a value of 1 for the first half of the time record and 0 for the second half.

Use this weighting function for periodic signals with only positive delays (lags) from channel 1 to channel 2.

For information on how this weighting function affects computation, see autocorrelation and cross correlation.

For more information on correlation weighting functions, refer to the analyzer's *Concepts Guide.*

*See also:* [ RECORD LENGTH ] softkey, [ CROSS CORRELATN ] softkey, [ AUTO CORR CHANNEL x ] softkey, [ CORRELATN ANALYSIS ] softkey

## [ZERO START] softkey

Key Path: [ **Freq** ]

Set the start frequency to 0 Hz (baseband). This softkey also anchors the start frequency.

*See also:* [ START FREQUENCY ] softkey

5

# Menu Map

This chapter lists the hardkeys in the left column and the softkeys menus associated with each hardkey in the right column. The softkeys under some of the hardkeys vary depending on the instrument mode selected. For these keys, the left column lists the instrument mode, and the right column lists the softkey menus for that instrument mode.

## Measurement group

**Inst Mode**

[ FFT ANALYSIS ]
[ OCTAVE ANALYSIS ]
[ ORDER ANALYSIS ]
[ SWEPT SINE ]
[ CORRELATN ANALYSIS ]
[ HISTOGRAM / TIME ]
[ CAPTURE ON OFF ]
[ 1 CHANNEL ]
[ 2 CHANNEL ]
[ CAPTURE SETUP ]
- [ START CAPTURE ]
- [ ABORT CAPTURE ]
- [ CAPTURE LENGTH ]
- [ ALLOCATE CAPTURE ]
  - [ CONFIRM ALLOCATE ]
- [ REMOVE CAPTURE ]
  - [ CONFIRM REMOVE ]
- [ TACHOMETR SETUP ]
  - [ TACH DATA ON OFF ]
  - [ MAX RPM ]
- [ ANALYSIS REGION ]
  - [ STRT TIME CHANNEL 1 ]
  - [ STOP TIME CHANNEL 1 ]
  - [ STRT TIME CHANNEL 2 ]
  - [ STOP TIME CHANNEL 2 ]
- [ CAPTURE HEADER ]

**Freq**

The softkeys vary depending on the instrument mode.

FFT Analysis

[ SPAN ]
[ CENTER ]
[ START ]
[ STOP ]
[ ZERO START ]
[ FULL SPAN ]
[ ENTRY STEP SIZE ]
[ RECORD LENGTH ]
[ RESOLUTN (LINES) ]

Octave Analysis

[ START ]
[ STOP ]
[ FULL OCTAVE ]
[ 1/3 OCTAVE ]
[ 1/12 OCTAVE ]

Order Analysis
[ MIN RPM ]
[ MAX RPM ]
[ MAX ORDER ]
[ DELTA ORDER ]
[ TRACK ON OFF ]
[ TRACK 1 ORDER ]
[ TRACK 2 ORDER ]
[ TRACK 3 ORDER ]
[ TRACK 4 ORDER ]
[ TRACK 5 ORDER ]

Swept Sine
[ SPAN ]
[ CENTER ]
[ START ]
[ STOP ]
[ ENTRY STEP SIZE ]
[ SWEEP LIN LOG ]
[ SWEEP UP DOWN ]
[ SWEEP AUTO MAN ]
[ MANUAL FREQ ]
[ RESOLUTN SETUP ]
- [ RESOLUTN ]
- [ AUTO RES ON OFF ]
- [ MAXIMUM % CHANGE ]
- [ MINIMUM RESOLUTN ]

Correlation Analysis
[ RECORD LENGTH ]
[ RESOLUTN (LINES) ]

Histogram/Time
[ RECORD TIME ]
[ SAMPLE TIME ]
[ HISTOGRAM LENGTH ]
[ HISTOGRAM BINS ]

**Window**

The softkeys vary depending on the instrument mode.

FFT Analysis
[ HANNING ]
[ FLAT TOP ]
[ UNIFORM ]
[ FORCE EXPO ]
[ CHANNEL 1 FORC EXPO ]
[ CHANNEL 2 FORC EXPO ]
[ FORCE WIDTH ]
[ EXPO DECAY ]

Order Analysis
[ HANNING ]
[ FLAT TOP ]
[ UNIFORM ]
[ CP DC BIN ON OFF ]

Correlation Analysis
[ ZERO PAD -T/4, T/4 ]
[ ZERO PAD 0, T/2 ]
[ UNIFORM -T/2, T/2 ]

