

## Errata

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### HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

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# **HP 85685A RF PRESELECTOR OPERATING AND PROGRAMMING MANUAL**

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## **1. General Information**

# SECTION 1

## GENERAL INFORMATION

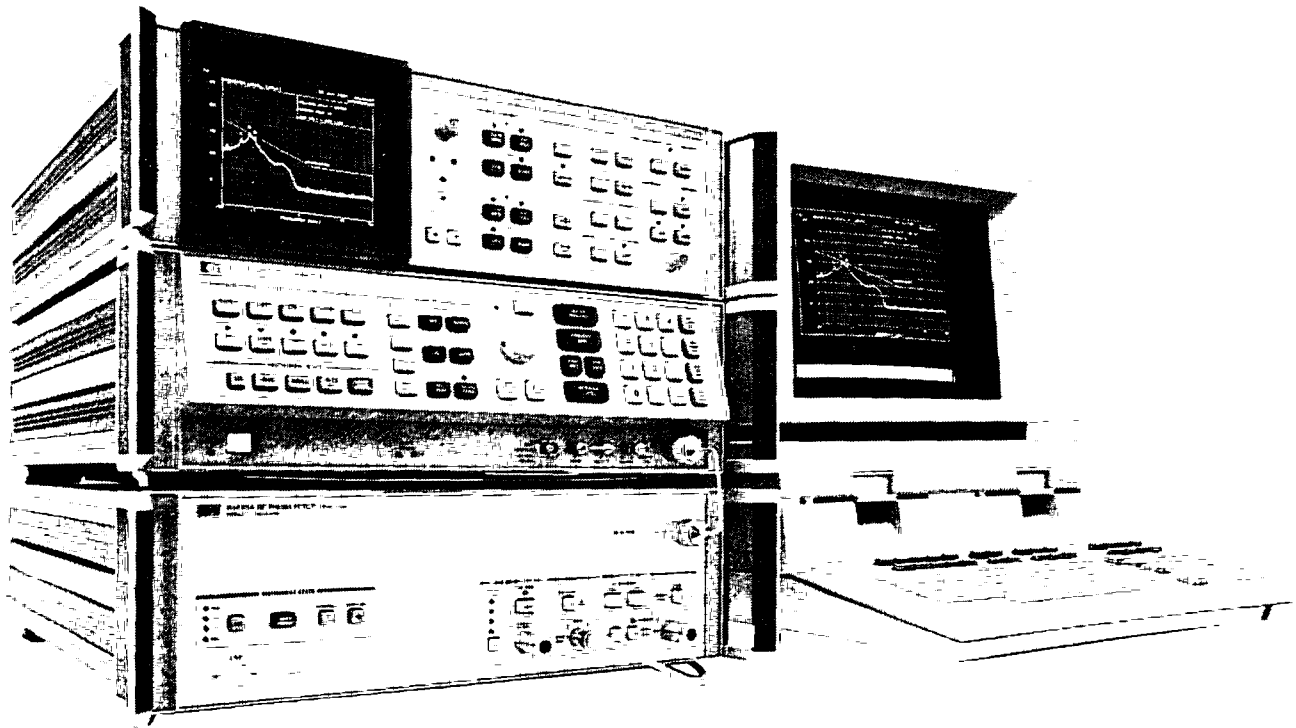


FIGURE 1-1. AUTOMATIC SPECTRUM ANALYZER / TEST RECEIVER

The HP 85685A RF Preselector adds high-performance test receiver capacity to HP 8566B and 8568B Spectrum Analyzers. The addition of the preselector provides tracking filters and preamplifiers, making the test receiver sensitive to low-level signals while offering overload protection from out-of-band signals. The result is a measurement range 30 dB greater than that of the spectrum analyzer alone.

The preselector is easy to operate. Under manual operation, the preselector tracks the spectrum analyzer automatically, providing preselected measurements with a minimum of user control. For remote operation, the preselector is also fully HP-IB programmable.

### SIGNAL MONITORING

Combining the spectrum analyzer and preselector provides the best features of both the analyzer and a test receiver in one multi-purpose instrument. This makes an ideal test receiver for signal monitoring, especially for applications where high-level interference is present. The test receiver measures signals within the passband, while rejecting



## GENERAL INFORMATION

out-of-band signals by 40 dB. In the presence of interference with a total input power of +10 dBm, the test receiver can monitor signals down to -150 dBm.

The test receiver also improves signal reception for the broadband environment of a mobile test station. It reduces interference from radio and TV broadcast stations, amateur radios, and cellular mobile transmitters.

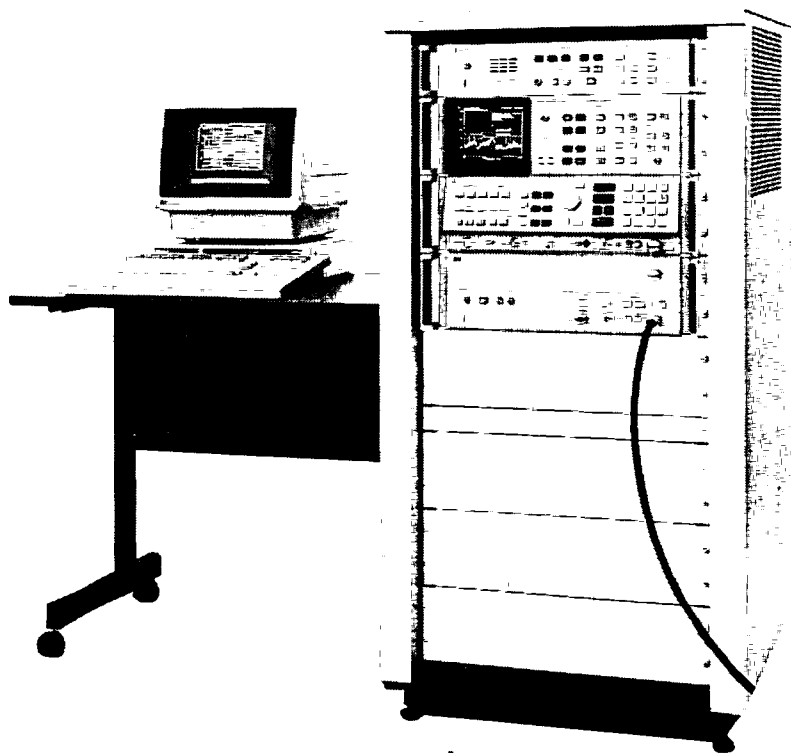


FIGURE 1-2. EMI TEST RECEIVER SYSTEM

## EMI

Combining the test receiver with an HP 85650A Quasi-Peak Adapter produces an EMI receiver with the characteristics recommended in CISPR Publication 16. The preselector provides the measurement sensitivity and overload protection necessary for open-site testing. For commercial and MIL-STD conducted EMI tests, the low-frequency input and rugged input attenuator tolerate large impulses and Line Impedance Stabilization Network transients. A built-in comb generator and calibration routine ensure  $\pm 2.0$  dB absolute amplitude accuracy. A linearity check using a 3 dB attenuator warns of potential overload and distortion.

## SIMPLIFIED BLOCK DIAGRAM

Figure 1-3 illustrates basic preselector operation.

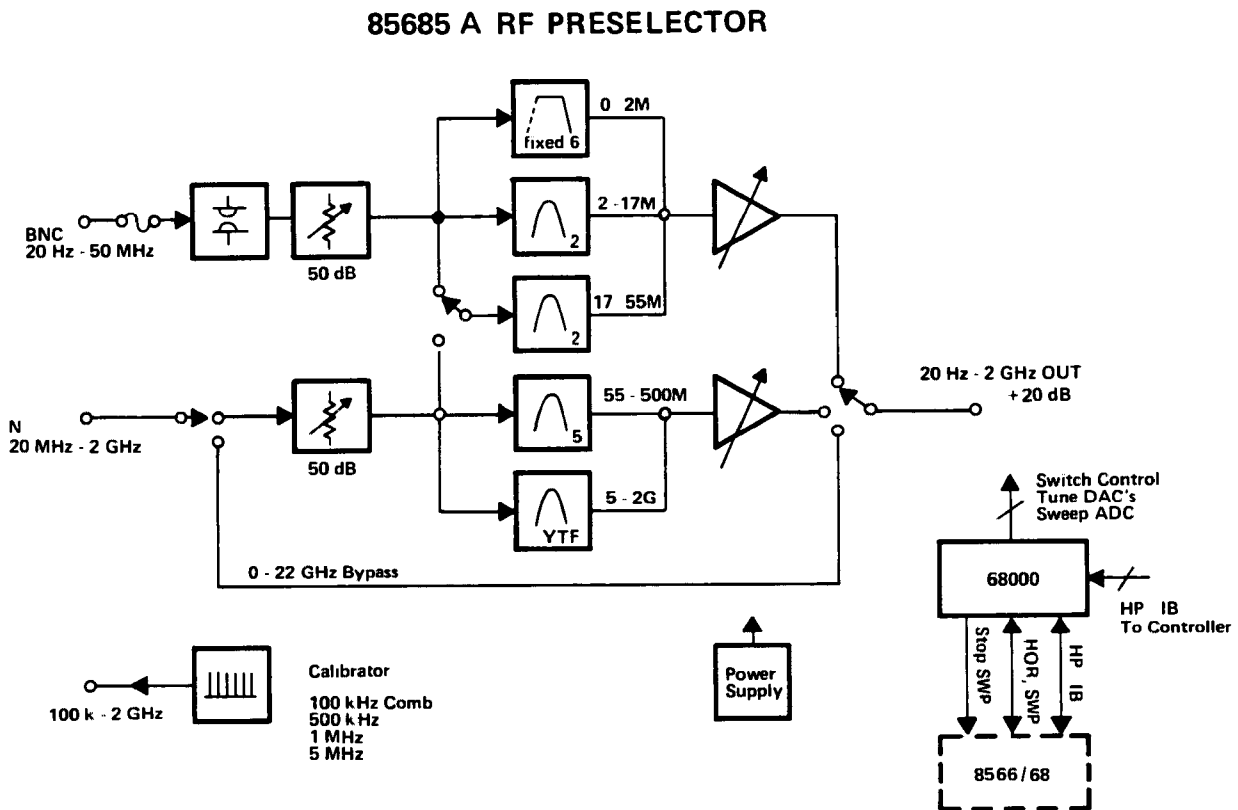


FIGURE 1-3. PRESELECTOR BLOCK DIAGRAM

The following sections instruct you on how to operate your test receiver manually and remotely. A brief description of each section follows.

## MANUAL ORGANIZATION

The HP 85685A Operating and Programming Manual is divided into 8 major sections:

**GENERAL INFORMATION** contains general preselector and manual information

**TEST RECEIVER CONFIGURATION** describes how to connect the preselector to an HP 8566B or 8568B Spectrum Analyzer and calibrate the system. This section also contains some general information on the HP-IB and private control bus.

## GENERAL INFORMATION

**MANUAL OPERATION** provides information for operating the system manually and includes section **FRONT-PANEL FUNCTIONS**, which describes front-panel functions individually.

**REMOTE OPERATION** describes how the system operates under computer control and provides general programming information. **PROGRAMMING COMMANDS**, a section of **REMOTE OPERATION**, contains command documentation.

**APPLICATION NOTES** provides a space to store preselector application notes, programming notes, and product notes.

The last section is the manual **INDEX**.



# SECTION 2

## TEST RECEIVER CONFIGURATION

### INTRODUCTION

This section lists spectrum analyzer version and firmware requirements, describes how to connect the HP 85685A Preselector to an HP 8566B or 8568B Spectrum Analyzer, explains the preselector's private control bus, HSWP, and HORIZ lines, and describes how to perform preselector calibration.

### SPECTRUM ANALYZER REQUIREMENTS

HP 8566 and 8568 "A" version Spectrum Analyzers have limited preselector compatibility. We recommend "A" version spectrum analyzers be upgraded to "B" versions.

Any HP 8566 or 8568 "B" version Spectrum Analyzer will work with the preselector, provided it meets firmware revision requirements. To identify the spectrum analyzer firmware revision, power up the spectrum analyzer. The firmware revision date code appears on the display below the spectrum analyzer address, as shown in Figure 2-1. Compatible firmware revisions for HP 8568B Spectrum Analyzers have date codes 9.9.86 (day.month.year) or later. Compatible firmware revisions for HP 8566B Spectrum Analyzers have date codes 29.9.86 or later.

For information on upgrading "A" version spectrum analyzers to "B" versions, or on acquiring firmware, call your HP sales office (listed at the end of the manual).

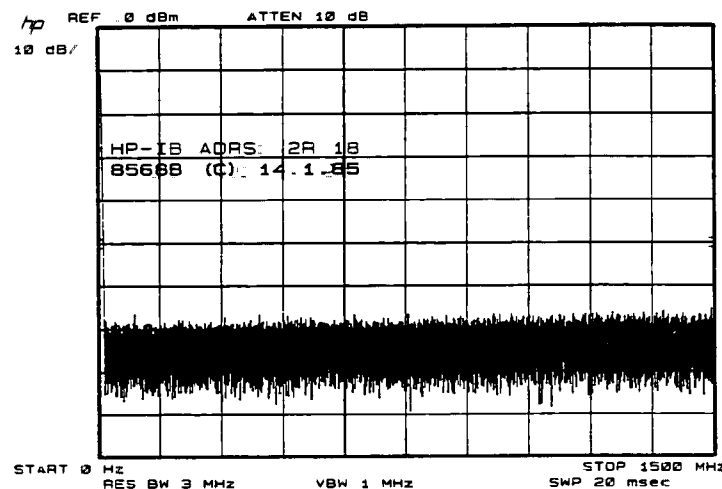


FIGURE 2-1. FIRMWARE IDENTIFICATION

## CONNECTING THE INSTRUMENTS

Included with the HP 85685A Preselector are:

- 1 - 50-pin interconnect cable with HSWP IN/OUT, HP part number 85662-60220
- 1 - BNC to SMA cable, HP part number 85685-60068
- 1 - 24 inch BNC-BNC coax cable, HP part number 8120-1839
- 1 - HP-IB cable (0.5 M), HP part number 10833D
- 2 - type N semi-rigid cables, HP part numbers 85685-20055 and 85685-20128
- 1 - N (m) to BNC (m) semi-rigid cable, HP part number 85685-60128
- 1 - type N coax calibration cable, HP part number 1820-4781
- 1 - lock link kit, HP part number 85650-60054

To connect the preselector to the spectrum analyzer, complete the following instructions.

1. Remove any HP-IB cables from the spectrum analyzer. Be sure that the preselector and spectrum analyzer LINE switches are OFF.
2. Fasten the lock links to the top of the preselector, as in Figure 2-2.

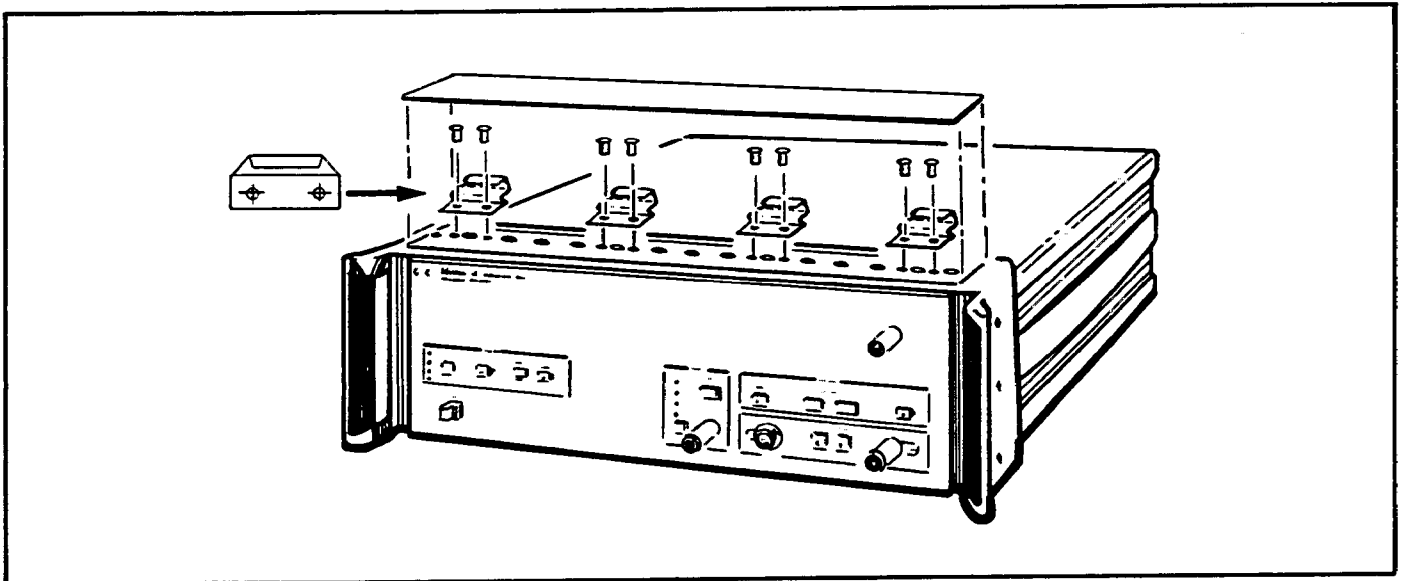


FIGURE 2-2. LOCK-LINK INSTALLATION

3. Remove the spectrum analyzer information-card tray and bottom feet. The card tray may be installed on the bottom of the preselector; it can no longer remain on the bottom of the spectrum analyzer.
4. Exchange the preselector's bottom rear lock feet with the spectrum analyzer's bottom rear lock feet, as in Figure 2-3.
5. Install the preselector underneath the spectrum analyzer, using the lock links to secure the instruments.
6. Using the thumbscrews, secure the spectrum analyzer's new bottom rear feet to the preselector's top rear feet, as in Figure 2-4.

