3

Remote Operation

3.1 Introduction

This chapter explains how to operate the 8003 Precision Scalar Analyzer from a remote location using a system controller in conjunction with necessary computer devices. The system operates over a General Purpose Interface Bus (GPIB) compliant with IEEE 488 interface standards.

3.2 IEEE Bus Interface

3.2.1 Connect the System Controller

Connect the GPIB port on your system controller to the 8003 with an IEEE 488 interface cable. Connect the interface cable to the GPIB/SYSTEM port on the 8003 rear panel. If you will be controlling the sweeper through the 8003 Analyzer, connect the sweeper GPIB interface cable to the GPIB/PRIVATE port. If you will be controlling the sweeper directly from the system controller, connect the sweeper GPIB interface cable to the GPIB/SYSTEM port (see Figure 3-1).

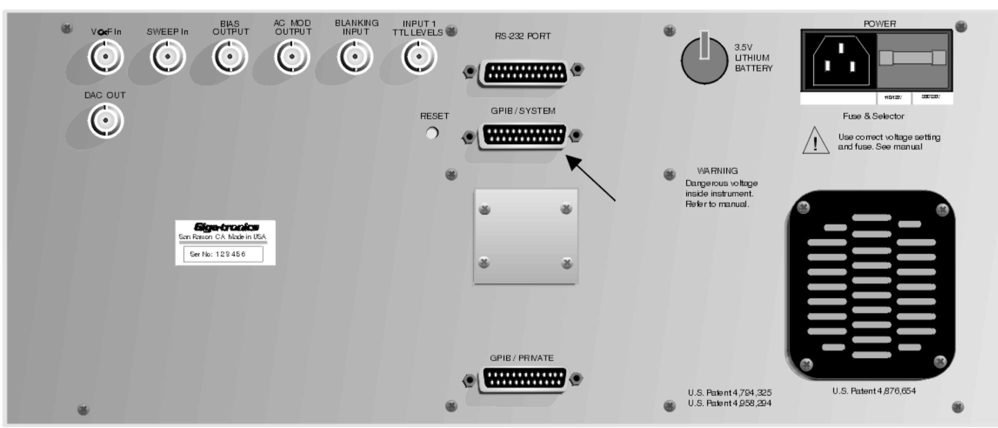


Figure 3-1: Location of GPIB/System Connection (Rear Panel)

3.2.2 Set the GPIB Address

The 8003 Analyzer has a default GPIB address of 4. If you need to change the address, press **[CONFIG]** on the front panel, then press the [GPIB DEVICES] softkey. You should see a message in the active entry area of the display that says ANALYZER ADDRESS 4 (or whatever the current address number is). Enter your new GPIB address on the numeric entry keypad and press the [GHz dB] units key.

3.2.2.1 Programming the 8003

The remainder of this chapter explains how to program the 8003 Analyzer and supported sweeper over the GPIB bus. The instructions assume that you are familiar with the front panel operation of the instrument and that you have properly configured the system.

The 8003 GPIB command set allows direct control of most front panel functions, including all of the functions found under the DEFINE, MEAS, DISPLAY, CURSOR, SCALE, CAL, MEMORY, START, POWER, SWEEP TIME, and PRESET softkeys (with the exception of the display setup functions found under the **DISPLAY** key). Some of the lesser used functions under the SERVICE softkey menu of the **CONFIG** key are not controlled via direct GPIB commands, but can be accessed through the keyboard emulation mode.

The GPIB command set allows extended capabilities of the analyzer beyond those accessible through the front panel. These include reading of swept measurement data, upload and download of trace memories, path cal and Cal Factor memories, three modes of high speed CW power measurements, and a Pass Through mode for direct communication with devices on the 8003 private bus.

The 8003 Analyzer uses a simple programming structure consisting of commands (called verbs) followed by command modifiers. Because the 8003 is driven by softkeys, these commands do not necessarily follow the same sequence as front panel key strokes. However, you will find that they do give a very logical access to the instrument's functions.

A simple sequence of commands is usually sufficient to set up the instrument and obtain data over the bus. The basic sequence of commands is:

1. Send a GPIB **device clear** to PRESET the analyzer to a known, fixed state.
2. Set up the analyzer measurement mode (SWEPT or CW) and configure its channels (single sensor, ratios, or differences).
3. Set up the sweeper parameters (frequencies, power levels).
4. Set up the analyzer's display mode and scaling (this step is optional).
5. If needed, Calibrate and Zero the sensors.
6. Take a reading of data.

This sequence of commands is illustrated in the programming example on the next four pages. The first two examples for CW and swept measurements are written in TBASIC for IBM-PC users. The second two examples are the identical programs written in HP-Basic for HP series 200 and 300 users.

Typical TBASIC Program for Swept Measurements

```
100 ! ***********************************************************
110 ! 8003 Swept Measurement Demonstration program
120 ! TBasic version
130 ! Copyright 2001, Giga-tronics Power Measurements Division
140 ! ***********************************************************
150 !
160 OPTION BASE 1! arrays start with index of 1
170 DIM Data array[512],Buffer$(5000)! allocate storage for swept data
180 !
190 POLL Status,Primary;4! Use serial poll to clear any existing srq s
200 WRITE GPIB CMD(Dcl)! Device Clear does a PRESET on the 8003
210 !
220 ! Set up Analyzer channel configuration first
230 !
240 PRINT @4:SWP 1,A;on;meas! channel 1 is in swept mode, sensor A,
250 !                        and reads in absolute units
260 PRINT @4:SWP 2,B;on;meas! channel 2 is in swept mode, sensor B,
270 !                        and reads in absolute units
280 PRINT @4:CHAN 3;off;CHAN 4;off! turn off channels 3 and 4
290 !
300 ! Now, set up the sweeper parameters
310 !
320 PRINT @4:SWPF;start 2000;stop 8000;level 10;swpt 500
330 ! Set start frequency 2GHz, stop frequency 8 GHz,
340 ! Output level +10 dBm, and sweep time 500 ms/sweep
350 PRINT @4:SWPF;level on! turn on RF output
360 SLEEP 8  ! put in appropriate wait time for sweeper to set up
370 !
380 ! These next lines set up display format but are not strictly
390 ! necessary for data collection over the bus
400 !
410 PRINT @4:GRAPH! graph display mode
420 PRINT @4:SWP 1;scale 1;ref pos 0;ref lev 10! scale channel 1
430 PRINT @4:SWP 2;scale 5;ref pos 0;ref lev 0! scale channel 2
440 !
450 ! Zero sensor A before taking a reading
460 !
470 ON SRQ GOTO Done zeroa! exit when zeroing done
480 PRINT @4:ZERO A;srq! Zero sensor A, pull srq when done
490 Loop1: GOTO Loop1! Wait until srq (or do other tasks)
500 Done zeroa: POLL Status,Primary;4! Clear srq with serial poll
560 OFF SRQ  ! disable further srq s
570 !
580 ! Take a reading
590 !
600 SLEEP 4  ! put in time to make sure sweeper is settled
610 PRINT @4:OUTPUT 1;items 512! read 512 swept data points
620 INPUT @4 LINE Buffer$! Read data into string buffer
625 INPUT FROM Buffer$:Data array! convert to data array
630 PRINT Data array;
640 !
650 END
```

Typical TBASIC Program for Stepped CW Measurements

```
100 ! ***********************************************************
110 ! 8003 CW Measurement Demonstration program
120 ! TBasic version
130 ! Copyright 2001, Giga-tronics Power Measurements Division
140 ! ***********************************************************
150 !
160 OPTION BASE 0! arrays start with index of 0
170 DIM Buffer[19]! allocate storage for CW data
180 !
190 POLL Status,Primary;4! Use serial poll to clear any existing srq s
200 WRITE GPIB CMD(Dcl)! Device Clear does a PRESET on the 8003
210 !
220 ! Set up Analyzer channel configuration first
230 !
240 PRINT @4:POWER 1,A;avg 4;on! channel 1 is in swept mode,
250 !                           Sensor A, 4 averages
260 PRINT @4:CHAN 2;off;CHAN 3;off;CHAN 4;off
270 !
280 ! Now, set up the sweep parameters
290 !
300 PRINT @4:FIXED;freq 2000;level -15
310 ! Set CW frequency of 2 GHz, level at -15 dBm
320 PRINT @4:FIXED;level on! turn on RF output
330 SLEEP 8  ! put in appropriate wait time for sweeper to set up
340 !
350 ! This next line sets up display format but is not strictly
360 ! necessary for data collection over the bus
370 !
380 PRINT @4:READOUT! power meter display mode
390 !
400 ! Zero sensor A before taking a reading
410 !
420 ON SRQ GOTO Done zeroa     ! exit when zeroing done
430 PRINT @4:ZERO A;srq! Zero sensor A, pull srq when done
440 Loop1: GOTO Loop1! Wait until srq (or do other tasks)
450 Done zeroa: POLL Status,Primary;4! Clear srq with serial poll
460 OFF SRQ     ! disable further srq s
470 !
480 ! Take a reading
490 !
500 FOR Reading no = 0 TO 19! take 20 readings
510 PRINT @4:FIXED;freq ;2000+Reading no/19*(8000-2000)
520 !step sweeper in 20 even steps from 2 to 8 GHz
530 SLEEP 1  ! make sure sweeper is settled
540 PRINT @4:POWER 1,avg off! turn averaging off to restart
550 PRINT @4:POWER 1,avg on! then turn averaging on
560 PRINT @4:OUTPUT 1! ask for reading
570 INPUT @4:Buffer[Reading no]! put reading in data buffer
580 NEXT Reading no
590 PRINT Buffer;
600 !
610 END
```

Typical HP-Basic Program for Swept Measurements

```
100 ! **********************************************************
110 ! 8003 Swept Measurement Demonstration Program
120 ! HP300 Series Version
130 ! Copyright 2001, Giga-tronics Power Measurements Division
140 ! **********************************************************
150 !
160 OPTION BASE 1! arrays start with index of 1
170 DIM Data array(512)! allocate storage for swept data
180 !
190 Status=SPOLL(704)! use serial poll to clear any existing srq s
200 CLEAR 704! Device Clear does a PRESET on the 8003
210 !
220 ! Set up analyzer channel configuration first
230 !
240 OUTPUT 704;SWP 1,A;on;meas! channel 1 is in swept mode, sensor A
250 !                         and reads in absolute units
260 OUTPUT 704;SWP 2,B;on;meas! channel 2 is in swept mode, sensor B
270 !                         and reads in absolute units
280 OUTPUT 704;CHAN 3;off;CHAN 4;off! turn off channels 3 and 4
290 !
300 ! Now, set up the sweeper parameters
310 !
320 OUTPUT 704;SWPF;start 2000;stop 8000;level 10;swpt 500
330 ! Set start frequency 2 GHz, stop frequency 8 GHz,
340 ! output level +10 dBm, and sweep time 500 ms/sweep
350 OUTPUT 704;SWPF;level on! turn on RF output
360 WAIT 8! put in appropriate wait time for sweeper to set up
370 !
380 ! These next lines set up display format but are not strictly
390 ! necessary for data collection over the bus
400 !
410 OUTPUT 704;GRAPH               ! graph display mode
420 OUTPUT 704;SWP 1;scale 1;ref pos 0;ref lev 10   ! scale channel 1
430 OUTPUT 704;SWP 2;scale 5;ref pos 0;ref lev 0   ! scale channel 2
440 !
450 ! Zero sensor A before taking a reading
460 !
470 ENABLE INTR 7;2! enable interrupts from instrument srq s
480 ON INTR 7 GOTO Done zeroa! exit when zeroing done
490 OUTPUT 704;ZERO A;srq! zero sensor A, pull srq when done
500 Loop1: GOTO Loop1! Wait until srq (or do other tasks)
510 Done zeroa: Status=SPOLL(704)! clear srq with serial poll
520 !
530 ! Take a reading
540 !
550 WAIT 4   ! put in time to make sure sweeper is settled
560 OUTPUT 704;OUTPUT 1;items 512  ! read 512 swept data points
570 ENTER 704;Data array(*)
580 PRINT Data array(*)
590 !
600 END
```

Typical HP-Basic Program for Stepped CW Measurements

```
100 ! ********************************************************
110 ! 8003 CW Measurement Demonstration Program
120 ! HP300 Series Version
130 ! Copyright 2001, Giga-tronics Power Measurements Division
140 ! *********************************************************
150 !
160 OPTION BASE 0! arrays in this example start with index of 0
170 DIM Buffer(19)! allocate storage for CW data
180 !
190 Status=SPOLL(704)! use serial poll to clear any existing srq s
200 CLEAR 704! Device Clear does a PRESET on the 8003
210 !
220 ! Set up analyzer channel configuration first
230 !
240 OUTPUT 704;POWER 1,A;avg 4;on! channel 1 is in CW mode, sensor A
250 !                            and has an averaging number of 4
260 OUTPUT 704;CHAN 2;off;CHAN 3;off;CHAN 4;off
270 !                turn off channels 2, 3, and 4
280 !
290 ! Now, set up the sweeper parameters
300 !
310 OUTPUT 704;FIXED;freq 2000;level -15
320 ! Set CW frequency of 2 GHz and output level of -15 dBm
330 OUTPUT 704;FIXED;level on! turn on RF output
340 WAIT 8! put in appropriate wait time for sweeper to set up
350 !
360 ! This next line sets up the display format but is not strictly
370 ! necessary for data collection over the bus
380 !
390 OUTPUT 704;READOUT! make sure that the analyzer is in readout
400 !                (large number display) mode
410 !
420 ! Zero sensor A before taking a reading
430 !
440 ENABLE INTR 7;2! enable interrupts from instrument srq s
450 ON INTR 7 GOTO Done zeroa! exit from current routine when zeroing
done
460 OUTPUT 704;ZERO A;srq! zero sensor A, pull srq when done
470 Loop1:  GOTO Loop1! Wait until srq (or do other tasks)
480 Done zeroa:  Status=SPOLL(704)! Clear srq with serial poll
490 !
500 ! Take a series of readings in CW mode
510 !
520 FOR Reading no=0 TO 19! take 20 readings
530 OUTPUT 704;FIXED;freq ;2000+Reading no/19*(8000-2000)
540 !  set sweeper cw frequency to evenly space readings from 2 to 8 GHz
550 WAIT 1! put in time to make sure sweeper and analyzer are settled
560 OUTPUT 704;POWER 1,avg off! restart averaging by first turning off
570 OUTPUT 704;POWER 1;avg on! then turn averaging on
580 OUTPUT 704;OUTPUT 1! ask for reading
590 ENTER 704;Buffer(Reading no)! put the reading in the data buffer
600 NEXT Reading no
610 PRINT Buffer(*)
620 !
630 END
```

3.3 Structured GPIB Language

The 8003 is a complex instrument with many features. The goal of providing a structured language environment is to make programming the 8003 easier. The advantage of using a structured language is that it provides a common structure for each command. This structure is easy to remember and makes the resulting programming command strings readable by others. This, in turn, helps make your programs more self documenting, thus aiding in maintaining them.

3.3.1 Common Structure

The language used in the 8003 command structures is in accordance with ANSI/IEEE Std. 488.2-1987, IEEE Standard Codes, Formats, Protocols, and Common Commands. Each structure defines a command, which addresses an 8003 feature or resource. The command is defined by a context setting VERB mnemonic. The general form for all commands is as follows:

VERB [*hs* specifier] [*ds* sensor specifier] [*us* modifier]...[*us* modifier]

Where **VERB** is a context setting mnemonic which is always required. For convenience, long and short forms for the same verb are sometimes available (for example, POWER and PWR).

The mnemonic inside the brackets is optional (see Section 3.3.3 for definition of each separator).

hs is a header separator
ds is a data separator
us is a unit separator

The ... notation indicates that a field may be repeated. In the general syntax format, it indicates that the modifier may be repeated.

The *specifier* can be either a channel or sensor specifier. The type of specifier is particular to the command.

A *channel specifier* is a mnemonic that defines the channel for which the command is to be applied. In the general syntax form shown above, this specifier is shown as optional. The type of command determines whether or not it is required. This specifier is for all channel-specific command VERBS. An example of a channel specific command would be a command that directed the 8003 to make a measurement on a given channel. An example of a non-channel specific command would be to direct the 8003 to use the graphic display mode or to turn off the private bus.

A *sensor specifier* is a mnemonic that defines a sensor or sensor pair for which the command is to be applied. This specifier is for all sensor-specific commands. An example would be a command that directs the 8003 to calibrate a sensor.

A *modifier* is a sub-structure to modify or augment the main context. This sub-structure also has a general format which is defined below. When several different versions of a modifier are given (such as OFFSET, OS, ATTN), any version can be used with the same results.

3.3.2 8003 GPIB Commands

Tables 3-2 and 3-3 lists the 8003 GPIB commands. The commands are duplicated on the separate laminated sheet furnished with this manual.

Giga-tronics

8003 GPIB Commands

Measurement Commands

SWP<?>
1, 2, 3, 4 ,
A, B, C, A/B, A/C, B/A, B/C, C/A, C/B ;
abs ; SRQ
norm
on
off
avg n / *on-off*
scale n /*auto*
ref_pos n
ref_lev n
items n
trace n
-trace n
store_trc
clear_trc
store_short n <linefeed> store_open
marker n /*all* ; on/off / clear/freq n
def_mrkr n ; freq n/curs freq
smooth n/*on-off*
limit *on-off*
limit n/*all* ; clear
point f1,p1,p2
flat f1,p1,p2,f2
slope f1,p1,f1,p3,p4

PWR<?>
1, 2, 3, 4 ,
A, B, C, A/B, A/C, B/A, B/C, C/A, C/B, A-B, A-C, B-A, B-C, C-A, C-B ;
on ; SRQ
off RFT
avg n/on-*off*
max n/on-*off*
min n/*on-off*
rel/*on-off*
items n
T0
T1
T2
T3

CURSOR
1, 2, 3, 4 ;
on
off
sch<?> max
min
right
left
bw
flat
freq<?>
delta on/off

Channel & Sensor Commands

CHAN
1, 2, 3, 4 ,
A, B, C, A/B, A/C, B/A, B/C, C/A, C/B, A-B, A-C, B-A, B-C, C-A, C-B ;
abs
norm
on
off

SENSOR
A, B, C ;
offset n
ac
dc
free run
trig
dly trig

Noise Figure Commands

NF<?>
1, 2, 3, 4 ,
A, B, C ;
abs ; SRQ
norm
on
off
avg n / *on-off*
scale n /*auto*
ref_pos n
ref_lev n
items n
trace n
-trace n
store_trc
clear_trc
store_short n <linefeed> store_open
marker n /*all* ; on/off / clear/freq n
def_mrkr n ; freq n/curs freq
smooth n/*on-off*
limit *on-off*
limit n/*all* ; clear
uncorr point f1,p1,p2
corr flat f1,p1,p2,f2
ngain slope f1,p1,f1,p3,p4

NFSET ;
source n
temp nn.n
A/B/C
if_atten auto
n
src_switch nf
gain
if_switch nf
ext

(See other side for more commands)

Figure 3-2: GPIB Commands (Front)

Giga-tronics 8003 GPIB Commands Cont.

Calibration Commands

CAL	A B C	;	srq
THRU	A B C	;	srq
SHORT	A B C	;	srq <linefeed> **OPEN**
ZERO	A B C	;	srq

Input/Output Commands

INPUT	;	Trace n Pathcal A/B/C Calfactor A/B/C ENR n		
OUTPUT	;	1 2 3 4 Trace n Pathcal A/B/C Calfactor A/B/C ENR n	;	items n curp srq limit

Instrument Configuration Commands

GRAPH

RDTEMP

***IDN?** (instrument identification)

DISABLE

ENABLE (private bus)

***ESR?** (read external status register)

BIAS 1 / 2 / 3 / 4 , n

MEMORY ; store n / recall n

KEYEM on / off

READOUT

Sweeper Commands

SWPF	;	start<?> stop<?> level<?> swpt<?> upd	n n n off on n on-off
FIXED	;	freq<?> level<?> opd	n n pff on on-off
SWPS	;	cd<?> span<?> level<?> swpt<?> upd	n n n off on n on-off

Printer Commands

PRINT	;	ink paint laser	
PLOT	;	all upl lowl lowr sp_trace sp_label sp_grid custom	;srq ;grid freq_lb summary scale title trace n logo

Figure 3-3: GPIB Commands (Back)

3.3.3 Command Execution

A command string is executed when an EOL signal is received (see Section 3.3.3.4). Until an EOL signal is received the 8003 will parse, check for operational errors and syntax errors and store but not execute the request as defined by a command string. Any number of context setting VERBS may appear in an input string. Each time a new VERB is parsed, a new context is established and all specifiers and modifiers to follow are interpreted for that VERB. The required syntax for each command must be followed to avoid generating syntax errors. The VERB structures may appear in any order within the program string.

3.3.3.1 *hs* Definition

The header separator (hs) mnemonic is defined as zero or more ASCII white space characters between a command header and accompanying data.

3.3.3.2 *ds* Definition

The data separator (ds) mnemonic is defined as zero or more ASCII white space characters followed by an ASCII comma followed by zero or more ASCII white space characters. It can be between any two items of data. Always see the syntax diagram for the specific command for the proper use of this separator.

3.3.3.3 *us* Definition

The unit separator (us) mnemonic is defined as zero or more ASCII white space characters followed by an ASCII semicolon followed by zero or more ASCII white space characters.

3.3.3.4 EOL Definition

The End Of Line separator (EOL) mnemonic is defined as zero or more ASCII white space characters followed by zero or one ASCII carriage return character followed by an ASCII line feed character. Alternatively, the IEEE 488 EOI line may be sent true with the last ASCII character of the last mnemonic. The command string is executed upon parsing of the EOL command.

3.3.3.5 Case Insensitivity

All of the command mnemonics can be sent in either upper or lowercase. Although the 8003 is insensitive to case, it is useful to program strings in a mix of upper and lowercase alphas. One suggestion is to construct VERB and sensor specifier mnemonics in uppercase and all other alpha mnemonics in lowercase alphas. The reason for this is to make the verbs more visible and hence more readable. Other programmers reading your ATE code will appreciate this and so will you when you are reviewing code months after you have written it. All of the examples in this chapter are presented in this fashion.

3.3.4 IEEE GPIB Interface Characteristics

AH1	Acceptor Handshake, complete capability
SH1	Source Handshake, complete capability
T6	Talker Function, complete capability (-TON)
TE0	Extended Talker Function, no capability
L4	Listener Function, Basic listener, unaddressed if MTA
LE0	Extended Listener Function, no capability
SR1	Service Request Function, complete capability
RL1	Remote Local Function, complete capability (LLO)
PP0	Parallel Poll Function, no capability
DC1	Device Clear Function, complete capability
DT1	Device Trigger Function, complete capability
C0	Controller Function, no capability

3.3.5 Channel Bias Voltage Definition Command Structure

BIAS, BV

Syntax:	**BV** *hs* Channel Specifier *ds* numerical value	
Example:	**BV 1,4500**	
Specifiers:	Channel specifiers:	**1, 2, 3,** and **4**
	Numerical value range:	-10000 to 10000
	assumed units:	millivolts

Description: This verb defines a bias voltage as a function of a specified channel. The bias voltage is available at the rear panel connector of the same name. This voltage is present at the rear panel connector whenever the 8003 is making a measurement on that channel. Up to four different voltages may be defined to correspond to the four channels.