Correlation Analysis
None

**Input**

[ CHANNEL 1 RANGE ]
[ CH1 FIXED RANGE ]
[ CH1 AUTO RANGE ]
[ CHANNEL 1 SETUP ]
  [ INPUT LOW FLOAT GND ]
  [ COUPLING AC DC ]
  [ ANTIALIAS ON OFF ]
  [ A WT FLTR ON OFF ]
  [ ICP SUPLY ON OFF ]
  [ ENG UNIT ON OFF ]
  [ ENG UNIT MULTIPLER ]
  [ ENG UNIT AT MKR ]
  [ ENG UNIT LABEL ]
[ CHANNEL 2 RANGE ]
[ CH2 FIXED RANGE ]
[ CH2 AUTO RANGE ]
[ CHANNEL 2 SETUP ]
[ TACHOMETR SETUP ]
  [ TACH PULS PER REV ]
  [ TRG RANGE +/- 20 4 ]
  [ LEVEL ]
  [ HOLDOFF TIME ]
  [ SLOPE POS NEG ]

**Source**

The softkeys vary depending on the instrument mode.

FFT Analysis, Correlation Analysis, Histogram/ Time

[ SOURCE ON OFF ]
[ LEVEL ]
[ RANDOM NOISE ]
[ BURST RANDOM ]
[ PERIODIC CHIRP ]
[ BURST CHIRP ]
[ PINK NOISE ]
[ FIXED SINE ]
[ ARBITRARY (D1-D8) ]
[ ARB SRC SETUP ]
  [ REPEAT ON OFF ]
  [ DATA REG D1 ]
  . . .
  [ DATA REG D8 ]

Octave Analysis, Order Analysis

[ SOURCE ON OFF ]
[ LEVEL ]
[ RANDOM NOISE ]
[ PINK NOISE ]
[ FIXED SINE ]

Swept Sine

[ LEVEL ]
[ RAMP RATE ]
[ AUTOLEVEL ON OFF ]
[ AUTOLEVEL SETUP ]
  [ REF CHAN CH1 CH2 ]
  [ REFERENCE LEVEL ]
  [ REFERENCE TOLERANCE ]
  [ MAX SRC LEVEL ]
  [ MAX INPUT LEVEL ]

**Trigger**

The softkeys vary depending on the instrument mode.

**FFT Analysis, Correlation Analysis, Histogram/ Time**

[ FREE RUN TRIGGER ]
[ EXTERNAL TRIGGER ]
[ CHANNEL 1 TRIGGER ]
[ CHANNEL 2 TRIGGER ]
[ SOURCE TRIGGER ]
[ HP-IB TRIGGER ]
[ TACHOMETR SETUP ]
[ TACHOMETR SETUP ]
    [ TACH PULS PER REV ]
    [ TRG RANGE +/- 20 4 ]
    [ LEVEL ]
    [ HOLDOFF TIME ]
    [ SLOPE POS NEG ]
[ TRIGGER SETUP ]
    [ LEVEL ]
    [ SLOPE POS NEG ]
    [ CHANNEL 1 DELAY ]
    [ CHANNEL 2 DELAY ]
[ ARM SETUP ]
    [ AUTOMATIC ARM ]
    [ MANUAL ARM ]
    [ RPM STEP ARM ]
    [ TIME STEP ARM ]
    [ START RPM USAGE ]
        [ RPM INCREASNG ]
        [ RPM DECREASNG ]
    [ START RPM ]
    [ RPM STEP SIZE ]
    [ TIME STEP SIZE ]
    [ WATERFALL STEPS ]
[ ARM ]

**Octave Analysis**

[ FREE RUN TRIGGER ]
[ EXTERNAL TRIGGER ]
[ HP-IB TRIGGER ]
[ LEVEL HIGH LOW ]
:
(continued)

[ AUTOMATIC ARM ]
[ RPM STEP ARM ]
[ TIME STEP ARM ]
[ ARM SETUP ]
    [ RPM INCREASNG ]
    [ RPM DECREASNG ]
    [ START RPM ]
    [ RPM STEP SIZE ]
    [ TIME STEP SIZE ]
    [ WATERFALL STEPS ]
[ DELAY TIME ]
[ TACHOMETR SETUP ]
[ TACHOMETR SETUP ]
    [ TACH PULS PER REV ]
    [ TRG RANGE +/- 20 4 ]
    [ LEVEL ]
    [ HOLDOFF TIME ]
    [ SLOPE POS NEG ]

**Order Analysis**

[ FREE RUN TRIGGER ]
[ EXTERNAL TRIGGER ]
[ LEVEL HIGH LOW ]
[ AUTOMATIC ARM ]
[ RPM STEP ARM ]
[ TIME STEP ARM ]
[ ARM SETUP ]
    [ START RPM OFF ]
    [ RPM INCREASNG ]
    [ RPM DECREASNG ]
    [ START RPM ]
    [ RPM STEP SIZE ]
    [ TIME STEP SIZE ]
    [ TRACK POINTS ]
    [ WATERFALL STEPS ]
[ TACHOMETR SETUP ]
[ TACHOMETR SETUP ]
    [ TACH PULS PER REV ]
    [ TRG RANGE +/- 20 4 ]
    [ LEVEL ]
    [ HOLDOFF TIME ]
    [ SLOPE POS NEG ]

**Start**

No softkeys under this hardkey.