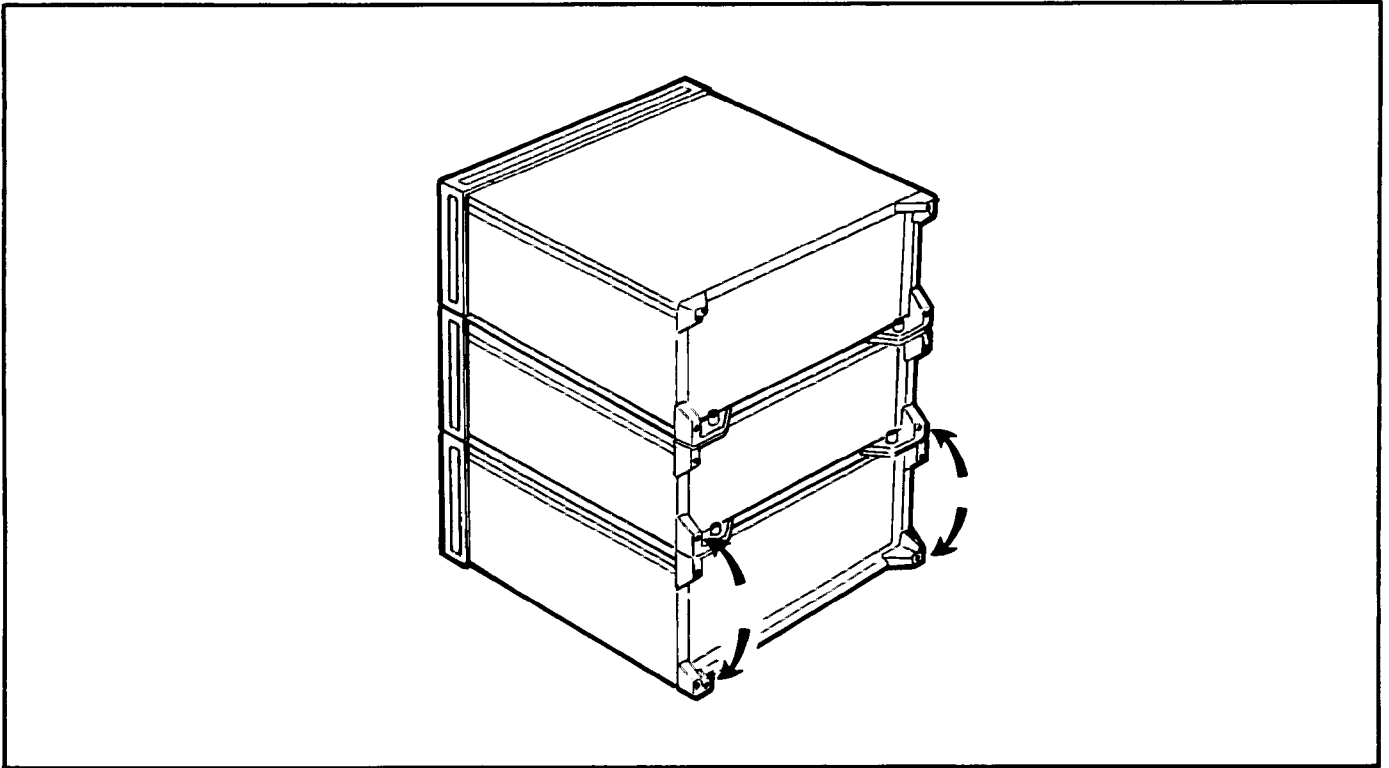


FIGURE 2-3. LOCK-FEET INSTALLATION

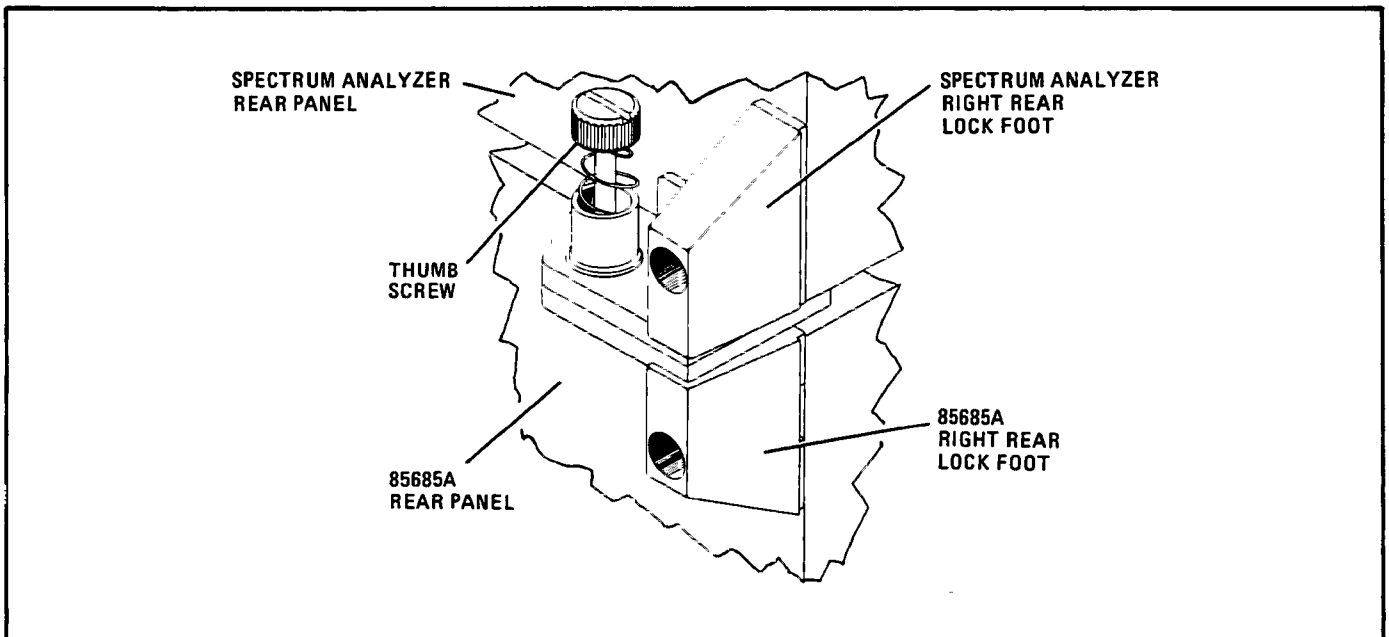


FIGURE 2-4 SECURING LOCK-FEET

## TEST RECEIVER CONFIGURATION

For steps 7 - 10, refer to Figure 2-5

7. Verify that the spectrum analyzer's 50-pin interconnect cable has an HSWP IN/OUT Port. If not, replace the 50-pin interconnect cable with the new one supplied.
8. Connect the HSWP IN/OUT from the spectrum analyzer's 50-pin interconnect to the preselector connector marked HSWP.
9. Connect the BNC-to-BNC cable from the IF Display RECORDER OUTPUT SWEEP connector to the preselector connector marked HORIZ.
10. Connect the HP-IB cable (provided with the preselector) from the spectrum analyzer to the preselector private control bus marked TO SPECTRUM ANALYZER

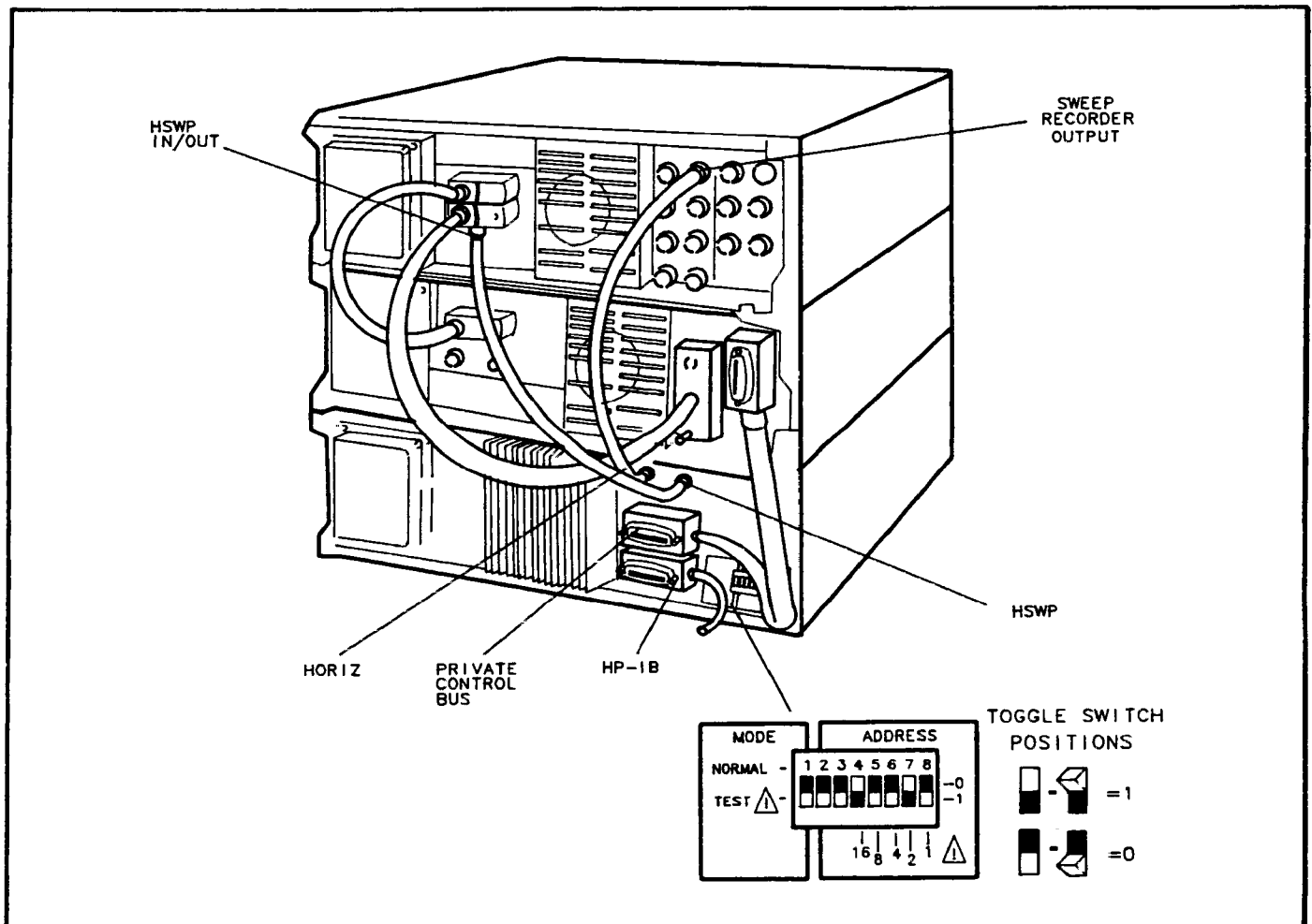


FIGURE 2-5. PRESELECTOR-SPECTRUM ANALYZER CONNECTIONS



- 11 Switch the spectrum analyzer LINE switch ON.
- 12 Note the spectrum analyzer HP-IB address. If it is set to 21, set it to another address (use keyshift P).
- 13 The preselector address is preset at the factory to 18 (see Figure 2-5). To activate the private control bus, be sure that the address switch on the preselector rear panel is set to 18, or some **even** address not greater than 30. Additional preselector address information is found in the **REMOTE OPERATION** section of this manual.
- 14 Switch the preselector LINE switch ON. The preselector performs an instrument preset, which activates all preselector front-panel LEDs and commands the spectrum analyzer to perform an instrument preset as well. When the preselector and spectrum analyzer LEDs turn off, the instrument preset is completed.

## SPECTRUM ANALYZER DISPLAY

The preselector modifies the spectrum analyzer CRT annotation to include the preselector input attenuation and the reference level at the input of the preselector. It also modifies the display so a line can be drawn across the bottom graticule; this line identifies portions of a span that are not preselected.

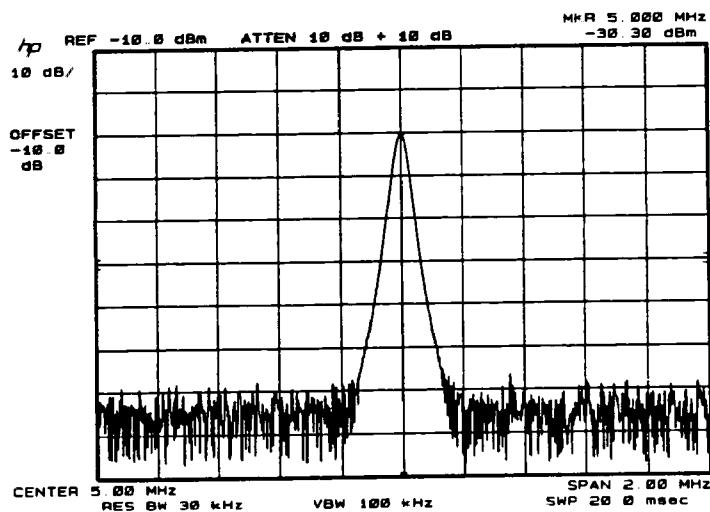


FIGURE 2-6. MODIFIED SPECTRUM ANALYZER DISPLAY

## THE PRIVATE CONTROL BUS

The preselector and spectrum analyzer communicate via the private control bus. Using the private control bus, the preselector can continually monitor the spectrum analyzer frequency settings, allowing the preselector to automatically track the spectrum analyzer. The preselector also uses this bus to send annotation information to the spectrum analyzer. The preselector pass through mode, which passes commands from the computer to the spectrum analyzer, also employs the private control bus. (Pass through is discussed in more detail in the **REMOTE OPERATION** section.)

Do not connect computers and other devices to the private control bus. Instead, connect these devices to the preselector HP-IB connector marked TO COMPUTER. For more information, see the **MANUAL OPERATION** and **REMOTE OPERATION** sections of this manual.

## HORIZ AND HSWP

The HORIZ line sends the spectrum analyzer sweep ramp to the preselector, allowing the preselector to sweep with the spectrum analyzer. The HSWP line enables the preselector to stop the spectrum analyzer sweep momentarily, in order to perform other functions. Once these functions are completed, the sweep continues. This allows the preselector to continue to sweep in sync with the spectrum analyzer.

## CALIBRATING THE TEST RECEIVER

Test receiver calibration, although not required, improves measurement accuracy

### Spectrum Analyzer Calibration

1. If the preselector is connected to an HP 8568B Spectrum Analyzer, connect the type N-to-type N semi-rigid cable, HP part number 85685-20055, from the preselector output to the spectrum analyzer input 2, as in Figure 2-7. If the preselector is connected to an HP 8566B Spectrum Analyzer, use the type N-to-type N semi-rigid cable, HP part number 85685-20128, instead.

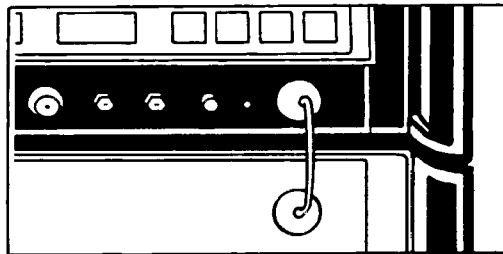


FIGURE 2-7. SEMI-RIGID CABLE CONNECTION

2. Activate the preselector BYPASS function (press the preselector ENABLE key, then the BYPASS key).
3. Connect the spectrum analyzer CAL OUT to preselector Input 2.
4. Execute the spectrum analyzer amplitude and bandwidth calibration routines (RECALL 8, RECALL 9, and SHIFT W) Once they have been completed, remove CAL OUT from the preselector input

## Preselector Calibration

- 1 The preselector calibration routine calibrates the preselector from the spectrum analyzer start frequency to the spectrum analyzer stop frequency. Set the desired spectrum analyzer start and stop frequencies, resolution and video bandwidths, and choose a linear or log scale. Note that the left input on the HP 8568B Spectrum Analyzer is required for frequencies lower than 100 kHz.
- 2 Connect the comb generator output to the preselector input that accommodates the chosen spectrum analyzer frequencies, and press the key next to the chosen input to enable it, as in Figure 2-8.

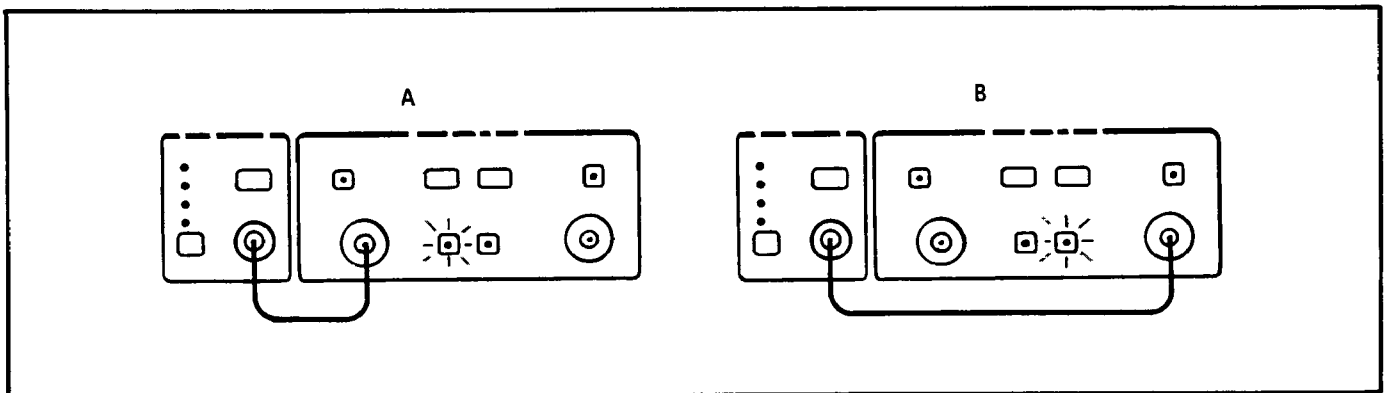


FIGURE 2-8. COMB GENERATOR CONNECTION

- 3 To execute the calibration routine, press the **START** key. The **CAL SEQ** LED lights up, indicating the function is active. The time required to complete calibration depends on the selected frequency span. The calibration routine ensures  $\pm 2.0$  dB amplitude accuracy for the selected frequencies, as recommended in CISPR publication 16 and as required by the FCC and VDE. When the **CAL SEQ** LED turns off, the preselector has completed the calibration routine.

A measurement technique for optimum test receiver amplitude accuracy is found in the **APPLICATION NOTES** section.



# SECTION 3

## MANUAL OPERATION

### INTRODUCTION

The HP 85685A RF Preselector is designed for simple and efficient manual operation. The preselector has few front-panel keys and requires little user control. For example, whenever any spectrum analyzer frequency functions are updated, the preselector reads the new settings via the private control bus and adjusts its own settings accordingly. This allows the preselector to frequency-track the spectrum analyzer automatically.

This section describes the preselector private control bus, reference level, unpreselected frequency identification, and front panel.

### THE PRIVATE CONTROL BUS

In manual operation, the preselector uses the private control bus to monitor the spectrum analyzer's frequency settings and track the spectrum analyzer automatically. It also sends annotation information over the private control bus to keep the spectrum analyzer display updated.

Connect only the spectrum analyzer to the private control bus. Connect computers and other devices to the preselector's HP-IB connector, labeled TO COMPUTER. For more information about the HP-IB, refer to REMOTE OPERATION CONFIGURATION, in the **REMOTE OPERATION** section of this manual.

The preselector private control bus address is preset to 21 and cannot be changed. To allow the preselector and spectrum analyzer to communicate on the private control bus, set the spectrum analyzer to an address other than 21.

#### NOTE

**The private control bus is active only when its rear panel address switch is set to an even value. Odd values deactivate the private control bus. If the private control bus is active, the preselector must have a powered-up spectrum analyzer connected to the private control bus for correct operation.**

## AUTOMATIC FREQUENCY TRACKING

When the spectrum analyzer frequencies change, the spectrum analyzer generates a service request. The service request triggers the preselector to read the new frequency settings from the private control bus and to adjust its own settings accordingly. As a result, the preselector can automatically frequency-track the spectrum analyzer.

### NOTE

**Do not set the spectrum analyzer sweep time faster than 50 milliseconds. Such sweep times may degrade amplitude accuracy.**

## PRESELECTOR REFERENCE LEVEL

The reference-level annotation on the spectrum analyzer display indicates the reference level at the input of the preselector. The preselector has 20 dB of gain when the input attenuation is set to 0 dB. The reference level offset incorporates the gain and attenuation into one term and shows the offset contributed by them on the left side of the display. For example, the above-mentioned settings result in a -20 dB offset. Increasing the attenuation to 20 dB produces a 0 dB offset.