3.3.6 Sensor Calibration Command Structure

CAL

Syntax:	**CAL** *hs* Sensor Specifier [*us* modifier] **EOL**	
Example:	**CAL B;srq EOL**	
Specifiers:		**A, B,** or **C**

Modifiers: This modifier is to request that a service request be sent upon completion of the Sensor Calibration.

Modifier name:	**SRQ**
Modifier Syntax:	**SRQ**

Description: This verb defines and initiates a Sensor Calibration.

If the SRQ modifier is received, the 8003 will calibrate the specified Sensor. When the calibration is complete, the event complete bit is set in the external status register and the service request and the external status bits are set in the instrument status byte.

3.3.7 Channel Definition Command Structure

CHAN, CH

Syntax: **CH** *hs* Channel Specifier [*ds* Sensor Specifier] [*us* modifiers] .. [*us* modifiers]

Example: **CHAN 2,B/C;on;meas;CHAN 1;off;CHAN 3;norm;on**

Specifiers: Channel Specifiers: **1, 2, 3,** and **4**

Sensor Specifiers: **A, B, C, A-B, A-C, B-A, B-C, C-A, C-B, A/B, A/C, B/A, B/C, C/A,** and **C/B**

Modifiers: This modifier defines the measurement to be made in absolute units (non-normalized).

Modifier name: **MEAS, M, ABS**

Modifier Syntax: **MEAS**

This modifier defines the measurement to be made in relative units (meas data - path cal).

Modifier name: **NORM, N, -PC**

Modifier Syntax: **NORM**

This modifier turns on a specified channel.

Modifier name: **ON, +**

Modifier Syntax: **ON**

This modifier turns off a specified channel.

Modifier name: **OFF,-**

Modifier Syntax: **OFF**

Description: This verb describes attributes to a channel. Such features as sensor assignment and turning a channel on or off are defined by a command string beginning with this verb.

3.3.8 Cursor Definition Command Structure

CURSOR, CUR

Syntax: **CUR** *hs* Channel Specifier [*us* modifier]..[*us* modifier]

Example: **CUR 4;on;sch? max**

Related Command:

SWP

Specifiers: Channel specifiers: **1, 2, 3,** and **4**

Modifiers: This modifier turns on a cursor for the specified channel making the SWEPT measurement.

Modifier name: **ON,+**

Modifier Syntax: **ON**

This modifier turns off a cursor for the specified channel making the SWEPT measurement.

Modifier name: **OFF,-**

Modifier Syntax: **OFF**

This modifier sets up a search condition for the cursor on the specified channel. The addition of the question mark affixed to the end of the SEARCH modifier is a query flag. If the query flag is set, the measurement will be made and the next time that the 8003 is addressed to talk it will output the value of the cursor as defined by the search request. The format of the returned data is described for each type of search request below.

Modifier name: **SEARCH, SEARCH?, SCH, SCH?**

Modifier Syntax: **SCH[?]** *us* SEARCH MOD

SEARCH MOD: MAX

FULL Modifier Syntax: **SCH[?]** *us* **MAX**

query value returned: freq, data **EOL**

freq: freq = D.ddd Where D is zero to 6 digits. The value represents the frequency of the maximum power point in the trace in units of MHZ.

data: data = ±d where D is zero to three digits to the right of the decimal point and three digits to the left. The assumed units are dBm or dB depending upon the measurement mode.

SEARCH MOD:	**MIN**
FULL Modifier Syntax:	**SCH[?]** *us* **MIN**
query value returned:	freq, data **EOL**
freq:	freq = D.ddd Where d is zero to 6 digits. The value represents the frequency of the minimum power point in the trace in units of MHZ.
data:	data = ±D Where D is zero to three digits to the right of the decimal point and three digits to the left. The assumed units are dBm or dB depending upon the measurement mode.
SEARCH MOD:	**RIGHT, RT**
FULL Modifier Syntax:	**SCH[?]** *us* **RT** *hs* numerical value
numerical value range:	-90.00 to +90.00
numerical resolution:	0.01
assumed units:	dBm, dB
query value returned:	freq, data **EOL**
freq:	freq = D.ddd Where D is zero to 6 digits. The value represents the frequency of the cursor in units of MHZ. This value is returned here for confirmation.
data:	data = ±D Where D is zero to three digits to the right of the decimal point and three digits to the left. The assumed units are dBm or dB depending upon the measurement mode.
SEARCH MOD:	**LEFT, LT**
FULL Modifier Syntax:	**SCH[?]** *us* **LT** *hs* numerical
value numerical value range:	-90.00 to +90.00
numerical resolution:	0.01
assumed units:	dBm, dB
query value returned:	freq, data **EOL**
freq:	freq = D.ddd Where D is zero to 6 digits. The value represents the frequency of the cursor in units of MHZ. This value is returned here for confirmation.
data:	data = ±D Where D is zero to three digits to the right of the decimal point and three digits to the left. The assumed units are dBm or dB depending upon the measurement mode.

SEARCH MOD:	**BW**
FULL Modifier Syntax:	**SCH[?]** *us* **BW** *hs* numerical
value numerical value range:	-90.00 to +90.00
numerical resolution:	0.01
assumed units:	dBm, dB
query value returned:	freq 1, freq 2, freq bw, data **EOL**
freq 1:	lower frequency of bandwidth in MHZ. The format is D.ddd where D is zero to six digits.
freq 2:	upper frequency of bandwidth in MHZ. The format is D.ddd where D is zero to six digits.
freq BW:	bandwidth in MHZ. The format is D.ddd where D is zero to six digits.
data:	±D.ddd dB bandwidth (specified by host computer and returned here for confirmation). Where D is zero to 3 digits to the left of the decimal point. The value is returned to the host computer for confirmation.
SEARCH MOD:	**FLAT**
FULL Modifier syntax:	**SCH?** *hs* **FLAT**
query value returned:	freq, data **EOL**
freq:	freq = D.ddd where D is zero to 6 digits. The value represents the current cursor frequency in MHz
data:	Finds the curve flatness where flatness = maximum trace power minus minimum trace power. Data format = D where D is zero to three digits to the left of the decimal point, and two digits to the right of the decimal point. The assumed units are dBm or dB, depending on the measurement mode.

This modifier defines the frequency of the cursor. The cursor will be placed at the frequency specified by this modifier.

Modifier name:	**FREQ, FREQ?**
Modifier Syntax:	**FREQ[?]** [*hs* numerical value]
numerical value range:	limited by the signal source if the source is supported upon the private bus. Otherwise the frequency range is 1.000 MHZ to 99.000 GHZ. If the query flag (‘?’) is selected, the next time the 8003 is talk addressed the instrument will return the cursor data in the following form:
query value returned:	freq, data **EOL**
freq:	freq = D.ddd Where D is zero to 6 digits. The value represents the frequency of the cursor in units of MHZ.
data:	±ddd.dd [units are dB(m)]
Description:	This modifier qualifies that it is the delta cursor which is to be modified.
Modifier name:	**DELTA**
Modifier Syntax:	**DELTA** *ds* state
State definition:	**ON, +** = delta cursor on
Full Syntax:	**CUR** *hs* [chan specifier] *us* **DELTA** state

Description: This verb defines a cursor function for a specified channel. The feature is specified via the modifiers for this verb. An example of a feature is to place the cursor at the maximum power point in a swept trace for a given channel

3.3.9 Instrument Preset Command Structure

<Device Clear>

Syntax: A standard GPIB device clear (either selective or general) will preset the instrument.

Examples: **CLEAR 704**: for HP Series Controllers

WRITE GPIB CMD(Dcl): for IBM Series Controllers running TBASIC

Description: A GPIB device clear will cause the instrument to perform an instrument preset. The instrument will go to the following default state:

Function	Default Setting
Cursor	
Cross Cursor:	OFF, frequency at 10000 MHz
Delta Cursor:	OFF
Markers:	OFF
Active Channel:	1
Sensor	
Sensor Mode:	DC
Sensor Specific for Source of Frequency:	Back Panel Swp Input
Sensor Frequency:	0.05 GHz
Sensor Cal Factor:	0
Sensor Offset:	0
Sensor Full Band Path Cal Option:	NO
Display	
Setup:	Swept Mode
Color Intensity:	Red, Green, Blue are bright
Graticule Color:	Green
Frequency Label:	ON
Title:	OFF
Channel	
Mode:	Swept Frequency
Parameter:	A, B, C, A/B for channels 1 through 4.
Color:	Cyan, Red, Yellow, Magenta for channels 1 through 4 respectively
Format:	dB mode
Memorized Trace:	0
Measurement:	Absolute Measurement
Average:	OFF, average factor = 8
Smoothing:	OFF, smooth apert = 5%
Continue Auto Scale:	OFF
Scale per Division:	20 dB
Reference Position:	Center
Reference Level:	0 dB
Bandwidth Search Value:	-3.00 dB
Channel Search Level:	-3.00 dB
CW Mode Setup:	REL OFF
Max Hold:	OFF
Min Hold:	OFF
Channel Title:	OFF
Limit Line:	OFF
Modulate Bias Voltage:	0 volt

	Function	Default Setting
Source		
	Signal Source Mode:	Start/Stop Swept Freq
	Start Frequency:	Sweeper Start Frequency or 1 MHz if not controlled by the 8003
	Stop Frequency:	Sweeper Stop Frequency
	Sweep Time:	200 ms
	RF Power Level:	OFF, minimum RF level of the signal source or 0 dBm if not controlled by the 8003.
	Source Modulation:	OFF

The following instrument settings are ***not*** changed during an instrument preset:

- All GPIB addresses (Analyzer, Source, Printers, and Plotters)
- Sensor linearity calibrations
- Trace Memories
- Path Cal Memories

3.3.10 Disable Private Bus Command Structure

DISABLE

Syntax: **DISABLE**

Related Command:

ENABLE

Description: This verb disables the private bus. When sent, the 8003 private bus becomes inactive. An Enable command must be sent or a power down/power up cycle must be executed to enable the private bus.

3.3.11 Enable Private Bus Command Structure

ENABLE

Syntax: **ENABLE**

Related Command:

DISABLE

Description: This verb enables the private bus. When sent, the 8003 private bus becomes active. A Disable command must be sent to disable the private bus.

3.3.12 External Status Register Query Command Structure

*ESR?

Syntax: ***ESR?**

Example: ***ESR?**

Description: This verb is the standardized COMMON external status register query command as defined by IEEE 488.2 1988. When talk addressed after receiving the command, the 8003 will output the value of its external status register. The return value is defined as follows:

status: **EOL**

Where status is an integer in the range of 0 to 128.

The description of the individual bits and their decoding can be found in Section 3.3.32.

3.3.13 Fixed Frequency Source Mode Definition Command Structure

FIXED

Syntax: **FIXED** [u*s* modifier]..[*us* modifier]

Examples: (See page 3-66 in the SWPF command description for a more complete programming example of the UPD modifier.)

Related Command:

POWER

Modifiers: This modifier defines a CW frequency for the FIXED frequency mode of signal source. The query flag (‘?’) affixed to the cw frequency modifier queries the value of the cw frequency. If set, the next time the 8003 is talk addressed it will output the value of the cw frequency in MHZ. The format of the returned data is:

D.dddddd: Where D is zero to 6 digits and the assumed units are MHZ

Modifier name:	**FREQ, FREQ?, FR, FR?, CW, CW?**
Modifier Syntax:	**CW[?]** [*ds* numerical value]
Numerical value range:	Dependent upon the signal source if the source is supported on the 8003 private bus. If not supported, the range is 1 MHZ to 99 GHZ This modifier defines a POWER LEVEL for the fixed frequency mode of signal source. The query flag (‘?’) affixed to the power level modifier queries the value of the power level. If set, the next time the 8003 is talk addressed it will output the value of the power level in dBm. The resolution is 0.01 dBm. The format of the returned data is: ±D.dd where D is zero to three digits and the assumed units are dBm
Modifier name:	**LEVEL, LEVEL?, PL, PL?**
Modifier Syntax:	**PL[?]** [*ds* numerical value]
Numerical value range:	Dependent upon the signal source if the source is supported upon the 8003 private bus. If not supported then the range is -99 to +99 dBm. The update modifier decouples analyzer frequency updates from sweeper frequency updates. This is most commonly used when the analyzer and sweeper are set to different frequencies, as in mixer or frequency multiplier measurements. The analyzer normally uses frequency information to change the operating frequencies of the sweeper, annotate x-axis of the swept

display, apply correct Cal Factors to the reading, take the correct portions of trace memories and path cal memories, and fix cursors and markers. The update modifier allows independent control of the sweeper frequencies and all other frequency related analyzer functions. If the modifier UPD ON is included once with the SWPF, SWPS, or FIXED verbs, then all subsequent uses of those verbs will update the sweeper frequency along with the analyzer frequency. If the modifier UPD OFF is included once with the above verbs, then all subsequent uses of those verbs will change only analyzer frequency parameters.

Modifier name: **UPD**

Modifier syntax: **UPD** *hs* state

State definition: **ON, OFF**

Send the following commands to modify both the sweeper and analyzer frequencies to 2000 MHz

FIXED;UPD ON

FIXED;2000

Send the following commands to modify only the analyzer frequency to 6000 MHz.

FIXED;UPD OFF

FIXED;6000

Description: This verb places the signal source mode to fixed frequency. This is an instrument wide command and, as such, has no channel or sensor specifiers. However there are many parameters associated with the source mode. These are defined by the modifiers which follow the verb.

3.3.14 Graph Display Definition Command Structure

GRAPH, GPH

Syntax: **GPH**

Example: **GRAPH**

Related Command:

SWP

Description: This verb places the 8003 display in the graph mode. There are no channel or sensor specifiers and no modifiers.

3.3.15 Instrument Identifier Command Structure

*IDN?

Syntax: ***IDN?**

Example: ***IDN?**

Description: This verb is the standardized COMMON identify query command as defined by IEEE 488.2 1988. When talk addressed after receiving the command, the 8003 will output a string that identifies itself as the 8003 SNA. The return value is defined as follows:

Giga-tronics,8003,0,Software rev,Software rev date**EOL**

Where:
Giga-tronics is the manufacturer's name
8003 is the model number
0 is an unused field
the software rev is the revision number such as 3.01
the software rev date is the date of the software revision

3.3.16 Input Command Structure

INPUT

Description: This verb inputs frequency, trace, pathcal, and cal factor information to the 8003 for use in specific test routines. When information is downloaded, the 8003 needs to know the span of the frequency range that the data represents. The first two values expected by the analyzer, therefore, will be the Start and Stop frequencies. The ensuing data will then represent values of power evenly spaced over the specified range. The first data item is a power reading at the start frequency, and the last data item is a power reading at the stop frequency. 512 power values are expected for trace memory, while 4096 values are required for sensor Pathcal and Cal Factor data. The units for frequency are MHz, and the units for power are dB. All data must be separated by a comma and end with a line feed.

Syntax: **INPUT** *us* memory modifier *hs* sensor/trace specifier

Modifiers:

Trace specifiers:	0 through 9
Sensor specifiers:	**A, B, C**
Pathcal specifiers:	**A, B, C**
Calfactor specifiers:	**A, B, C**
Trace:	This refers to the 10 trace memories that can be used for ratio measurements with any channel (see Section 2.3.7 on page 2-14 in the OPERATION Chapter of this manual for a complete description).
Pathcal:	This refers to the sensor's path calibration memory (see Section 2.8.2 under *Frequency Response Correction* for a complete description).
Calfactor:	This refers to the sensor's calibration factor data (see the paragraph starting at the bottom of Section 2.12 on page 2-95 in the OPERATION chapter of this manual for a complete description).

Data Input Format:

START FREQ,STOP FREQ (MHz)	D.ddd
then 512 data points for **TRACE** (dB)	±ddd.dd
then 4096 data points for **PATHCAL**	±ddd.dd
then 4096 data points for **CALFACTOR**	±ddd.dd
	D = 0 to 6 digits

Example: ***start frequency,stop frequency,data,(start freq),...,data(stop freq)***

Immediately following the **INPUT** command string, the analyzer expects the data with the above format.

Syntax Examples:

INPUT,TRACE 4
INPUT;PATHCAL B
INPUT;CALFACTOR C

Programming Examples:for HP 200 or 300 series controllers:

OUTPUT 704;INPUT;TRACE 4,Start_freq,stop freq,Data_array(*)

Related Command: OUTPUT

3.3.17 Key Stroke Emulation Enable/Disable Command Structure

KEYEM, KE

Syntax: **KEYEM** *hs* modifier

Modifiers: This modifier turns on the key stroke emulation mode.

Modifier name: **ON,+**

Modifier Syntax: **ON**

This modifier turns off the key stroke emulation mode.

Modifier name: **OFF,-**

Modifier Syntax: **OFF**

Description: Key Stroke Emulation is a feature that allows the GPIB controller to access 8003 functions that are not available through normal GPIB commands. This is a special mode wherein a sub-set of ASCII characters are interpreted as the 36 keys on the front panel of the 8003 (see Figure 3-1 on page 3-1).

There are two completely separate methods for entering and exiting the key emulation mode which cannot be interchanged. In the first method, the controller sends a KEYEM ON command and then asserts a global local. The GPIB 488 REN line is sent false and all characters are passed on as key strokes, just as if they were entered from the front panel. It should be kept in mind that once the key emulation mode is turned on, any commands sent to the 8003 while it is in local (remote enable line false) will be interpreted as a key stroke. It is still possible to program the instrument in remote while the key emulation mode is enabled. This is done by placing the 8003 in remote (remote enable set true and listen addressed). This allows the host controller to switch between the true remote state and the local key stroke emulation mode without disabling the key stroke emulation mode. The feature is disabled by sending a KEYEM OFF command.

Although the above method is easy to do and will work no matter what data must be sent to the 8003, it does require the controller to place all of the instruments on the bus in the local mode with the global local command. This can cause certain devices to change their settings which might not be desirable.

The second method does not require the entire bus to go into the local mode. It can be accessed as described above but, instead of a global local command, a device specific go to local command is used. Characters will then be treated as key strokes until a reserved character [in this case an asterisk (*)] is received to exit the key emulation mode and start converting characters back into normal GPIB commands. Under the circumstances described in #2 on the next page, the timing of the * character must be programmed so as not to prematurely abort some keyboard emulation function that might still be in process. This means that if the buffer were full with 16 characters, the routine would not see the * reserved character and would continue to try and interpret GPIB commands as key strokes.

Because the key stroke emulator is implemented as a succession of key strokes, certain limitations should be kept in mind:

1. The **go to local** command just before key stroke emulation will terminate most GPIB functions still in progress. A waiting time of at least 1 second between the last GPIB command and the go to local command is recommended. Likewise, a small 10 millisecond waiting period after the go to local command has been given is recommended before giving key stroke emulation commands.

2. The key stroke emulator buffers a maximum of 16 characters or individual key strokes. The buffer is emptied serially as the instrument completes each keystroke emulation. If the buffer is full, any extra key strokes sent to the instrument will be lost. The time it takes to empty the buffer varies depending on the key stroke function requested. Some key strokes such as entering limit lines are processed quickly, while others such as plotting take a longer time to process. It is up to the programmer to make sure that the instrument has digested the key strokes in its buffer before sending new key strokes.

3. When given a **go to remote** command after key stroke emulation, the analyzer will wait for the key stroke commands to finish execution before processing any further bus commands. This feature allows a program to automatically wait for the execution of slow key stroke commands (such as plotting). See the example on the next page for use of this feature to separate two key stroke commands when the first takes an indeterminate amount of time.

Table 3-1: Definition of ASCII Codes

Key Stroke	Definition	Key Stroke	Definition	Key Stroke	Definition
A	soft 1	O	Memory	5	5
B	soft 2	P	Start freq	6	6
C	soft 3	Q	Power	7	7
D	soft 4	R	Stop freq	8	8
E	soft 5	S	Sweep time	9.	9
F	soft 6	T	Preset	a	Enter off
G	soft 7	U	Config	b	Backspace
H	soft 8	-	Minus	c	MHZ/msec/dBm
I	Define	.	Decimal pt	d	GHZ/sec/dB
J	Meas	0	0	e	Channel 1
K	Scale	1	1	f	Channel 2
L	Disp	2	2	g	Channel 3
M	Cal	3	3	h	Channel 4
N	Cursor	4	4	i	Channel off

Examples

Simple example using an HP Series 300 Controller:

```
100  OUTPUT 704;KEYEM ON! enable keystroke emulation
110  !
120  WAIT 1! always wait before go to local command
130  LOCAL 7   ! send remote enable false
140  WAIT .01  ! always wait 10 ms after local command
150  OUTPUT 704;LDA! key stroke emulation for plotting
160  ! current display
170  REMOTE 704! exit key stroke emulation mode
180  !
190  OUTPUT 704;KEYEM OFF! disable keystroke emulation
```

More complex example using an HP Series 300 Controller (see Figure 3-2):

```
100  CLEAR 704 ! Instrument preset
110  OUTPUT 704;SWPF;start 2000;stop 4000;level 0;level
120  ! Sweep from 2 to 4 GHz at 0 dBm
130  OUTPUT 704;CH 2;off;CH 3;off;CH 4;OFF
140  OUTPUT 704;SWP 1;scale 1;rp 0;rl 0
150  ! Manually scale ch 1, turn other channels off
160  !
170  OUTPUT 704;KEYEM ON! Enable key stroke emulation
180  !
190  ! Local mode turns key stroke emulation on
200  WAIT 1! always wait before a local command
210  LOCAL 7   ! send remote enable false
220  WAIT .01  ! always wait 10 ms after local command
230  !
240  ! First, set up a limit line with 2 segments:
250  OUTPUT 704;LDBC2d4d-4d
260  ! First half sets up slope limit with 2 GHz start freq
270  ! and +/- 4 dB upper and lower limits
280  WAIT 1! wait 1 second to process key strokes
290  OUTPUT 704;3d3d-3d
300  ! Second half sets 3 GHz stop freq and +/-3 dB limits
310  WAIT .5! wait to process key strokes
320  OUTPUT 704;LDBB3d3d-3d4d
330  ! Now, set up flat limit from 3 to 4 GHz with
340  ! +/- 3 dB upper and lower limits
350  WAIT 1! wait to process key strokes
360  OUTPUT 704;LDA! Turn limit lines on
370  WAIT 1! wait to process key strokes
380  !
390  OUTPUT 704;LCA! plot the current display
400  !
410  ! Use go to remote feature to automatically wait
420  ! for the end of the plotting function
430  REMOTE 704! go to remote
440  OUTPUT 704;CH 1;ON! Dummy bus command is not
450  ! executed until analyzer finishes plotting
460  !
470  ! Now continue with other key stroke functions
480  WAIT 1
490  LOCAL 7   ! go to local sequence
500  WAIT .01
510  OUTPUT 704;LAEB! turn smoothing on
```

```
520  REMOTE 704! done with key stroke emulation
530  !
540  OUTPUT 704;KEYEM OFF! disable key stroke emulation
```

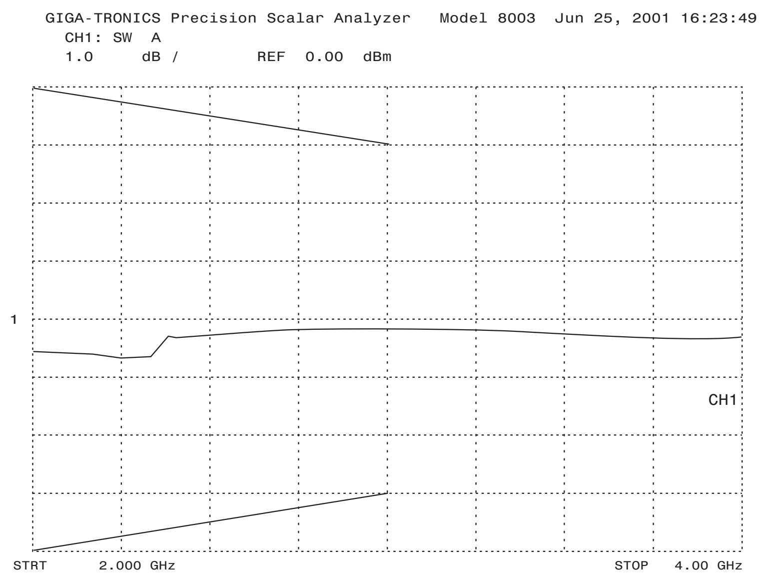


Figure 3-4: Plot Obtained Using More Complex HP Series 300 Prg. Example

3.3.18 Memory Command Structure

MEMORY

Syntax: **MEMORY** [*us* modifier] [*ds* numeric value]

Examples: **MEMORY;STORE 1**
Store front panel setting in store/recall memory 1

MEMORY;RECALL 1

Recall front panel setting from store/recall memory 1

Modifiers: Stores current front panel state in store/recall memory n.