**Pause Cont**

No softkeys under this hardkey.

**Avg**

The softkeys vary depending on the instrument mode.

FFT Analysis

[ AVERAGE ON OFF ]
[ NUMBER AVERAGES ]
[ AVERAGE TYPE ]
  [ RMS ]
  [ RMS EXPONENTL ]
  [ VECTOR ]
  [ VECTOR EXPONENTL ]
  [ PEAK HOLD ]
[ FAST AVG ON OFF ]
[ UPDATE RATE ]
[ REPEAT ON OFF ]
[ OVERLAP PERCENT ]
[ OVLD REJ ON OFF ]
[ PREVIEW SETUP ]
  [ PREVIEW OFF ]
  [ MANUAL PREVIEW ]
  [ TIMED PREVIEW ]
  [ TIME ]
  [ REJECT TIME REC ]
  [ ACCEPT TIME REC ]

Octave Analysis

[ LINEAR ]
[ EXPONENTL ]
[ EQUAL CONFID ]
[ PEAK HOLD ]
[ HOLD SETUP ]
  [ OFF ]
  [ MAXIMUM ]
  [ MINIMUM ]
[ AVERAGE TIME ]
[ CONFIDNCE LEVEL ]
[ IMPULSE ON OFF ]
[ REPEAT ON OFF ]

Order Analysis

[ AVERAGE ON OFF ]
[ NUMBER AVERAGES ]
[ TIME ]
[ TIME EXPONENTL ]
[ REPEAT ON OFF ]

Swept Sine

[ SETTLE TIME ]
  [ S ]
  [ mS ]
  [ uS ]
  [ CYCLES ]
[ INTEGRATE TIME ]
[ FAST AVG ON OFF ]

Correlation Analysis

[ NUMBER AVERAGES ]
[ AVERAGE TYPE ]
  [ RMS ]
  [ RMS EXPONENTL ]
  [ VECTOR ]
  [ VECTOR EXPONENTL ]
[ FAST AVG ON OFF ]
[ UPDATE RATE ]
[ REPEAT ON OFF ]
[ OVERLAP PERCENT ]
[ OVLD REJ ON OFF ]

Histogram/ Time

[ FAST AVG ON OFF ]
[ REPEAT ON OFF ]
[ AVERAGE ON OFF ]

## Display group

**Meas Data**

The softkeys vary depending on the instrument mode.

FFT Analysis

[ PWR SPEC CHANNEL 1 ]
[ PWR SPEC CHANNEL 2 ]
[ LIN SPEC CHANNEL 1 ]
[ LIN SPEC CHANNEL 2 ]
[ TIME CHANNEL 1 ]
[ TIME CHANNEL 2 ]
[ FREQUENCY RESPONSE ]
[ COHERENCE ]
[ CROSS SPECTRUM ]
[ MORE ]
  [ ORBIT ]
  [ WINDOWED TIME CH1 ]
  [ WINDOWED TIME CH2 ]
  [ CAPTURE CHANNEL 1 ]
  [ CAPTURE CHANNEL 2 ]
  [ MATH FUNCTION ]
    [ F1 ]
    ...
    [ F5 ]
  [ DATA REGISTER ]
    [ D1 ]
    ...
    [ D8 ]
  [ WATERFALL REGISTER ]
    [ W1 ]
    ...
    [ W8 ]

Octave Analysis

[ PWR SPEC CHANNEL 1 ]
[ PWR SPEC CHANNEL 2 ]
[ CAPTURE CHANNEL 1 ]
[ CAPTURE CHANNEL 2 ]
[ MATH FUNCTION ]
[ DATA REGISTER ]
[ WATERFALL REGISTER ]

Order Analysis

[ PWR SPEC CHANNEL 1 ]
[ PWR SPEC CHANNEL 2 ]
[ TIME CHANNEL 1 ]
[ TIME CHANNEL 2 ]
[ ORBIT ]
[ CAPTURE CHANNEL 1 ]
[ CAPTURE CHANNEL 2 ]
[ MORE ]
  [ COMP PWR CHANNEL 1 ]
  [ COMP PWR CHANNEL 2 ]
  [ ORDER TRK CHANNEL 1 ]
    [ TRACK 1 ]
    [ TRACK 2 ]
    [ TRACK 3 ]
    [ TRACK 4 ]
    [ TRACK 5 ]
  [ ORDER TRK CHANNEL 2 ]
    [ TRACK 1 ]
    [ TRACK 2 ]
    [ TRACK 3 ]
    [ TRACK 4 ]
    [ TRACK 5 ]
  [ RPM PROFILE ]
  [ MATH FUNCTION ]
  [ DATA REGISTER ]
  [ WATERFALL REGISTER ]