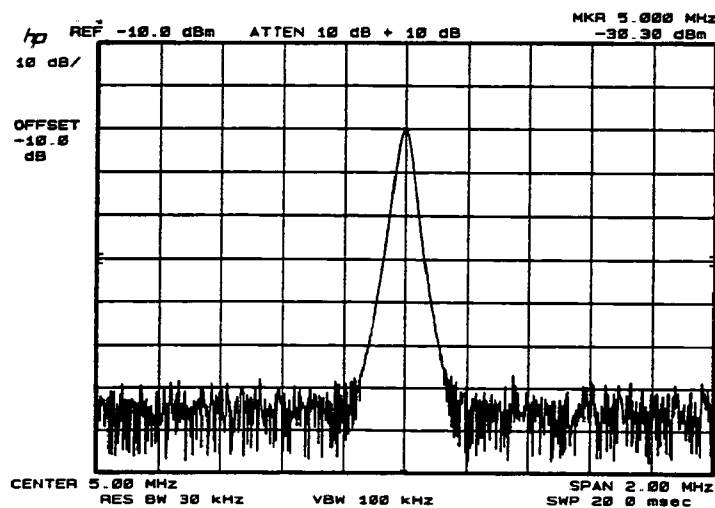


FIGURE 3-1. PRESELECTOR REFERENCE LEVEL

## IDENTIFYING UNPRESELECTED FREQUENCIES

As the spectrum analyzer's frequency span increases, the preselector employs more sweeping filters to preselect the span, and the fraction of the span each filter preselects decreases. Eventually, the frequency span may become too wide to guarantee the tracking accuracy of the preselector sweeping filters. When this occurs, a low-pass filter is activated to replace the sweeping filter that is too narrow for the span. A line across the display's bottom graticule identifies the low-pass filter, which extends from the spectrum analyzer start frequency to the first sweeping filter (see Figure 3-2).

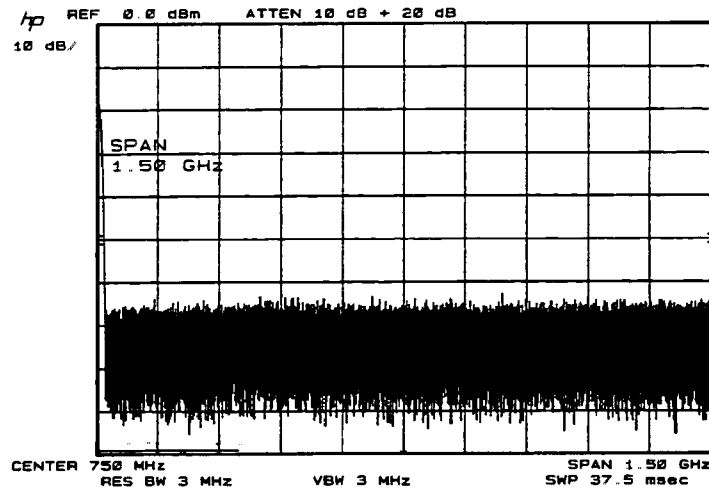


FIGURE 3-2. UNPRESELECTED FREQUENCIES IDENTIFICATION

Table 3-1 lists the widest fully-preselected frequency spans available to a given start frequency.

TABLE 3-1. START FREQUENCY VS. FREQUENCY SPAN

Start Frequency Between:	Maximum Fully-Preselected Span
0 Hz – 75 kHz	10 MHz
75 kHz – 6 MHz	30 MHz
6 MHz – 17 MHz	50 MHz
17 MHz – 30 MHz	110 MHz
30 MHz – 55 MHz	285 MHz
55 MHz – 100 MHz	310 MHz
100 MHz – 155 MHz	500 MHz
>155 MHz	850 MHz
(approximate values)	(approximate values)

## PRESETTING THE SPECTRUM ANALYZER

Executing the spectrum analyzer instrument preset function disrupts communication between the spectrum analyzer and preselector. It effectively "disconnects" the spectrum analyzer from the private control bus. To "reconnect" the instruments, press either the preselector INSTR PRESET or NORMAL key.

## THE PRESELECTOR FRONT PANEL

The front panel functions fall into three groups: those that affect the instrument state, the comb generator, or the preselector RF input. A brief explanation of each group follows.

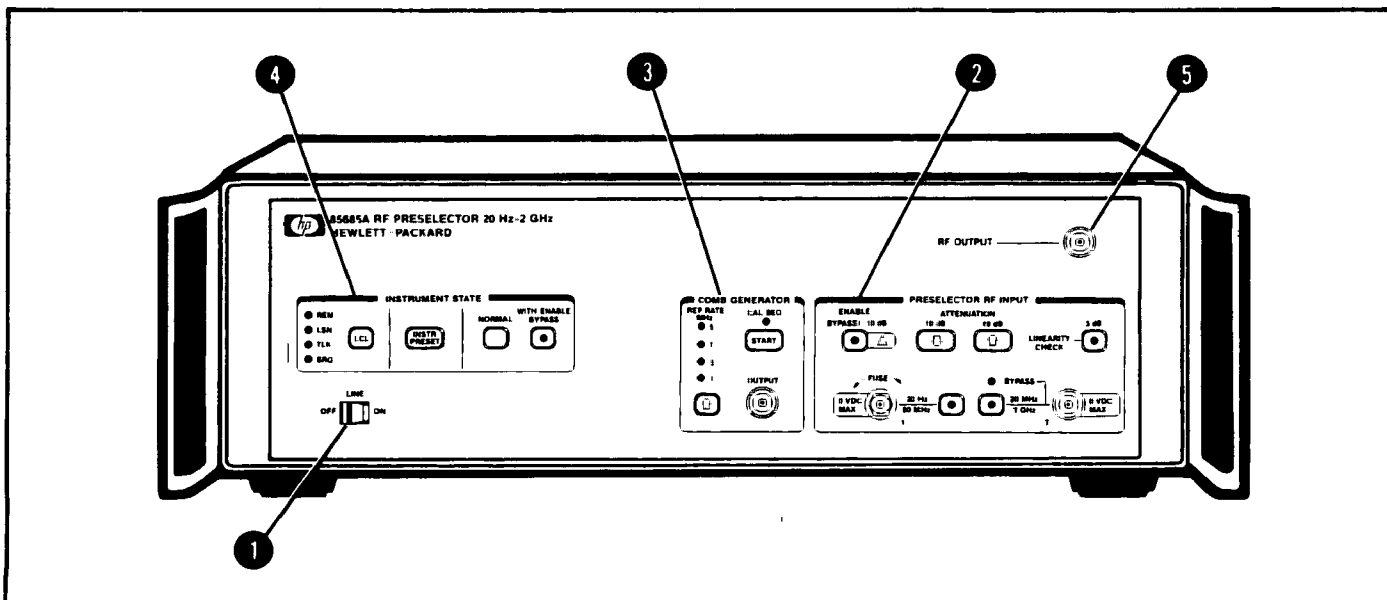


FIGURE 3-3. PRESELECTOR FRONT PANEL

- |                       |  |
|-----------------------|--|
| Line.                 | Powers the preselector.  |
| Preselector RF Input: | Provides two inputs, attenuation selection, and a test receiver linearity check. |
| Comb Generator:       | Provides a calibrated source and a test receiver calibration routine.            |
| Instrument State:     | Allows you to control and view the instrument state.                             |
| Output:               | Outputs the preselected signal.  |

**FRONT-PANEL FUNCTIONS** examines each group in more detail and explains each function individually.



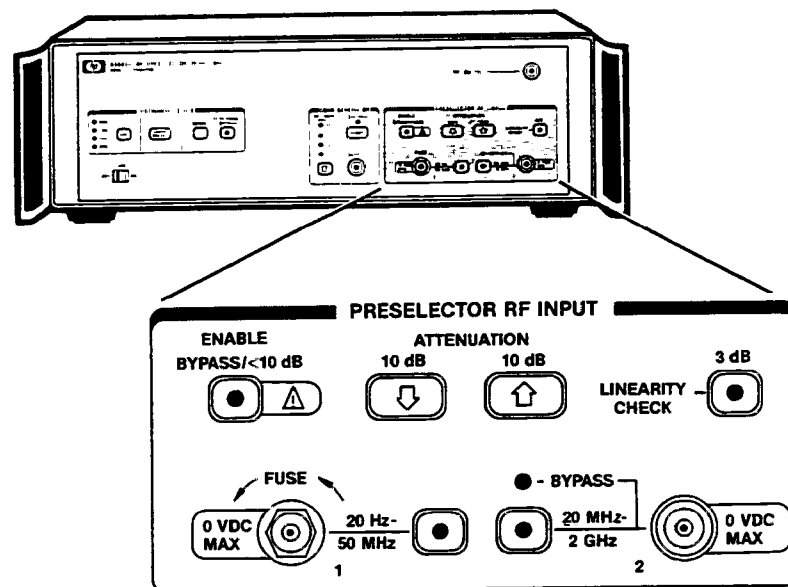


# FRONT-PANEL FUNCTIONS

## PRESELECTOR RF INPUT

### INTRODUCTION

The preselector RF input functions provide two inputs, attenuation selection, and a test receiver linearity check.



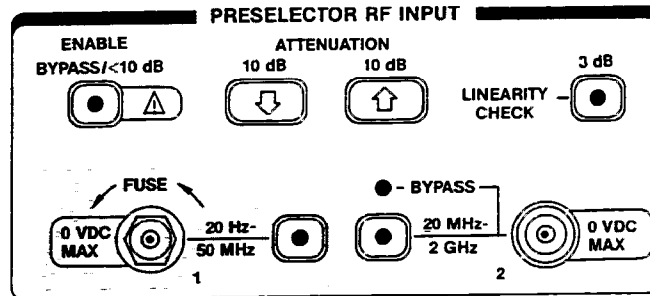
The preselector is designed with two inputs to accommodate both conducted and radiated emission measurements — two common types of EMI measurements. One input is a fused, low-frequency input, designed to tolerate large transient signals that may occur during conducted emission measurements. The other is a more sensitive, higher-frequency input designed to accommodate radiated emission measurements.

The preselector's attenuation functions allow you to select 0 dB to 53 dB of preselector input attenuation. The 3 dB linearity check indicates if test-receiver overload is present.

### CAUTION

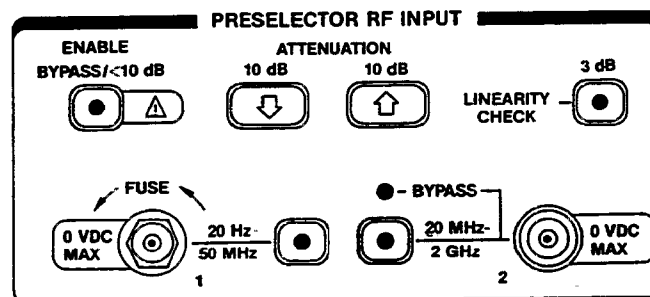
**Do not connect signals greater than +30 dBm to the preselector. Exceeding this power level may damage the preselector input attenuator. The maximum DC input level is 0V DC.**

## INPUT 1



Input 1 ranges in frequency from 20 Hz to 50 MHz. It is a rugged, fused input designed for making conducted emission measurements. The fuse and input attenuator protect the preselector from high-level impulses and Line Impedance Stabilization Network transients. To activate Input 1, press the key to the right of the input connector. The LED in the key lights up, indicating the input is active.

## INPUT 2

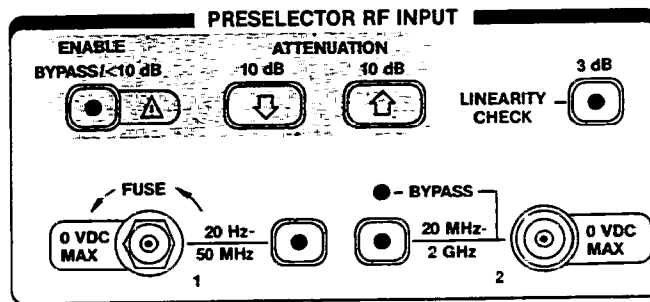


Input 2 ranges in frequency from 20 MHz to 2 GHz. This input is not fused, but it is sensitive, has a good frequency response, and is well-suited for radiated emission measurements. To activate Input 2, press the key to the left of the input connector. The LED in the key lights up, indicating the input is active.

## PRESELECTOR INPUT ATTENUATION

**CAUTION**

**Do not connect signals greater than +30 dBm to a preselector with 0 dB preselector input attenuation; doing so may damage the preselector input circuits. Maximum DC input level is 0V DC.**



The preselector input attenuation ranges from 0 dB to 50 dB, and is variable in 10 dB increments. To select preselector input attenuation, use the attenuation step-keys. The preselector's input-attenuation setting appears at the top of the spectrum analyzer display, as shown in Figure 3-4. The input attenuation affects the reference level offset; see PRESELECTOR REFERENCE LEVEL in the **MANUAL OPERATION** section.

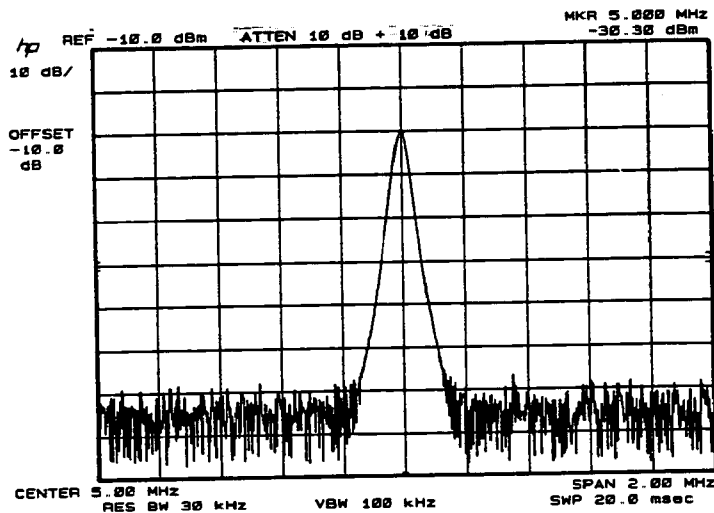
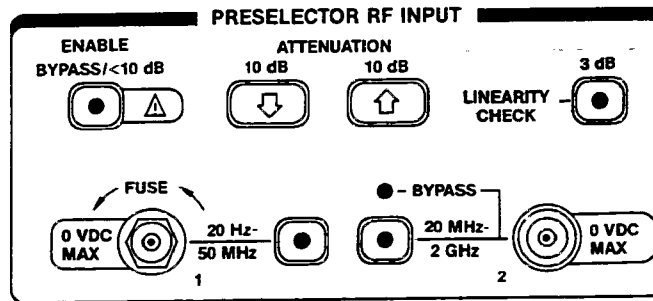


FIGURE 3-4. PRESELECTOR ATTENUATION ANNOTATION

0 dB input attenuation provides maximum preselector sensitivity. To remove all preselector input attenuation, decrease the input attenuation to 10 dB, press the ENABLE key, then press the attenuation step down key again. This sequence makes it difficult to accidentally remove all input attenuation and possibly damage sensitive input circuits. When 0 dB attenuation is enabled, the preselector attenuation annotation flashes. To deactivate 0 dB attenuation, press the step up attenuation key.

### 3 dB LINEARITY CHECK

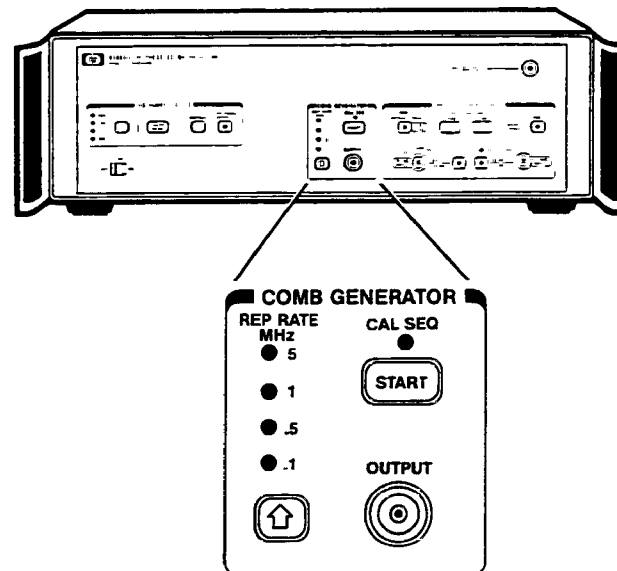


This function uses a 3 dB attenuator to identify signal distortion or overload. To activate the function, press the 3 dB linearity key. The LED in the key lights up, to indicate the function is active, and the attenuation annotation increases 3 dB. If no distortion is present, the signal amplitude remains the same. If signal distortion or overload is present, the signal amplitude changes. In this case, increase the preselector input attenuation 10 dB. To deactivate the function, press the key again. If enough attenuation was added, the signal level will not change when the linearity check is deactivated.

## COMB GENERATOR

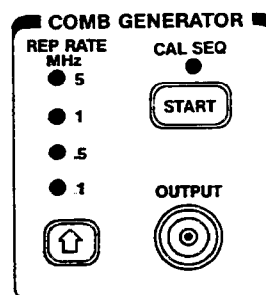
### INTRODUCTION

The comb generator functions provide a comb generator and a test receiver calibration routine.



The comb generator is a calibrated signal source and can generate combs at any one of four repetition rates. The comb generator provides a source for the calibration routine, which ensures  $\pm 2.0$  dB amplitude accuracy required for electromagnetic emission measurements.

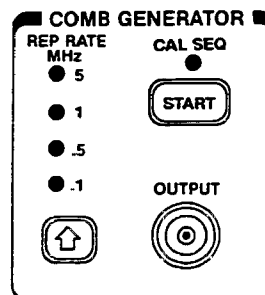
### COMB GENERATOR



The comb generator produces combs with frequency spacings of 100 kHz, 500 kHz, 1 MHz, or 5 MHz. To activate the comb generator, press the comb generator step key. This selects the 100 kHz comb frequency, as indicated by the LED next to the frequency on the front panel. To select the next comb frequency, press the step key again. When the 5 MHz comb frequency is reached, pressing the step key again turns off the comb generator.

The comb generator is calibrated at the factory, and selected tooth amplitudes are stored in the preselector for use in the calibration routine.

## CAL SEQ



The test receiver can be calibrated for most settings selected on the preselector and spectrum analyzer. It is possible, however, to select an instrument setting that will abort the calibration routine. If this occurs, a message appears on the spectrum analyzer display that identifies the incorrect setting. Make the adjustment indicated by the error message and continue calibration.

The calibration START key activates the calibration sequence, which calibrates the preselector as follows.

The output of the comb generator is input to the preselector, and selected comb teeth are measured by the spectrum analyzer. Any variation between the measured comb tooth amplitude and the value stored in the preselector is corrected by an internal preselector gain adjustment.

Before the preselector is calibrated, enable the preselector BYPASS function, and perform amplitude and bandwidth calibrations on the spectrum analyzer (see CALIBRATING THE TEST RECEIVER in the **TEST RECEIVER CONFIGURATION** section).

To calibrate the preselector, complete the following steps.

1. The calibration routine calibrates the preselector from the spectrum analyzer start frequency to the spectrum analyzer stop frequency. Select the desired spectrum analyzer start and stop frequencies, resolution and video bandwidths, and scale.
2. Connect the output of the comb generator to the preselector input that covers the chosen spectrum analyzer frequency settings, and activate the input.
3. Press the START key. The CAL SEQ LED blinks on and off, indicating that the routine is running. The number of calibration points checked and the length of the calibration routine depend upon the spectrum analyzer frequency span. When the calibration routine has been completed, the CAL SEQ LED remains lit, indicating that calibration data exists for the current frequency span. As long as the spectrum analyzer and RF preselector remain tuned within the frequency span that was calibrated, the CAL SEQ LED will be lit, but as soon as the instruments are tuned above or below that frequency range, the LED turns off.