Modifier name:	**STORE**
Modifier syntax:	**STORE** [*ds* numeric value]
valid numeric values:	0 through 9
assumed units:	no units (these are store/recall memories)

Recalls current front panel state from store/recall memory n.

Modifier name:	**RECALL**
Modifier syntax:	**RECALL** [*ds* numeric value]
valid numeric values:	0 through 9
assumed units:	no units (these are store/recall memories)

Description: The memory verb stores and recalls the entire instrument front panel state in the instrument's store and recall memories.

3.3.19 Measurement Query Command Structure

OUTPUT, OP

Output Current Data Syntax:

OP *hs* Channel Specifier *us* modifier [*us* modifier]

Output Current Data:

One form of the OP verb defines a measured data output. The data captured will be the data measured on the channel indicated by the channel specifier which follows the output verb. The format of the measured data depends upon the measurement mode and the output request. If the channel is making a swept measurement and the data returned represents the measured trace, the format is:

data(freq min),data(freq n),...,data(freq max) **EOL**.

See the section describing the swept measurement verb **SWP** on page 3-54 for more details. If the channel is making a CW measurement and the data represents the measured data point, the format is data**EOL**.

See the section describing the **CW** power measurement verb **POWER** on page 3-36 for more details. If the request is for cursor power measured at the cursor frequency, the format definition can be found on page 3-31 using the **CURP** modifier.

Output Current Data Specifiers:

Channel Specifiers are **1, 2, 3**, and **4**

Output Current Data Modifiers:

This modifier defines the number of data items to be returned when the measured data is requested for output to the host computer.

Modifier name:	**ITEMS**
Modifier Syntax:	**ITEMS** *ds* numerical value
valid numerical values:	1 to 512
assumed units:	no units

This modifier is used if the channel is making a swept measurement. The format of the returned data is detailed in the section describing the swept measurement verb **SWP** on page 3-54.

This modifier is to specify that a service request be sent upon completion of the measurement defined for this channel.

Modifier name:	**SRQ**
Modifier Syntax:	**SRQ**

Once the SRQ modifier is received, the 8003 will make the measurement specified for this channel. If the number of averages defined for this channel has been satisfied, the event complete bit is set in the external status register and the service request and the external status bits are set in the instrument status byte.

The **LIMIT** modifier reads the PASS/FAIL status of a limit line test. This command assumes that a limit line has been previously defined and turned on (see **SWP** command, LIMIT modifier). When this command is received, the analyzer will read the PASS/FAIL status of the indicated channels limit line test and wait to be talk-addressed by the controller. When talk-addressed, the analyzer will return the string **PASS** or **FAIL** according to the results of the limit line test (PASS indicates that the channel's trace was within the limits, FAIL indicates outside the limits).

Modifier name:	**LIMIT**
Modifier syntax:	**LIMIT**
return data format:	**PASS** or **FAIL**

This modifier is to request that the power be measured at the cursor position (assumes channel is in swept mode and that the cursor is turned on). The data returned will be in the following format:

cursor data = freq, data **EOL**

freq = F

data = ±D

where F is a variable field number with three digits to the right of the decimal point in MHZ, and D is a variable field number with three digits to the right of the decimal point in dBm or dB.

Modifier name:	**CURP**
Modifier Syntax:	**CURP**

Output Current Data Example:

OP 3;srq;curp EOL

Output Current Data Related Command:

SWP

Output Stored Data:

The second form of the **OP** command sends TRACE, PATHCAL, or CALFACTOR data from the 8003 to the controller. The data format is as follows:

start freq, stop freq, $\text{data}_{\text{START DATA}}$, ..., $\text{data}_{\text{FREQ N}}$,....$\text{data}_{\text{STOP FREQ}}$

Output Stored Data Syntax:

OP *us* memory specifier *hs* sensor/trace specifier

Output Stored Data Specifiers:

Memory specifiers are **TRACE, PATHCAL,** and **CALFACTOR**
Sensor specifiers are **A, B,** and **C**
Trace specifiers are 0 through 9

☛ ***NOTE: TRACE** uses a Trace specifier, **PATHCAL** and **CALFACTOR** use Sensor specifiers.*

Output Stored Data Format:

START FREQ,STOP FREQ (MHz)	D.ddd
then 512 data points for **TRACE** (dB)	±ddd.dd
then 4096 data points for **PATHCAL**	±ddd.dd
then 4096 data points for **CALFACTOR**	±ddd.dd
	D = 0 to 6 digits

Output Stored Data Examples:

OUTPUT;TRACE 5
OUTPUT;PATHCAL A
OUTPUT;CALFACTOR C

Output Stored Data Related Command:

INPUT

Description: There are two forms of Output commands. One form outputs currently measured data. The other form outputs stored data such as Trace memories, Path Cal memories, and sensor Cal Factor memories. These forms have completely different syntaxes but share the same verb. Users are cautioned to make note of the difference between the two. The Output Current Data and the Output Stored Data descriptions starting on page 3-31.

3.3.20 Plot Command Structure

PLOT

Syntax: **PLOT** us modifier [*us* modifier] [*us* SRQ]

Examples: **PLOT;ALL;SRQ**

Full size plot of all parameters, assert SRQ when done.

PLOT;LOWR;SRQ

Plot in lower right quadrant, assert SRQ when done.

PLOT;CUSTOM;GRID;FREQ_LB;SRQ

Custom plot of grid and frequency labels only, assert SRQ when done.

PLOT;CUSTOM;SCALE

Make analyzer read new P1, P2 plotter coordinates

PLOT;CUSTOM;DEF_LOGO;NEW LOGO

Plots NEW LOGO instead of Giga-tronics logo

Modifiers: Does a full size plot with all parameters

Modifier name:	**ALL**
Modifier syntax:	**ALL**
Modifier Description:	Does a plot in the upper left (**UPL**), upper right (**UPR**), lower left (**LOWL**), or lower right (**LOWR**) quadrants of the paper.
Modifier name:	**UPL, UPR, LOWL,** or **LOWR**
Modifier syntax:	**UPL, UPR, LOWL,** or **LOWR**
Modifier Description:	Does a special plot of trace only (**SP_TRACE**), labels only (**SP_LABEL**), or frequencies only (**SP_FREQ**).
Modifier name:	**SP_TRACE, SP_LABEL,** or **SP_FREQ**
Modifier syntax:	**SP_TRACE, SP_LABEL,** or **SP_FREQ**
Modifier Description:	Asserts GPIB **SRQ** at the end of a plot. The system controller would normally use an interrupt service routine to take action once the analyzer asserts **SRQ**. An **SRQ** can be cleared by doing a GPIB serial poll of the analyzer.
Modifier name:	**SRQ**
Modifier Description:	Does a custom plot with user defined features. The modifier **CUSTOM** should be followed by a set of modifiers that define the custom plot (see examples next page).

Modifier name:	**CUSTOM**
Modifier syntax:	**CUSTOM** [*us* modifier] ... [*us* modifier]

Custom Modifiers:

Modifier Description:	See page 2-29 for a brief description of the **GRID, FREQ_LB, SUMMARY, SCALE,** and **LABEL** modifiers.
Modifier name:	**GRID, FREQ_LB, SUMMARY, SCALE,** and **LABEL**
Modifier syntax:	**GRID, FREQ_LB, SUMMARY, SCALE,** and **LABEL**
Modifier Description:	The trace modifier for **CUSTOM** determines which channel(s) are plotted.
Modifier name:	**TRACE**
Modifier syntax:	**TRACE** *ds* numerical value
valid numerical value:	0 to 4
assumed units:	no units (This is the channel number)
Modifier Description:	The logo modifier for **CUSTOM** plots the Giga-tronics logo and date at the top of the plot.
Modifier name:	**LOGO**
Modifier Description:	The def_logo modifier for **CUSTOM** plots a user-defined string instead of the Giga-tronics logo.
Modifier name:	**DEF_LOGO**
Modifier syntax:	**DEF_LOGO** *us label* where label is an alphanumeric string up to 50 characters long.

Description: The plot verb makes various plots of the display on a plotter connected to the analyzer's private GPIB bus. For a detailed description of the different types of plots, please see the Plot & Print Softkey description starting on page 2-27 in the OPERATION chapter of this manual. Since plots may take more than a minute to complete, it is strongly advised to use the SRQ function to detect when the plot is finished (see the example of a typical Plotter Command program on page 3-35.)

Plotter Command Programming Example

```
10  !************************************************************
20  ! PLOTTER COMMAND DEMONSTRATION
30  !************************************************************
40  !
50  CLEAR 704 ! device clear presets analyzer
60  WAIT 4
70  !
80  OUTPUT 704;SWP 1,A;on;SWP 2,A;off;CHAN 3;off;CHAN 4;off
90  OUTPUT 704;SWPF;start 2000;stop 4000;level 10;level on;swpt 300
100 WAIT 3! wait for sweeper to digest changes and output clean sweep
110 OUTPUT 704;SWP 1;scale auto! autoscale trace
120 WAIT 1
130 !
140 !.........................................................
150 BEEP
160 INPUT Press RETURN when plotter is ready for demo ... , Inp$
170 ! First set up controller to use SRQ s
180 ON INTR 7 GOSUB Service srq
190 ENABLE INTR 7;2
200 !
210 GOTO Jumparound
220 ! Full size plot of entire display
230 OUTPUT 704;PLOT;all;srq
240 GOSUB Wait for srq
250 !
260 PAUSE
270 ! Plot entire display in lower right hand quadrant
280 OUTPUT 704;PLOT;lowr;srq
290 GOSUB Wait for srq
300 !
310 PAUSE
320 ! Custom plot with trace and frequency readouts only
330 OUTPUT 704;PLOT;custom;trace 1;freq 1b;srq
340 GOSUB Wait for srq
350 !
360 PAUSE
370 Jumparound:!
380 ! Custom plot with logo changed
390 OUTPUT 704;PLOT;custom;grid;trace 1;def logo MY COMPANY NAME1234
400 ! Note that HP Basic requires double quotes to insert a quotation
410 ! mark within a quoted string
420 STOP
430 !...........................................................
440 !
450 ! Various subroutines:
460 !
470 Wait for srq:! This subroutine waits until an SRQ occurs
480    Received srq=0! Clear flag to stay in next loop
490    WHILE Received srq=0! Exit loop only when srq service sets flag
500    END WHILE
510    Status1=SPOLL(704)! Serial poll clears srq message
520    ENABLE INTR 7;2! Re-enable interrupts
530 RETURN
540 !
550 Service srq:!
560    Received srq=1! Set srq flag when interrupt received
570 RETURN
580 !...........................................................
590 END
```

3.3.21 CW Power Measurement Command Structure

POWER

Syntax: **POWER [?]** *hs* channel specifier [*ds* sensor specifier] [*us* trigger mode] [*us* modifiers]

Specifiers: Channel specifier: 1 through 4

Sensor specifier: **A, B, C, (A/B, A/C, B/A, B/C, C/A, C/B, A-B, A-C, B-A, B-C, C-A,** or **C-B** allowed for trigger mode **TØ** only)

Trigger Modes:

Trigger mode syntax: TØ, T1, T2, T3

Default trigger mode: TØ

General Description:

Once the trigger mode is set, the 8003 will remain in that trigger mode until another trigger mode command is sent. If the **POWER** command is sent with one of the fast data modes (T1 through T3), the analyzer will freeze its display to maximize data rate through the GPIB bus. When any one channel is put in one of the fast data modes, all channels change to the same fast data mode. To place the instrument in the standard **TØ** mode with display updates, do any of the following:

- Send the **POWER** command with mode TØ
- Send a DEVICE CLEAR bus command to the analyzer
- Send an INTERFACE CLEAR bus command
- Put the instrument in LOCAL mode - either manually or over the bus

In the fast data modes (T1 through T3), it is advisable to use the **RDTEMP** command to periodically update low level temperature and offset drift correction. See the description for the **RDTEMP** command in Section 3.3.22.

Normal CW Mode:

Trigger mode name: **TØ**

This is the analyzer's default power-up mode. In this mode, the analyzer free-runs at a relatively slow data rate. The mode offers familiar power meter functionality to the user with channel ratioing and differences, averaging, max and min holds, and relative measurements - although at a slower reading rate than the fast CW modes described below. When the analyzer receives an **OUTPUT** [*channel#*] command over the bus, it will send the current power reading for that channel to the controller (see the **OUTPUT** command description in Section 3.3.19 for more information). The power reading is corrected for Cal Factor, temperature, and low-level offsets. Reading rate is fairly slow (greater than 10 readings per second). The analyzer will wait until it is talk addressed, and then it will return the reading in the format ±ddd.dd in dB.

Fast Free-run CW Mode:

Trigger mode name: **T1**

In this mode, the analyzer makes high speed CW power measurements. The analyzer free runs but does not update the display to maximize measurement speed. The free-run mode is the simplest to use, and is intended for ATE measurements where the timing of the reading is not extremely critical. All four channels may be used and configured in any sequence of sensors but channels are restricted to single-sensor-per-channel measurements only (no ratios or differences). Every measurement cycle, the analyzer takes a reading for each active channel (or n readings if the AVG n modifier is specified). Note that the averaging number may be different for each channel. Whenever the analyzer is talk addressed, it sends the most recent (averaged) reading from each active channel to the controller. The OUTPUT command is not required before talk-addressing the analyzer. Unlike the TØ mode, the T1 mode will send the data for all active channels when talk addressed. The data returns in the format:

±ddd.dd,±ddd.dd,...,±ddd.dd

with one data item for each active channel separated by commas. The T1 mode is capable of measurement speed in excess of 180 measurements per second.

Fast Bus Triggered CW Mode:

Trigger mode name: **T2**

This is also a high speed CW reading mode with display updates suppressed. This mode is very similar to the T1 mode described above except that the analyzer does not free run, but instead waits for a trigger from the controller. This allows precise timing of measurement events in the system. The trigger is the GPIB Group Execute Trigger (GET) command. Note that there are both addressed and universal versions of the GET command so that just the analyzer, or all instruments on the bus can be triggered. When the trigger is received, the analyzer takes a reading on each active channel (or n readings if AVG n is specified) and then waits to be talk addressed. When talk addressed, the analyzer sends each channel's data to the controller in the serial fashion described above. Note that in the triggered mode, the 8003 expects the controller to read the data after the trigger is received. In the Free Run Mode (T1), the controller never needs to read the data.

An additional capability in Triggered Mode is the use of data buffers for each active channel. Buffering the data allows the analyzer to measure even faster since it does not have to output the data between readings. Buffering is requested by adding the ITEMS n modifier to the **POWER** command (see the ITEMS modifier under the T2 MODIFIERS section on page 3-40).

For full GPIB handshaking with buffered measurements, see the SRQ modifier description under the T2 MODIFIERS section on page 3-40 also.

Fast TTL Triggered CW Mode:

Trigger mode name: **T3**

This mode is exactly like the T2 mode described above except that the analyzer is triggered by a TTL signal provided to the 8003 rear panel BNC input marked INPUT 1/TTL LEVELS. The mode should be used when it is more convenient, or more accurate to time the measurement by a digital TTL signal, rather than a GPIB bus command. The measurement is edge triggered - that is, the 8003 waits to see a TTL-transition from low to high at the input before triggering the reading. The TTL-high signal must be present for at least 500 ms for the analyzer to see it. Buffers may be used in this mode and are described in the ITEMS modifier description for T3 mode on page 3-41. Note that care must be taken in this mode to ensure that the signal source's (or UUT's) output power is completely settled before giving the TTL trigger.

For full TTL handshaking with buffered measurements, see the RFT modifier description under the T3 MODIFIERS section on page 3-41. A typical programming example for the Fast TTL Triggered mode is shown on page 3-47.

Modifiers: Modifiers Common To All Trigger Modes

Modifier Description:	This modifier turns on a specified channel in CW power measurement mode.
Modifier Name:	**ON,+**
Modifier Syntax:	**ON**
Modifier Description:	This modifier turns off the specified channel.
Modifier Name:	**OFF,-**
Modifier Syntax:	**OFF**
Modifier Description:	This modifier determines the average factor for the measurement. In TØ mode, averaging works like a continuous filter, with each subsequent reading taken from the end of the filter. To dump the filter and restart averaging, use the RESET or RS modifier. In T1, T2, and T3 modes, each reading is newly averaged n times.
Modifier Name:	**AVERAGE, AVG**
Modifier Syntax 1:	**AVG** *hs* numerical value
Valid numerical units:	1, 2, 4, 8, 16, 32, 64, 128, 256
Modifier Syntax 2:	**AVG** *hs* state
State definition:	**ON, +, OFF, -, RESET, RS**

Modifiers:	Modifiers Used Only With TØ Mode	
	Modifier Description:	This modifier places the instrument in max hold mode. Every time the analyzer is talk-addressed, the instrument will output the maximum reading seen since the mode was activated.
	Modifier name:	**MAXH**
	Modifier syntax:	**MAXH** *hs* state
	State definition:	**ON, +, OFF, -**
	Modifier Description:	This modifier places the instrument in min hold mode. Every time the analyzer is talk-addressed, the instrument will output the minimum power reading seen since the mode was activated.
	Modifier name:	**MINH**
	Modifier syntax:	**MINH** *hs* state
	State definition:	**ON, +, OFF, -**
	Modifier Description:	This modifier places the measurement in relative reading mode. When the command is received by the analyzer, it takes the current power reading and stores it as a reference. Every time the analyzer is talk-addressed, the instrument will output the difference between the current reading and the stored reference reading (in dB).
	Modifier name:	**REL**
	Modifier syntax:	**REL** *hs* state
	State definition:	**ON, +, OFF, -**
	Modifier Description:	SRQ in TØ mode operates slightly differently than SRQ in T2 mode. In the TØ mode, when the SRQ modifier is sent the analyzer will wait until the number of averages defined for the channel has been completed. The analyzer will then set the event complete bit in the external status register. The service request and external status bits are set in the instrument status byte. The SRQ interrupt line on the GPIB bus is asserted. This should cause an interrupt in the external controller which may be handled by an interrupt service routine.
	Modifier name:	**SRQ**
Modifiers:	Modifiers Used Only With T1 Mode:	
	NONE:	There are no modifiers specific to the T1 mode.

Modifiers: Modifiers Used Only With T2 Mode

Modifier Description:	ITEMS activates buffered readings in T2 mode. A Buffer is memory internal to the analyzer set aside to store readings. The memory is user defined to any length between 1 and 512 readings. In buffered reading mode, the analyzer directs readings to the buffer memory until the buffer is full. When talk-addressed, the analyzer then sends the entire buffer full of readings to the controller. Buffering the data allows the analyzer to measure even faster since it does not have to output the data to the controller between each reading. Once a buffer is specified for one channel, all active channels must use a buffer of the same size. The last ITEMS n command received determines the buffer size for all channels. When n=1 or when ITEMS is not specified, the triggered mode waits to be talk-addressed after each reading. For buffer sizes greater than 1, the analyzer does not wait to be talk-addressed after each trigger, but instead adds the new reading to each active channel's buffer. When the buffer is full, the analyzer halts and waits to be talk-addressed. When talk-addressed, the analyzer sends the buffered readings to the controller. The entire buffer for the lowest channel number is sent first, followed by the buffer for the next highest channel number, and so on, until all buffers are sent. Each individual data item is separated from the next by a comma, and data from the end of one buffer and the beginning of the next is simply separated by a comma.
Modifier name:	**ITEMS**
Modifier syntax:	**ITEMS** *hs* numerical value
Valid numerical values:	Any integer between 1 and 512
Modifier Description:	SRQ sets up a GPIB handshake for buffered readings in T2 mode. In GPIB-triggered mode, the analyzer ignores extra triggers that may occur while the analyzer is occupied with a reading. When data buffers are used, this may lead to a situation where the controller thinks that the 8003 should be through taking data, while the 8003 is waiting for more triggers. One way around this problem is to ensure that the trigger rate is below the 8003's maximum data rate. Another way is to use the optional SRQ modifier to provide a full GPIB handshake. When the SRQ modifier is added to the **POWER** command, the analyzer will assert the bus SRQ line after it completes each reading. The controller software must then be written to wait for the SRQ interrupt before giving another trigger. Due to the overhead of processing the SRQ interrupt, full handshake operation may be slower than single-ended triggering of the readings.
Modifier name:	**SRQ**
Modifier syntax:	**SRQ**

Modifiers:	Modifiers Used Only With T3 Mode	
	Modifier Description:	ITEMS activates buffered readings in T3 mode. A Buffer is memory internal to the analyzer set aside to store readings. The memory is user defined to any length between 1 and 512 readings. In buffered reading mode, the analyzer directs readings to the buffer memory until the buffer is full. When talk-addressed, the analyzer then sends the entire buffer full of readings to the controller. Buffering the data allows the analyzer to measure even faster since it does not have to output the data to the controller between each reading. Once a buffer is specified for one channel, all active channels must use a buffer of the same size. The last ITEMS n command received determines the buffer size for all channels. When n=1 or when ITEMS is not specified, the triggered mode waits to be talk-addressed after each reading. For buffer sizes greater than 1, the analyzer does not wait to be talk-addressed after each trigger, but instead adds the new reading to each active channel's buffer. When the buffer is full, the analyzer halts and waits to be talk-addressed. When talk-addressed, the analyzer sends the buffered readings to the controller. The entire buffer for the lowest channel number is sent first, followed by the buffer for the next highest channel number, and so on, until all buffers are sent. Each individual data item is separated from the next by a comma, and data from the end of one buffer and the beginning of the next is simply separated by a comma.
	Modifier name:	**ITEMS**
	Modifier syntax:	**ITEMS** *hs* numerical value
	Valid numerical values:	Any integer between 1 and 512
	Modifier Description:	The RFT (Ready For Trigger) modifier provides a full hardware handshake for TTL-triggered readings. As with GPIB-triggered readings, the 8003 will ignore extra hardware triggers that occur before it is ready to take another reading. In the TTL-triggered mode, an optional hardware handshake is provided which is analogous to the SRQ handshake used in the GPIB-triggered mode. The hardware handshake mode with data buffers is the analyzer's fastest way to collect data. Single channel reading speeds of greater than 400 readings per second are possible in this mode. To use the hardware handshake, add the RFT modifier to the **POWER** command (this assumes you have already selected T3 mode). The AC MOD OUT connector on the 8003 provides the hardware handshake. If the RFT modifier is given, the 8003 provides a TTL-high at the AC MOD OUT connector until it receives a hardware trigger on its INPUT 1 connector. It then sets AC MOD OUT to TTL-low while it is busy processing the reading. When it has finished the reading, the 8003 toggles the AC MOD OUT connector back to TTL-high. Appropriate circuitry in the test system can decode and use this signal to complete the handshake. There are a couple of timing consider-

ations that must be observed. First, when the 8003 asserts AC MOD OUT high to indicate Ready for Trigger, the test system must wait for at least 500 µs before pulling the INPUT 1 trigger line high. Second, the INPUT 1 trigger must be kept high for at least 500 m.