**Swept Sine**

[ LIN SPEC CHANNEL 1 ]
[ LIN SPEC CHANNEL 2 ]
[ TIME CHANNEL 1 ]
[ TIME CHANNEL 2 ]
[ FREQUENCY RESPONSE ]
[ CROSS SPECTRUM ]
[ NORM VAR CHANNEL 1 ]
[ NORM VAR CHANNEL 2 ]
[ MORE ]
  [ MATH FUNCTION ]
  [ DATA REGISTER ]
  [ WATERFALL REGISTER ]

**Correlation Analysis**

[ TIME CHANNEL 1 ]
[ TIME CHANNEL 2 ]
[ AUTO CORR CHANNEL 1 ]
[ AUTO CORR CHANNEL 2 ]
[ CROSS CORRELATN ]
[ WINDOWED TIME CH1 ]
[ WINDOWED TIME CH2 ]
[ CAPTURE CHANNEL 1 ]
[ CAPTURE CHANNEL 2 ]
[ MORE ]
  [ MATH FUNCTION ]
  [ DATA REGISTER ]
  [ WATERFALL REGISTER ]

[ HISTOGRAM CHANNEL 2 ]
[ PDF CHANNEL 1 ]
[ PDF CHANNEL 2 ]
[ CDF CHANNEL 1 ]
[ CDF CHANNEL 2 ]
[ UNFILTERD TIME CH 1 ]
[ UNFILTERD TIME CH 2 ]
[ MORE ]
  [ CAPTURE CHANNEL 1 ]
  [ CAPTURE CHANNEL 2 ]
  [ MATH FUNCTION ]
  [ DATA REGISTER ]
  [ WATERFALL REGISTER ]

**Histogram/ Time**

[ HISTOGRAM CHANNEL 1 ]

**Trace Coord**

[ LINEAR MAGNITUDE ]
[ LOG MAGNITUDE ]
[ dB MAGNITUDE ]
[ PHASE ]
[ UNWRAPPED PHASE ]
[ MORE: NYQ REAL IMAG ]
  [ REAL PART ]
  [ IMAGINARY PART ]
  [ NYQUIST DIAGRAM ]
[ X UNITS ]
  [ HZ (SEC) ]
  [ RPM (SEC) ]
  [ ORDER (REV) ]
  [ USER X UNIT ]
  [ ORDER SETUP ]
    [ HZ/ORDER RATIO ]
    [ TRACE RPM ]
    [ ORDER AT MKR ]
  [ USER X SETUP ]
    [ USER FREQ FACTOR ]
    [ USER TIME FACTOR ]
    [ USER X AT MKR ]
    [ FREQ LABEL ]
    [ TIME LABEL ]
[ Y UNITS ]
  [ AMPLITUDE PEAK RMS ]
  [ PHASE DEG RAD ]
  [ dB REF SETUP ]
    [ dBV (dBEU) ]
    [ dBm ]
    [ dBSPL (20 uPa) ]
    [ USER REFERENCE ]
    [ dBm REF IMPEDANCE ]
    [ USER REF LEVEL ]
    [ USER LABEL ]
  [ VOLTS ]
  [ VOLTS ^ 2 ]
  [ V/rtHz ]
  [ V ^ 2/Hz (PSD) ]
  [ V ^ 2s/Hz (ESD) ]
[ X-AXIS LIN LOG ]

**Scale**

[ AUTOSCALE ON OFF ]
[ TOP REFERENCE ]
[ CENTER REFERENCE ]
[ BOTTOM REFERENCE ]
[ INP RANGE TRACKING ]
[ Y PER DIV (DECADES) ]
[ MATCH X SCALE ]
[ MATCH Y SCALE ]
[ AXES SCAL MARKERS ]
  [ AXIS X Y ]
  [ FULL SCALE ]
  [ HOLD SCALE ]
  [ SCALE AT MARKERS ]
  [ LEFT (BOTTOM) ]
  [ WIDTH (HEIGHT) ]
  [ RIGHT (TOP) ]
  [ CENTER ]

**Active Trace**

No softkeys under this hardkey.