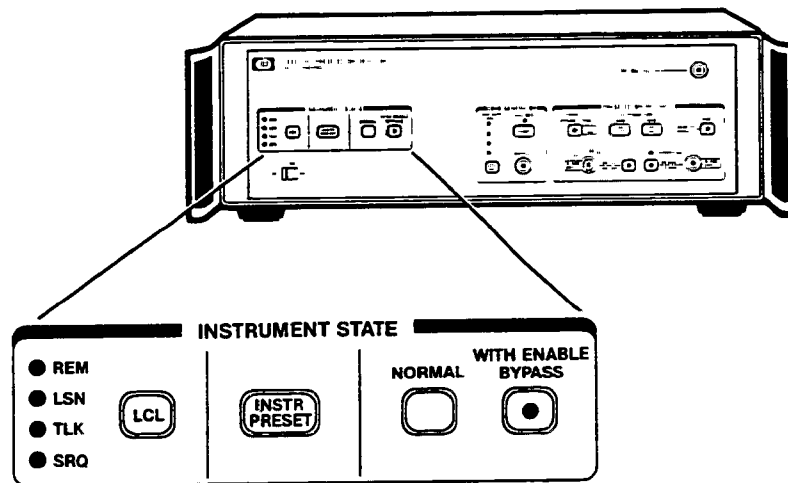
The calibration data remains in the preselector until the power is cycled.

To maintain preselector calibration, perform the routine weekly or whenever the temperature varies more than 5°C.

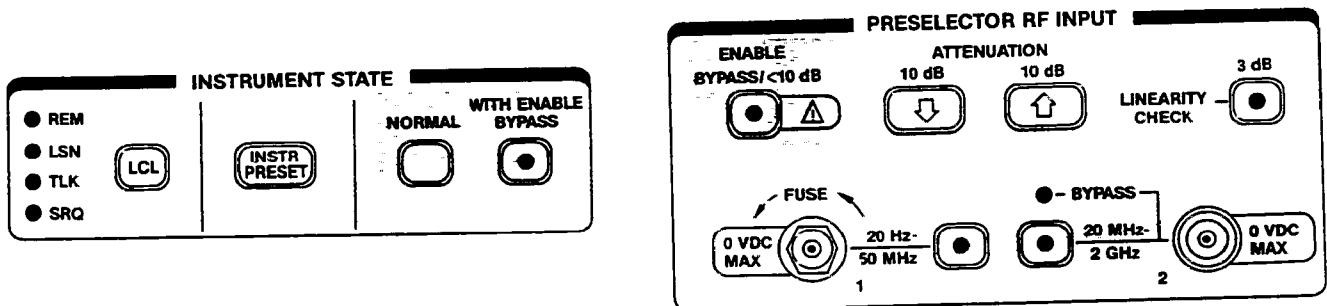
## INSTRUMENT STATE

### INTRODUCTION

The instrument state functions provide a preselector bypass path, an instrument preset, instrument state indicators, and a return to local mode



### NORMAL/BYPASS



### CAUTION

**Do not connect signals greater than +30 dBm to the preselector while in BYPASS is active. Exceeding this power level may damage the spectrum analyzer.**



The bypass function activates an alternate signal path that bypasses the preselector and sends the signal directly into the spectrum analyzer. It also deactivates the preselector tracking capability and releases preselector control of the spectrum analyzer sweep. Bypass allows you to input 0 Hz - 18 GHz signals into the preselector, without having to manually make or break connections and without limiting HP 8566B Spectrum Analyzer capability. Only signals connected to Input 2 can bypass the preselector. To activate the function, press the ENABLE key, then the BYPASS key. Both the LED in the bypass key and the LED above Input 2 light up, indicating the function is active. To deactivate bypass, press the NORMAL key or an input select key. This returns the preselector to the signal path; NORMAL reactivates the previously selected input.

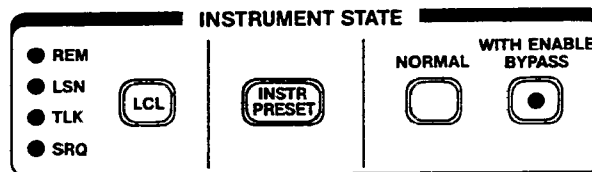
**NOTE**

**Executing a spectrum analyzer instrument preset disrupts communication between the spectrum analyzer and preselector. It effectively “disconnects” the spectrum analyzer from the private control bus. To “reconnect” the instruments, press either the preselector NORMAL or INSTR PRESET key.**

**NOTE**

**BYPASS must be enabled before executing the spectrum analyzer calibration routine.**

**INSTR PRESET**



The preselector instrument preset routine sets the preselector functions to the following conditions:

- 50 MHz - 2 GHz Input — active
- Attenuation — 20 dB
- All other front-panel functions — deactivated.

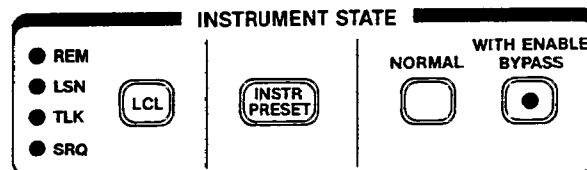
If the preselector private control bus is active, the instrument preset routine also commands the preselector to find a device on the private control bus and determine if it is an HP 8566B or 8568B Spectrum Analyzer. After the preselector obtains the device's address, it commands the spectrum analyzer to perform an instrument preset and notify the preselector of changes in its frequency settings. Selecting an odd address on the preselector address switch disables this part of the instrument preset routine and also disables communication between the preselector and spectrum analyzer via the private control bus.

To activate instrument preset, press the INSTRUMENT PRESET key.

An instrument preset is automatically executed when the LINE switch is switched ON.

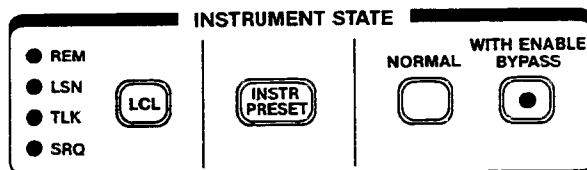
After the preselector performs an instrument preset, if the preselector front-panel keys are not working, check the private control bus connections and make sure the spectrum analyzer is powered up. If the preselector front-panel keys are still not working, refer to the preselector's Troubleshooting and Repair Manual.

## INSTRUMENT STATE INDICATORS



These LEDs allow you to view preselector conditions during remote operation. When the preselector is under remote control, the remote (REM) LED is always active. In this state, either the talk (TLK) or listen (LSN) LED is also active, depending upon whether the preselector is talking or listening to the computer. When the preselector is under remote control, no preselector functions (except for the remote-to-local function and the LINE switch) are accessible from the front panel. The SRQ LED lights up when the preselector requests service. For additional remote operation information, refer to the **REMOTE OPERATION** section of this manual.

## LCL



The local function returns the preselector from remote to manual, or local, operation and deactivates the REM, TLK, and LSN LEDs. If the private control bus is active, it also returns the spectrum analyzer from remote to local operation. LCL makes functions accessible from the front panel again.

### FIRMWARE DATE CODE AND HP-IB ADDRESSES

RF preselectors with firmware dated 09.27.88 and later can display the current firmware revision date and HP-IB addresses on the CRT of the spectrum analyzer. To activate this feature, press the ENABLE key, then the LCL key. The following information will appear on the spectrum analyzer CRT:

85685A (c) rev 09.27.88  
HP-IB PROG ADRS: RFP 19, SA 18  
(RFP Switch Adrs 18, SA Dev Adrs 18)

Push < CLEAR-WRITE A > to continue.

To return to normal operation, press the CLEAR-WRITE A key on the spectrum analyzer.

The programming addresses refer to the addresses used when controlling the instruments with a computer over the HP-IB bus. The RFP Switch Address is the physical HP-IB switch setting on the rear panel of the HP 85685A RF Preselector. The SA Device Address is the instrument address setting on the spectrum analyzer.



# SECTION 4

## REMOTE OPERATION

### INTRODUCTION

This section describes how to configure the test receiver for remote operation. This section also describes the preselector's programmable capabilities and its effects on spectrum analyzer remote operation.

### REMOTE OPERATION CONFIGURATION

To configure the test receiver for remote operation, connect an HP-IB cable between the computer and preselector HP-IB connector, marked TO COMPUTER, as shown in Figure 4-2.

Connect all other computer-controlled devices to the HP-IB, not to the private control bus.

This is the most common remote operation configuration, and is used with HP 85864B EMI Software.

### PRIVATE CONTROL BUS

While under computer control, the preselector continues to provide automatic frequency tracking and annotation updates via the private control bus. It also makes use of the private control bus for pass through.

### PASS THROUGH

The preselector's pass through mode passes commands from the computer to the spectrum analyzer via the preselector. Without the pass through mode, commands for the spectrum analyzer could not transmit beyond the preselector (see Figure 4-2).

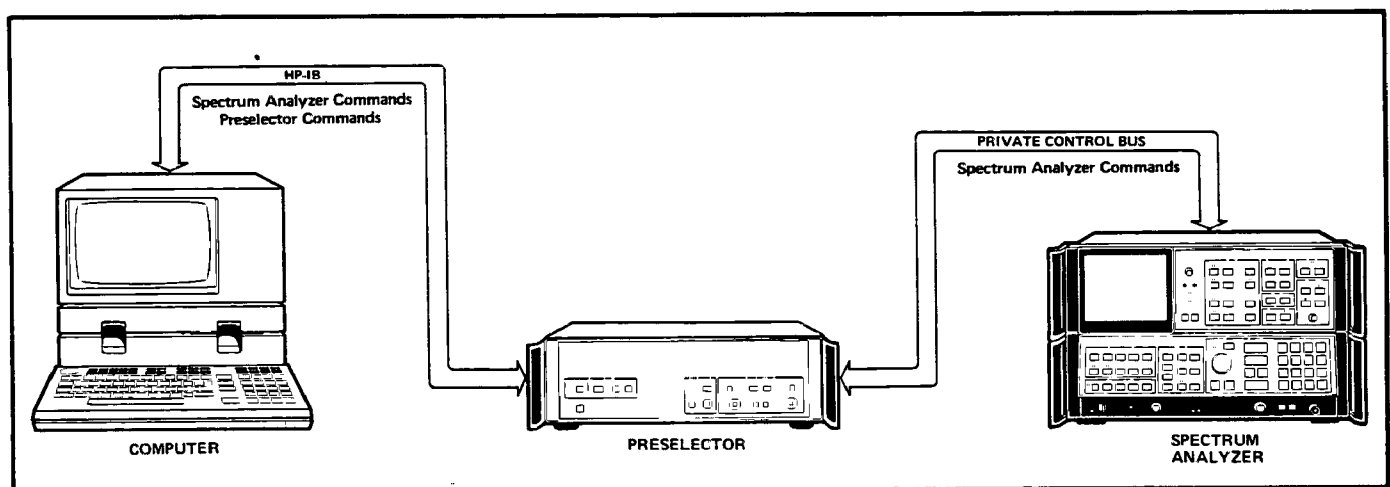


FIGURE 4-1. SPECTRUM ANALYZERS COMMANDS PASS THROUGH THE PRESELECTOR

REMOTE OPERATION

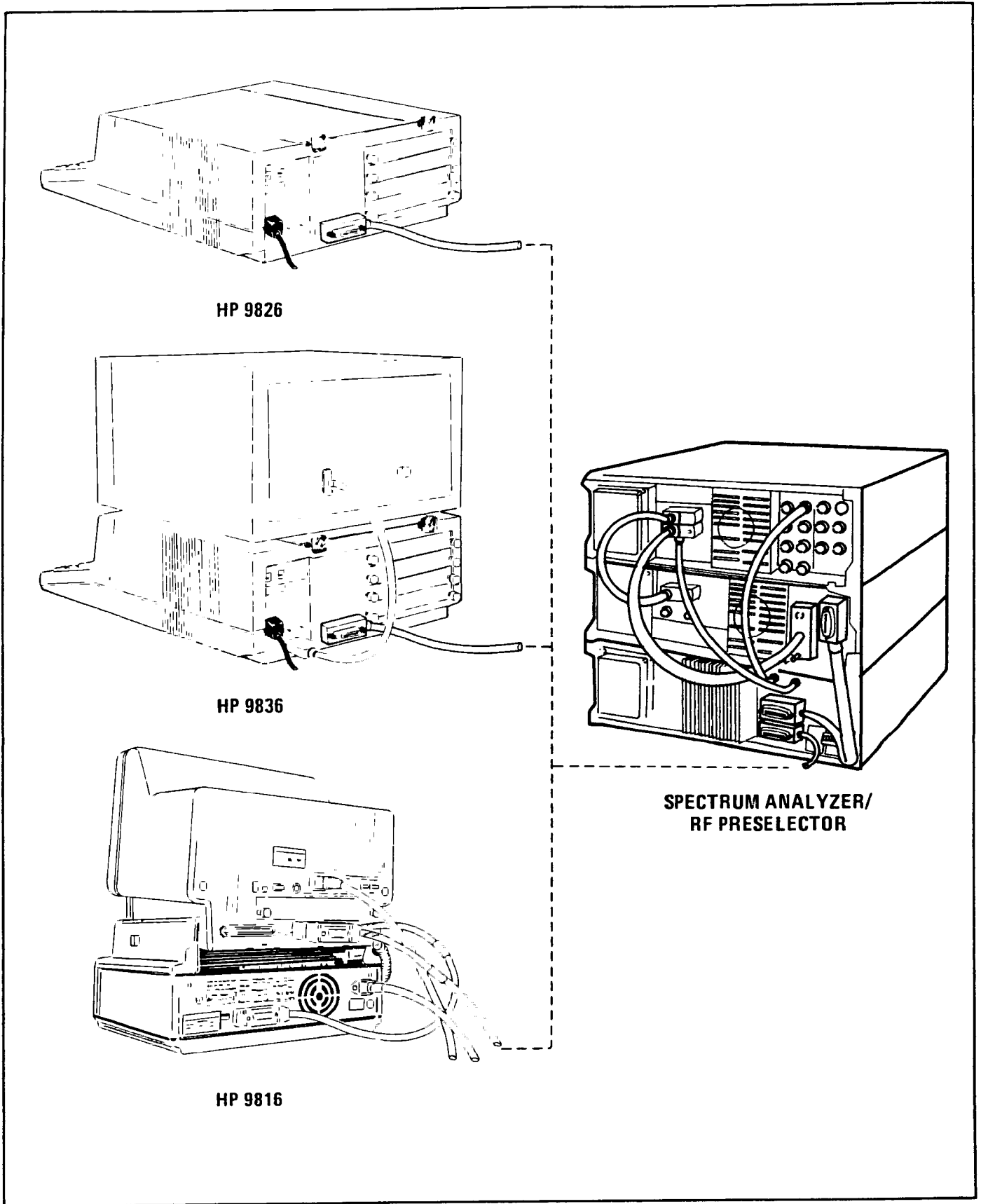


FIGURE 4-2. REMOTE OPERATION CONFIGURATION

The pass through mode is automatically enabled when commands are sent to the preselector's even address (i.e., when the spectrum analyzer is addressed; see SELECTING HP-IB ADDRESSES). However, pass through disables the preselector's automatic frequency-tracking capability. After sending commands to the spectrum analyzer, send the COUPLE command to the preselector (see COUPLE in the PROGRAMMING COMMANDS section). This disables pass through and restores the preselector's automatic frequency tracking. Other methods of deactivating pass through and restoring tracking are executing a BASIC command LOCAL 7, pressing the preselector front-panel LCL key, or executing a preselector instrument preset.

**NOTE**

**Pass through can be activated only when the preselector rear-panel address switch is set to an even number. Pass through cannot be activated when the preselector address is set to an odd value.**

**SELECTING HP-IB ADDRESSES**

The preselector rear-panel address switch selects HP-IB addresses for both the preselector and the spectrum analyzer. Set the preselector address switch to an even address, preferably 18 (see Figure 4-3). Set the spectrum analyzer address to the same even value. This even address is the spectrum analyzer HP-IB address, and is the one to use to send commands to the spectrum analyzer. The address value one greater than this is the preselector's HP-IB address, and is the one to use when sending commands to the preselector. For example, the program examples in this manual were written with both the preselector address switch and the spectrum analyzer address set to 18. Commands sent to the spectrum analyzer use address 18, and commands sent to the preselector use address 19.

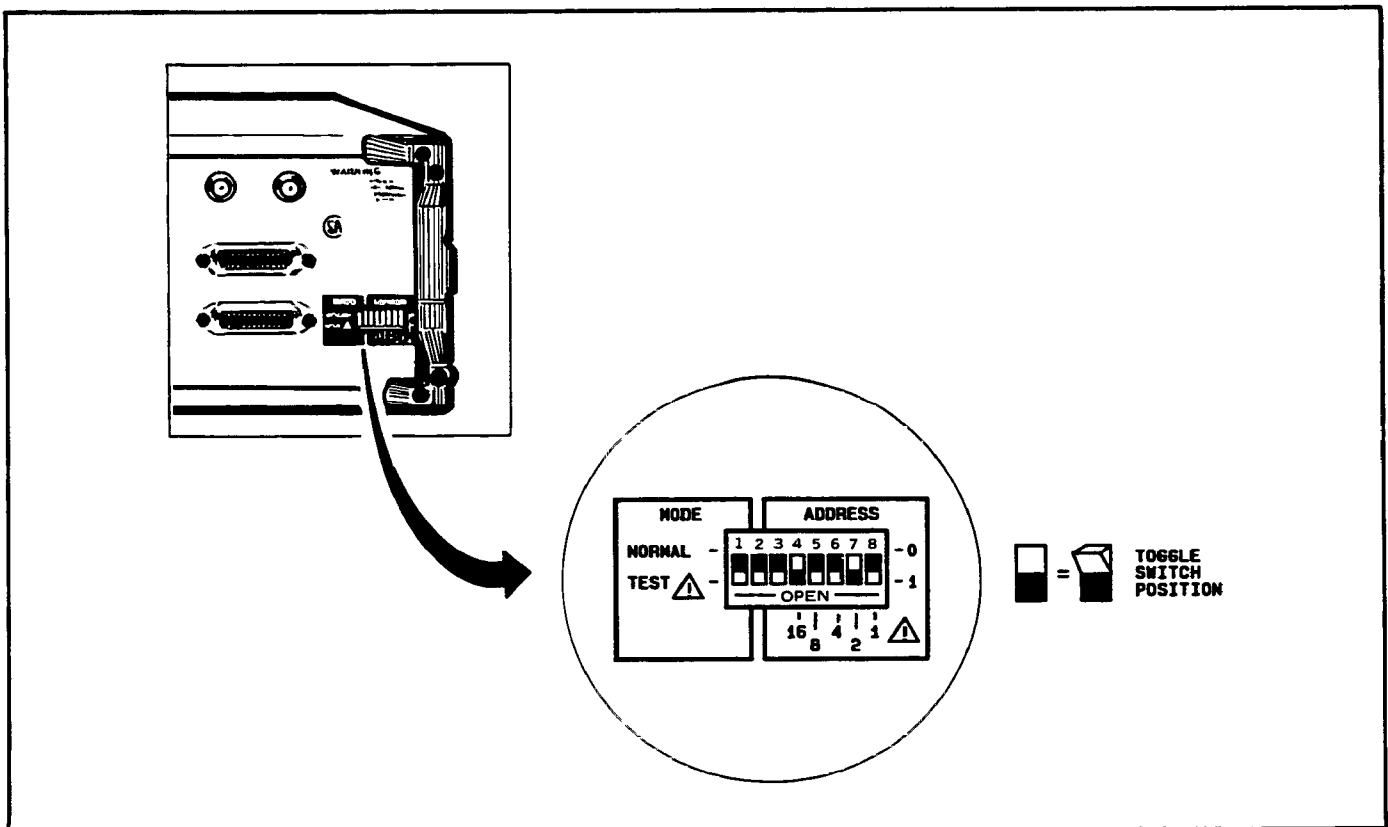


FIGURE 4-3. PRESELECTOR ADDRESS SWITCH

## PROGRAMMABLE FUNCTIONS

The preselector can execute commands that perform the same functions as the front-panel keys. It can also execute commands that adjust its center frequency, frequency span, and other frequency settings.