Modifier name: **RFT**

Modifier syntax: **RFT**

Description: The 8003 analyzer offers a very powerful and flexible CW measurement capability over the GPIB bus. Four modes of CW measurements allow 1) slow readings with display updates, 2) fast free-running measurements, 3) fast GPIB-triggered measurements, and 4) fast TTL-triggered measurements. Single channel reading rates in excess of 300 readings per second are achievable in the fast data modes. In addition, the fast GPIB and TTL-triggered modes both allow the optional use of internal data buffers and bus or hardware handshakes to maximize system throughput.

CW power measurements are made over the GPIB bus using the **POWER** command.

See the Fast-CW Mode Programming Example starting on page 3-43.

See the Tri-Triggered Fast-CW Mode Programming Example on page 3-47.

See the Fast Step CW Measurement Mode Programming Example on page 3-48.

Fast-CW Mode Programming Example

```
10   !**********************************************************
20   ! PROGRAM TO DEMONSTRATE MEASUREMENT SPEED OF
30   ! GIGA-TRONICS 8003 PRECISION SCALAR ANALYZER RUNNING IN
40   ! fast-cw MODE.
50   ! COPYRIGHT 2001 GIGA-TRONICS INC.
60   !
70   ! This program assumes:
80   !  1) Analyzer at GPIB address 4
90   !  2) Sweeper in CW mode and set to desired power level
100  !  3) Sensor plugged into A input and connected to sweeper output
110  !
120  !************************************************************
130  !
140  OPTION BASE 1! All arrays start at index 1
150  INTEGER Maxcount,Counter
160  !
170  CLEAR 704 ! Send device clear to preset the analyzer
180  !
190  OUTPUT 704;READOUT! Numeric screen format
200  OUTPUT 704;POWER 1,A! Channel 1 reads sensor A
210  OUTPUT 704;CHAN 1;ON;CHAN 2;OFF;CHAN 3;OFF;CHAN 4;OFF
220  !
230  ! Set up sweeper for measurement
240  ! CW, 2 GHz, RF on, 0 dBm
250  OUTPUT 704;FIXED;FREQ 2000;LEVEL ON;LEVEL 0
260  WAIT 2! Wait for sweeper to set up parameters
270  !
280  !........................................................
290  ! MEASUREMENT OF FREE RUNNING FAST CW MODE MEASUREMENT SPEED
300  !
310  ! Example of zeroing sensor first (use only for low level msmts)
320  ON INTR 7 GOSUB Zero srq! SRQ service routine
330  Srq flag=0! Clear srq flag
340  ENABLE INTR 7;2! Enable interrupts
350  OUTPUT 704;ZERO A;srq! Zero sensor A, assert SRQ when done
360  WHILE Srq flag=0! Endless loop while waiting for zero
370  END WHILE ! (of course, program could be doing
380  ! something else)
390  WAIT 1
400  !
410  OUTPUT 704;POWER 1;T1! Set free running fast cw mode = T1
420  WAIT 1! IMPORTANT** wait for analyzer to change modes and update
430  !   temperature correction
440  !
450  OUTPUT 704;POWER 1;AVG OFF! No averaging for this example
460  !
470  ! Example of updating temp and low level calibration
480  OUTPUT 704;RDTEMP!
490  WAIT 1! Wait to complete command
500  !
510  GOTO Msmt loop! Jump around srq service routine
520  Zero srq: Srq flag=1! srq service routine sets srq flag
530  Status 8003=SPOLL(704)! serial poll clears srq message
540  ENABLE INTR 7;2! re-enable interrupts
550  RETURN
560  !
570  Msmt loop:!
580  ! Initialize loop variables
590  Maxcount=1000! Take 1000 readings
600  Counter=0 ! Initialize counter
610  !
620  ! MAIN LOOP
630  Starttime=TIMEDATE
640  WHILE Counter<Maxcount
```

```
650     ENTER 704;Reading! In free running mode, analyzer gives last readin
660      ! any time that it is talk-addressed.
670      Counter=Counter+1
680  END WHILE
690  Tottime=TIMEDATE-Starttime
700  OUTPUT 704;PWR 1;T0! Good housekeeping returns to display update mode
710  WAIT 1! Always wait after mode change
720  !
730  PRINT Free running mode msmts/second = ;Maxcount/Tottime,Power = ;Rea
740  !
750  !.........................................................
760  ! MEASUREMENT OF TRIGGERED FAST CW MODE MEASUREMENT SPEED
770  !
780  OUTPUT 704;PWR 1;T2! First set triggered fast cw mode = T2
790  WAIT 1! IMPORTANT** wait for analyzer to change modes and update
800      !  temperature correction
810  !
820  ! Initialize loop variables
830  Maxcount=1000! Take 1000 readings
840  Counter=0 ! Initialize counter
850  !
860  ! MAIN LOOP
870  Starttime=TIMEDATE
880  WHILE Counter<Maxcount
890  TRIGGER 704! Triggered mode requires Group Execute Trigger
900  ENTER 704;Reading
910  Counter=Counter+1
920  END WHILE
930  Tottime=TIMEDATE-Starttime
940  !
950  PRINT Triggered mode msmts/second = ;Maxcount/Tottime,Power = ;Readin
960  !
970  OUTPUT 704;PWR 1;T0! Good housekeeping to return analyzer to
980  ! standard cw mode to update display
990  WAIT 1
1000 !
1010 !.........................................................
1020 ! EXAMPLE OF 2 CHANNEL MEASUREMENT IN FAST-TRIGGERED MODE
1030 !
1040 OUTPUT 704;POWER 1,A;ON;POWER 2,A;ON;CHAN 3;OFF;CHAN 4;OFF
1050 ! Note that both channels are reading the same sensor A. This is just
1060 ! for convenience in running a demo. It is just as easy to define
1070 ! channel 2 to read sensor B. With 2 different sensors, the msmt speed
1080 ! is almost identical to the code running here.
1090 !
1100 OUTPUT 704;PWR 1;T2! First set triggered fast cw mode = T2
1110 WAIT 1! IMPORTANT** wait for analyzer to change modes and update
1120 ! temperature correction
1130 !
1140 ! Initialize loop variables
1150 Maxcount=1000! Take 1000 readings
1160 Counter=0 ! Initialize counter
1170 !
1180 ! MAIN LOOP
1190   Starttime=TIMEDATE
1200 WHILE Counter<Maxcount
1210    TRIGGER 704! Triggered mode requires Group Execute Trigger
1220    ENTER 704;Reading a,Reading b
1230 ! Now, analyzer returns 2 readings for every trigger
1240    Counter=Counter+1
1250 END WHILE
1260 Tottime=TIMEDATE-Starttime
1270 !
1280 PRINT Sensor A = ;Reading a;, Sensor B = ;Reading b
1290 PRINT 2-channel msmt speed = ;Maxcount/Tottime; rdgs/second
```

```
1300 !
1310 OUTPUT 704;PWR 1;T0! Good housekeeping to return analyzer to
1320 ! standard cw mode to update display
1330 WAIT 1
1340 !.........................................................
1350 ! EXAMPLE OF BUFFERED MEASUREMENTS IN FAST-TRIGGERED MODE
1360 !
1370 OUTPUT 704;POWER 1,A;ON;POWER 2,A;ON;CHAN 3;OFF;CHAN 4;OFF
1380 ! Read from 2 channels in this example
1390 !
1400 ! ***** THE ITEMS n COMMAND SETS THE BUFFER SIZE *****
1410 OUTPUT 704;PWR 1;T2;ITEMS 100! Triggered fast cw mode = T2
1420 ! Also, buffer of 100 elements set for each active channel
1430 WAIT 1! IMPORTANT** wait for analyzer to change modes and update
1440 ! temperature correction
1450 !
1460 DIM Buffer a(100), Buffer b(100)
1470 ! MAIN LOOP
1480 FOR Reading=1 TO 100
1490 TRIGGER 704! Triggered mode requires Group Execute Trigger
1500 ! Analyzer automatically buffers one reading per channel for
1510 !   each trigger
1520     WAIT .005! Important to not send new trigger before analyzer is
1530 ! ready to accept it. See T1 mode description
1540 NEXT Reading
1550 !
1560 ! Now read buffers from the analyzer
1570 OUTPUT 704;OUTPUT 1! Tell analyzer to send buffers
1580 ENTER 704;Buffer a(*),Buffer b(*)
1590 !
1600 ! Print buffers
1610 FOR I=1 TO 100
1620    PRINT I; Chan A = ;Buffer a(I); Chan B = ;Buffer b(I)
1630 NEXT I
1640 !
1650 OUTPUT 704;PWR 1;T0! Good housekeeping to return analyzer to
1660 ! standard cw mode to update display
1670 !
1680 !.........................................................
1690 ! EXAMPLE OF BUFFERED MODE WITH FULL GPIB HANDSHAKE
1700 !
1710 OUTPUT 704;POWER 1,A;ON;CH 2;OFF;CH 3;OFF;CH 4;OFF
1720 ! Use only channel 1 for this example
1730 !
1740 ! *** THE SRQ MODIFIER TELLS ANALYZER TO ASSERT SRQ AFTER EVERY READING
1750 ! Use GPIB triggered mode with 100 element buffer
1760 OUTPUT 704;POWER 1;T2;ITEMS 100;SRQ

1770 WAIT 1! IMPORTANT** wait for analyzer to change modes and update
1780 ! temperature correction
1790 !
1800 ! SET UP INTERRUPT SERVICE ROUTINE TO HANDLE SRQ
1810   Srq flag=0! Reset interrupt service routine flag
1820 ON INTR 7 GOSUB Reading srq
1830 ENABLE INTR 7;2
1840 !
1850 ! MAIN LOOP
1860 FOR Reading=1 TO 100
1870 TRIGGER 704! Triggered mode requires Group Execute Trigger
1880 ! Analyzer automatically buffers one reading per channel for
1890 !   each trigger
1900 WHILE Srq flag=0! Infinite loop waits for reading SRQ
1910 END WHILE
1920 NEXT Reading
1930 !
```

```
1940 ! NOW READ BUFFER FROM ANALYZER
1950 ENTER 704;Buffer a(*)
1960 !
1970 ! Print buffer
1980 FOR I=1 TO 100
1990 PRINT I; Chan A = ;Buffer a(I)
2000 NEXT I
2010 !
2020 OUTPUT 704;PWR 1;TO! Good housekeeping to return analyzer to
2030 ! standard cw mode to update display
2040 STOP
2050 !
2060 ! INTERRUPT SERVICE ROUTINE FOR READING SRQ
2070 Reading srq:!
2080   Srq flag=1! Set SRQ flag
2090   Status=SPOLL(704)! Serial poll clears srq
2100   ENABLE INTR 7;2! Re-enable interrupts
2110 RETURN
2120 END
```

TTL-Triggered Fast-CW Measurement Programming Example

```
10   !**********************************************************
20   ! PROGRAM TO DEMONSTRATE AN APPLICATION OF TTL-TRIGGERED
30   ! FAST CW MEASUREMENTS
40   !
50   ! COPYRIGHT 2001 GIGA-TRONICS INC.
60   !
70   ! This program assumes:
80   ! 1) Analyzer at GPIB address 4
90   ! 2) Gigatronics 7200 Sweeper on the system bus at GPIB address 20
100  ! 3) Sensors plugged into A and B channel inputs
110  !
120  !****************************************************************
130  !
140  OPTION BASE 1
150  DIM Buffer a(181),Buffer b(181)
160  !
170  ! FIRST CONFIGURE THE ANALYZER
180  CLEAR 704 ! Send device clear to preset the analyzer
190  OUTPUT 704;READOUT! Numeric screen format
200  OUTPUT 704;POWER 1,A;POWER 2,C;CHAN 3;OFF;CHAN 4;OFF
210  ! Channel 1 reads incident power, chan 2 reads output power
220  !
230  ! SET UP GIGATRONICS 7200 SIGNAL GENERATOR IN DIGITAL STEP SWEEP MODE
240  OUTPUT 720;GA2GZ! Start frequency of 2 GHz
250  OUTPUT 720;GB20GZ! Stop frequency of 20 GHz
260  OUTPUT 720;GC100MZ! Step frequency of 100 MHz
270  OUTPUT 720;GD10MS! Step dwell time of 10 ms
280  OUTPUT 720;PL0DB! Output power level of 0 dBm
290  OUTPUT 720;RF1! Turn the RF on
300  WAIT 3! Wait for the sig gen to set up parameters
310  !
320  !..........................................................
330  ! MEASUREMENT OF INCIDENT AND OUTPUT POWER DURING DIGITAL STEP SWEEP
340  !   USING TTL TRIGGER TO MAKE 8003 POWER READINGS
350  !
360  OUTPUT 704;PWR 1;T3;ITEMS 181
370  WAIT 1! IMPORTANT to allow analyzer to process trigger mode change
380  ! TTL trigger mode with 501 item buffer on channels 1 and 2
390  ! Analyzer is now armed and ready. Any TTL triggers received
400  !   will trigger a reading on each channel and stuff in buffer
410  !
420  OUTPUT 720;D2! Now, trigger synthesizer to take a single sweep
430  WAIT 10! Wait for step sweep to finish
440  !
450  OUTPUT 704;OUTPUT 1! Tell analyzer to output data
460  ENTER 704;Buffer a(*),Buffer b(*)
470  ! Analyzer outputs channel A buffer first, then chan B buffer
480  PRINT Buffer a(*);
490  PRINT Buffer b(*);
500  !
510  OUTPUT 704;POWER 1;T0! Good housekeeping to return analyzer
520  ! to display update mode
530  WAIT 1
540  END
```

Fast Step CW Measurement Mode Programming Example

```
10   !****************************************************************
20   ! PROGRAM TO DEMONSTRATE FAST CW MEASUREMENTS USING
30   ! GIGA-TRONICS 8003 PRECISION SCALAR ANALYZER RUNNING IN
40   ! fast-cw MODE
50   ! COPYRIGHT 2001 GIGA-TRONICS INC.
60   !
70   ! The program assumes:
80   ! 1) Analyzer at GPIB address 4
90   ! 2) Sweeper connected to 8003 private bus
100  ! 3) Sweeper capable of 8-12 GHz freq range and +10 dBm output
110  ! 4) Sensor connected to 8003 channel A input and sweeper output
120  !****************************************************************
130  !
140  CLEAR 704 ! Send device clear to preset the analyzer
150  !
160  OUTPUT 704;CHAN 1;ON;CHAN 2;OFF;CHAN 3;OFF;CHAN 4;OFF
170  OUTPUT 704;READOUT! Numeric screen format
180  !
190  ! Set up sweeper for stepped-CW operation at +10 dBm
200  OUTPUT 704;FIXED;FREQ 8000;LEVEL ON;LEVEL 10
210  WAIT 2
220  !
230  ! This next command puts the analyzer in power meter mode, displaying
240  ! power from sensor A on channel 1.
250  OUTPUT 704;PWR 1,A;AVG OFF
260  WAIT 2! Not necessary, but allows number on display
270  !
280  OUTPUT 704;PWR 1;T2! First set triggered fast cw mode = T2
290  WAIT 1! IMPORTANT** wait for analyzer to change modes and update
300  ! temperature correction
310  !
320  ! MAIN ROUTINE
330  ! Steps sweeper from 8 to 12 GHz in 100 MHz steps and measures power
340  !
350  FOR I=8000 TO 12000 STEP 100
360      OUTPUT 704;FIXED;FREQ ;I! Change sweeper frequency
370      WAIT .4! User adjust for sweeper settling time
380      TRIGGER 704! Trigger 8003 to make fast cw measurement
390      ENTER 704;Reading! Read power
400      PRINT I;Reading
410  NEXT I
420  !
430  OUTPUT 704;PWR 1;T0! Good housekeeping to return to standard
440  ! cw measurement mode so that display updates
450  END
```

3.3.22 Temperature & Low Level Offset Update Structure

RDTEMP

Syntax: **RDTEMP** *hs* sensor specifier

Specifiers: ***A, B,*** *or* ***C***

Output format for temperature:

dd.d

Assumed units:

degrees C

Description: In the fast CW measurement modes (trigger modes T1 through T3 of the POWER command), temperature and low level correction are turned off to maximize the measurement speed. At most power levels (>-50 dBm), this causes negligible reading error. At very low power levels, the RDTEMP command should be used before each fast measurement run to update temperature and low level offset drift.

If the analyzer is listen addressed immediately after the RDTEMP command, it will also output the temperature in degrees Celsius for the sensor.

3.3.23 Print Definition Command Structure

PRINT

Syntax: **PRINT** *us* modifier **EOL**

Examples: **PRINT;paint;SRQ**

PRINT;laser'SRQ

Modifiers: This modifier defines the type of printer to be receiving the raster scan plot as an HP INK JET PRINTER.

Modifier name:	**INK**
Modifier Syntax:	**INK**
Modifier Description:	This modifier defines the type of printer to be receiving the raster scan plot as an HP PAINT JET PRINTER.
Modifier name:	**PAINT**
Modifier Syntax:	**PAINT**
Modifier Description:	This modifier defines the type of printer to be receiving the raster scan plot as an HP LASER JET+ PRINTER.
Modifier name:	**LASER**
Modifier Syntax:	**LASER**
Modifier Description:	Asserts GPIB SRQ at the end of a print routine. The system controller would normally use an interrupt service routine to take action once the analyzer asserts SRQ. An SRQ can be cleared by doing a GPIB serial poll of the analyzer.

Description: This verb drives an external Ink Jet or Paint Jet printer through the analyzer's private GPIB bus (or Laser Jet printer connected to the analyzer's RS-232 bus). The 8003 does a screen dump to the printer in the raster scan mode - capturing everything currently on the screen. Because the print takes a considerable (and variable) amount of time to execute, it is highly recommended to use the SRQ modifier to tell the controller when the print is finished.

3.3.24 Readout Display Definition Command Structure

READOUT, TEXT, TXT

Syntax: **TXT**

Example: **READOUT**

Related Command:

POWER

Description: This verb places the 8003 display in the readout (non-graph) mode. There are no channel or sensor specifiers and no modifiers.

3.3.25 Sensor Definition Command Structure

SENSOR, SEN

Syntax:	**SEN** *hs* Sensor Specifier [*us* modifier]..[*us* modifier]	
Specifiers:		**A, B,** and **C**
Modifiers:	This Modifier defines an offset in dBs for the sensor.	
	Modifier name:	**OFFSET, OS, ATTN**
	Modifier Syntax:	**OS** *ds* numerical value
	numerical value range:	-90.00 to +90.00
	numerical resolution:	0.01
	assumed units:	dB
	Modifier Description:	This modifier defines the detection mode as AC detection for the sensor specified.
	Modifier name:	**AC**
	Modifier Syntax:	**AC**
	Modifier Description:	This modifier defines the detection mode as DC detection for the sensor specified
	Modifier name:	**DC**
	Modifier Syntax:	**DC**

Description: There are two separate formats that use the SWP verb. One form (described above) defines a current Swept power measurement mode and attributes for a channel. The second form (described starting on page 3-60) measures TRACE, PATHCAL, and CALFACTOR data that will be stored to be used with future measurements.

Modifiers Specific to 8034XA Series Peak Sensors Only

The 8034XA Series Peak Sensors allow measurement of pulsed RF signals. Unlike the standard CW sensors, the Peak Sensors require a trigger signal. The Peak Sensors capture the instantaneous power at the moment of the trigger and hold the value until the next trigger. The Peak Sensors offer three different trigger modes - one internal free-running trigger mode, and two external trigger modes. The following modifiers choose between the three trigger modes. For Section 3.3.25, the examples have been provided after their modifier unlike the previous sections, due to numerous modifiers for the 8034XA.

Examples: **SEN R A;ac;attn -10.5;SEN B;dc;SEN C;dc**

SENSOR A;FREERUN

SEN B;dlytrig

Modifier Description:	The **FREERUN** modifier puts the Peak Sensor in free running trigger mode. This mode is primarily intended for measuring CW signals (where no external trigger is available) with the Peak Sensor. Triggers are internally generated at approximately 1 kHz rate.

Modifier Name:	**FREERUN**
Modifier Syntax:	**FREERUN**
Modifier Description:	The **TRIG** modifier puts the Peak Sensor in trigger immediate mode. In this mode, when a TTL transition from low to high occurs at the trigger input connector on the sensor, the Peak Sensor captures and holds the instantaneous peak power. The internal delay from TTL trigger to actual power capture is nominally 250 ns. The user is expected to externally synchronize the trigger to read at the desired point in the pulse.
Modifier Name:	**TRIG**
Modifier Syntax:	**TRIG**
Modifier Description:	The **DLYTRIG** modifier puts the Peak Sensor in delayed trigger mode. This mode is similar to the one above except that a fixed delay is added after the trigger, before the sensor reads the RF pulse power. This delay is factory set (or can be adjusted by changing a potentiometer setting on the Peak Sensor circuit board). It's nominal value is 500 ns and can be manually adjusted from 500 ns to 3 m.
Modifier Name:	**DLYTRIG**
Modifier Syntax:	**DLYTRIG**

Description: This verb ascribes attributes to a sensor. Such features as AC or DC detection and offsets are attributed to a given sensor by a command string beginning with this verb.

3.3.26 Sensor Short/Open Calibration Command Structure

SHORT

Syntax: **SHORT** *hs* Sensor Specifier *us* [modifier 1] **EOL** modifier 2 **EOL**

Example: **SHORT A;srq EOL OPEN EOL**

Sensor Specifiers: **A, B,** or **C**

Modifiers: This modifier requests that a service request be sent upon completion of the Sensor short calibration. **When the short calibration is complete the OPEN CALIBRATION modifier MUST be sent**.