**Analys**

[ DEFINE FUNCTION ]
  [ DEFINE F1 ]
  . . .
  [ DEFINE F5 ]
    [ MEAS DATA ]
      (same keys as under Meas Data for each instrument mode)
      [ + ]
      [ - ]
      [ * ]
      [ / ]
      [ ) ]
      [ ENTER ]
    [ OPERATION ]
      [ CONJ( ]
      [ MAG( ]
      [ REAL( ]
      [ IMAG( ]
      [ SQRT( ]
      :

(continued)

      [ FFT( ]
      [ INVERSE FFT( ]
      [ PSD( ]
      [ MORE ]
        [ LN( ]
        [ EXP( ]
        [ *jOMEGA( ]
        [ /jOMEGA( ]
        [ AWEIGHT( ]
        [ BWEIGHT( ]
        [ CWEIGHT( ]
        [ DIFF( ]
        [ INTEG( ]
    [ ( ]
[ DEFINE CONSTANT ]
  [ DEFINE K1 ]
  . . .
  [ DEFINE K5 ]
    [ ENTER ]
    [ + j ]
    [ EXP ]
[ LIMIT TEST ]
  [ LINES ON OFF ]
  [ TEST EVAL ON OFF ]
  [ FAIL BEEP ON OFF ]
  [ DEFINE UPPER LIM ]
    [ MOVE MKR HORIZNTAL ]
    [ MOVE MKR VERTICAL ]
    [ START SEGMENT ]
    [ FINISH SEGMENT ]
    [ MOVE ALL VERTICAL ]
    [ DELETE SEGMENT ]
    [ DELETE ALL ]
      [ CONFIRM/ DELETE ]
    [ TRACE TO LIMIT ]
  [ DEFINE LOWER LIM ]
[ CURVE FIT ]
  [ START FIT ]
  [ ABORT FIT ]

  :

(continued)

[ CURVE FIT REGISTER ]
  [ D1 ]
  . . .
  [ D8 ]
[ EDIT TABLE ]
  [ CHANGE VALUE ]
    [ kHz ]
    [ Hz ]
    [ mHz ]
    [ + j ]
    [ EXP ]
  [ ADD VALUE ]
  [ DELETE VALUE ]
  [ UNDELETE VALUE ]
  [ FIX VALUE TOGGLE ]
  [ CLEAR TABLE ]
    [ CONFIRM CLEAR ]
[ COPY FROM SYNTHESIS ]
[ FIT REGION ]
  [ FULL SPAN ]
  [ USER SPAN ]
  [ START ]
  [ STOP ]
[ CURVE FIT SETUP ]
  [ ORDER MAX FIXED ]
  [ NUMBER OF POLES ]
  [ NUMBER OF ZEROS ]
  [ WEIGHT AUTO USER ]
  [ WEIGHT REGISTER ]
    [ D1 ]
    . . .
    [ D8 ]
  [ TIME DELAY ]
  [ FREQUENCY SCALE ]
[ TABLE ON OFF ]
[ SYNTHESIS ]
  [ START SYNTHESIS ]
  [ SYNTHESIS REGISTER ]
    [ D1 ]
    . . .
    [ D8 ]
  :
(continued)

  [ EDIT TABLE ]
  [ COPY FROM CURVE FIT ]
  [ CONVERT TABLE ]
    [ CONVRT TO POLE ZERO ]
    [ CONVRT TO POLE RESD ]
    [ CONVRT TO POLYNMIAL ]
  [ SYNTHESIS SETUP ]
    [ GAIN FACTOR ]
    [ TIME DELAY ]
    [ FREQUENCY SCALE ]
    [ X-AXIS LIN LOG ]
  [ TABLE ON OFF ]
[ DATA EDIT ]
  [ EDIT D1 ]
  . . .
  [ EDIT D8 ]
    [ START X ]
    [ STOP X ]
    [ MODIFY START Y ]
    [ MODIFY STOP Y ]

**Disp Format**

  [ SINGLE ]
[ UPPER/ LOWER ]
[ FRONT/ BACK ]
[ WATERFALL ]
[ MEASURMNT STATE ]
[ INPUT STATE ]
[ WATERFALL ACT TRACE ]
[ WATERFALL SETUP ]
  [ Z AXIS RANGE ]
    [ TRACE NUMBER ]
  [ TRACE HEIGHT ]
  [ HIDN LINE ON OFF ]
  [ SKEW ON OFF ]
  [ SKEW ANGLE ]
  [ BASELINE SUPPRESS ]
[ BODE DIAGRAM ]
[ MORE ]
  [ GRID ON OFF ]
  [ BLANK ANNOTATN ]
  [ BLANK DISPLAY ]
  [ TRACE TITLE ]
  [ DFLT TITL ON OFF ]