The preselector commands also return status information to the computer, such as the state of a function or the model number of a device connected to the private bus.

The following program illustrates how to activate a preselector function, query the preselector for the function's value, and enter the value as a variable for further use.

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"AT 30DB;"
30  OUTPUT @Rfps;"AT?;"
40  ENTER @Rfps;N
50  PRINT N
60  END
    
```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Set the preselector attenuation to 30 dB.

Line 30: Query the preselector for the attenuation value.

Line 40: Enter the value in the computer.

Line 50: Print the value on the computer display.

Line 60: End the program.

Real numbers returned from the preselector contain decimal points. For example, if the preselector center frequency is set to 75 MHz, it returns the value as 75000000.0.

The following program example performs a signal search through the FM band. It searches for frequencies above 40 dBmV, and if any are detected, prints their amplitude and frequency values.

```

1      ! **** SAMPLE PROGRAM
2      ! 850404 file "SAMPLE"  tb
3      OPTION BASE 1
4      DIM Signal(2,1000)  ! DEFINE VARIABLES
5      Freq_incr=1.0E+5    !
6      Start_freq=8.81E+7  !
7      Stop_freq=1.08E+8   !
8      Cent_freq=Start_freq !
9      Res_bw=1.0E+4       !
10     Video_bw=10         !
11     Ref_level=50        !
12     Log_scale=5         !
13                                     ! *****
14                                     !
15     Prt=701             ! ASSIGN PRINTER
16                                     !
17                                     ! *****
    
```



```

18 ASSIGN @Sa TO 718      ! ASSIGN I/O PATH
19 ASSIGN @Rfp TO 719    ! *****
20 ! SET START FREQUENCY AND SPAN OF SA & RFP
21 !
22 OUTPUT @Sa;"CF";Start_freq;"HZ;SP10KZ;TS;"
23 OUTPUT @Rfp;"COUPLE;"
24 ! SET UP ANALYZER
25 !
26 OUTPUT @Sa;"RB1MZ;VB3MZ;TS;S2;M2;"
27 OUTPUT @Sa;"LN;KSC;RL75DB;ST.100SC;"
28 OUTPUT @Sa;"KSb;"
29 I=0 ! COUNTER
30 Cent_freq=Start_freq
31 ! **** BEGIN TEST ****
32 REPEAT
33   OUTPUT @Sa;"CF";Cent_freq;"HZ;"
34   OUTPUT @Rfp;"COUPLE;"
35   REPEAT
36     Flag1=1
37     OUTPUT @Sa;"TS;MKPK HI;MA;"
38     ENTER @Sa;Marker
39     IF ABS(Marker-Ref_level)<.5 THEN
40       Ref_level=Ref_level+10
41       OUTPUT @Sa;"RL";Ref_level;"DB;"
42       Flag1=0
43     END IF          ! MARKER HIGH
44     IF ABS(Marker-Ref_level)>20 THEN
45       Ref_level=Ref_level-10
46       OUTPUT @Sa;"RL";Ref_level;"DB;"
47       Flag1=0
48     END IF          ! MARKER LOW
49   UNTIL Flag1
50   IF Marker>=40 THEN
51     I=I+1
52     Signal(2,I)=Marker
53     OUTPUT @Sa;"MF;"
54     ENTER @Sa;Freq
55     Signal(1,I)=Freq
56   END IF          ! IF MARKER
57   Cent_freq=Cent_freq+Freq_incr
58 UNTIL Cent_freq>Stop_freq
59 ! ***** PRINT DATA *****
60 !
61 IMAGE 2X,"NO.",4X,"FREQ",10X,"AMPTD"
62 OUTPUT Prt USING 61
64 IMAGE X,DDD,3X,DDD.DD," MHz",4X,DD.DD," dBuV"
65 IF I=0 THEN PRINT "NO DATA FOUND"
67 PRINT "=> => READY!! => PRESS CONTINUE"
68 FOR X=1 TO I
69   OUTPUT Prt USING 64;X,Signal(1,X)/1.E+6,Signal(2,X)
70   IF X MOD 15=0 AND Prt=1 THEN
71     PRINT " => => READY !! => press CONTINUE"
72     PAUSE
73   END IF          ! PAUSE

```

## REMOTE OPERATION

74 NEXT X  
75 END

Lines 4-12: Define the program variables and set their values.

Line 15: Set the value of variable Prt to the printer address.

Lines 18-19: Assign the spectrum analyzer and preselector addresses as the values @Sa and @Rfp, respectively.

Line 22: Set the spectrum analyzer center frequency to 88.1 MHz and the frequency span to 10 kHz.

Line 23: Set the preselector to the same center frequency and frequency span.

Lines 26-28: Set the spectrum analyzer resolution and video bandwidths. Activate the single sweep mode and marker, and set the scale to dBmV. Set the reference level, sweep time, and positive peak detector.

Line 29: Set counter I to 0.

Line 30: Set the variable Cent\_freq to 88.1 MHz.

Line 32: Repeat the subroutine in Lines 33 - 57 until the conditions in Line 58 are met.

Lines 33-34: Set the spectrum analyzer center frequency to the value in variable Cent\_freq. Set the preselector to the same center frequency.

Line 35: Repeat the marker routine in Lines 34 - 48 until the conditions on Line 49 are met.

Line 36: Set Flag 1 to 1.

Lines 37-38: Find the highest amplitude signal and enter its amplitude in variable Marker.

Lines 39 - 43: If the signal peak is too high (less than .5 dB away from the reference level), increase the reference level. Set Flag 1 to 0.

Lines 44 - 48: If the signal peak is too low (more than 20 dB from the reference level), decrease the reference level. Set Flag 1 to 0.

Line 49: Continue the routine in Lines 36 - 48 until Flag 1 equals 1.

Lines 50 - 56: If the value in Marker is greater than 40 (the signal detected is higher than 40 dBmV), increment the counter and store the signal amplitude in a string. Measure the signal frequency and store that value in a second string.

Line 57: Increment the center frequency 100 kHz.

Line 58: Continue the routine in Lines 33 - 57 until the center frequency exceeds 108 MHz.

Lines 61-74: Print the signal frequencies and amplitudes stored in the strings.

## NUMERIC ENTRIES VIA HP-IB

A numeric entry consists of a number followed by a message that specifies the number units and terminates the entry. The number is a string of (ASCII) decimal numbers plus an optional decimal point. If the decimal point is not included in the entry, it is assumed to be at the end of the number. Plus and minus signs may precede numbers. Number entries in either fixed or floating notation are acceptable. For example, the entries "1.3E6", "1.3e6", and "1300000" all enter the same number. The number of significant digits that the preselector accepts and stores depends upon which function is active. Range restrictions and acceptable number types for each command are available in the **PROGRAMMING COMMANDS** section.

Numbers may be terminated with the following messages: HZ, KZ, MZ, GZ, or DB. Other acceptable number terminators are the semicolon, line feed, carriage return, space, or comma; of these, only a semicolon is recommended. Where frequency units are not defined, the units default to HZ.

## INSTRUMENT STATE INDICATORS

These LEDs allow you to view the state of the preselector during remote operation. When the preselector is under remote control, the remote (REM) LED is always active. In this state, either the talk (TLK) or listen (LSN) LED is also active, depending upon whether the preselector is talking or listening to the computer. The service request (SRQ) LED is active when the preselector is requesting service.

## REMOTE TO LOCAL OPERATION

When the preselector is under remote control, all front-panel functions are deactivated, except for the LCL key and the LINE switch. To return to manual control, press the LCL key or use the computer's LOCAL command.

## ALTERNATE REMOTE OPERATION

The preselector can be configured for independent remote operation (see Figure 4-4). Set the preselector address switch to an odd value. Remove the spectrum analyzer from the private control bus and connect it to the preselector HP-IB, marked TO COMPUTER. Connect the computer to this bus also. Stand-alone operation allows the preselector and spectrum analyzer to be programmed independently. However, since the private control bus is not used, the preselector's automatic tracking capability and calibration sequence are disabled.

## DOWNLOADABLE PROGRAMMING

Spectrum analyzer downloadable programs allow a spectrum analyzer to present measurement information without the aid of a computer. The spectrum analyzer can also use downloadable programs to control the HP 85685A RF Preselector. Such downloadable programs allow the spectrum analyzer to make accurately preselected measurements and evaluate the data independent of any user or computer control.

This section provides user prerequisites, describes how to configure the test receiver to run downloadable programs, explains how to write downloadable programs that control the preselector, and provides example downloadable programs.

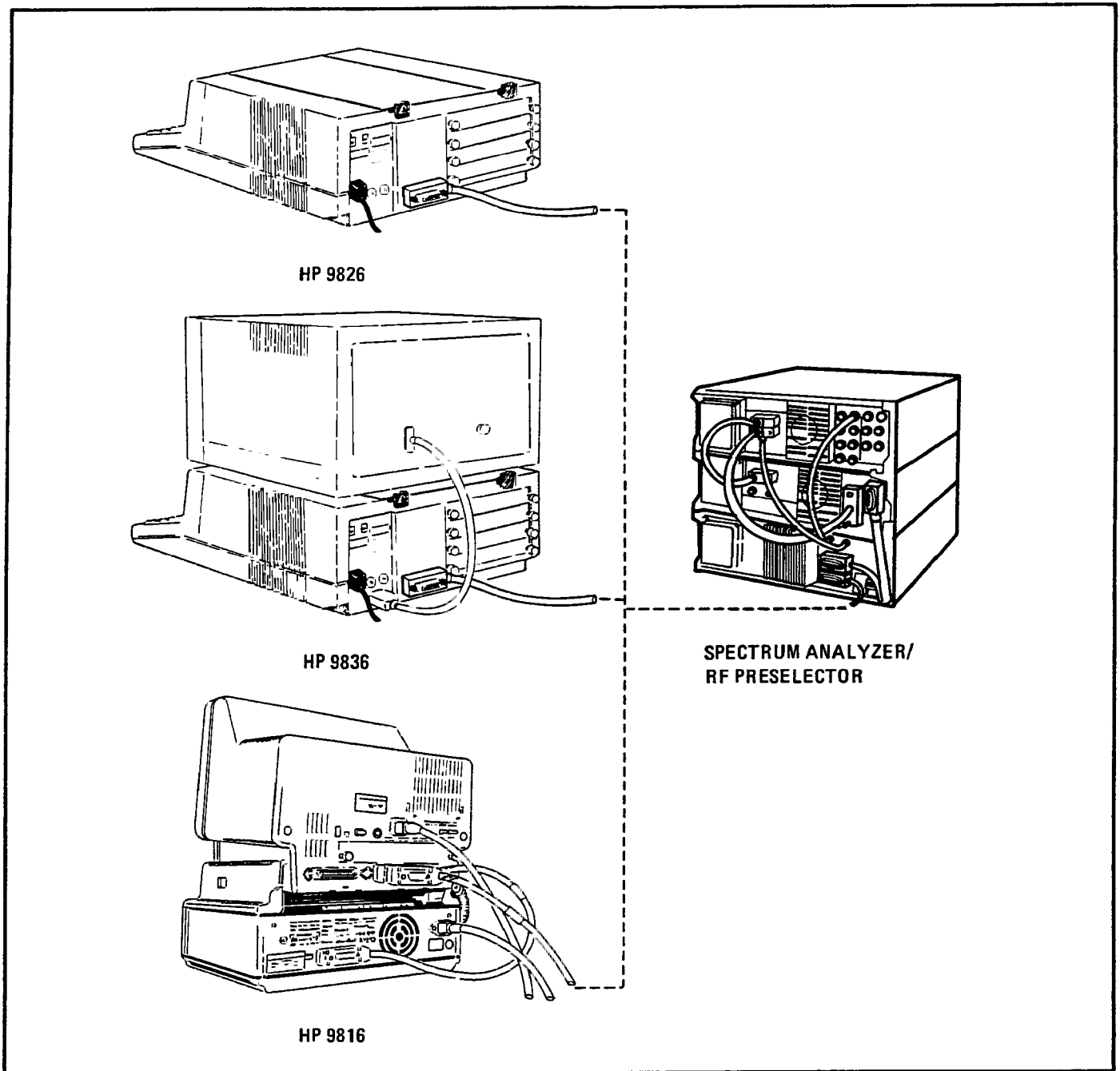


FIGURE 4-4. ALTERNATE REMOTE OPERATION CONFIGURATION

### Requirements

To write downloadable programs, use any HP-IB compatible computer.

Before learning to write downloadable programs that control the preselector, some experience in writing downloadable programs is required. Programming Note, "A Structured Approach to Downloadable Programming" (publication number 5952-9392), describes how to write downloadable programs.

## Test Receiver Configuration

The preselector is not required until the downloadable program is ready to be executed from the spectrum analyzer. To execute the downloadable program, set the preselector address to an odd value (such as 19), and connect the spectrum analyzer to the preselector's HP-IB bus, marked TO COMPUTER as in Figure 4-8.

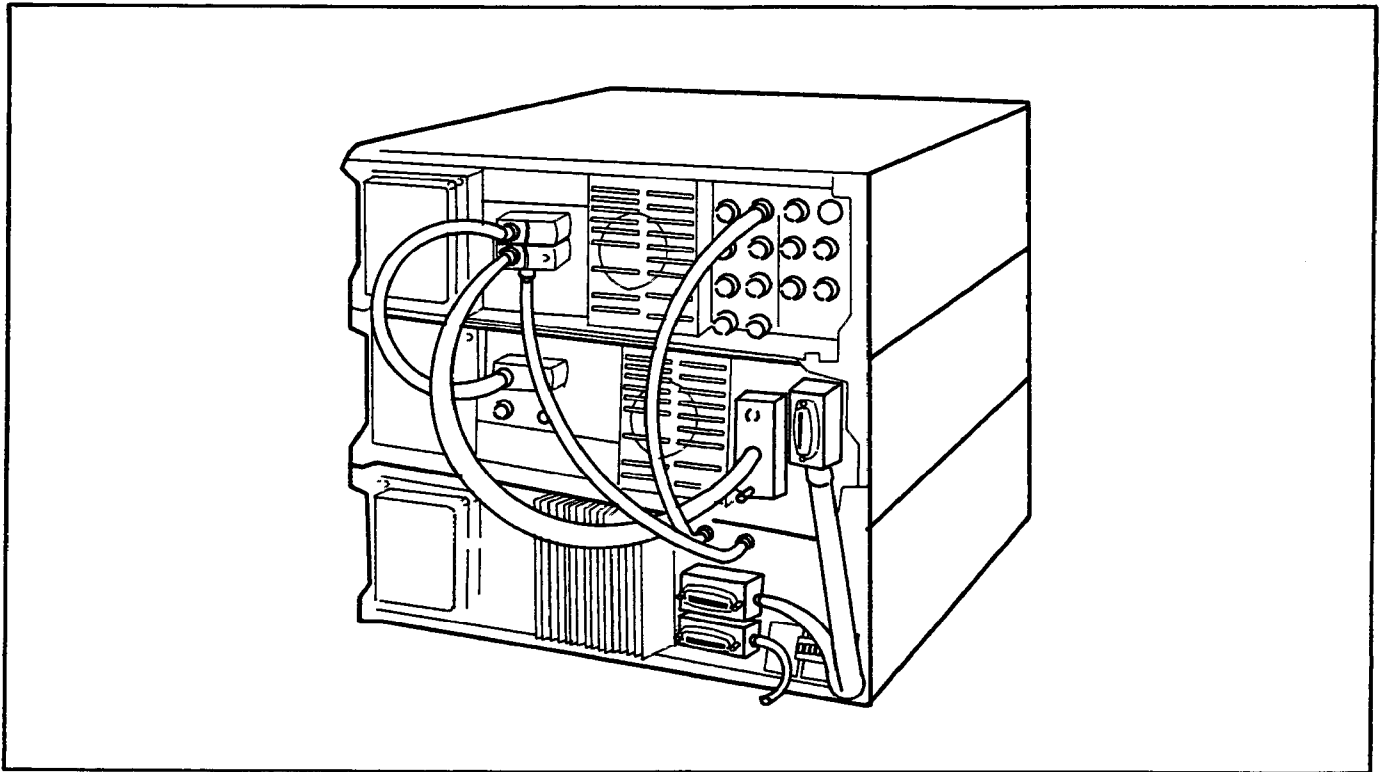


FIGURE 4-8. DOWNLOADABLE-CONTROLLED CONFIGURATION

Note the private control bus is not used; the preselector automatic frequency tracking, annotation, and passthrough mode are disabled.

## Creating Downloadable Programs

The key to the spectrum analyzer's ability to control the preselector is its OUTPUT and ENTER commands. These two commands give the analyzer control over other HP-IB devices.

To write a downloadable program that controls the preselector, all preselector commands that select frequency settings must be used with the spectrum analyzer's on end of sweep (ONEOS) command.

The following illustrates how to write a downloadable program. This program creates preselector attenuation annotation and continually updates it, and allows the preselector to track the spectrum analyzer center frequency and frequency span.

## REMOTE OPERATION

```
1      ! MANUAL PRESECTOR CONTROL
2      ! ;850501 : file: RF_PRESEL:  tb
3      !
4      ASSIGN @Sa TO 718
5      OUTPUT @Sa;"VARDEF C_FREQ,0;"
6      OUTPUT @Sa;"VARDEF S_PAN,0;"
7      OUTPUT @Sa;"VARDEF A_TTEN,0;"
8      OUTPUT @Sa;"VARDEF A_T,1;"
9      OUTPUT @Sa;"VARDEF R_EF,0;"
10     !
11     OUTPUT @Sa;"FUNCDEF P_RESEL %"
12     !
13     OUTPUT @Sa;"ONEOS &"
14     OUTPUT @Sa;"OUTPUT 19,K,'AT?';"
15     OUTPUT @Sa;"ENTER 19,K,A_TTEN;"
16     OUTPUT @Sa;"IF A_TTEN,NE,A_T THEN"
17     OUTPUT @Sa;"  D2;DA3072;PU;PA 500,984;"
18     OUTPUT @Sa;"  TEXT $  + $;"
19     OUTPUT @Sa;"  DSPLY A_TTEN,4.0;"
20     OUTPUT @Sa;"  TEXT $  dB$;"
21     OUTPUT @Sa;"  MOV R_EF,RL;"
22     OUTPUT @Sa;"  SUB ROFFSET,A_TTEN,20;"
23     OUTPUT @Sa;"  MOV RL,R_EF;"
24     OUTPUT @Sa;"  MOV A_T,A_TTEN;"
25     OUTPUT @Sa;"ENDIF;"
26     !
27     OUTPUT @Sa;"IF C_FREQ,NE,CF THEN"
28     OUTPUT @Sa;"  OUTPUT 19,K,'CF';"
29     OUTPUT @Sa;"  OUTPUT 19,K,CF;"
30     OUTPUT @Sa;"  OUTPUT 19,K,'HZ;';"
31     OUTPUT @Sa;"  MOV C_FREQ,CF;"
32     OUTPUT @Sa;"ENDIF;"
33     !
34     OUTPUT @Sa;"IF S_PAN,NE,SP THEN"
35     OUTPUT @Sa;"  OUTPUT 19,K,'SP';"
36     OUTPUT @Sa;"  OUTPUT 19,K,SP;"
37     OUTPUT @Sa;"  OUTPUT 19,K,'HZ;';"
38     OUTPUT @Sa;"  MOV S_PAN,SP;"
39     OUTPUT @Sa;"ENDIF;"
40     OUTPUT @Sa;"&";"
41     OUTPUT @Sa;"%";"
42     OUTPUT @Sa;"KEYDEF 85,P_RESEL;"
43     END
```

Line 4: Assign the spectrum analyzer address as @Sa.

Lines 5-9: Define the program variables and set their values.

Line 11. Lines 13-41 contain the routine P\_\_RESEL.

Line 13: Lines 14-40 contain the routine to be performed at the end of every spectrum analyzer sweep.

Line 14: Query the preselector for its attenuation value.

Line 15: Enter the value in variable A\_\_TTEN.

Lines 16-25: If the preselector attenuation is not equal to the value in variable A\_\_T, display the preselector attenuation.

Lines 27-32: If the preselector center frequency is not the same as the spectrum analyzer center frequency, change the preselector center frequency so that it is equal to the spectrum analyzer center frequency. Update variable C\_\_FREQ to contain the current preselector center frequency.

Lines 34-39: If the preselector frequency span is not the same as the spectrum analyzer center frequency, change the preselector frequency span so that it is equal to the spectrum analyzer frequency span. Update variable S\_\_PAN to contain the current preselector frequency span.

Line 40: End the routine that occurs on the end of the sweep.

Line 41: End the routine P\_\_RESEL.

Line 42: Store the downloadable program in softkey 85.

Line 43: End the program.

This downloadable program will continue to execute indefinitely. However, the preselector front-panel functions are disabled while it is running. The following downloadable program, which checks for signal distortion and overload, can be executed while the first one is running.