Modifiers name: **FB, NB**

Modifier Syntax 1: **Full Band, Narrow Band**

Modifier name: **SRQ**

Modifier Syntax 2: **SRQ**

If the SRQ modifier is received the 8003 will initiate the SHORT CALIBRATION upon the specified Sensor. When completed, the event complete bit will be set in the external status register and the service request and the external status bits will be set in the instrument status byte.

Modifier Description: This modifier initiates the second part of the SHORT/OPEN CALIBRATION.

Modifier name: **OPEN**

Modifier Syntax: **OPEN EOL**

Description: This verb defines and initiate a Sensor Short/Open Calibration. This is a very special operation. The Frequency Response Correction Using Path Calibration discussion starting on section 2.8.2.2 of the OPERATION chapter should be consulted for a complete description. It should be noted that after the short calibration is completed the 8003 expects an OPEN verb to be sent so that the calibration can be completed.

3.3.27 Swept Measurement Command Structure

SWP, SWP?

Current Swept Measurements:

Swept power measurements are defined by a command string beginning with SWP. The addition of the question mark affixed to the end of the SWP verb is a query flag. This is used if the Swept data measured on the specified channel is to be captured and returned to the host controller when the instrument is next talked addressed. The return value is defined as follows:

data(freq 1),data(freq 2),......,data(freq n)EOL

where:

freq 1 = start frequency
freq n = stop frequency
freq 2 = freq 1 + 2 *(freq 2 - freq 1)/(items-1)
items = an integer from 1 to 512 defined by the ITEMS modifier.

where a data item, data(freq x), is returned in the fixed form of ±ddd.dd. The assumed units for the data items is dBm if in absolute measurement mode or dB if in relative measurement mode. The data returned represents the next full sweep (or n full sweeps if an averaging factor of n is chosen). The Output command can capture and return data (see the related verb OUTPUT section 3.3.19 for more information.) If the channel is making a CW measurement and the data returned represents the measured data point, the format is dataEOL.

Current Swept Measurement Syntax:

SWP[?] *hs* Channel Specifier [*ds* Sensor Specifier] *us* [modifiers]..[modifiers]

Current Swept Measurement Specifiers:

Channel specifiers:	**1, 2, 3,** and **4**
Sensor Specifiers:	**A, B, C, A/B, A/C, B/A, B/C, C/A,** and **C/B**

Current Swept Measurement Modifiers:

Modifier Description:	This modifier defines an average factor for the measurement.
Modifier name:	**AVERAGE, AVG**
Modifier Syntax 1:	**AVG** *ds* numerical value or state
valid numerical values:	1, 2, 4, 8, 16, 32, 64, 128, 256
assumed units:	no units
Modifier Syntax 2:	**AVG** *hs* state
State definition:	**ON, +, OFF, -, RESET, RS**
Modifier Description:	This modifier defines the measurement to be made in absolute power (dBm) units with the appropriate Cal Factors applied.

If a non-valid numerical value is used, the valid value closest to the entered value is used.

Modifier name:	**MEAS, M, ABS**
Modifier Syntax:	**MEAS**
Modifier Description:	This modifier defines the measurement to be made in relative units (meas data - path cal).
Modifier name:	**NORM, N, -PC**
Modifier Syntax:	**NORM**
Modifier Description:	This modifier sets the scale factor used for the CRT graphical swept data display.
Modifier name:	**SCALE, SC**
Modifier Syntax 1:	**SC** *ds* state
State definition:	**+CA** = continuous auto scale on
	-CA = continuous auto scale off
	AUTO = auto scale ONCE
Modifier Syntax 2:	**SC** *ds* numerical value
valid numerical values:	0.1, 0.2, .05, 1.0, 2.0, 5.0, 10, 20
Modifier Description:	This modifier defines the reference position for the measured trace for the 8003 CRT graphic display.
Modifier name:	**REF_POS, RP**
Modifier Syntax:	**RP** *ds* numerical value
valid numerical value:	-4 = bottom of screen -3 = next graticule up -2 = next graticule up -1 = next graticule up 0 = center graticule +1 = next graticule up +2 = next graticule up +3 = next graticule up +4 = top of screen

All other non-valid numerical values force the setting to center screen.

Modifier Description:	This modifier sets the value of the reference level
Modifier name:	**REF_LEV, RL**
Modifier Syntax:	**RL** *ds* numerical value
numerical value range:	-90 to +90
assumed units:	dBm or db
Modifier Description:	This modifier turns on a specified channel which is to make the swept measurement.
Modifier name:	**ON, +**
Modifier Syntax:	**ON**
Modifier Description:	This modifier turns off a specified channel which is to make the SWEPT measurement.
Modifier name:	**OFF, -**
Modifier Syntax:	**OFF**
Modifier Description:	This modifier is to request that a service request be sent upon completion of the SWEPT measurement defined for this channel.
Modifier name:	**SRQ**
Modifier Syntax:	**SRQ**

Once the SRQ modifier is received, the 8003 will make the measurement specified for this channel. If the number of averages defined for this channel has been satisfied, the event complete bit is set in the external status register and the service request and the external status bits are set in the instrument status byte.

☛ ***NOTE:*** *This SRQ is used with Query Flag only.*

Modifier Description:	This modifier defines the number of data items to be returned when the measured data is requested for output to the host computer.
Modifier name:	**ITEMS**
Modifier Syntax:	**ITEMS** *ds* numerical value
valid numerical values:	1 to 512
assumed units:	no units
Modifier Description:	The following modifiers define and control the markers on the trace. As from the front panel, 10 markers (numbered 0 through 9) can be defined. A marker must be defined (its frequency set) before it can be used. Once a marker is defined for any channel, it will appear on all active channels at the defined frequency.

Modifier name:	**MARKER**
Modifier Syntax:	**MARKER** *hs* numerical value [*us* state]
valid numerical values:	0 through 9, all
assumed units:	no units (these are marker numbers)
State Syntax:	**ON, OFF, CLEAR** (turns marker on, off, or clears marker)
Modifier name:	**DEF_MKR**
Modifier Syntax:	**DEF_MKR** hs numerical value [*us* frequency f]
valid numerical values:	0 through 9
assumed units:	no units
Frequency Syntax 1:	**FREQ** hs frequency (User defined marker frequency)
valid frequency values:	0 to 99999
assumed units:	MHz
Frequency Syntax 2:	**CURSFREQ** (Assigns the current cursor frequency to the marker)
Modifier Examples:	**SWP 1;DEF_MKR 2;FREQ 3500** Defines Marker 2 on channel 1 at frequency 3500 MHz **SWP 4;DEF_MKR 9;CURSFREQ** Defines Marker 9 on channel 4 at the current cursor frequency **SWP 2;MARKER 3;ON** Turn on Marker 3 **SWP 1;MARKER ALL;OFF** Turn off all markers **SWP 3;MARKER 8;CLEAR** Clear marker 8 (turn off and clear frequency assignment)
Modifier Description:	These modifiers are used to perform an OPEN/SHORT bridge calibration with trace memories instead of path cal memories. The operator should connect a SHORT to the bridge before the system executes the STORE_SHORT modifier. The operator should then connect the OPEN to the bridge and the system should execute only the STORE_OPEN modifier by itself. The SRQ service request is optionally used to tell the controller when the analyzer has finished each operation. Do not send the verb SWP n; before the STORE_OPEN modifier (see examples next page).

Modifier name:	**STORE_SHORT**
Modifier Syntax:	**STORE_SHORT** *hs* numerical value [*us* SRQ]
valid numerical values:	0 through 9
assumed units:	no units (these are trace memory numbers)
Modifier name:	**STORE_OPEN**
Modifier Syntax:	**STORE_OPEN** [*us* SRQ]
Modifier Examples:	**SWP 2;STORE_SHORT 8;SRQ** Take the current trace on channel 2 and store it in trace memory 8. Assert SRQ when done. **STORE_OPEN;SRQ** This should be sent to the analyzer as a string just by itself once the operator has connected the OPEN to the bridge. The analyzer then takes the current trace, averages it with the previously stored trace, and stores it in trace memory 8. Asserts SRQ when done.
Modifier Description:	The **SMOOTH** modifier activates the trace smoothing function.
Modifier name:	**SMOOTH**
Modifier Syntax:	**SMOOTH** hs numerical value or state
valid numerical values:	0.1 to 20.0
assumed units:	percent of trace, resolution in tenths
state definition:	**ON, OFF**
Modifier Example:	**SWP 3;SMOOTH 0.5;SMOOTH ON** Defines smoothing at 0.5% of full trace, turns smoothing on
Modifier Description:	The **LIMIT** modifier allows GPIB definition of limit lines. Limit lines are defined for each channel. Each limit line consists of a point, a flat line segment, a sloped line segment or multiple combinations of the three. The **LIMIT** modifier has two syntaxes. The first turns entire limit lines on or off. The second defines limit lines. See page 2-31 of the DISPLAY key discussion in the Front Panel Functional Description section for a more detailed description of limit lines.

☛ ***NOTE:*** Please see the **LIMIT** modifier of the **OUTPUT** command at the top of page 3-31 for a description of reading PASS/FAIL indications from limit lines.

Modifier name:	**LIMIT**
Modifier Syntax 1:	**LIMIT** *hs* state
state definition:	**ON, OFF** turns off entire limit line for the specified channel.
Modifier Syntax 2:	**LIMIT** *hs* numerical value or **ALL** modifier
valid numerical values:	1 to 12 corresponding to segment numbers
Limit Modifier 1:	**CLEAR** clears segment n (or all) for active channel's limit lines
Modifier Syntax:	**CLEAR**
Limit Modifier 2:	**POINT** defines a point limit
Modifier Syntax:	**POINT *hs* f1 *ds* p1 *ds* p2**
Argument syntax:	see Limit Modifier 4, below
Limit Modifier 3:	**FLAT** defines a flat line segment limit
Modifier Syntax:	**FLAT *hs* f1 *ds* p *ds* p2 *ds* f2**
Argument syntax:	see Limit Modifier 4, below
Limit Modifier 4:	**SLOPE** defines a sloping line segment limit
Modifier Syntax:	**SLOPE *hs* f1 *ds* p1 *ds* p2 *ds* f2 *ds* p3 *ds* p4**
Argument syntax:	**f1** starting frequency in MHz **p1** upper limit in dB (starting limit) **p2** lower limit in dB (starting limit) **f2** ending frequency in MHz **p3** ending upper limit in dB **p4** ending lower limit in dB
Modifier Examples:	**SWP 1;LIMIT 1;POINT 2500,10.5,9.5** Defines a point limit line for channel 1 at 2500 MHz with 10.5 dB upper limit, and 9.5 dB lower limit **SWP 1;LIMIT ON** Turns on limit line defined above. **SWP 3;LIMIT 3;SLOPE 8000,0,-5,12000,5,-10** Defines a slope limit segment (third segment of the limit line) for channel 3. Line is defined from 8 GHz to 12 GHz. Upper segment goes from 0 dB at 8 GHz to 5 dB at 12 GHz. Lower segment goes from -5 to -10 dB. **SWP 3;LIMIT 3;CLEAR** Clears third segment of limit line on channel 3.

Current Swept Measurement Example:

SWP? 3;abs;avg 16;srq;items 200

Current Swept Measurement Related Commands:

OUTPUT
GRAPH
SWPF
SWPS

Swept Measurements To Be Stored:

The second trace form of the **SWP** command stores, displays, or clears TRACE data.

Stored Swept Measurement Syntax:

SWP *hs* Channel Specifier *us* Memory Trace Specifier *ds*

Stored Swept Measurement Syntax:

SWP *hs* Channel Specifier *us* Memory Trace Specifier *ds*

Stored Swept Measurement Specifiers:

Trace specifiers:	**TRACE n, -TRACE n, STORE_TRC n, CLEAR_TRC n**
valid n values:	0 through 9 (**ALL** is valid for **CLEAR_TRC**)
TRACE n:	Programs the specified channel to display memorized Trace n.
-TRACE n:	Programs the specified channel to be ratio'ed with Trace n.

☛ ***NOTE:*** *To deactivate ratioing with a trace, use the MEAS modifier. See MEAS modifier description on page 3-55 and the Trace Memory Programming example on page 3-61.*

STORE_TRC n:	Stores a swept measurement to memorized Trace n.
CLEAR_TRC n:	Clears a single measurement of all memorized traces.

Stored Swept Measurement Examples:

SWP 1;TRACE 4:

(makes channel 1 display memorized trace 4)

SWP 3;-TRACE 7:

(makes channel 3's measurement a ratio of sensor A to trace 7)

SWP 4;STORE_TRC 8:

(stores the swept measurement being made by channel 4 into trace memory number 8)

SWP 2; CLEAR_TRC ALL:

(clears all stored traces)

Stored Swept Measurement Related Commands

INPUT
OUTPUT

Trace Memory Programming Example

```
10   ! ************************************************************
20   ! PROGRAMMING EXAMPLE FOR TRACE MEMORY MANIPULATION
30   ! ************************************************************
40   !
50   OPTION BASE 1! All arrays start with index of 1
60   DIM Trace data(512)
70   !
80   ! First configure 8003 Analyzer
90   CLEAR 704 ! Device clear presets 8003
100  OUTPUT 704;SWP 1,A;on! Channel one displays sensor A power
110  OUTPUT 704;CHAN 2;off;CHAN 3;off;CHAN 4;off! turn off unused channels
120  !
130  ! Next configure the sweeper
140  OUTPUT 704;SWPF;start 8000;stop 12000;swpt 1000;level 0;level on
150  ! sweep from 8 GHz to 12 GHz, with 1 second sweep time, at 0 dBm
160  WAIT 5! Wait for sweeper to execute commands
170  !
180  ! Now scale analyzer for easy display
190  OUTPUT 704;SWP 1;scale .5;ref lev 0
200  !
210  ! ================================================================
220  ! Trace memory examples
230  !
240  ! First store channel 1 trace into trace memory 1
250  OUTPUT 704;SWP 1;store trc 1
260  !
270  ! Next subtract trace 1 from currently displayed trace (normalize)
280  OUTPUT 704;SWP 1;-trace 1
290  !
300  ! Display stored trace on channel 2
310  OUTPUT 704;SWP 2,A;on;trace 1
320  ! and scale channel 2
330  OUTPUT 704;SWP 2;scale .5;ref lev 0
340  WAIT 1! wait for analyzer to finish processing display
350  !
360  ! Now read trace into controller
370  OUTPUT 704;OUTPUT;trace 1
380  ENTER 704;Start freq,Stop freq,Trace data(*)
390  ! Note: output format is always start freq (MHz), stop freq (MHz), then
400      ! 512 data points of trace data in dB
410  !
420  ! Invert trace data as an example of user-manipulated trace data
430  MAT Trace data= (0)-Trace data
440  !
450  ! Now read trace back to different trace memory in analyzer
460  OUTPUT 704;INPUT;trace 2,Start freq,Stop freq,Trace data(*)
470  ! Note: input format follows above output format
480  !
490  ! And display user-manipulated trace on channel 3
500  OUTPUT 704;SWP 3,A;on;trace 2
510  ! and scale display
520  OUTPUT 704;SWP 3;scale .5;ref lev 0
530  !
540  ! To return channel 1 to measurement mode without trace memory
550  OUTPUT 704;SWP 1;meas
560  !
570  ! DEMONSTRATION OF OPEN/SHORT BRIDGE CALIBRATION USING TRACE MEMORIES
580  !
590  ! We will use SRQ interrupt to tell controller when calibration step
600  ! is done
610  Srq flag=0! Clear flag to indicate no SRQ received yet
620  ON INTR 7 GOSUB Trace srq
630  ENABLE INTR 7;2! Enable interrupts
```

```
640  !
650  OUTPUT 704;SWP 4,A;on! Use channel 4 for open/short demo
660  WAIT 4! Wait until channel 4 trace is updated
670  !
680  BEEP
690  INPUT Connect SHORT to bridge, press RETURN ... ,Key$
700  OUTPUT 704;SWP 4;store short 3;SRQ
710  WHILE Srq flag=0! infinite loop waits for srq from analyzer
720  END WHILE
730  !
740  Srq flag=0
750  BEEP
760  INPUT Connect OPEN to bridge, press RETURN ... ,Key$
770  OUTPUT 704;store open;SRQ
780  WHILE Srq flag=0
790  END WHILE
800  !
810  STOP
820  !
830  ! SRQ interrupt service routine
840  Trace srq:!
850  Srq flag=1! Set srq flag to indicate srq received
860  Status1=SPOLL(704)! Serial poll clears srq
870  ENABLE INTR 7;2! Re-enable interrupts
880  RETURN
890  END
```

Limit Line Programming Example

```
10   !**************************************************************
20   ! DEMONSTRATION OF LIMIT LINE PROGRAMMING
30   !**************************************************************
40   CLEAR 704 ! Device clear presets analyzer
50   !
60   ! First configure analyzer and sweeper
70   OUTPUT 704;SWP 1,A;on;CH 2;off;CH 3;off;CH 4;off
80   ! channel 1 on, all other channels off
90   OUTPUT 704;SWPF;start 2000;stop 4000;level 0;level on
100  ! Sweep from 2 to 4 GHz at 0 dBm
110  OUTPUT 704;SWP 1;scale 1;rp 0;rl 0! Manually scale channel 1
120  WAIT 4! Wait for sweeper to settle and make full trace update
130  !
140  !=============================================================
150  ! Limit line demonstration
160  OUTPUT 704;SWP 1;limit all;clear! clear previous limit lines
170  !
180  ! Set 3 segments, a slope segment, point segment, and flat segment
190  OUTPUT 704;SWP 1;limit 1;slope 2000,4,-4,3000,2,-2
200  OUTPUT 704;SWP 1;limit 2;point 3200,1,-1
210 OUTPUT 704;SWP 1;limit 3;flat 3400,2,-2,4000
220  !
230  ! Now, turn limit line on
240  OUTPUT 704;SWP 1;limit on
250  !
260  ! Read pass or fail status of limit line test
270  ! Analyzer returns string PASS or FAIL as result of test
280  OUTPUT 704;OUTPUT 1;limit
290  ENTER 704;Pass fail$
300  PRINT Limit line status = ;Pass fail$
310  END
```

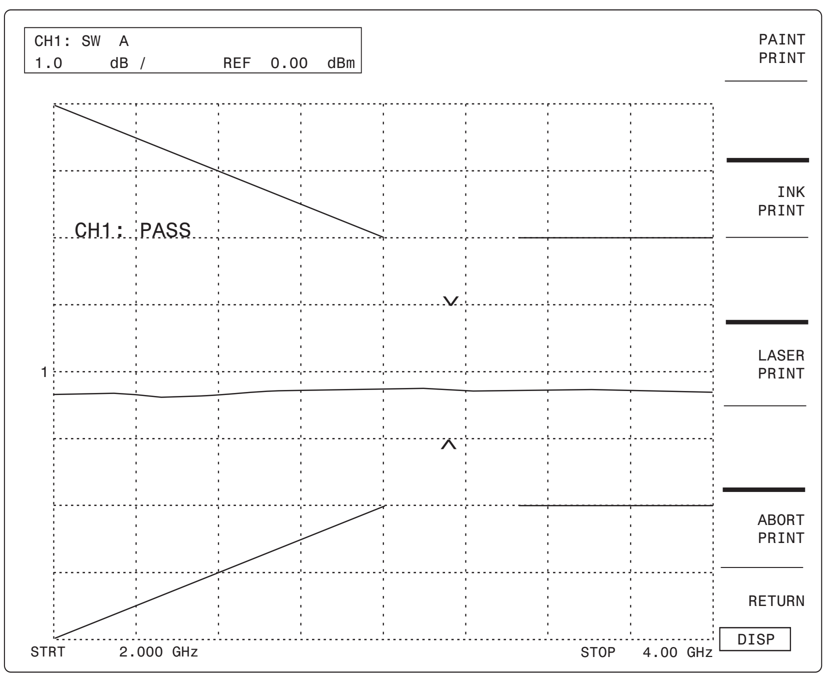


Figure 3-5: Limit Line Display Example

3.3.28 Start/Stop Swept Frequency Source Mode Def. Cmd. Structure

SWPF

Syntax:	**SWPF *us* [*us* modifier]..[*us* modifier]**
Modifiers:	This modifier defines a start frequency for the start/stop swept frequency mode of signal source. The query flag ('?') affixed to the start frequency modifier queries the value of the start frequency. If set, the next time the 8003 is talk-addressed it will output the value of the start frequency in MHZ. The format of the returned data is D.dddddd, where D is zero to 6 digits and the assumed units are MHZ

Modifier name:	**START, START?, FA, FA?**
Modifier Syntax:	**FA[?]** [*ds* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is 1 MHZ to 99 GHZ
Modifier Description:	This modifier defines a stop frequency for the start/stop swept frequency mode of signal source. The query flag ('?') affixed to the stop frequency modifier queries the value of the stop frequency. If set, the next time the 8003 is talk-addressed it will output the value of the stop frequency in MHz. The format of the returned data is D.dddddd, where D is zero to 6 digits and the assumed units are MHZ
Modifier name:	**STOP, STOP?, FB, FB?**
Modifier Syntax:	**FB[?]** [*hs* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported upon the 8003 private bus. If not supported then the range is 1 MHZ to 99 GHZ
Description:	This modifier defines a POWER LEVEL for the start/stop swept frequency mode of signal source. The query flag ('?') affixed to the power level modifier queries the value of the power level. If set, the next time the 8003 is talk-addressed it will output the value of the power level in dBm. The resolution is 0.01 dBm. The format of the returned data is ±D.dd, where D is zero to three digits and the assumed units are dBm
Modifier name:	**LEVEL, LEVEL?, PL, PL?**
Modifier Syntax 1:	**PL[?]** [*hs* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is -99 to +99 dBm.
Modifier Syntax 2:	**PL** *hs* on
State definition:	**OFF, ON**

Modifier Description: This modifier defines a SWEEP TIME for the start/stop swept frequency mode of signal source. The query flag ('?') affixed to the sweep time modifier queries the value of the sweep time. If set, the next time the 8003 is talk-addressed it will output the value of the sweep time in ms. The resolution is 1 ms. The format of the returned data is D, where D is two to five digits.

Modifier name: **SWPT, SWPT?, ST, ST?**

Modifier Syntax: **PL[?]** [*ds* numerical value]

numerical value range: Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is 99000 to 40 ms.

Modifier Description: The update modifier decouples analyzer frequency updates from sweeper frequency updates. This is most commonly used when the analyzer and sweeper are set to different frequencies, as in mixer or frequency multiplier measurements. The analyzer normally uses frequency information to change the operating frequencies of the sweeper, annotate x-axis of the swept display, apply correct Cal Factors to the reading, take the correct portions of trace memories and path cal memories, and fix cursors and markers. The update modifier allows independent control of the sweeper frequencies and all other frequency related analyzer functions. If the modifier UPD ON is included once with the SWPF, SWPS, or FIXED verbs, then all subsequent uses of those verbs will update the sweeper frequency along with the analyzer frequency. If the modifier UPD OFF is included once with the above verbs, then all subsequent uses of those verbs will change only analyzer frequency parameters.

Modifier name: **UPD**

Modifier syntax: **UPD** *hs* state

State definition: **ON, OFF**

Modifier Examples: Send the following commands to modify both sweeper and analyzer frequencies to 2000 to 4000 MHz.