# Marker group

**Marker**

[ MARKER ON OFF ]
[ COUPLED ON OFF ]
[ MARKER X ENTRY ]
[ MKR VALUE ABS REL ]
[ REFERENCE TO MARKER ]
[ REFERENCE SETUP ]
  [ REFERENCE TO MARKER ]
  [ REFERENCE X ENTRY ]
  [ REFERENCE Y ENTRY ]
[ PEAK TRK ON OFF ]
[ NEXT PEAK RIGHT ]
[ NEXT PEAK LEFT ]
[ MARKER TO PEAK ]

**Marker Fctn**

[ MARKER FCTN OFF ]
[ HARMONIC MARKER ]
  [ FUNDAMNTL FREQUENCY ]
  [ NUMBER OF HARMONICS ]
  [ COMPUTE OFF ]
  [ THD ]
  [ HARMONIC POWER ]
[ BAND MARKER ]
  [ BAND SPAN ]
  [ BAND CENTER ]
  [ BAND START ]
  [ BAND STOP ]
  [ COMPUTE OFF ]
  [ BAND POWER ]
  [ RMS SQRT(PWR) ]
[ SIDEBAND MARKER ]
  [ CARRIER FREQ ]
  [ SIDEBAND INCREMENT ]
  [ NUMBER OF SIDEBANDS ]
  [ COMPUTE OFF ]
  [ SIDEBAND POWER ]
[ WATERFALL MARKERS ]
  [ SCROLL UP ]
  [ SCROLL DOWN ]
  :

(continued)

  [ TRACE SELECT ]
    [ S ]
    [ mS ]
    [ TRACE NUMBER ]
    [ RPM ]
    [ kRPM ]
    [ TRACE NUMBER ]
    [ COUNT ]
    [ kCOUNT ]
    [ TRACE NUMBER ]
    [ AVG ]
    [ kAVG ]
    [ TRACE NUMBER ]
  [ SLICE SELECT ]
  [ SAVE AND DISP DATA ]
  [ SAVE TO DATA REG ]
  [ SELECT SAVE REG ]
    [ D1 ]
    . . .
    [ D8 ]
  [ WATERFALL SETUP ]
[ TIME PARAMTERS ]
  [ START TIME ]
  [ STOP TIME ]
  [ COMPUTE OFF ]
  [ OVERSHOOT ]
  [ RISE TIME ]
  [ SETTLING TIME ]
  [ DELAY TIME ]
[ GAIN/PHAS MARGINS ]
  [ START FREQUENCY ]
  [ STOP FREQUENCY ]
  [ COMPUTE OFF ]
  [ COMPUTE MARGINS ]
[ FREQ & DAMPING ]
  [ START FREQUENCY ]
  [ STOP FREQUENCY ]
  [ COMPUTE OFF ]
  [ COMPUTE COEFFICNT ]
[ SUPLMENTL INFO ]

## System group

**Preset**

- [ DO PRESET ]
- [ RECALL AUTOSTATE ]

**BASIC**

- [ DISPLAY SETUP ]
  - [ OFF ]
  - [ FULL ]
  - [ UPPER ]
  - [ LOWER ]
  - [ CLEAR SCREEN ]
- [ CONTINUE ]
- [ INSTRUMNT BASIC ]
  - [ RUN PROGRAM ]
  - [ SELECT PROGRAM ]
  - [ LABEL PROGRAM ]
  - [ EDIT ]
    - [ ENTER ]
    - [ INSERT SPACE ]
    - [ INSERT LINE ]
    - [ DELETE LINE ]
    - [ RECALL LINE ]
    - [ DELETE CHARACTER ]
    - [ DELETE TO LINE END ]
    - [ TYPING UTILITIES ]
      - [ ENTER ]
      - [ INSERT SPACE ]
      - [ INSERT KEYWORD ]
        - [ CANCEL]
      - [ DELETE CHARACTER ]
      - [ UPPERCASE lowercase ]
      - [ INSERT +-*^/=() ]
      - [ INSERT "&#;:,@| ]
      - [ INSERT $<>[]{}\ ]
      - [ INSERT ~%'!?'_ ]
    - [ GOTO LINE ]
      - [ ENTER ]
      - [ ( _ ) ]
      - [ UPPERCASE lowercase ]
    - [ END EDIT ]

  :

(continued)

  - [ PRINT PROGRAM ]
  - [ UTILITIES ]
    - [ MEMORY SIZE ]
    - [ AUTO MEMORY ]
    - [ SCRATCH ]
      - [ SCRATCH ]
      - [ SCRATCH C ]
      - [ SCRATCH A ]
      - [ PERFORM SCRATCH ]
    - [ RENUMBER ]
      - [ START LINE # ]
      - [ INCREMENT ]
      - [ PERFORM RENUMBER ]
    - [ SECURE ]
      - [ START LINE # ]
      - [ END LINE # ]
      - [ PERFORM SECURE ]
  - [ ENABLE RECORDING ]
  - [ DEBUG ]
    - [ RUN ]
    - [ CONTINUE ]
    - [ SINGLE STEP ]
    - [ LAST ERROR ]
    - [ EXAMINE VARIABLE ]
    - [ RESET ]

**Help**

No softkeys under this hardkey.