```

1      ! **** LIN TEST ****
2      ! 850501 FILE:LIN_DLP   tb
3      ASSIGN @Sa TO 718
4      !
5      OUTPUT @Sa;"FUNCDEF L_IN %"
6      OUTPUT @Sa;"TS;MKPK HI;M3;" ! MARKER DELTA
7      !
8      OUTPUT @Sa;"OUTPUT 19,K,'LIN ON;';" ! 3dB ON
9      !
10     OUTPUT @Sa;"TS;TS;MKPK HI;" ! MARKER AMPTD
11     !
12     OUTPUT @Sa;"IF MA,GT,.5 THEN" ! IF CHANGE > .5
13     OUTPUT @Sa;"OUTPUT 19,K,'AT UP;';" ! ADD ATTENUATION
14     OUTPUT @Sa;"ENDIF;"
15     OUTPUT @Sa;"IF MA,LT,-.5 THEN" ! IF CHANGE <-.5
16     OUTPUT @Sa;"OUTPUT 19,K,'AT UP;';" ! ADD ATTENUATION
17     OUTPUT @Sa;"ENDIF;"
18     OUTPUT @Sa;"OUTPUT 19,K,'LIN OFF;';" ! 3dB OFF
19     OUTPUT @Sa;"M2;"
20     OUTPUT @Sa;"S1;%;"
21     END

```

Line 3: Assign the spectrum analyzer address as @Sa.

Line 5: Lines 6 - 20 contain the routine L\_\_IN.

Line 6: Read the amplitude of the highest signal on the screen and activate the marker delta mode.

Line 7: Activate the preselector 3 dB linearity check

## REMOTE OPERATION

Line 10: Reread the signal amplitude.

Lines 12-17: If the signal amplitude has changed more than .5 dB, increase the preselector attenuation.

Line 18: Deactivate the linearity check.

Line 19: Move the marker to the center of the screen.

Line 20: Set the sweep to continuous mode and end the routine.

Line 21: Store the routine in softkey 2.

Line 22: End the program.

Program `L__IN` will not operate properly unless `P__RESEL` is running, because `L__IN` has no commands that control the preselector frequency settings (i.e., the preselector will not track the spectrum analyzer and, therefore, will not preselect).

As with standard remote operation, all front-panel functions can be controlled remotely from within downloadable programs

## SERVICE REQUESTS

Preselector service requests enable the preselector to interrupt a computer's program sequence, making the program branch to an interrupt routine. There are several preselector instrument states that can trigger a service request (SRQ). For example, a "key pressed" service request can cause a program to branch to a particular routine only when a key is pressed on the preselector front panel.

When a service request is generated, the preselector sets the HP-IB SRQ line true and activates its front-panel SRQ LED. The SRQ line signals to the computer that an SRQ has been generated. The computer can then request to read the status byte from the preselector, which identifies the type of service request. After identifying the service request, the computer can branch to the appropriate routine.

### NOTE

**Use a serial poll to return service request information to the computer. Do not use a parallel poll. A serial poll can be executed only on the preselector's odd address.**

## Service Request Interrupts

Computer response to an SRQ varies among types of computers. The operating manuals for each computer discuss that computer's reaction to setting the SRQ line true. Series 200 computers have a sequence of commands that enable it to respond to a service request. These commands allow the computer to monitor the SRQ line and read, interpret, and clear the status byte. This sequence of commands and a subroutine, selected according to the type of service request, form a service routine. A general setup and the service request commands for Series 200 computers follow.



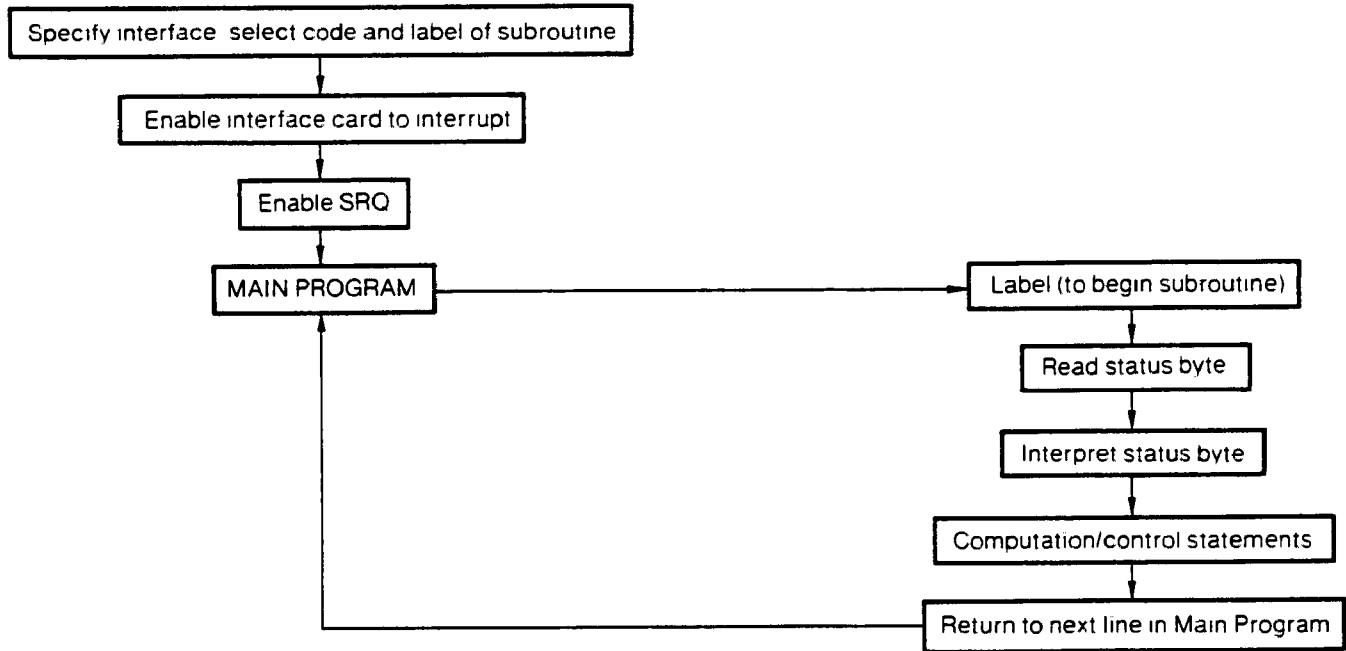


FIGURE 4-5. INTERRUPT SETUP

TABLE 4-1 BASIC SERVICE ROUTINE COMMANDS

Interrupt Statements	Example	Comments
ON INTR	ON INTR CALL Shutoff	Declares the name of the service routine where program execution branches on interrupt from the peripheral specified by select code 7.
ENABLE INTR	ENABLE INTR 7;2	Enables the calculator to accept an SRQ interrupt from select code 7;2 (the HP-IB).
RETURN	RETURN	Signals the end of an interrupt service routine. While executing the service routine, the interrupt for the peripheral being serviced must be disabled to prevent cascading of interrupts (e.g., OFF INTR 7).
SUBEND	SUBEND	Signals the end of an interrupt service subprogram.
<b>Bit Functions</b>		
S POLL	A = S POLL (719)	Reads the preselector status byte, assigns its decimal value to A and clears the SRQ line.
BIT	BIT (A, N)	Returns the value of the Nth bit in A (0 or 1).

For more information on these BASIC service routine commands, refer to the BASIC Language Reference.

### Status Byte Definition

Both the computer's SPOLL command and the preselector's OS command enable the computer to read the preselector status byte. From this status byte the computer can then determine the type of service request. The preselector actually has two status bytes. The first status byte contains preselector service request information. The second, or extended, status byte contains spectrum analyzer service request information. This extended status byte allows the preselector to pass spectrum analyzer service requests to the computer. For more information on how the preselector affects spectrum analyzer service requests, see Enabling Spectrum Analyzer Service Requests in this section.

Table 4-2 gives both preselector status byte numbers and definitions.

TABLE 4-2. PRESELECTOR STATUS BYTES

STATUS BYTE (#1)								
Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
Function	Preselector Request Service (SRQ)	Request Service (SRQ)	SRQ on Illegal Command		SRQ on Broken Hardware	SRQ on End of Sweep	SRQ on Key Pressed	
EXTENDED STATUS BYTE (#2)								
Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
Function		Request Service (SRQ)	SRQ on Illegal Command		SRQ on Broken Hardware	SRQ on End of Sweep	SRQ on Units Key Pressed	

Bits 1 through 5 of both status bytes specify the type of service request. Bit 6, the universal HP-IB service request bit, is always set when a service request has occurred on the device. Preselector service requests also set bit 7 of byte 1, enabling the computer to differentiate between preselector and spectrum analyzer service requests.

Bit masks control which service requests are seen by the computer. Preselector commands R and RQS set bit masks that allow the desired service requests to be passed to the computer. To set the bit masks, these commands use decimal values that are derived from treating the status bytes as binary values. An example of this conversion is in Table 4-3.

TABLE 4-3. BINARY TO DECIMAL CONVERSION

bit number	7 6	5 4 3	2 1 0
status byte	1 1	0 0 0	0 1 0
decimal value	1 9 2	0	2

$$192 + 0 + 2 = 194$$

Status bytes can also be converted to octal values, as in Table 4-4. The spectrum analyzer service request commands use both decimal and octal equivalents of the status bytes to identify their service requests. One method of determining the octal equivalent of the status byte is to treat the status byte as a binary number, partition the binary number 3 bits at a time (beginning from the least significant bit), and treat each section as a single binary number.

TABLE 4-4. BINARY TO OCTAL CONVERSION

bit number	7 6	5 4 3	2 1 0	
status byte	1 1	0 0 0	0 1 0	= 302
octal value	3	0	2	

### Service Request Commands

As mentioned previously, preselector service requests are enabled using the preselector's RQS command. The preselector service request that identifies illegal preselector commands is enabled when the preselector is turned on. For more information about the RQS command, refer to the **PROGRAMMING COMMANDS** section.

### Example

The following program illustrates how to use preselector service requests to interrupt a program and call a subprogram.

```

1   COM /Devices/ @Rfps,INTEGER Sel_code
2   ASSIGN @Rfps TO 719
3   Sel_code=7
10  OUTPUT @Rfps;"RQS 234;"
20  !
25  ON INTR Sel_code CALL Interrupt_serv
30  ENABLE INTR Sel_code;2
40  PRINT "Push a key on the preselector"
50  PRINT "Push any key on the computer to stop"
60  !

```

## REMOTE OPERATION

```
61   Tired=0
62   ON KBD ALL GOSUB Done
70 Idle:REPEAT
80       ! wait for interrupt or calculator key pressed
90   UNTIL Tired=1
100  OUTPUT @Rfps;"RQS 224;" ! put preselector back in illegal command
interrupt mode
110  STOP
120 Done:Tired=1
130  RETURN
140  END
150  SUB Interrupt_serv
151    COM /Devices/ @Rfps,INTEGER Sel_code
160    OFF INTR Sel_code
170    Status_byte=SPOLL(@Rfps)
171    IF BIT(Status_byte,6)=1 THEN
180      IF BIT(Status_byte,3)=1 THEN PRINT "Hardware Broken"
190      IF BIT(Status_byte,1)=1 THEN
191        PRINT "key pressed"
200        WAIT .1
201        OUTPUT @Rfps;"194;"
202      END IF
204    ELSE
205      ! look for another device that interrupted
206    END IF
207    ENABLE INTR Sel_code;2
210  SUBEND
```

Line 10: Define variables to be used in the program.

Line 20: Assign the preselector address as @Rfps.

Line 30: Set the value of variable Sel\_code to 7.

Line 40: Set bits 7, 6, 5, and 1 of the preselector status byte. This enables the illegal command, hardware broken, and key pressed service requests.

Line 60: Branch to subprogram Interrupt\_serv on interrupt from the device specified by select code 7.

Line 70: Enable the computer to accept an interrupt from select code 7;2 (the HP-IB).

Lines 80-90: Prompt the user to trigger an interrupt by pressing a key. This program may be terminated by pressing a key on the computer.

Lines 130-180: Wait for a preselector interrupt or key pressed. Any program may be inserted here.

Line 210: Lines 220 - 360 contain the subprogram Interrupt\_serv.

Line 230: Turn off further interrupts from the preselector. This prevents the interrupts from cascading should another interrupt occur.

Line 240: Serial poll the preselector. This returns only the first status byte.

Lines 250-290: Find the bit that corresponds to the interrupt and print the appropriate comment.

Line 300: Reactivate the preselector's key pressed interrupt.

Lines 320-340: If the preselector did not cause an interrupt, a space is provided to insert a program that looks for an interrupt generated from another device.

Line 350: Re-enable the computer to accept preselector interrupts.

Line 360: End the subprogram.

Line 190: Signals the end of the interrupt routine.

Line 200: End of program.

## ENABLING SPECTRUM ANALYZER SERVICE REQUESTS

Since the spectrum analyzer is no longer directly connected to the computer, it cannot send its service requests directly to the computer. Instead, when the spectrum analyzer generates a service request, it sends the service request to the preselector. The preselector identifies the service request and, if requested, sends it to the computer. Preselector service request commands allow the preselector to identify and pass selected spectrum analyzer service requests. These preselector commands, R and RQS, enable the preselector to identify and send the same SRQs that are initiated by the spectrum analyzer's R1, R2, R3, R4 and RQS commands. For example, to enable an SRQ 102 in the spectrum analyzer and enable the preselector to pass it to the computer, type in the following commands:

```

10  ASSIGN @Sa TO 718
20  ASSIGN @Rfps TO 719
30  OUTPUT @Sa;"R4;"
40  OUTPUT @Rfps;"R4;"

```

Line 10. Assign the preselector address as the value @Rfps.

Line 20: Assign the preselector address as the value @Rfps.

Line 30: Set a bit mask in the spectrum analyzer that enables the illegal command, units key pressed, and frequency limit exceeded service requests.

Line 40: Set a bit mask in the preselector that is identical to the one in the spectrum analyzer.

More detailed explanations of the R and RQS commands are in the **PROGRAMMING COMMANDS** section.

Once a service request is generated, return the spectrum analyzer status byte to the computer using the preselector OS command.

## REMOTE OPERATION

```
50 OUTPUT @Rfps;"OS;"
60 ENTER @Rfps;S0,S1
70 PRINT S0
80 PRINT S1
90 END
```

Line 50: Query the preselector for both its service request status and the spectrum analyzer service request status.

Line 60: Enter the preselector service request status in variable S0. Enter the spectrum analyzer service request status in variable S1.

Lines 70-80: Print the values on the computer display. These values are the decimal equivalents of the preselector status byte and extended status byte. For more information on spectrum analyzer service request capabilities, refer to the HP 8566B or 8568B Operating and Programming Manual.

### Example

The following program illustrates how the preselector affects enabling and returning spectrum analyzer service request information.

```
10 COM /Devices/ @Sa,@Rfps,INTEGER Sel_code
20 ASSIGN @Sa TO 718
30 ASSIGN @Rfps TO 719
40 Sel_code=7
50 OUTPUT @Sa;"R1;R3;R4;"
60 !
70 OUTPUT @Rfps;"R1;R3;R4;"
80 ON INTR Sel_code CALL Interrupt_serv
90 ENABLE INTR Sel_code;2
100 PRINT "Push Hz key on analyzer."
110 PRINT "Push any key on calculator to stop"
120 !
130 Tired=0
140 ON KBD ALL GOSUB Done
150 Idle:REPEAT
160 ! wait for interrupt or calculator key pressed"
170 UNTIL Tired=1
180 OUTPUT @Sa;"R1;" ! put analyzer back in R1 interrupt mode
190 OUTPUT @Rfps;"R1;"
200 STOP
210 Done:Tired=1
220 RETURN
230 END
240 SUB Interrupt_serv
250 COM /Devices/ @Sa,@Rfps,INTEGER Sel_code
260 OFF INTR Sel_code
270 OUTPUT @Rfps;"OS;"
280 ENTER @Rfps;S0,S1
```