SWPF;fa 2000;fb 10000;pl -10;st 500
SWPF;UPD ON
SWPF;START 2000;STOP 4000

Send the following commands to modify only the analyzer frequency to 6000 to 8000 MHz

SWPF;UPD OFF
SWPF;START 6000;STOP 8000

Related Command:

SWP

Description: This verb places the signal source mode to start/stop swept frequency. This is an instrument wide command and, as such, has no channel or sensor specifiers. However there are many parameters associated with the source mode. These are defined by the modifiers which follow the verb.

Update Command Programming Example

```
10   !*******************************************************************
20   ! DEMONSTRATION OF UPDate COMMAND:
110  !******************************************************************
120  !
130  CLEAR 704 ! device clear presets analyzer
140  WAIT 4
150  !
151  ! First, configure analyzer to display channel 1 only
160  OUTPUT 704;SWP 1, A;on;SWP 2,A;off;CHAN 3;off;CHAN 4;off
170  OUTPUT 704;SWP 1;scale .2;ref lev 10! manually scale display
200   WAIT 1
840  !...............................................................
850  ! Demonstration of UPDATE command
880  ! First send new setup to both analyzer and sweeper
890  OUTPUT 704;SWPF;UPD ON! Tells analyzer to update both sweeper
891      ! settings and analyzer displays
892  ! Set sweeper and analyzer to 2 to 4 GHz frequency sweep at +10 dBm
900  OUTPUT 704;SWPF;start 2000;stop 4000;level 10;level on
910  WAIT 2! wait for sweeper to update sweep
940  !
941  BEEP
942  INPUT Press RETURN to set analyzer at different frequency ... ,Key$
950  ! Now send analyzer to different start and stop frequency
960  OUTPUT 704;SWPF;UPD OFF! Do not update sweeper, update analyzer
961      ! frequency display only
970  OUTPUT 704;SWPF;start 6000;stop 8000
980  !
990  ! NOTE that the display changes slightly to reflect the new Cal Factors
1000 ! applied at the second set of frequencies
1360 END
```

3.3.29 Span Swept Frequency Source Mode Def. Cmd. Structure

SWPS

Syntax: **SWPS [*us* modifier]...[*us* modifier]**

Examples: (See page 3-66 in the SWPF command description for a complete programming example of the UPD modifier.)

Send the following commands to modify both sweeper and analyzer frequencies to 2000 to 4000 MHz.

SWPS;cf 15000;st 1000;span 500;pl 15.5
SWP;UPD ON
SWPF;START 2000;STOP 4000

Send the following commands to modify only the analyzer frequency to 6000 to 8000 MHz

SWPF;UPD OFF
SWPF;START 6000;STOP 8000

Related Command:

SWP

Modifiers: This modifier defines a center frequency for the center/span swept frequency mode of signal source. The query flag ('?') affixed to the center frequency modifier queries the value of the center frequency. If set, the next time the 8003 is talk-addressed it will output the value of the center frequency in MHZ. The format of the returned data is D.dddddd, where D is zero to 6 digits and the assumed units are MHz.

Modifier name:	**CF, CF?**
Modifier Syntax:	**CF[?]** [*hs* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is 1 MHZ to 99 GHZ
Modifier Description:	This modifier defines a span frequency for the center/span swept frequency mode of signal source. The query flag ('?') affixed to the span frequency modifier queries the value of the span frequency. If set, the next time the 8003 is talk-addressed it will output the value of the span frequency in MHZ. The format of the returned data is D.dddddd, where D is zero to 6 digits and the assumed units are MHZ.
Modifier name:	**SPAN, SPAN?**
Modifier Syntax:	**SPAN[?]** [*hs* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is 1 MHZ to 99 GHZ.
Modifier Description:	This modifier defines a POWER LEVEL for the start/stop swept frequency mode of signal source. The query flag ('?') affixed to the power level modifier queries the value of the power level. If set, the next time the 8003 is talk-addressed it will output the value of the power level in

	dBm. The resolution is 0.01 dBm. The format of the returned data is ±D.dd, where D is zero to three digits and the assumed units are dBm.
Modifier name:	**LEVEL, LEVEL?, PL, PL?**
Modifier Syntax 1:	**PL[?]** [*hs* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is -99 to +99 dBm.
Modifier Syntax 2:	**PL** *hs* on
State definition:	**OFF, ON**
Modifier Description:	This modifier defines a SWEEP TIME for the start/stop swept frequency mode of signal source. The query flag ('?') affixed to the sweep time modifier queries the value of the sweep time. If set, the next time the 8003 is talk-addressed it will output the value of the sweep time in ms. The resolution is 1 ms. The resolution is 1 ms. The format of the returned data is: D where D is two to five digits
Modifier name:	**SWPT, SWPT?, ST, ST?**
Modifier Syntax:	**PL[?]** [*hs* numerical value]
numerical value range:	Dependent upon the signal source if the source is supported on the 8003's private bus. If not supported then the range is 940 to 9000 ms.
Modifier Description:	The update modifier decouples analyzer frequency updates from sweeper frequency updates. This is most commonly used when the analyzer and sweeper are set to different frequencies, as in mixer or frequency multiplier measurements. The analyzer normally uses frequency information to change the operating frequencies of the sweeper, annotate the x-axis of the swept display, apply correct Cal Factors to the reading, take the correct portions of trace memories and path cal memories, and fix cursors and markers. The update modifier allows independent control of the sweeper frequencies and all other frequency related analyzer functions. If the modifier UPD ON is included once with the SWPF, SWPS, or FIXED verbs, then all subsequent uses of those verbs will update the sweeper frequency along with the analyzer frequency. If the modifier UPD OFF is included once with the above verbs, then all subsequent uses of those verbs will change only analyzer frequency parameters.
Modifier name:	**UPD**
Modifier syntax:	**UPD** *hs* state
State definition:	**ON, OFF**

Description: This verb places the signal source mode to center/span swept frequency. This is an instrument wide command and, as such, has no channel or sensor specifiers. However there are many parameters associated with the source mode. These are defined by the modifiers which follow the verb.

3.3.30 Sensor Path Calibration Command Structure

THRU, PATH

Syntax: **THRU** *hs* Sensor Specifier [*us* modifier] **EOL**

Example: **PATH A;srq EOL**

Specifiers: **A, B,** or **C**

Modifiers: This modifier is to request that a service request be sent upon completion of the Sensor Path Calibration.

Modifiers name:	**Full Band, Narrow Band**
Modifier Syntax 1:	**FB, NB**
Modifier name:	**SRQ**
Modifier Syntax 2:	**SRQ**

If the SRQ modifier is received, the 8003 will path calibrate the specified sensor. When the calibration is complete, the event complete bit will be set in the external status register and the service request and the external status bits will be set in the instrument status byte.

Description: This verb defines and initiates a Sensor Path Calibration.

3.3.31 Sensor Zeroing Command Structure

ZERO

Syntax: **CAL** *hs* Sensor Specifier [*us* modifier] **EOL**

Example: **ZERO B EOL**

Specifiers: **A, B,** or **C**

Modifiers: This modifier is to request that a service request be sent upon completion of the Sensor Zeroing.

Modifier name: **SRQ**

Modifier Syntax: **SRQ**

If the SRQ modifier is received the 8003 will zero the specified sensor. When the zeroing is complete, the event complete bit will be set in the external status register and the service request and the external status bits will be set in the instrument status byte.

Description: This verb defines and initiates Sensor Zeroing.

3.3.32 STATUS MESSAGES

3.3.32.1 488.2 Status Byte

The 8003 supports the IEEE 488.2 1988 definition of the STATUS BYTE. This status message is returned in response to a serial poll. The status message is coded as follows:

most significant bit(7):	not used
bit(6):	request service
bit(5):	External status register has message
bit(4):	not used
bit(3):	not used
bit(2):	not used
bit(1):	not used
bit(0):	not used

Whenever the value of bit 6 is true, the 8003 is requesting service. This will generate a service request message (SRQ TRUE) on the bus. The reason for the service request is always coded into the external status message. Therefore, the value of bit 5 will also be true. To discover the meaning of the service request the host computer must read the external status register. Reading the status byte via a serial poll will clear the status byte.

3.3.32.2 488.2 External Status

The 8003 supports the IEEE 488.2 1988 definition of the External Status Register. This status message is returned in response to an external status register query. The command for this is *ESR? and is defined as a command verb. Please see the Common Structure in Section 3.3.1 for a more detailed description of VERB. The status message is coded as follows:

most significant bit(15):	not used
bit(14):	not used
bit(13):	not used
bit(12):	not used
bit(11):	not used
bit(10):	not used
bit(9):	not used
bit(8):	not used
bit(7):	Power on flag
bit(6):	not used
bit(5):	Command error (Syntax error)
bit(4):	Execution error (operation error)
bit(3):	not used
bit(2):	Sampling Sensor Temperature Flag. This bit indicates that the Peak Power Sensor (when used with the instrument) has changed temperature by more than ±5 °C since its last calibration, and should be recalibrated for maximum accuracy. The indication will be returned as 0 if the temperature is within range, or as 1 if out of range.
bit(1):	not used
bit(0):	Operation complete (Data ready flag/calibration complete)

To read the external status register, the host computer first sends the *ESR? VERB and then talk addresses the 8003. After the register has been read, it is cleared.

3.3.33 GPIB/PRIVATE Interface

Programming commands, controller command bytes, various data, and SRQs can be passed through the 8003 from the controller to instruments connected to the 8003's GPIB/PRIVATE interface port, located on the rear panel. This is accomplished by first sending the pass through command **PT d,** where **d** is the decimal address of the GPIB/SYSTEM interface. Subsequent addressing of the GPIB/SYSTEM interface will pass through commands to the selected device. The **PT d** command can be sent at any time. The default addresses for pass through commands are as follows:

8003 GPIB/SYSTEM Interface:	4 decimal
Source:	20 decimal
Plotter:	05 decimal
Printer:	01 decimal

The next section explains how to pass through commands to instruments connected to the 8003 GPIB/ PRIVATE interface.

3.3.34 Pass Through Feature

The GPIB/PRIVATE rear panel connector is physically similar to the GPIB/SYSTEM interface port, but it is used specifically to control all compatible sources, plotters, and printers that are being used in the setup.

The transfer of commands and data is performed by first sending a Pass Through command **PT d** to the 8003, where **d** is the decimal address of the desired device. Subsequent addressing of the GPIB/PRIVATE interface will pass through commands to the selected instrument.

The address of the GPIB/PRIVATE interface is determined by complementing the least significant bit of the current 8003 address. For example, since the 8003 default address is 4 decimal = 0100 binary, the default GPIB/PRIVATE address is 5 decimal = 0101 binary. As another example, if the 8003 address were set to 7 decimal = 111 binary, the GPIB/PRIVATE address would become 6 decimal = 110 binary.

An example of how to pass through commands to the source with address 20 using the 8003 default address (4 decimal) is:

1. Address device 4 (the GPIB/SYSTEM interface on the 8003) and send the command **PT 20**.
2. Address device 5 (the GPIB/PRIVATE interface) and send commands to the source.
3. Address device 4. This returns the 8003 to its normal GPIB/SYSTEM operation.

An example of how to pass through commands to the plotter with address 05 decimal using the 8003 default address (4 decimal) is:

1. Address device 4 (the GPIB/SYSTEM interface) and send the command **PT 05**.
2. Address device 5 (the GPIB/PRIVATE interface) and send commands to the plotter.
3. Address device 4. This returns the 8003 to its normal GPIB/SYSTEM operation.

4

Performance Test & Calibration

4.1 General

Information is this section is useful for periodic evaluation of the 8003 Precision Scalar Analyzer and its power sensors. These tests can also be used for incoming inspection testing when the instrument is first received, if required.

If the 8003 has not previously been used, this manual should be reviewed to ensure that the instructions covering power requirements (Chapter 1) and GPIB address selection (Chapter 2), for example, have been complied with before the instrument is turned on. Prior to starting the following procedures, the instrument should be allowed to warm up for at least 30 minutes to assure maximum stability during testing.

The Specification Test for the Calibrator Output Power Reference Level given in this section is valid for an ambient temperature range between +15°C and +35°C (+59°F to +95°F).

The instrument plus power sensor linearity test is valid when the sensor has been calibrated using the front panel calibrator at a temperature between 0°C and +50°C (+32°F to +122°F), and if operating within ±5°C (±9°F) of that calibration temperature.

It is recommended that the verification be done in the order described since some of the steps use the configuration from a previous step.

As an aid to executing the steps presented, keystroke sequences used on the 8003 are shown in the outer column of the page. Also, as in the preceding chapters, a distinction is made between the front panel "hardkeys" and the CRT adjacent "softkeys". The "hardkeys" are shown in **BOLD**, for example, **[CONFIG]**, and the softkeys are shown in *ITALICS*, for example, *[SENSORSAC/DC]*.

For information on how to calibrate the 8003 refer to Chapter M2, Maintenance, in the 8003 Maintenance Manual (P/N 20791-001).

Table 4-1: Test Equipment Required

Description	Representative Key	Key Characteristics
Microwave Sweeper	Giga-tronics 12720A	8003 Supported
Oscilloscope	Tektronix 2235	BW = > 100 kHz; Sens = > 2V/DIV
CW Thermistor Power Meter	HP 432A	V_{RF} and V_{COMP} available externally
Thermistor Mount	HP 478A-H75	≤1.07 VSWR @ 50 MHz (30 dB return loss) Accuracy ±0.5% @ 50 MHz
Digital Voltmeter (DVM)	Fluke 8842A	±0.05% accuracy & 1 mV resolution
Directional Coupler, 10 dB	Mini Circuits ZFDC-10-1 10 dB	≤1.15 SWR @ 50 MHz
Step Attenuator, 0 to 90 dB	Weinshel Model AC 118A-90-33	≤1.15 SWR @ 50 MHz±0.1 dB attenuation
RF Source (Signal Generator) (High Power)	Wavetek Model 2405 Option XP	+22 dBm @ 50 MHz
Low Pass Filter	Integrated Microwave Model 904 881	> 30 dB attenuation @ 100 MHz
GPIB Controller	IBM PC	National GPIB Card or equivalent
Printer	HP LaserJet Series II	RS-232 Interface & Command Set
High Resolution Color Display Monitor (Required 60 Hz Field Rate for 8003 Option 02 only)	NEC Multisync	31 kHz Line Rate 60 Hz Field Rate RGB Input

☛ ***NOTE:*** *Performance Verification Test Data Recording sheets are located starting on page 4-14. These sheets can be copied, and the copies used for recording test results each time that specification and performance verification testing is performed on this instrument.*

4.2 Calibrator Verification Procedure

If any of the instrument performance characteristics are not within specifications, refer the problem to Giga-tronics Customer Service.

4.2.1 Calibrator Output Power Reference Level

This test determines if the Calibrator Output Power Reference Level given in this section is valid for an ambient temperature range between +5°C and +35°C (+41°F to +95°F).

The Calibrator Output power reference is factory adjusted to 1 mW ±0.7%. To achieve this accuracy, Giga-tronics uses a precision measurement system with accuracy to ±0.5% (traceable to the NIST - formerly the NBS), and allows for a transfer error of ±0.2% for a total of ±0.7%. If an equivalent measurement system is used for verification, the power reference oscillator output can be verified to 1 mW ±1.9% (±1.2% accuracy, ±0.5% verification system error, ±0.2% transfer error, for a maximum error of ±1.9%). To ensure maximum accuracy in verifying the Calibrator Output power reference, the following procedure provides step-by-step instructions for using specified test instruments of known capability. If equivalent test instruments are substituted, refer to the Key Characteristics section in Table 4-1.

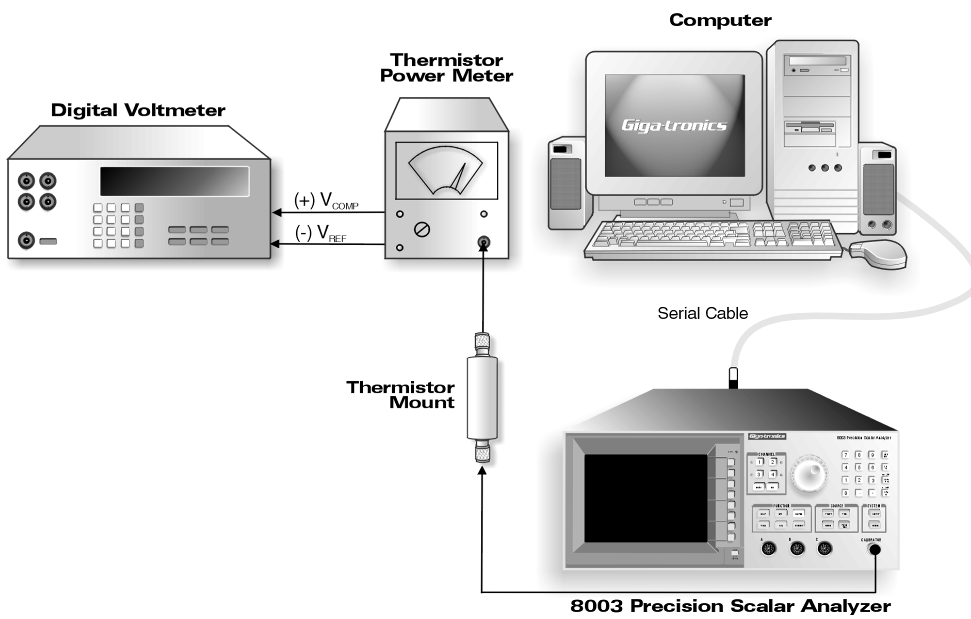


Figure 4-1: Calibrator Output Test Setup

4.2.1.1 Procedure

In the following steps, thermistor power measurements will be made using the 432A Power Meter. For detailed information on using the 432A, please refer to the operating section on the 432A manual.

1. Connect the 432A to the Calibrator Output on the 8003 as shown in Figure 4-1.

2. Turn on all equipment and then wait 30 minutes for the thermistor mount to stabilize before proceeding to the next step.

3. Set the 432A RANGE switch to COARSE ZERO, and adjust the front panel COARSE ZERO control to obtain a zero (±2% F.S.) meter indication.

> ☛ ***NOTE**: Ensure that the DVM input leads are isolated from chassis ground when performing the next step.*

4. Set the DVM to a range that results in a resolution of 1 µV and connect the positive and negative input, respectively, to the V_{COMP} and V_{RF} connectors on the rear panel of the 432A.

5. Fine zero the 432A on the most sensitive range, then set the 432A range switch to 1 mW.

6. Record the DVM indication as V_0.

7. Turn ON the 8003 Calibrator RF power as follows:

   Press **[CONFIG]** [*SERVICE*] [*SET CAL*]

   In the "System" section of the front panel of the 8003 is a key *[SET CAL]* labeled **CONFIG**. Press this key and a menu will appear with a softkey labeled *SERVICE*. Press this key and another menu will appear with a softkey labeled *SET CAL*. Press *[SET CAL]*. Record the reading shown on the DVM as V_1.

> ☛ ***NOTE**: The V^1 reading must be taken within 15 seconds after pressing [SET CAL]. Otherwise, press the ABORT softkey and repeat Steps 6 and 7.*

8. Disconnect the DVM negative lead from the V_{RF} connector on the 432A, and reconnect it to the 432A chassis ground. Record the new indication observed on the DVM as V_{COMP}.

9. Press the *ABORT* softkey on the 8003.

10. Calculate the Calibrator Output level (P_{CAL}) using the following formula:

$$P_{CAL}(Watts) = \frac{2V_{COMP}\,(V_1 - V_0) + V_0^2 - V_1^2}{4R(Calibration\ Factor)}$$

   where:

   P_{CAL} = calibrator output power reference level
   V_{COMP}= previously recorded value in Step 8
   V_1= previously recorded value in Step 7
   V_0= previously recorded value in Step 6
   R= 200Ω (assuming HP478A-H75 mount)

   Calibration factor = value for the thermistor mount at 50 MHz (traceable to the NIST)

11. Verify that the P_{CAL} is within the following limits:

    1 mW ±0.019 mW (0.981 to 1.019 mW)

   For record purposes, the measured value of P_{CAL} can be entered on the Performance Verification Test Data Recording Sheet starting on page 4-14.

4.2.2 Calibrator Frequency Check

To measure the frequency of the calibrator:

1. Connect the frequency counter to the calibrator output connector.
2. Turn ON the calibrator according to the procedure given in Procedure Step 8 on the previous page.
3. Measure 49 to 51 MHz.
4. Set the calibrator frequency to 1.000 GHz (with Option 12 only).
5. Measure 999.5 MHz to 1.0005 GHz (with Option 12 only).
6. Turn the calibrator OFF.

4.3 Performance Verification Tests

Information in this section is useful for periodic evaluation of the 8003 and its power sensors. These tests can also be used for incoming inspection testing when the instrument is first received, if required.

If the 8003 has not previously been used, review the precautions in Section 1.2.1 of the manual before the instrument is turned on. Prior to starting the following procedures, the instrument should be allowed to warm up for at least 24 hours to assure maximum stability during testing.

The instrument plus power sensor linearity test is valid when the sensor has been calibrated using the front panel calibrator at a temperature between 0°C and +50°C (+32°F to +122°F), and if operating within ±5°C (±9°F) of that calibration temperature.

It is recommended that the verification be done in the order described since some of the steps use the configuration from a previous step.

4.3.1 Equipment Required

See Table 4-1 for a list of the equipment required for performance testing of the 8003 Precision Scalar Analyzer.

Performance Verification Test Data Recording sheets are located on pages 4-14 thru 4-17. These sheets can be copied used for recording test results each time specifications and performance verification testing is performed on the specific instrument described by this manual.

4.3.2 Instrument Plus Power Sensor Linearity

4.3.2.1 Test Description

Connect the test setup as shown in Figure 4-2. The linearity will be tested over the range +20 dBm to -60 dBm (CW Mode) and +20 dBm to -50 dBm (Swept Mode). At low power levels, the linearity measurement will include the uncertainty due to the zero set specification. The procedure should be repeated for each sensor used with the 8003.