**Save/ Recall**

- [ SAVE DATA ]
  - [ SAVE TRACE ]
    - [ INTO D1 ]
    - . . .
    - [ INTO D8 ]
    - [ INTO FILE ]
      - [ OVERWRITE FILE ]
  - [ SAVE CAPTURE ]
  - [ SAVE WATERFALL ]
    - [ INTO W1 ]
    - . . .
    - [ INTO W8 ]
    - [ INTO FILE ]
  - [ CONTINUE SAVE ]
  - [ CATALOG ON OFF ]
- [ SAVE STATE ]
- [ SAVE MORE ]
  - [ SAVE UPPER LIM ]
  - [ SAVE LOWER LIM ]
  - [ SAVE MATH ]
  - [ SAVE PROGRAM ]
  - [ RE-SAVE PROGRAM ]
  - [ SAVE FIT TABLE ]
  - [ SAVE SNTH TABLE ]
  - [ SAVE AUTOSTATE ]
- [ RECALL DATA ]
  - [ RECALL TRACE ]
    - [ FROM FILE INTO D1 ]
    - . . .
    - [ FROM FILE INTO D8 ]
    - [ CATALOG ON OFF ]
  - [ RECALL CAPTURE ]
  - [ RECALL WATERFALL ]
    - [ FROM FILE INTO W1 ]
    - . . .
    - [ FROM FILE INTO W8 ]
    - [ CATALOG ON OFF ]
  - [ CONTINUE RECALL ]
  - [ CATALOG ON OFF ]
- [ RECALL STATE ]
- :

(continued)

- [ RECALL MORE ]
  - [ RECALL UPPER LIM ]
  - [ RECALL LOWER LIM ]
  - [ RECALL MATH ]
  - [ RECALL PROGRAM ]
  - [ RCL FIT TABLE ]
  - [ RCL SYNTH TABLE ]
- [ RECALL AUTOSTATE ]
- [ CATALOG ON OFF ]
- [ DEFAULT DISK ]
  - [ NON-VOL RAM DISK ]
  - [ VOLATILE RAM DISK ]
  - [ INTERNAL DISK ]
  - [ EXTERNAL DISK ]
  - [ CATALOG ON OFF ]

**Disk Utility**

- [ RENAME FILE ]
  - [ ORIGINAL FILENAME ]
  - [ NEW FILENAME ]
  - [ PERFORM RENAME ]
  - [ CATALOG ON OFF ]
- [ DELETE FILE ]
- [ DELETE ALL FILES ]
- [ COPY FILE ]
  - [ SOURCE FILENAME ]
  - [ DESTIN FILENAME ]
  - [ PERFORM FILE COPY ]
  - [ CATALOG ON OFF ]
- [ COPY ALL FILES ]
  - [ SOURCE DISK ]
  - [ DESTIN DISK ]
  - [ PERFORM COPY ALL ]
  - [ CATALOG ON OFF ]
- [ FORMAT DISK ]
  - [ DISK TYPE LIF DOS ]
  - [ RAM DISK SIZE ]
  - [ INTRLEAVE FACTOR ]
  - [ PERFORM FORMAT ]
  - [ CATALOG ON OFF ]
- [ CATALOG ON OFF ]
- [ DEFAULT DISK ]

**Local/ HP-IB**

[ ABORT HP-IB ]
[ SYSTEM CONTROLLR ]
[ ADDRESSBL ONLY ]
[ ANALYZER ADDRESS ]
[ GPIB ECHO ON OFF ]
[ PLOTTER ADDRESS ]
[ PRINTER ADDRESS ]
[ DISK ADDRESS ]
[ DISK UNIT ]

**Plot/ Print**

[ START PLOT/PRNT ]
  [ OVERWRITE FILE ]
[ ABORT PLOT/PRNT ]
[ PLOT DATA SELECT ]
  [ ALL ]
  [ TRACE ]
  [ TRACE MARKER ]
  [ MARKER REFERENCE ]
  [ GRID ]
[ PLOT PEN SETUP ]
  [ DEFAULT PENS ]
  [ TRACE A PEN ]
  [ TRACE B PEN ]
  [ TRACE A MKR PEN ]
  [ TRACE B MKR PEN ]
  [ ALPHA PEN ]
  [ GRID PEN ]
[ PLOT LINE SETUP ]
  [ TRACE A LINE TYPE ]
    [ SOLID ]
    [ DOTTED ]
    [ DASHED ]
    [ USER DEFINED ]
    [ USER LINE TYPE ]
  [ TRACE B LINE TYPE ]
  [ LIMIT A LINE TYPE ]
  [ LIMIT B LINE TYPE ]
[ TRACE A LINE TYPE ]
[ TRACE B LINE TYPE ]
[ OUTPUT FILENAME ]
:
(continued)