```

290     Status_byte=S1
300     IF Status_byte>64 THEN      ! Spectrum Analyzer interrupt
310         IF Status_byte=72 THEN PRINT "Hardware Broken"
320         IF Status_byte=66 THEN
330             PRINT "Units key pressed"
340             WAIT .1
350             OUTPUT @Sa;"R4;"! re-enable R4 interrupt
360             OUTPUT @Rfps;"R4;"
370         END IF
390     ELSE
400         ! look for another device that interrupted
410     END IF
420     ENABLE INTR Sel_code;2
430 SUBEND

```

Line 10: Define the variables to be used in the program.

Line 20: Assign the spectrum analyzer address as the value @Sa.

Line 30: Assign the preselector address as the value @Rfps.

Line 40: Set the value of variable Sel\_code to 7.

Line 50: Set a bit mask in the spectrum analyzer that enables the illegal command, hardware broken, and units key pressed service requests.

Line 70: Set a bit mask in the preselector that is identical to the one in the spectrum analyzer.

Line 80: Branch to subprogram Interrupt\_serv on interrupt from the device specified by select code 7.

Line 90: Enable the preselector to accept an interrupt from select code 7:2 (the HP-IB).

Lines 100-110: Prompt the user to trigger an interrupt by pressing a key. This program may be terminated by pressing a key on the computer.

Lines 130-210: Wait for a preselector interrupt or computer key pressed. Any program may be inserted here.

Line 240: Lines 250 - 420 contain the subprogram Interrupt\_serv.

Line 260: Turn off further interrupts from the spectrum analyzer. This prevents the interrupts from cascading, should another one occur.

Line 270: Query the preselector for both its service request status and the spectrum analyzer service request status.

Line 280: Enter the preselector service request status in S0. Enter the spectrum analyzer service request status in S1.

Line 290: Set variable Status\_byte to the value in S1.

## REMOTE OPERATION

Lines 300-400: If the value of Status\_\_byte is greater than 64 (64 is the decimal value of bit 6 in the status byte. It is always set if a service request has occurred), find the bit that corresponds to the interrupt and print the appropriate comment. If the specturm analyzer did not cause an interrupt, a space is provided to insert a program that looks for an interrupt from another device.

Line 410: Re-enable the computer to accept spectrum analyzer interrupts.

Line 420: End of subprogram.

Line 220: Signals end of interrupt routine.

Line 230: End of program.

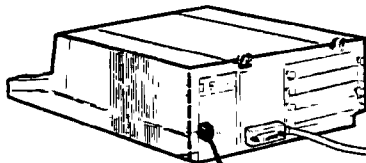
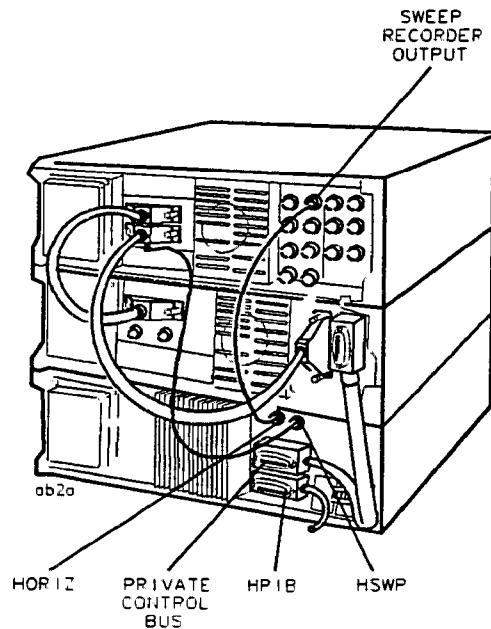


# PRESELECTOR BUS CONFIGURATION GUIDE

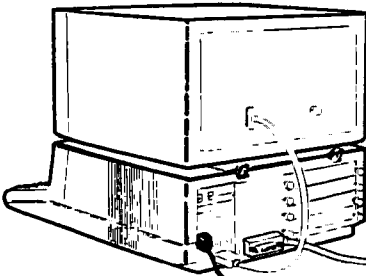
## CONFIGURATION: MANUAL OPERATION

**PRESELECTOR ADDRESS SWITCH:**  
set to an even value, preferably 18.

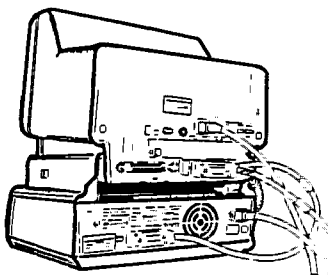
**PRIVATE CONTROL BUS:**  
active



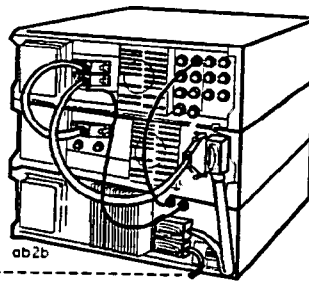
HP 9826



HP 9836



HP 9816



SPECTRUM ANALYZER/  
RF PRESELECTOR

**CONFIGURATION: STANDARD REMOTE OPERATION**  
(provides automatic frequency tracking using the COUPLE command) Use this configuration for most remote applications, including HP 85864B software.

**PRESELECTOR ADDRESS SWITCH:**  
set to an even value, preferably 18.

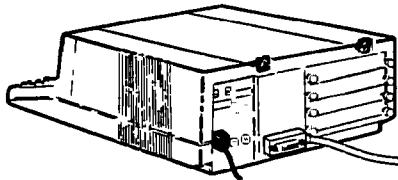
Spectrum Analyzer Address = Setting on the preselector address switch

Send spectrum analyzer commands to the selected even address. Send preselector commands to the address value one greater than the even address.

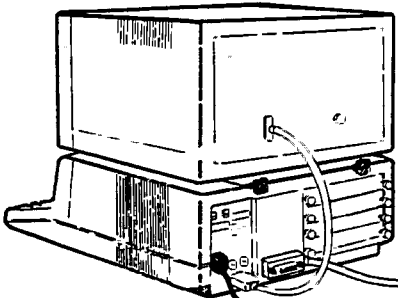
**PRIVATE CONTROL BUS:**  
active.

**PASSTHROUGH:**  
activated when commands are sent to the even address (i.e., when the spectrum analyzer is addressed). This deactivates the preselector automatic tracking capability. To reactivate it, use the preselector COUPLE command, the BASIC command LOCAL 7, or press the preselector LCL key.

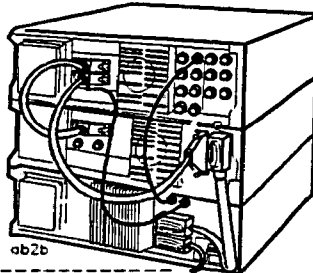
# PRESELECTOR BUS CONFIGURATION GUIDE



HP 9826

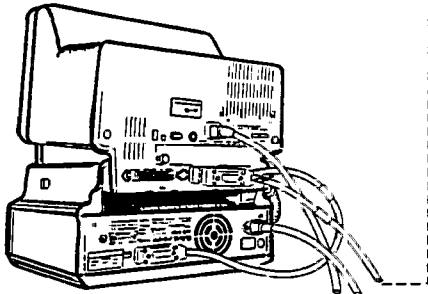


HP 9836



ab2b

SPECTRUM ANALYZER/  
RF PRESELECTOR



HP 9816

## CONFIGURATION: ALTERNATE REMOTE OPERATION

(provides independent remote operation of the preselector and spectrum analyzer).

### PRESELECTOR ADDRESS SWITCH:

set to an odd value, preferably 19

Send preselector commands to the selected odd address.

### PRIVATE CONTROL BUS:

deactivated. Automatic frequency tracking and calibration routine are disabled. Preselector input attenuation and reference level annotation, and unpreselected frequencies identification are disabled.

## CONFIGURATION: ALTERNATE MANUAL OPERATION

(Spectrum Analyzer controls the preselector using down loadable programs. Use this configuration to generate plots using the spectrum analyzer direct plotter output)

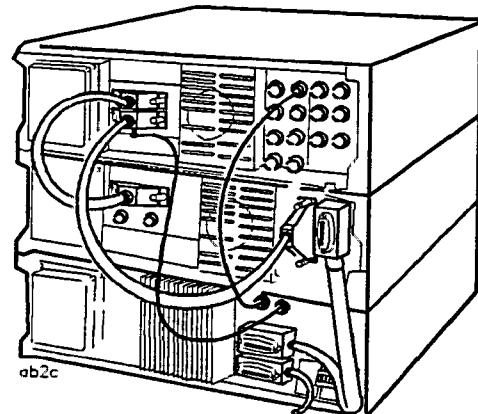
### PRESELECTOR ADDRESS SWITCH:

set to an odd value, preferably 19.

Send preselector commands to the selected odd address.

### PRIVATE CONTROL BUS:

deactivated. Automatic Frequency tracking and calibration routine are disabled. Preselector input attenuation and reference level annotation and unpreselected frequencies identification are disabled.



ab2c

## **Programming Commands**

## PROGRAMMING COMMANDS

### PAGE FORMAT

Information about preselector commands is arranged so that you can learn the commands quickly. The commands are listed alphabetically, and a brief description and syntax chart provide most of the information. The following illustrates the command documentation format:

**DESCRIPTION** gives a brief description of the command's function.

**SYNTAX** displays the command's syntax chart.

**PARAMETERS** describes the command's parameters, their default values, and range restrictions.

**EXAMPLE** provides a simple command example.

**ADDITIONAL INFORMATION** provides command information which explains the command's function in more detail.

### SYNTAX CHARTS

The syntax charts are composed of lines and four types of symbols: narrow ovals, wide ovals, circles, and rectangles. Narrow ovals contain command names and wide ovals contain command parameters. All characters enclosed in these symbols must be entered exactly as shown. Circles contain command punctuation; descriptions can be found in Command Punctuation. Rectangles contain character data, whose descriptions and range restrictions are listed below the syntax charts. Solid lines represent preferred syntax paths. Dotted lines represent optional syntax paths which are accepted, but not recommended. Code that is written using optional syntax paths may not be compatible with future instrument revisions.

The following lists define the syntax chart abbreviations.

#### Command Parameters

DB Decibel  
 DN Decrement the parameter  
 GZ Gigahertz  
 HZ Hertz  
 KZ Kilohertz  
 MZ Megahertz  
 OFF Turn off the function  
 ON Turn on the function  
 UP Increment the parameter  
 ? Returns a query response containing the parameter value or state.

Defaults: Unspecified frequency parameters default to Hz. No other parameters have defaults.

#### Command Punctuation

CR Carriage return. CR is an ASCII code (13) in the computer's language and may be used as a command terminator, but semicolons are preferred.

## REMOTE OPERATION

, Use commas to separate command parameters. Spaces may also be used, although they are not recommended. Commas may also terminate commands, but semicolons are preferred.

LF Line feed. LF is an ASCII code (10) in the computer's language and may be used as a command terminator, but semicolons are preferred.

; Use semicolons to terminate the commands. Alternate terminators are LF, CR, SP or a comma (,). However, these are not recommended.

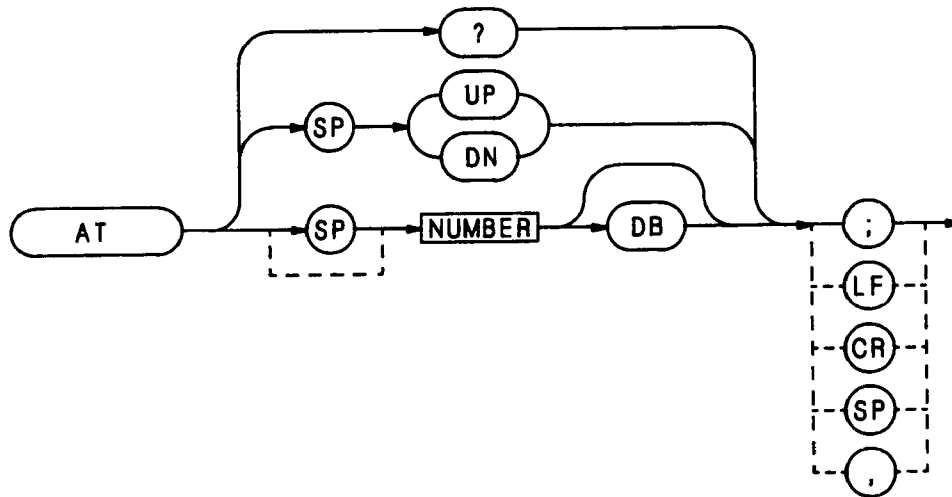
SP Space. Spaces may be used anywhere in the data stream except where binary data is accepted or within identifiers. Spaces can also be used to separate command parameters, but commas are preferred.

# AT

## DESCRIPTION

The AT command sets the preselector input attenuation from 0 dB to 53 dB.

## SYNTAX



## PARAMETERS

**Number:** Selects the input attenuation. Must be an integer (0-53).

**?** Returns the preselector input attenuation as an integer to the computer. If the preselector bypass function is active, ? returns 0 dB.

**ERROR:** If an attenuation value is selected outside the given range, the preselector ERROR command returns "X DB OUT OF RANGE", where x is the out-of-range value.

## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"AT 30DB;"
30  OUTPUT @Rfps;"AT?;"
40  ENTER @Rfps;N
50  PRINT N
60  END
    
```

Line 10: Assign the preselector address (19) as @Rfps.

Line 20: Set the preselector attenuation to 30 dB.

Line 30: Query the preselector for the input attenuation value.

## REMOTE OPERATION

Line 40: Enter the value into the computer.

Line 50: Print the value.

## ADDITIONAL INFORMATION

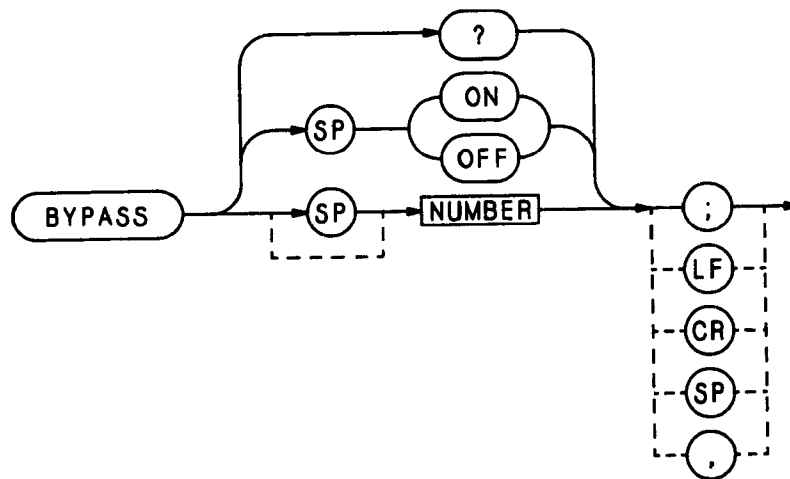
Preselector input attenuation values are 0 dB, 3 dB, 10 dB, 13 dB, etc., up to 53 dB. Other numbers within the 0 - 53 range may be selected, but they will default to the nearest lesser attenuation value. For example, attenuation values from 20 dB to 22 dB default to 20 dB. Attenuation values from 23 dB to 29 dB default to 23 dB.

The attenuation annotation appears at the top of the spectrum analyzer's display.

The AT command performs the same functions as the front-panel attenuation keys.

**BYPASS****DESCRIPTION**

The **BYPASS** command selects an alternate RF signal path that bypasses the preselector and sends the RF signal directly to the spectrum analyzer. Only RF signals sent to Input 2 may bypass the preselector.

**SYNTAX****PARAMETERS**

Number: Selects the state of the bypass function (0 = [off], 1 = [on])

? Returns the state of the bypass function as an integer to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"BYPASS ON;"
30  OUTPUT @Rfps;"BYPASS?;"
40  ENTER @Rfps;N
50  PRINT N
60  OUTPUT @Rfps;"BYPASS OFF;"
70  END

```

Line 10: Assign the preselector address (19) as @Rfps.

Line 20: Activate the bypass function.

Line 30: Query the preselector for the state of the bypass function.



## REMOTE OPERATION

Line 40: Enter the state of the function to the computer.

Line 50: Print the value.

Line 60: Deactivate bypass.

## ADDITIONAL INFORMATION

When **BYPASS** is activated, the LEDs in the front-panel bypass key and above the Input 2 light up.

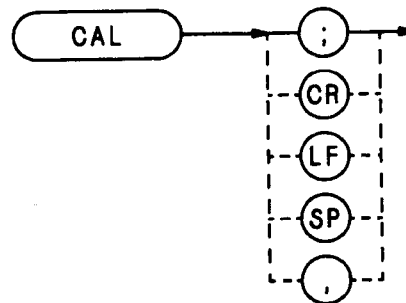
The **BYPASS** command provides a convenient way to remove the preselector from the signal path without having to make and break connections manually or limit HP 8566B Spectrum Analyzer 2 GHz - 22 GHz measurement capability.

If a query is made for the preselector attenuation while bypass is active, 0 dB is returned to the computer.

**BYPASS** must be activated prior to calibrating the spectrum analyzer (refer the the **TEST RECEIVER CONFIGURATION** section). The bypass command performs the same function as the front-panel bypass key.

**CAL****DESCRIPTION**

The CAL command executes the preselector calibration routine.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT 718;"FA 100MZ;FB 150MZ;"
30  OUTPUT 718;"RB 1MZ;"
40  OUTPUT @Rfps;"COUPLE;"
50  OUTPUT @Rfps;"CAL;"
60  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Set the spectrum analyzer start and stop frequencies.

Line 30: Set the resolution bandwidth.

Line 40: Couple the preselector to the spectrum analyzer.

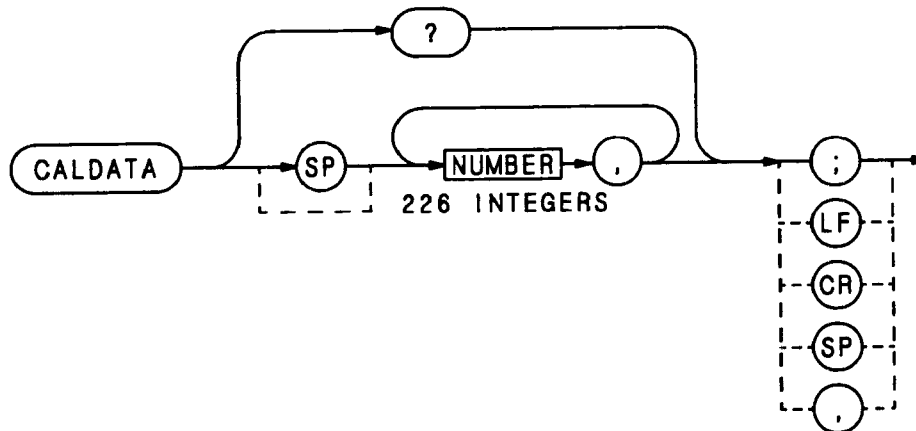
Line 50: Execute the calibration routine.

**ADDITIONAL INFORMATION**

The calibration routine calibrates the preselector as follows. The output of the comb generator is input to the preselector, and selected comb teeth are measured by the spectrum analyzer. Any variation between the measured comb tooth amplitude and the value stored in the preselector is corrected by an internal preselector gain adjustment. Before calibrating the preselector, calibrate the spectrum analyzer (see **CALIBRATING THE TEST RECEIVER** in the **TEST RECEIVER CONFIGURATION** section). To calibrate the preselector, set the spectrum analyzer to the desired frequency settings, resolution and video bandwidths, and scale. Connect the comb generator to the preselector output that covers the chosen frequencies, and activate the input. Execute the CAL command.

**CALDATA****DESCRIPTION**

The CALDATA command transfers calibration data to and from the preselector.

**SYNTAX****PARAMETERS**

number: Each of the 226 integers represents a calibration data point. The value of each integer is transferred in standard ASCII format.

? Returns the preselector calibration data as a string to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  INTEGER Caldata(1:226)
30  OUTPUT @Rfps;"CALDATA?;"
40  ENTER @Rfps;Caldata(*)
50  OUTPUT @Rfps;"CALDATA;"
60  OUTPUT @Rfps;Caldata(*)
70  END

```

Line 10: Assign the preselector address as the value @RFps.

Line 20: Dimension array Caldata.

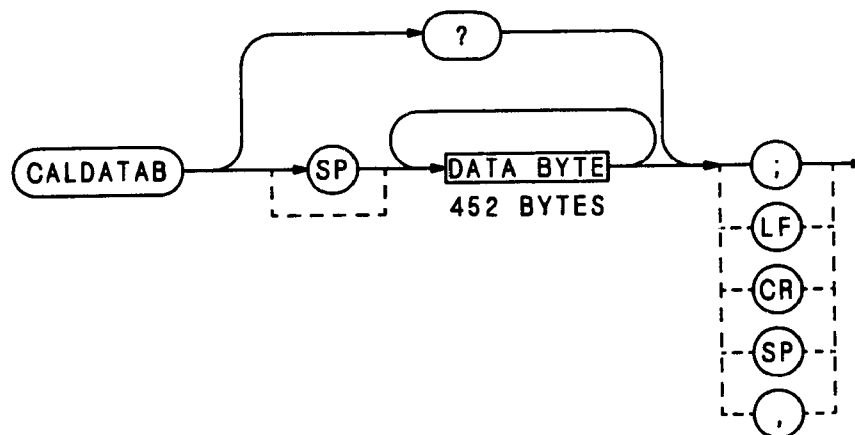
Line 30: Query the preselector for its calibration data.