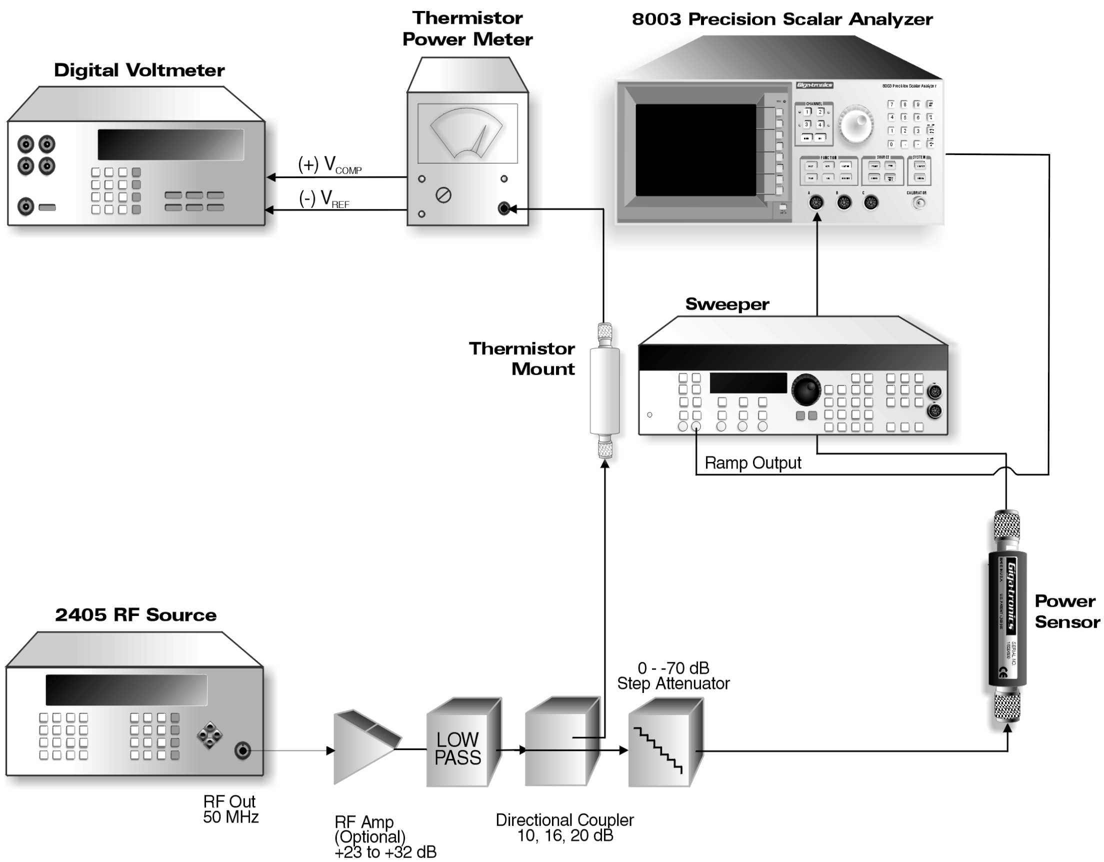


Figure 4-2: Power Linearity Test Setup

When measuring the linearity of a low VSWR (8031XA Series) or a high power sensor (8032XA Series) sensor, the power output of the source as well as the directional coupler coupling factor, must be increased from 10 dB to either 16 or 20 dB respectively (see Figure 4-2). The power coefficient of the step attenuator will also have to be considered. The specification of power coefficient for the Weinschel attenuator cited in the Equipment List is: <0.005 dB/(dB/W). The latter will affect the linearity of each 10 dB segment, and make it necessary to expand the overall linearity specification by this quantity.

In assembling the test setup shown in Figure 4-2, keep in mind that if testing is to be conducted with Low VSWR or High Power sensors, the optional RF Amplifier must have frequency and bandwidth parameters to match the sensor's characteristics (see the Sensor Selection Guide in Appendix A, if unsure of characteristics), and the Directional Coupler must be increased as stated above for the particular series of sensors. All Standard (8030XA Series) and True RMS (8033XA Series) sensors are tested with a 10 dB Directional Coupler and without the optional RF amplifier, and with a 10 dB Directional Coupler.

Refer to the CW Linearity Data and the Swept Linearity Data sections of the 8003 Performance Verification Test Data Sheets located on pages 4-14 through 4-17. These sections facilitate the collection of data for the CW and Swept power linearity tests. The tolerance is already entered for the various steps, and includes an allowance for specified zero set errors at low power levels.

☛ ***NOTE:*** *To ensure accurate and repeatable measurements, the 432A power meter should be zeroed just before taking each reading that will be used to calculate P1 in the Power Meter column of the Performance Verification Test Data Sheets on pages 4-14 through 4-17.*

4.3.2.2 Setup Parameters

The following setup parameters should be accomplished prior to performing the Power Linearity test:

1. The 8003 and sensor should be calibrated.
2. The 8003 is placed in the CW mode by pressing the **DEFINE** key and toggling the *CW/SWEPT* softkey if necessary.

   [DEFINE] *[CW]*
3. A "Readout" display is obtained by pressing the **DISPLAY** key and toggling the *GRAPH/READOUT* softkey as required.

   [DISPLAY] *[READOUT1]*
4. Set the 8003 to display linear units of power (mW) by pressing the **DISPLAY** key and selecting the appropriate *UNITS* soft-key labels.

   [DISPLAY] *[UNITS]*
   [LINEAR]
5. The CW Averaging is set to 4 by entering the key sequence shown to the left.

   [DISPLAY] *[AVG]* [4]
   [ENTER]*[AVG ON]*

4.3.2.3 Test Procedure

[CAL] *[ZERO SENSOR]*
[SENSOR A/B/C ZERO]

Extreme care is required in the following procedure since the accuracy requirements are critical to ensure the most accurate test results.

Power readings are determined using the thermistor power meter in the same general way as given in the Power Reference Level test. That is, P1 and P2 north Power Meter reading column of the Performance verification Test Data Sheet tables are calculated each time for the respective values of V_{COMP}, V_0, and V_1 read on the DVM.

1. Set the step attenuator to 70 dB. Turn the source power output off, and then zero the 8003.

   (The 8003 is zeroed by pressing **CAL** key located in the "Function" section on the front panel, and then following the softkey label instructions).

2. Set the step attenuator to 0 dB after the 8003 chimes to signal the completion of the zeroing process.

3. Set the power output of the RF source so that the thermistor power meter indicates 1.00 mW ±0.025 mW.

4. Record the calculated power meter reading and the displayed 8003 reading in the correct columns of the Linearity Data Recording sheet on page 4-14.

5. Set the power output of the RF source so that the thermistor power meter indicates 3.98 mW ±0.10 mW.

6. Record the new calculated power meter reading and the new displayed 8003 reading as in Step 4, above.

7. Set the power output of the RF Source so that the thermistor power meter indicates 5.01 mW ±0.10 mW.

8. Record the new calculated power meter reading and the new displayed 8003 reading as in Step 4, above.

9. Repeat using the power meter indications in the data sheet on page 4-15. Note that the Step Attenuator is used to generate the remaining 70 dB range of 10 dB steps for a total range of 80 dB. Repeat Step 1, above, between each 10 dB step shown on the Linearity Data Recording sheet.

10. Make the calculations indicated on the Linearity Data sheet, and enter the values in the appropriate blank spaces.

11. Repeat Steps 1 through 10 using the Swept Mode (1 second sweep), and record the results on the Swept Linearity Data sheet (page 4-16).

    [DEFINE] *[SWEPT]*

☛ ***NOTE:*** *In the Swept mode it is necessary to calculate the linear power from the dBm reading on the 8003. Also, be sure that the Start and End frequencies are set to 50 MHz.*

4.3.3 Serial Port Check

The following steps are used to confirm that the RS-232 port on the 8003 is functional. The following are the factory default settings for the communications parameters on the serial port of the 8003:

Baud Rate: **9600**
Parity: **N**
Data Bits: **8**
Stop Bits: **1**

If required, the 8003 can support baud rates of 1200, 2400 and 4800 by moving W8 on the Processor PC Board (A12).

1. Configure the 8003 to be in Graph Mode.

   [DISPLAY] *[GRAPH]*

2. Connect the RS-232 cable between the Serial Port on the rear of the 8003 and the Serial Port on the LaserJet printer.

   [DISPLAY] *[PLOT & PRINT]*

3. Print a graph.

   [PRINT] *[LASER PRINT]*

☛ ***NOTE:*** *Paint Print and Ink Print can only be executed over the GPIB.*

4.3.4 GPIB/System Port Check

The following steps confirm that the GPIB port is functional:

1. Set the 8003 to the desired address (the default is 4).

   [CONFIG] *[GPIB DEVICES]*
   [nn] [ENTER]

2. Connect the GPIB controller to the GPIB Port on the rear of the 8003.

3. Send the command (if emulating an HP 438):

   *IDN? or ?ID

   The verb is the standardized COMMON identify query command as defined by IEEE 488.2 1988. When talk addressed after receiving the command, the 8003 will output a string that identifies itself as the 8003 Scalar Network Analyzer.

   (*IDN? is the IEEE 488.2 Common ID query. When addressed to talk after receiving the command, the 8003 will output a string that identifies itself as 8003 Scalar Network Analyzer).

4. Display the response on the controller. For further information on using the 8003 through the GPIB, refer to Chapter 3.

4.3.5 GPIB/Private Port Check

1. Connect the 12720A GPIB port to the GPIB/Private Port on the rear of the 8003 (or one of the other supported sweepers listed in section B.3.3).

2. Determine the GPIB address of the 12720A. Press the CONFIG button located on the front panel. Press the GPIB softkey next to the GPIB display. Read the GPIB address on the GPIB Parameters Menu.

3. Enter the address obtained in Step 2 as the Source Address on the 8003.

   [CONFIG] *[GPIB DEVICES]*

   [SOURCE ADDRESS] **[nn]**

   [ENTER]

4. Check that the 8003 recognizes the sweeper by verifying that sweeper dependent softkey selections on the 8003 (such as “Power”) are NOT dark blue.

   [POWER] [Softkey labels are green or blue]

4.3.6 Sweep in Connector Check

1. Connect the Sweep Out connection from the sweeper to the Sweep In on the 8003.

2. Configure the 8003 to be in the Graph/Swept Mode.

   [DISPLAY] *[GRAPH]*

   [DEFINE] *[SWEPT]*

3. Select a swept time of 1 second.

   [SWEEP TIME] [1] [S]

4. Calibrate the Sweep Ramp.

   [CONFIG] *[CAL SWP RAMP]*

5. Display Channel and Autoscale.

   [CH 1] [SCALE] *[Autoscale]*

6. Disconnect, and then connect the BNC cable to the Sweep In connector on the 8003.

7. Observe that the trace is being swept only when the BNC cable is connected.

4.3.7 AC Mode Output Connector Check

The 8003 AC Modulation Output voltage default values are +5V (AC Modulation off), and a square wave switching between +5V and 0V (AC Modulation on), at a nominal 1kHz frequency. The 8003 can generate different voltages using values stored in an internal lookup table depending on the sweeper to which it is connected via the GPIB/Private port.

1. Connect the AC Mod Output to the Vertical input on the oscilloscope. Set the oscilloscope as follows:

Coupling:	**DC**
Volts/Div:	**2V /Div**
Time/Div:	**200 µs/Div**
Triggering:	**AC/Auto/Int**

2. Ground the oscilloscope input and center the trace.

3. Set the 8003 to the DC Mode of operation.

   [CONFIG] *[SENSORS AC/DC]*
   [ALL DC]

4. Select DC coupling on the oscilloscope, and check that it indicates a positive voltage of 5V.

5. Set the 8003 to the AC Mode of operation.

   [CONFIG] *[SENSORS AC/DC]*
   [ALL DC]

6. Check that the oscilloscope displays a square wave, repetition frequency between 500 Hz and 1.5 kHz, voltage between 0V and+5V.

4.3.8 Bias Output Connector Check

The following steps are used to confirm that the Bias Output Voltage connector is functional. These steps can be bypassed if it not intended to use this capability for applications such as supplying power to PIN diode attenuators.

☛ ***NOTE:*** *The Bias Voltage Output is channel dependent, and only on during the sweep time for each channel which has been configured by the user to output a bias voltage.*

In the following procedure it is recommended that the 8003 be set to display channel only, and that a sweep time of 1 second be set on the sweeper.

[CH 1] [CH 2] [OFF] [CH 3]

[OFF] [CH 4] [OFF] [SWEEP TIME] [1] [S]

1. Set the 8003 to be in the Graph/Swept Mode.

   [DISPLAY] *[GRAPH]* **[DEFINE]** *[SWEPT]*

2. Connect the Bias Output Voltage connector on the rear of the 8003 to the vertical input of the oscilloscope. Set the oscilloscope as follows:

Volts/Div:	**5V /Div**
Time/Div:	**200 μs/Div**
Triggering:	**AC/Auto/Int**

3. Ground the oscilloscope input and center the trace.

4. Select DC coupling on the oscilloscope.

5. Set the Bias Output Voltage on the 8003 to + 10V.

   [DEFINE] *[BIAS VOLTAGE]* **[1] [0] [S]**

6. Check that the trace on the oscilloscope moves up 2 divisions (+10V) from center screen during the sweep, and back to center (0V) on retrace.

7. Set the Bias Voltage Output on the 8003 to -10V.

   [DEFINE] *[BIAS VOLTAGE]* **[-] [1] [0] [S]**

8. Check that the trace on the oscilloscope moves down 2 divisions (-10V) from center screen during the sweep, and back to center (0V) on retrace.

4.3.9 DAC Output Connector Check

Not Presently Used.

4.3.10 RGB Video Output Connector Check

Connect the 8003 Op 02 RGB Video Output to the High Resolution Color Display Monitor and display a stable color picture that duplicates the display on the 8003.

4.3.11 SUMMARY

This completes the performance test and calibration tests for the 8003 Precision Scalar Analyzer and its sensors. If the instrument has performed as described in this chapter, it is correctly calibrated and within specifications.

If the instrument fails to meet any of the criteria defined in the tests, refer to the calibration and/or maintenance sections of the 8003 Maintenance Manual (P/N 20791-001).

GIGA-TRONICS 8003 Performance Verification Test Data Recording Sheet	
Date:	
Operator:	
Test Number:	(If required)
8003 S/N:	
Power Sensor S/N:	

Calibrator Output Power Reference		
Minimum	**Actual Reading**	**Maximum**
0.981 mW		1.019 mW

Linearity Data (+16 dBm to +20 dBm)

Step Attenuator Value	Power Set Point	Power Meter Reading (P)	8540 (DUT) Reading (R)	Reference Power Ratio	8540 (DUT) Reading Ratio	Linearity Error (%)[1]	
						Linearity Specification	Accumulated Linearity Error[2]
0 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	3.98 mW ±0.10 mW	P2 =	R2 =			±1%	Same as Lin. error above
0 dB	3.98 mW ±0.10 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	5.01 mW ±0.13 mW	P2 =	R2 =			+1% -1.6%	
0 dB	5.01 mW ±0.13 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	6.31 mW ±0.16 mW	P2 =	R2 =			+1% -2.7%	
0 dB	6.31 mW ±0.16 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	7.94 mW ±0.2 mW	P2 =	R2 =			+1% -3.8%	
0 dB	7.94 mW ±0.2 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10 mW ±0.25 mW	P2 =	R2 =			+1% -4.9%	
(continued)							

+16 dBm to -60 dBm Linearity Data is on the next page.

NOTES:

1. Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

CW Linearity Data - (+16 dBm to -60 dBm)							
Step Attenuator Value	**Power Set Point**	**Power Meter Reading (P)**	**8540 (DUT) Reading (R)**	**Reference Power Ratio**	**8540 (DUT) Reading Ratio**	**Linearity Error (%)[1]**	
						Linearity Specification	**Accumulated Linearity Error[2]**
0 dB						See Note 3	
						±1%	Same as Lin. error above
10 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
20 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
30 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
40 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
50 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1%	
60 dB (Increase avg. to 8)	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.5%	
70 dB (Increase avg. to 16)	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±6%	

NOTES:

1. Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.
3. Use the first CW Linearity error value entered in the +16 dBm to +20 dBm Linearity Data on page 4-14.

Swept Linearity Data (+16 dBm to +20 dBm)							
Step Attenuator Value	Power Set Point	Power Meter Reading (P)	8003 (DUT) Reading (R)	Reference Power Ratio	8003 (DUT) Reading Ratio	Linearity Error (%)[1]	
						Linearity Specification	Accumulated Linearity Error[2]
0 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	3.98 mW ±0.10 mW	P2 =	R2 =			±1%	Same as Lin. error above
0 dB	3.98 mW ±0.10 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	5.01 mW ±0.13 mW	P2 =	R2 =			+1% -1.6%	
0 dB	5.01 mW ±0.13 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	6.31 mW ±0.16 mW	P2 =	R2 =			+1% -2.7%	
0 dB	6.31 mW ±0.16 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	7.94 mW ±0.2 mW	P2 =	R2 =			+1% -3.8%	
0 dB	7.94 mW ±0.2 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10 mW ±0.25 mW	P2 =	R2 =			+1% -4.9%	
(continued)							

+16 dBm to -50 dBm Swept Linearity Data is on the next page.

NOTES:

1. Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

Swept Linearity Data - (+16 dBm to -50 dBm)							
Step Attenuator Value	**Power Set Point**	**Power Meter Reading (P)**	**8540 (DUT) Reading (R)**	**Reference Power Ratio**	**8540 (DUT) Reading Ratio**	**Linearity Error (%)[1]**	
						Linearity Specification	**Accumulated Linearity Error[2]**
0 dB						See Note 3	
						±1.4%	Same as Lin. error above
10 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.4%	
20 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.4%	
30 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.4%	
40 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±1.5%	
50 dB	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±2.4%	
60 dB (Increase avg. to 8)	1.00 mW ±0.025 mW	P1 =	R1 =	P1/P2 =	R1/R2 =		
	10.00 mW ±0.25 mW	P2 =	R2 =			±11.4%	

NOTES:

1. Linearity Error (%) = [(R1/R2) / (P1/P2) - 1] x 100
2. Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.
3. Use the first CW Linearity error value entered in the +16 dBm to +20 dBm Linearity Data on page 4-16.

A

Power Sensors

A.1 Introduction

This appendix contains the selection and specifications data for the Giga-tronics power sensors used with the 8003 Precision Scalar Analyzer.

Giga-tronics power sensors contain balanced zero-biased Schottky diodes for power sensing.

CAUTION

Input power in excess of +23 dBm (200 mW, which is the 100% average for standard and pulse sensors) can degrade or destroy these diodes. Diodes degraded or destroyed in this manner will not be replaced under warranty. Destructive signal levels are higher for high power, true rms, and low VSWR sensors. When connecting power sensors to other devices, do not turn the body of the sensor in order to tighten the RF connection. This can damage the connector mating surfaces.

A.2 Power Sensor Selection

Standard sensors include the 803XXA Series for CW signals, the 80500 Series CW Return Loss Bridges, and the 8033XA Series True RMS sensors.

Giga-tronics True RMS sensors are recommended for applications such as measuring quadrature modulated signals, multi-tone receiver intermodulation distortion power, noise power, or the compression power of an amplifier. These sensors include a pad to attenuate the signal to the RMS region of the diode's response. This corresponds to the -70 dBm to -20 dBm linear operating region of Standard CW Sensors. The pad improves the input VSWR to $\leq$1.15 at 18 GHz.

High Power (1, 5, 25 & 50 Watt) and Low VSWR sensors are also available for use with the 8003. Table A-1 lists the Giga-tronics power sensors used with the 8003. Refer to applicable notes on page A-3.

A.2.1 Power Sensor Selection Charts

Table A-1: Power Sensor Selection Guide

Model	Freq. Range/ Power Range	Max. Power	Power Linearity[4] (Freq >8 GHz)	RF Conn	Lgth.	Dia.	Wgt	VSWR
CW Power Sensors								
200 mW Peak Power								
80301A	10 MHz to 18 GHz -70 to +20 dBm	+23 dBm (200 mW)	-70 to -20 dBm ±0.00 dB -20 to +20 dBm ±0.05 dB/10 dB	Type N(m) 50Ω	114.5 mm (4.5 in)	32 mm (1.25 in)	0.18 kg (0.4 lb)	1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.29:12.4 - 18 GHz
80302A	10 MHz to 18 GHz -70 to +20 dBm			APC-7 50Ω				
80303A	10 MHz to 26.5 GHz -70 to +20 dBm		-70 to +20 dBm ±0.00 dB -20 to +20 dBm ±0.1 dB/10dB	Type K(m)[1] 50Ω				1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.38:12.4 - 18 GHz 1.43:18 - 26.5 GHz 1.92:26.5 - 40 GHz
80304A	10 MHz to 40 GHz -70 to 0 dBm		-70 to -20 dBm ±0.00 dB -20 to 0 dBm ±0.2 dB/10 dB					
Low VSWR CW								
80310A	10 MHz to 18 GHz -64 to +26 dBm	+29 dBm (800 mW)	-64 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.05 dB/10 dB	Type K(m)[1] 50Ω	127mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5lb)	1.13:0.01 - 2 GHz 1.15:2 - 12 GHz 1.23:12 - 18 GHz 1.29:18 - 26.5 GHz 1.50:26.5 - 40 GHz
80313A	10 MHz to 26.5 GHz -64 to +26 dBm		-64 to -14 dBm ±0.00 dB -14 to + 26 dBm ±0.1 dB/10 dB					
80314A	10 MHz to 40 GHz -64 to +6 dBm		-64 to -14 dBm ±0.00 dB -14 to + 6 dBm ±0.2 dB/10 dB					
1W CW								
80320A	10 MHz to 18 GHz -60 to +30 dBm	+30 dBm (1 W)	-60 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.05 dB/10 dB	Type K(m)[1] 50Ω	127 mm (5.0 in)	32 mm (1.25 in)	0.23 kg (0.5 lb)	1.11:0.01 - 2 GHz 1.12:2 - 12 GHz 1.18:12 - 18 GHz 1.22:18 - 26.5 GHz 1.36:26.5 - 40 GHz
80323A	10 MHz to 26.5 GHz -60 to +30 dBm		-60 to -10 dBm ±0.00 dB -10 to +30 dBm ±0.1 dB/10 dB					
80324A	10 MHz to 40 GHz -60 to +10 dBm		-60 to -10 dBm ±0.00 dB -10 to +10 dBm ±0.2 dB/10 dB					
True RMS Sensors (f_m > 1.5 MHz) (-30 to +20 dBm)								
80330A 80333A 80334A	10 MHz to 18 GHz 10 MHZ to 26.5 GHz 10 MHz to 40 GHz	+33 dBm (2 W)	-30 to +20 dBm ±0.00 dB	Type K(m)[1] 50Ω	152.5 mm (6.0 in)	32 mm 1.25 in)	0.27 kg (0.6 lb)	1.12:0.01 - 12 GHz 1.15:12 - 18 GHz 1.18:18 - 26.5 GHz 1.29:26.5 - 40 GHz
Triggerable Pulse Peak Power Sensors (f_m > 1.5 MHz) (-30 to +20 dBm)								
80340A 80343A	50 MHz to 18 GHz -20 to +20 dBm (Trig.) -30 to +20 dBm (Free Run) 50MHz to 26.5 GHz	+23 dBm (200 mW)	±0.13 dB, 0 dBm to -30 dBm ±0.13 dBm, ±0.01 dB/dB from 0 dBm to +20 dBm	Type N(m)[1] 50Ω	146 mm (5.75 in)	37 mm (1.44 in)	0.3 kg (0.6lb)	1.12:0.01 - 2 GHz 1.22:2 - 12.4 GHz 1.37:12.4 - 18 GHz
80344A	50 MHz to 40 GHz -20 to 0 dBm (Trig.) -30 to 0 dBm (Free Run)		±0.13 dB, 0 dBm to -30 dBm	Type K(m)[1] 50Ω				1.50:18 - 26.5 GHz 1.92:26.5 - 40 GHz

See NOTES next page

Table A-2: Power Sensor Cal Uncertainties

Freq. (GHz)		Root Sum of Squares (RSS) Uncertainties (%)[3]					
Lower	Upper	80301A 80302A	80303A 80304A	80310A 80313A 80314A	80320A 80323A 80324A	80321A[4]	80330A 80333A 80334A
Min	1	1.04	1.64	1.58	1.58	4.54	1.58
1	2	1.20	1.73	1.73	1.73	4.67	1.73
2	4	1.33	1.93	1.91	1.91	4.89	1.90
3	6	1.41	2.03	2.02	2.01	5.01	2.01
6	8	1.52	2.08	2.07	2.06	5.12	2.06
8	12.4	1.92	2.55	2.54	2.53	5.56	2.53
12.4	18	2.11	2.83	2.80	2.79	5.89	2.78
18	26.5	——	3.63	3.68	3.62	——	3.59
26.5	40	——	6.05	5.54	5.39	——	5.30

See NOTES below

NOTES:

1. The K connector is electrically and mechanically compatible with the APC-3.5 and SMA connectors. Use a Type N(m) to SMA(f) adapter (P/N 29835) for calibration of power sensors with Type K(m) connectors.
2. For frequencies above 8 GHz, add power linearity to system linearity.
3. Square root of sum of the individual uncertainties squared (RSS).
4. Cal Factor numbers allow for 3% repeatability when connecting attenuator to sensor, and 3% for attenuator measurement uncertainty and mismatch of sensor/pad combination.