[ MORE SETUP ]
  [ OUTPUT TO HPIB FILE ]
  [ DEVICE IS PLOT PRNT ]
  [ TIME STMP ON OFF ]
  [ PAGE EJCT ON OFF ]
  [ PLOT PEN SPEED ]
    [ FAST (50 cm/s) ]
    [ SLOW (10 cm/s) ]
    [ DEFINE (? cm/s) ]
  [ P1 P2 SETUP ]
    [ USER P1P2 ON OFF ]
    [ USER P1 X ]
    [ USER P1 Y ]
    [ USER P2 X ]
    [ USER P2 Y ]
  [ TITLE LINE 1 ]
  [ TITLE LINE 2 ]

**System Utility**

[ CALIBRATN ]
  [ SINGLE CAL ]
  [ AUTO CAL ON OFF ]
  [ SAVE CH1 CAL TRACE ]
    [ INTO D1 ]
    . . .
    [ INTO D8 ]
  [ SAVE CH2 CAL TRACE ]
[ BEEPER ON OFF ]
[ CLOCK SETUP ]
  [ TIME HHMM ]
  [ DATE MMDDYY ]
  [ TIMESTAMP SETUP ]
    [ 24 HR DD/MM/YY ]
    [ 24 HR DD.MM.YY ]
    [ 24 HR YY MM DD ]
    [ 12 HR DD/MM/YY ]
    [ 12 HR MM-DD-YY ]
[ OPTIONS SETUP ]
  [ INSTALL ]
[ MEMORY USAGE ]
  [ REMOVE CAPTURE ]
    [ CONFIRM REMOVE ]
:
(continued)

[ REMOVE WATERFALL ]
[ CONFIRM REMOVE ]
[ REMOVE WTFL REGS ]
[ CONFIRM REMOVE ]
[ REMOVE PROGRAMS ]
[ CONFIRM REMOVE ]
[ REMOVE RAM DISK ]
[ CONFIRM REMOVE ]
[ KEYBOARD SETUP ]
[ FRENCH ]
[ GERMAN ]
[ ITALIAN ]
[ SPANISH ]
[ SWEDISH/ FINNISH ]
[ U.K. ENGLISH ]
[ U.S. ENGLISH ]
[ FAULT LOG ]
[ CLEAR FAULT LOG ]
[ S/N VERSION ]
[ SELF TEST ]
see *Service Guide*
[ SERVICE TESTS ]
see *Service Guide*

## Miscellaneous menus

**Suffix menus**

[ dBVrms ]
[ Vrms ]
[ mVrms ]
[ dBVpk ]
[ Vpk ]
[ mVpk ]
[ kHz ]
[ Hz ]
[ mHz ]
[ DECADES ]
[ OCTAVES ]
[ ORDERS ]
[ EXP ]
[ dB ]
[ RPM ]
[ kRPM ]
[ kilo- EXP 3 ]
[ milli- EXP -3 ]
[ PERCENT (%) ]
[ S ]
[ mS ]
[ uS ]
[ RECORDS ]
[ POINTS ]
[ POINTS / SWEEP ]
[ PERCENT (%) ]
[ POINTS / DECADE ]
[ POINTS / OCTAVE ]
[ V/EU ]
[ mV/EU ]
[ EU/V ]
[ mEU/V ]
[ EU ]
[ EUrms ]
[ mEU ]
[ mEUrms ]
[ dBEU ]
[ dBEUrms ]
:
(continued)

[ mVrms/S ]
[ Vrms/S ]
[ mVpk/S ]
[ Vpk/S ]
[ OHM ]
[ Hz PER ORDER ]
[ RPM PER ORDER ]
[ COUNT ]
[ kCOUNT ]
[ AVG ]
[ kAVG ]
[ Rev ]
[ kRev ]

**Alpha Entry menu**

[ ENTER ]
[ INSERT SPACE ]
[ DELETE CHARACTER ]
[ MORECHARS +-*^/=() ]
[ MORECHARS \"&#;:,@| ]
[ MORECHARS $< >[]{}\ ]
[ MORECHARS ~%'!?'_ ]
[ UPPERCASE lowercase ]
[ CLEAR ENTRY ]

# Index

## R



## S