A.2.2 Directional Bridges

The 80500 CW Directional Bridges are designed specifically for use with Giga-tronics power meters to measure the Return Loss/SWR of a test device. Each bridge includes an EEPROM which has been programmed with Identification Data for that bridge.

Table A-3: Directional Bridge Selection Guide

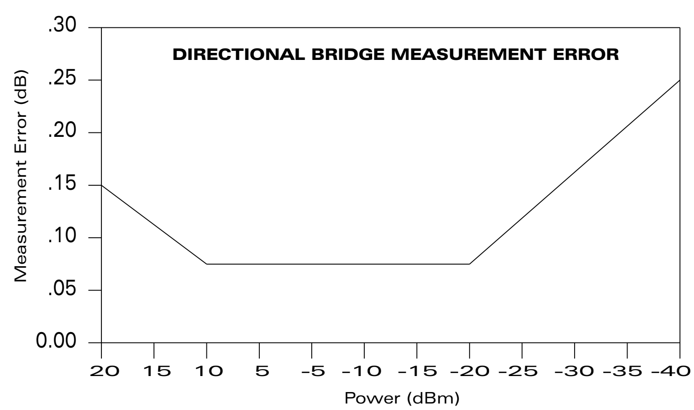
Bridge Selection Guide								
Model	**Freq. Range/ Power Range**	**Max. Power**	**Power Linearity[4] (Frequency >8 GHz)**	**Input**	**Test Port**	**Direct-tivity**	**Wgt**	**VSWR**
Precision CW Return Loss Bridges								
80501	10 MHz to 18 GHz -35 to +20 dBm	+27 dBm (0.5W)	-35 to +10 dBm ±0.1 dB +10 to +20 dBm ±0.1 dB ±0.005 dB/dB	Type N(f) 50 Ω	Type N(f) 50 Ω	38 dB	0.340 kg	<1.17:0.01 - 8 GHz <1.27:8 - 18 GHz
80502					APC-7(f) 50 Ω	40 dB		<1.13:0.01 - 8 GHz <1.22:8 - 18 GHz
80503	10 MHz to 26.5 GHz -35 to +20 dBm			SMA(f) 50 Ω	SMA(f) 50 Ω	35 dB		<1.22:0.01 - 18 GHz <1.27:8 - 26.5 GHz
80504	10 MHz to 40 GHz -35 to +20 dBm			Type K(f) 50 Ω	Type K(f) 50 Ω	30 dB	0.198 kg	<1.35:0.01 - 26.5 GHz <1.44:26.5 - 40 GHz

The Selection Guide in Table A-3 shows primary specifications. Additional specifications are:

Bridge Frequency Response: Return loss measurements using the 8003 can be frequency compensated using the standard *Open/Short* supplied with the bridge.

Insertion Loss: 6.5 dB, nominal, from input port to test port

Directional Bridge Linearity Plus Zero Set & Noise vs. Input Power: (50 MHz, 25°C ±5°C, 0 dBm Ref.) +27 dBm (0.5 W)



Weight: 80501: 340 g (12 oz)
80502: 340 g (12 oz)
80503: 198 g (7 oz)
80504: 198 g (7 oz)

Directional Bridge Accessories: An Open/Short is included for establishing the 0 dB return loss reference during path calibration.

Dimensions: 80501: 76 x 50 x 28 mm (3 x 2 x 1 1/8 in)
80502: 76 x 50 x 28 mm (3 x 2 x 1 1/8 in)
80503: 19 x 38 x 29 mm (3/4 x 1 1/2 x 2 1/8 in)
80504: 19 x 38 x 29 mm (3/4 x 1 1/2 x 2 1/8 in)

B

System Configuration

B.1 Introduction

This appendix contains the default function settings for the 8003, it also contains instructions for the proper connection of the most common test equipment and the initial printer installation directions for the 8003's ability to generate hardcopies of displayed data and/or plots. It is assumed that the user has read all manuals for other test equipment in the system, and has set up the test equipment properly.

B.2 8003 Default Parameters

Factory programmed settings of various user definable functions have the following defaults whenever there have been no changes made to the settings by the operator during any test routines. The default settings are given for the CURSOR, SENSOR, DISPLAY, CHANNEL and SOURCE component parameters.

Table B-1: 8003 Default Settings

	Function	Default Setting
CURSOR	Cross Cursor	OFF, frequency at 10000 MHz
	Delta Cursor	OFF
	Markers	OFF
	Active Channel	1
SENSOR	Sensor Mode	DC
	Sensor Specific for Source of Frequency	Back Panel SWP Input
	Sensor Frequency	0.05 GHz
	Sensor Cal Factor	0
	Sensor Offset	0
	Sensor Full Band	
	Path Cal Option	NO
DISPLAY	Setup	Swept Mode
	Color Intensity	RED, GREEN, BLUE are bright
	Graticule Color	GREEN
	Frequency Label	ON
	Title	OFF

Table B-1: 8003 Default Settings (Continued)

	Function	Default Setting
CHANNEL	Mode	Swept Frequency
	Parameter	A, B, C A/B for Channels 1 through 4
	Color	CYAN, RED, YELLOW, MAGENTA for channels 1 through 4 respectively dB Mode.
	Format	dB mode.
	Memorized Trace	0
	Measurement	Absolute Measurement
	Average	OFF, average factor = 8
	Smoothing	OFF, smooth apert = 5%
	Continue Auto Scale	OFF
	Scale per Division	20 dB
	Reference Position	Center
	Reference Level	0 dB
	Bandwidth Search Value	-3.00 dB
	Channel Search Level	-3.00 dB
	CW Mode Setup	REL OFF
	Max Hold	OFF
	Min Hold	OFF
	Channel Title	OFF
	Limit Line	OFF
	Modulate Bias Voltage	0 Volt
SOURCE	Signal Source Mode	Start/Stop Swept Freq
	Start Frequency	Sweeper Start Frequency or 1 MHz if not controlled by the 8003
	Stop Frequency	Sweeper Stop Frequency
	Sweep Time	200 ms
	RF Power Level	OFF, minimum RF level of the signal source or 0 dBm if not controlled by the 8003.
	Source Modulation	OFF

B.3 8003 System

The 8003 Precision Scalar Analyzer is always used with other test equipment and accessories to make a complete component measurement system. See Section B.3.3.1 which outlines the proper connection of the most common test equipment.

B.3.1 Sensor Installation

The 8003 Precision Scalar Analyzer should be connected only to the Giga-tronics Series 803XXA Power Sensors. A special sensor cable is shipped with the 8003 to connect the power sensor to any of the three analyzer sensor inputs marked A, B, and C. The sensor cable is made specifically for the 8003 Analyzer and should not be used with other products. See Section A.2.1 for the technical specifications and data for the Series 803XXA Power Sensors used with the 8003 Scalar Analyzer.

To make swept component measurements, a scalar analyzer is always used with a swept microwave source (sweeper), one or more power sensors, and a microwave signal splitting device (usually a return loss bridge, directional coupler, or power splitter).

B.3.2 Bridge Installation

Only Giga-tronics Series 80500 Return Loss Bridges can be used with the 8003 Analyzer. If you are using a bridge, it should be connected to any of the three analyzer sensor inputs marked A, B, or C via the sensor cable shipped with the analyzer.

☛ ***NOTE:*** *The bridge uses the same sensor cable as the power sensors.*

B.3.3 Sweeper Installation

The 8003 supports the following sweepers:

- Giga-tronics 12720A
- Giga-tronics 7200 Series or 910 Series Synthesized Sweep Generators
- Giga-tronics 610 Series Sweep Oscillator
- HP8350A/B with an RF plug-in (HP86200 series with the HP11869A adapter)
- HP8340A/B, HP8341A/B or HP8360 Synthesized Sweepers
- Marconi 6300 Series Sweepers
- Wiltron 6600B Sweep Generators
- Wiltron 6700B Synthesized Sweep Generators

The 8003 supports a variety of sweepers. Because the analyzer requires several connections to the microwave sweepers, please refer to the installation interconnection instructions on the this page and the next.

B.3.3.1 8003 to Sweeper BNC Connections

Connections shown in capital letters are the actual function names printed on the instrument housing (on the rear panels).

FOR: (Desired Function)	Sweep Ramp Signal	Prevention of Band-Switching Glitches	AC Detection
CONNECT FROM:			
8003 Analyzer	SWEEP IN	BLANKING INPUT	AC MOD OUTPUT
CONNECT TO:			
Giga-tronics (12720A)	RAMP OUT	BLANK/MARKER OUT	Pulse in
Giga-tronics (7200 Series)	RAMP OUT	Neg. blank out	Pm in
Giga-tronics (910 Series)	Sweep out	Unblank/markers	Pulse in
Giga-tronics (610 Series)	Sweep out	Unblank	Pulse in
HP 8350	Sweep out	POS Z BLANK	Pulse in
HP 8340 Series and HP 8360	SWEEP OUTPUT	POS BLANK	PULSE INPUT
Marconi (6300 Series)	SWEEP o/p	SYNC o/p	PULSE i/p
Wiltron (6600B Series)	HORIZ OUTPUT	SEQ SYNC OUTPUT	EX AM INPUT
Wiltron (6700B Series)	HORIZ OUTPUT	RETRACE BLANKING o/p (SHIFT → Trigger 109)	PULSE GATE TRIG o/p

B.3.3.2 GPIB Interconnect Cable Connections

	GPIB Connector Label Out	To Set Sweeper Address
8003 Analyzer	GPIB PRIVATE	Press: **CONFIG** → GPIB DEVICES (softkey) → SOURCE ADRS (softkey) → 20 → GHz/dB
Giga-tronics (12720A)	GPIB	Press: **CONFIG** → GPIB (softkey) → 20 → GHz
Giga-tronics (7200 Series)	REMOTE	Press: SPECIAL FUNCTION → A → S_ADDR (softkey) → **20** → **GHz/dB**
Giga-tronics (910 & 610)	REMOTE	Rear Panel DIP Switches set to: Position: 1 2 4 8 16 Setting: 0 0 1 0 1
HP 8350 Series or HP 8360 Series	HP INTERFACE BUS	Press: SHIFT → LCL → 20 → dBm/dB
HP 8340 Series	HP INTERFACE BUS	Press: SHIFT → LOCAL → 20 → kHz/msec
Marconi 6300 Series	SYSTEM	Press: SHIFT → STATUS 2 → S_ADDR (softkey) → 20 → kHz/int
Wiltron 6600B Series	IEEE 488 INTERFACE	Rear Panel DIP Switches set to: Position: 1 2 4 8 16 Setting: 0 0 1 0 1
NOTE: If GPIB communication with the Model 8003 is not automatically established when the 8003 and the 6600B are interconnected and turned on, press the RESET key on the front of the Wiltron 6600B Series instrument.)		
Wiltron 6700B Series	IEEE 488 INTERFACE	Press: SHIFT → ADRS → 20 → ENTER

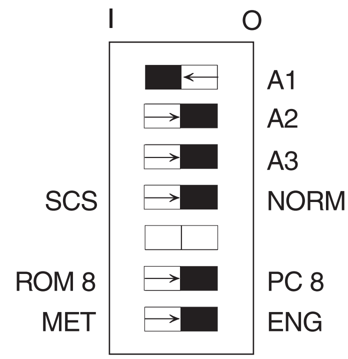
B.4 Printer Installation

The 8003 supports the following printers for generating hardcopies of displayed data and/or plots:

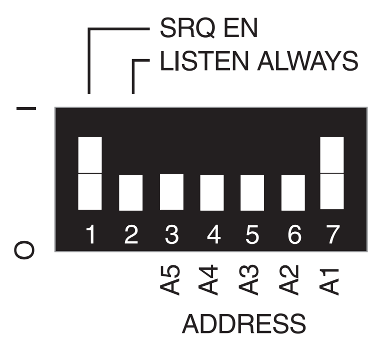
- HP PaintJet Printer
- HP ThinkJet Printer
- HP LaserJet Family of Printers

The installation instructions on the next 3 pages will define the necessary interconnections and address settings for each of these printers, and will also describe the RS-232 cable required when using the HP LaserJet family of printers.

B.4.1 PaintJet Color GPIB Cable Interconnections

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PRINTER ADDRESS (softkey) → **1** → **GHz/dB**
CONNECT TO:		
HP PaintJet Color Graphics Printer	HP-IB Connector (rear panel of printer)	Set rear panel DIP switches as shown below: 
NOTE: After setting the address, the printer must be turned OFF and then ON again.		

B.4.2 ThinkJet GPIB Cable Interconnections

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PRINTER ADDRESS (softkey) → **1** → **GHz/dB**
CONNECT TO:		
HP PaintJet Color Graphics Printer	GP-IB Connector (rear panel of printer)	Set rear panel DIP switches as shown below: 
NOTE: After setting the address, the printer must be turned OFF and then ON again.		

B.4.3 LaserJet Family RS-232 Cable Interconnections

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	RS-232 Port (rear panel female connection)	N/A – Direct Connection
CONNECT TO:		
HP LaserJet Family	RS-232	N/A – Direct Connection

B.4.3.1 RS-232 Electrical Description

M -M Cable		
Printer Connection:	Pin Number	Function
	1	FG – Frame Ground
	2	TD – Transmit data to the 8003
	3	RD – Received data from the 8003
	7	SG – Signal Ground
	20	DTR – Data Terminal Ready
8003 Connection:	1	FG – Frame Ground
	2	TD – Received Data from the printer
	3	RD – Transmit Data to the printer
	7	SG – Signal Ground
	20	DTR – Data Terminal Ready

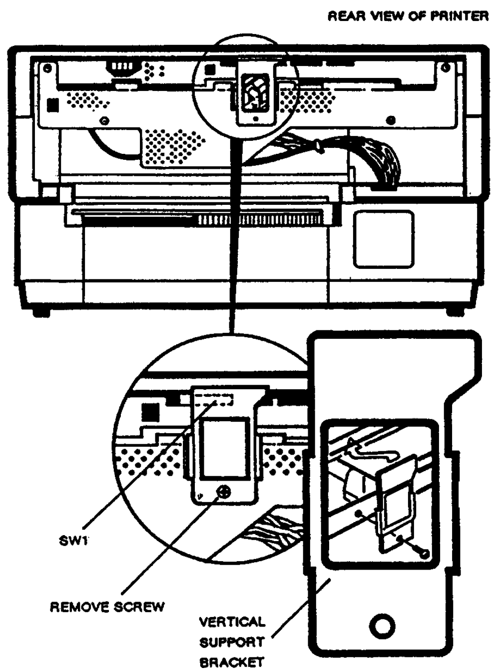
Since the HP LaserJet printer is designed to operate through either RS-232 or RS-422 cable interconnections, there is a switch (SW 1- Switch 1) and a jumper (JP 2- Jumper 2) on the printer's rear panel that must be properly set. The diagrams on the next page will show the location and proper positioning of these components.

☛ ***NOTE:** The 8003 Analyzer operates only at a Baud rate of 9600.*

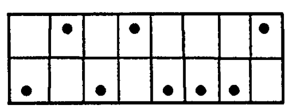
☛ ***NOTE:** After setting the address, the printer must be turned OFF and then ON again.*

B.4.4 LaserJet Printer Switch & Jumper Location and Settings

SW 1 Location and Setting

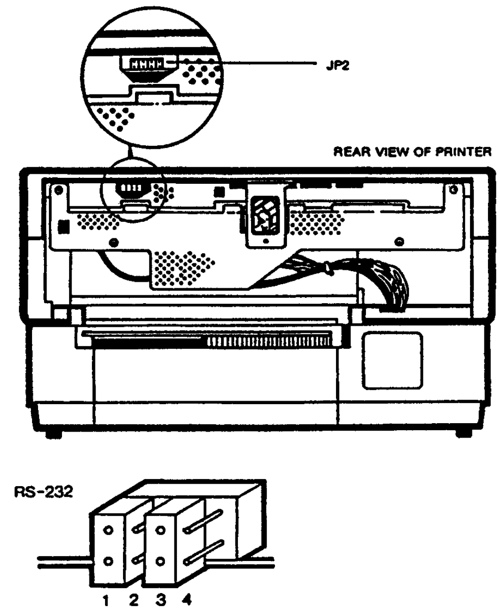


ON



OFF

JP 2 Location and Setting:



B.5 Plotter GPIB Installation Interconnections & Pen Colors

The 8003 Analyzer can plot data on most compatible GPIB plotters. The instructions given on the next 5 pages cover the plotters that are generally the most commonly used in the industry.

- HP 7550A
- HP 7440A
- HP 7475A
- HP 7470A
- HP 7090A

When you wish to connect a plotter to the analyzer, please refer to the installation instructions given for your particular plotter. Initial pen colors to correspond with the 8003's default color format are also defined.

B.5.1 HP 7550A

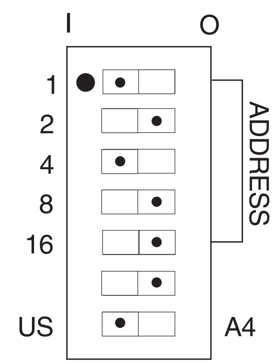
	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PLOTTER (softkey) → **5** → **GHz/dB**
CONNECT TO:		
HP 7550A Plotter	HP-IB Connector	The HP 7550A should be set to its default address of 5. This can be checked by following the instructions given in the HP operating manual pertaining to HP-IB operation.

B.5.1.1 HP 7550A Pen Color Format (8 Pens)

(When pens are formatted as follows, the colors will correspond to the 8003's default display.)

Pen Number	Color	Displayed Function
1	Black	Giga-tronics Logo
2	Red	Channel 2
3	Yellow	Channel 3
4	Green	Grid, Title, Channel Title, and Frequency
5	Cyan	Channel 1
6	Blue	Not Used
7	Magenta	Channel 4
8	Not Used	

B.5.2 HP 7440A

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PLOTTER (softkey) → **5** → **GHz/dB**
CONNECT TO:		
HP 7440A Plotter	HP-IB Connector	Set rear panel DIP switches as shown below: 

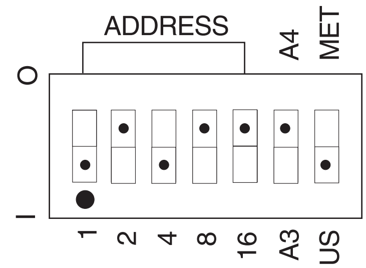
B.5.2.1 HP 7440A Pen Color Format (8 Pens)

(When pens are formatted as follows, the colors will correspond to the 8003's default display.)

Pen Number	Color	Displayed Function
1	Black	Giga-tronics Logo
2	Red	Channel 2
3	Yellow	Channel 3
4	Green	Grid, Title, Channel Title, and Frequency
5	Cyan	Channel 1
6	Blue	Not Used
7	Magenta	Channel 4
8	Not Used	

☛ ***NOTE:*** *After setting the address, the plotter must be turned OFF and then ON again.*

B.5.3 HP 7475A

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PLOTTER (softkey) → **5** → **GHz/dB**
CONNECT TO:		
HP 7475A Plotter	HP-IB Connector	Set rear panel DIP switches as shown below: 

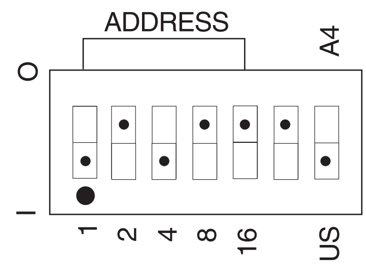
B.5.3.1 HP 7475A Pen Color Format (6 Pens)

(When pens are formatted as follows, the colors will correspond to the 8003's default display.)

Pen Number	Color	Displayed Function
1	Black	Giga-tronics Logo
2	Red	Channel 2
3	Yellow	Channel 3
4	Green	Grid, Title, Channel Title, and Frequency
5	Cyan	Channel 1
6	Blue	Not Used

☛ ***NOTE:*** *After setting the address, the plotter must be turned OFF and then ON again.*

B.5.4 HP 7470A

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PLOTTER (softkey) → **5** → **GHz/dB**
CONNECT TO:		
HP 7475A Plotter	HP-IB Connector	Set rear panel DIP switches as shown below: 

B.5.4.1 HP 7470A Pen Color Format (2 Pens)

(When pens are formatted as follows, the colors will correspond to the 8003's default display.)

Pen Number	Color	Displayed Function
1	Black	Giga-tronics Logo, Channel 1, Channel 3, Channel 4
2	Red	Channel 2, Grid, Title, Channel Title and Frequency

☛ ***NOTE:*** *After setting the address, the plot must be turned OFF and then ON again.*

B.5.5 HP 7090A

	Instrument Connector Label	To Set Printer Address
CONNECT FROM:		
8003 Analyzer	GPIB/PRIVATE	Press: **CONFIG** → GPIB DEVICES → (softkey) → PLOTTER (softkey) → **5** → **GHz/dB**
CONNECT TO:		
HP 7090A Plotter	HP-IB Connector	Set rear panel DIP switches as shown below:

B.5.5.1 HP 7090A Pen Color Format (6 Pens)

(When pens are formatted as follows, the colors will correspond to the 8003's default display.)

Pen Number	Color	Displayed Function
1	Black	Giga-tronics Logo, Channel
2	Red	Channel 2
3	Yellow	Channel 3
4	Green	Grid, Title, Channel Title and Frequency
5	Cyan	Channel 1
6	Blue	Not Used

☛ ***NOTE:*** *After setting the address, the plotter must be turned OFF and then ON again.*

B.6 Connecting Analyzer to an Instrument Controller

The 8003 Analyzer can be remotely controlled via the GPIB (IEEE 488) bus. To connect the 8003 Analyzer to an IEEE 488 compatible Instrument Controller, use the GPIB connection marked “GPIB/SYSTEM” on the rear panel of the analyzer.

☛ ***NOTE:*** *This is a different GPIB connector than the “GPIB/PRIVATE” connection used for sweeper, plotter and printer control.*

Be sure that the remote controller is connected only to the GPIB/SYSTEM connection as it will not function if connected to the “PRIVATE” interface.

For further information see the installation and address setting instructions given on page 3-1 of Chapter 3, REMOTE OPERATION.

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