Line 40: Enter the data in the string.

Lines 50-60: Send the array data from the computer to the preselector.

**CALDATAB****DESCRIPTION**

The CALDATAB command transfers calibration data to and from the preselector.

**SYNTAX****PARAMETERS**

data byte: Each calibration point is transferred as 2 data bytes.

? Returns the preselector calibration data as a string to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  ASSIGN @Rfps_bin TO 719;FORMAT OFF
30  !
40  INTEGER Caldata(1:226)
50  !
60  OUTPUT @Rfps;"CALDATAB?;"
70  ENTER @Rfps_bin;Caldata(*)
80  END

```

Lines 10-20: Assign the preselector address as the values @RFps and @Rfps\_bin. When @Rfps is used, the computer uses ASCII data representation while sending and receiving data through the I/O path. When @Rfps\_bin is used, the computer uses its internal data representation.

Line 40: Dimension array Caldata.

Line 60: Query the preselector for its calibration data.

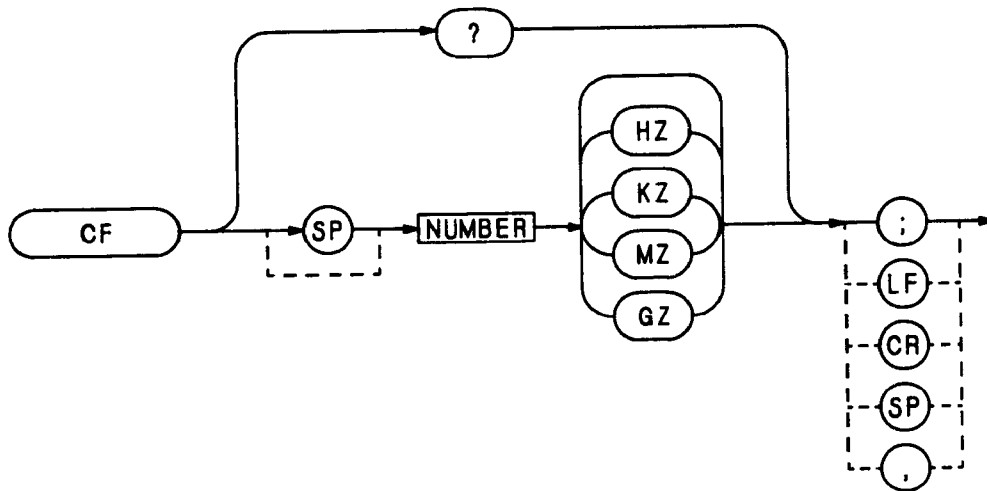
Line 70: Enter the data in the string

# CF

## DESCRIPTION

The CF command sets the preselector center frequency.

## SYNTAX



## PARAMETERS

**Number:** Selects the preselector center frequency. Must be a real number (0 - 1500 000 000 for HP 8568B Spectrum Analyzers and 0 - 2000 000 000 for HP 8566B Spectrum Analyzers).

**?** Returns the preselector center frequency to the computer as a real number, in hertz.

**ERROR:** If the preselector start frequency is exceeded, ERROR returns "START FREQUENCY >2 GHZ" to the computer.

## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"CF 1.2GZ;"
30  OUTPUT @Rfps;"CF?;"
40  ENTER @Rfps;N
50  PRINT N
60  END
  
```

Line 10: Assign the preselector address (19) as @Rfps.

Line 20: Set the preselector center frequency to 1.2 GHz.

## REMOTE OPERATION

Line 30: Query the preselector for the center frequency.

Line 40: Enter the center frequency in the computer.

Line 50: Print the center frequency.

## ADDITIONAL INFORMATION

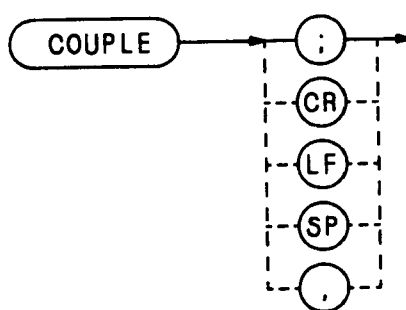
Although the CF command sets the preselector center frequency, if the preselector address switch is set to an even value, the preselector can automatically track spectrum analyzer frequency settings using the COUPLE command (see COUPLE). If the preselector address switch is set to an odd value (e.g., for alternate remote operation or in a downloadable configuration), only the CF command changes the center frequency.

## COUPLE (CPL)

### DESCRIPTION

The COUPLE command enables the preselector to read the spectrum analyzer frequency settings, and whenever these settings change, adjust its own frequency settings accordingly. This provides automatic frequency tracking.

### SYNTAX



Note: COUPLE may be abbreviated to CPL.

### EXAMPLE

```

10  ASSIGN @Sa TO 718
20  ASSIGN @Rfps TO 719
30  OUTPUT @Sa;"FA 1.2GZ;FB 1.5GZ;"
40  OUTPUT @Rfps;"COUPLE;"
50  OUTPUT @Rfps;"FA?;FB?;"
60  ENTER @Rfps;N
70  ENTER @Rfps;M
80  PRINT N
90  PRINT M
100 END

```

Line 10: Assign the spectrum analyzer address (18) as the value @Sa.

Line 20: Assign the preselector address (19) as the value @Rfps.

Line 30: Set the spectrum analyzer start and stop frequencies.

Line 40: Activate the COUPLE function. The preselector reads the spectrum analyzer frequency settings and adjusts its own settings accordingly.

## REMOTE OPERATION

Line 50: Query the preselector for its start and stop frequencies.

Lines 60-70: Enter the start and stop frequencies in the computer.

Lines 80-90: Print the values.

## ADDITIONAL INFORMATION

The preselector pass-through mode allows commands to pass from the computer to the spectrum analyzer. Pass-through is automatically enabled when commands are sent to the preselector's even address (i.e., when commands are sent through the preselector to the spectrum analyzer). While pass-through is enabled, the preselector cannot automatically track the spectrum analyzer. The COUPLE command deactivates pass-through, allowing the preselector to resume tracking the spectrum analyzer automatically.

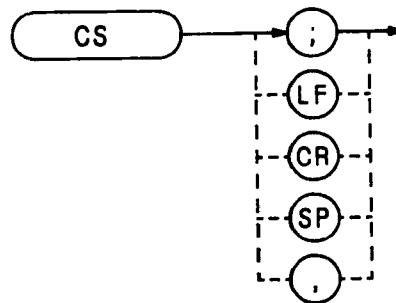
The preselector COUPLE command can be activated only when the preselector address switch is set to an even value.

The default mode set by the preselector COUPLE command is also set after a preselector instrument preset or BASIC command LOCAL 7 is executed, after the preselector LCL key is pressed, or after the power is cycled.



**CS****DESCRIPTION**

The CS command clears the preselector service request status.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"CS;"
30  END

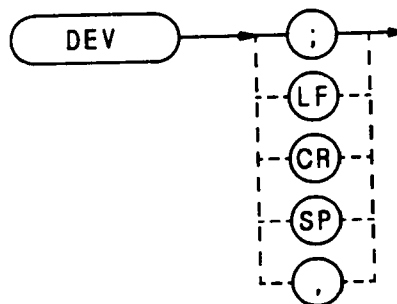
```

**ADDITIONAL INFORMATION**

The preselector stores not only its service request status but also the spectrum analyzer service request status. The CS command clears all service request status information in the preselector, including extinguishing the SRQ LED. For more information about preselector service requests, see SERVICE REQUESTS in the **REMOTE OPERATION SECTION**.

**DEV****DESCRIPTION**

The DEV command returns to the computer the model number of the device connected to the preselector's private bus.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"DEV;"
30  ENTER @Rfps;N$
40  PRINT N$
50  END

```

Line 10: Assign the preselector address (19) as the value @Rfps.

Line 20: Query the preselector for the model number.

Line 30: Enter the model number as a string in the computer.

Line 40: Print the string.

**ADDITIONAL INFORMATION**

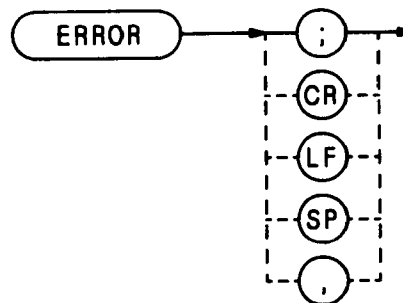
The DEV command returns the spectrum analyzer model number ( HP 8566B, or HP 8568B). If the preselector address switch is set to an odd value, the preselector returns "NO ANALYZER" to the computer

# ERROR

## DESCRIPTION

The ERROR command returns a string to the computer containing the last preselector error message.

## SYNTAX



## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  DIM N$[100]
30  OUTPUT @Rfps;"AT 70DB;"
40  OUTPUT @Rfps;"ERROR;"
50  ENTER @Rfps;N$
60  PRINT N$
70  END

```

Line 10: Assign the preselector address (19) as @Rfps.

Line 20: Dimension the string to 100 characters.

Line 30: Set the attenuation to 70 dB, an out-of-range value.

Line 40: Activate the ERROR function.

Line 50: Enter the error message in the computer as a string.

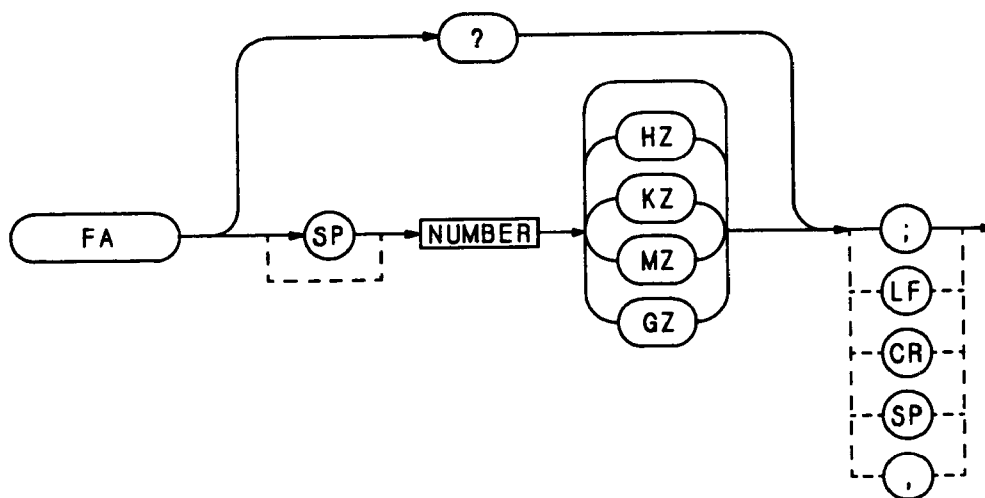
Line 60: Print the message.

## ADDITIONAL INFORMATION

The preselector commands AT, HP, IMP, and R have range restrictions. If these range restrictions are exceeded, the ERROR command returns "X OUT OF RANGE", where x is the out-of-limits value selected. A further restriction on the HP command is whether a value can be even or odd. If an unacceptable value is selected, ERROR returns "ILLEGAL MODE CHANGE" to the computer. For more information, see AT, HP, IMP, or R.

**FA****DESCRIPTION**

The FA command sets the preselector start frequency.

**SYNTAX****PARAMETERS**

**Number:** Selects the preselector start frequency. Must be a real number (0 - 1500 000 000 for the HP8568B and 0 - 2000 000 000 for the HP 8566B Spectrum Analyzers).

**?:** Returns the start frequency to the computer as a real number, in hertz.

**ERROR:** If the preselector start frequency is exceeded, ERROR may return "START FREQ >2GHZ" or "SPAN >2 GHZ" to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"FA 1.2GZ;"
30  OUTPUT @Rfps;"FA?;"
40  ENTER @Rfps;N
50  PRINT N
60  END

```

## REMOTE OPERATION

Line 10: Assign the preselector address (19) as the value @Rfps.

Line 20: Set the preselector start frequency to 1.2 GHz.

Line 30: Query the preselector for its start frequency.

Line 40: Enter the start frequency in the computer.

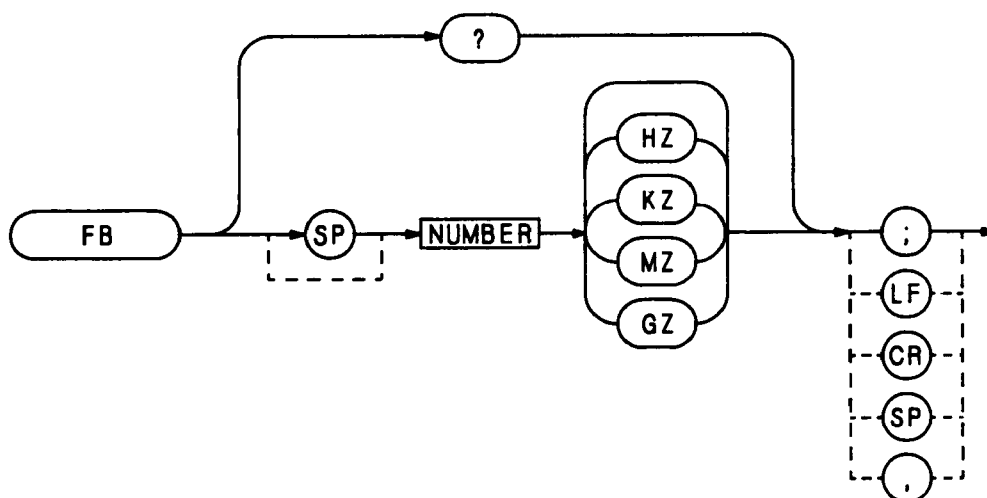
Line 50: Print the value.

## ADDITIONAL INFORMATION

Although the FA command sets the preselector start frequency, if the preselector address switch is set to an even value, the preselector can automatically track spectrum analyzer frequency settings using the COUPLE command (see COUPLE). If the preselector address switch is set to an odd value (e.g., for alternate remote operation or in a downloadable configuration), only the FA command changes the start frequency.

**FB****DESCRIPTION**

The FB command sets the preselector stop frequency.

**SYNTAX****PARAMETERS**

**Number:** Selects the preselector stop frequency. Must be a real number (0 - 1500 000 000 for HP 8568B, 2000 000 000 for HP 8566B).

**?** Returns the stop frequency to the computer as a real number, in hertz.

**ERROR:** If the stop frequency is exceeded, ERROR may return "START FREQ >2 GHZ" or "SPAN >2 GHZ" to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"FB 1.5GZ;"
30  OUTPUT @Rfps;"FB?;"
40  ENTER @Rfps;N
50  PRINT N
60  END

```

## REMOTE OPERATION

Line 10: Assign the preselector address (19) as the value @Rfps.

Line 20: Set the preselector stop frequency to 1.5 GHz

Line 30: Query the preselector for the stop frequency.

Line 40: Enter the value in the computer.

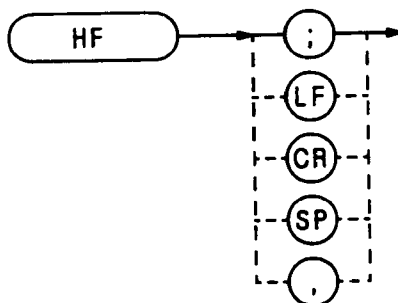
Line 50: Print the value.

## ADDITIONAL INFORMATION

Although the FB command sets the preselector stop frequency, if the preselector address switch is set to an even value, the preselector can automatically track spectrum analyzer frequency settings using the COUPLE command (see COUPLE). If the preselector address switch is set to an odd value (e.g., for alternate remote operation or in a downloadable configuration), only the FB command changes the stop frequency.

**HF****DESCRIPTION**

The HF command selects Input 2.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"LF;"
30  OUTPUT @Rfps;"HF;"
40  END

```

**ADDITIONAL INFORMATION**

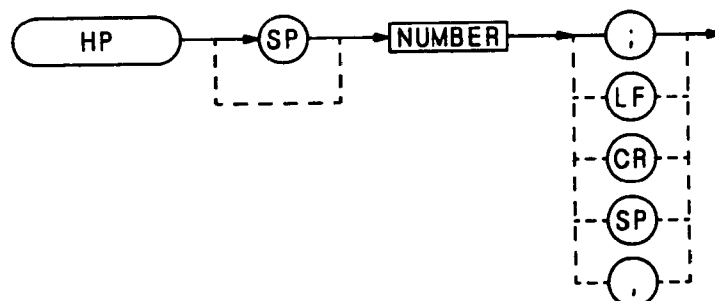
Input 2 ranges in frequency from 20 MHz to 2 GHz. Although this input is not fused, it is sensitive, has a good frequency response, and is well-suited for radiated-emission measurements.

The HF and I commands perform the same function as the front-panel key that selects Input 2.



**HP****DESCRIPTION**

The HP command changes the preselector address values

**SYNTAX****PARAMETERS**

Number: Selects the preselector address (0 - 30).

**ERROR:** If the selected address value is less than 0 or greater than 30, the preselector ERROR command returns "X OUT OF RANGE" to the computer, where x is the value selected. If the preselector address switch is set to an even value, and an odd value is sent using the HP command (or vice versa), ERROR returns "ILLEGAL MODE CHANGE" to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"HP 22;"
30  OUTPUT 723;"AT UP;"
40  PRINT "PRESS THE PRESELECTOR'S LCL KEY, THEN THE INST PRESET KEY"
50  PRINT "PRESS CONTINUE"
60  PAUSE
70  OUTPUT @Rfps;"AT UP;"
80  END

```

Line 10: Assign the preselector address (19) as the value @Rfps.

Line 20: Change the preselector addresses to 22 and 23.

Line 30: Increase the preselector attenuation. This shows that the preselector address is now set to 23.

Lines 40-50: Reset the preselector address to the value on the address switch.

Line 70: Increase the preselector attenuation. This shows the preselector address has returned to its original value

## REMOTE OPERATION

### **ADDITIONAL INFORMATION**

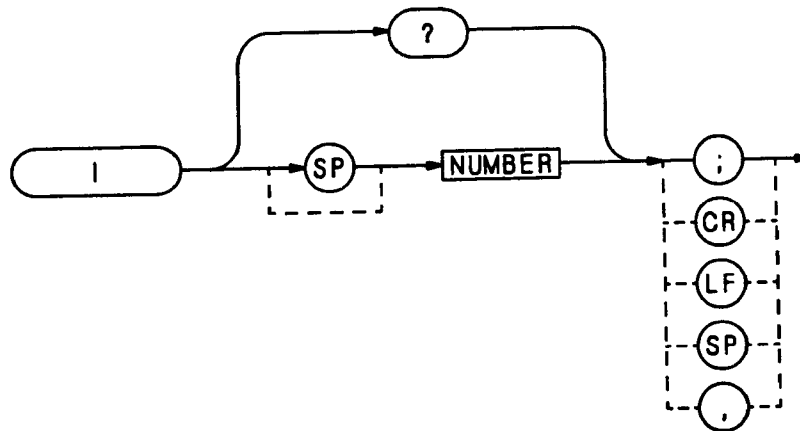
If the preselector address switch is set to an even value, the HP command accepts only even numbers, and the private control bus remains active. Use this even number to send commands to the spectrum analyzer and a number one greater to send commands to the preselector. If the preselector address switch is set to an odd value, the HP command accepts only odd values, and the private control bus remains deactivated.

To return the preselector address to the value set on the address switch, execute an instrument preset from the preselector front panel or switch the LINE switch off.

## DESCRIPTION

The I command activates the preselector inputs.

## SYNTAX



## PARAMETERS

Number: Selects the desired input (1 or 2).

? Returns the number of the active input to the computer.

## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"I1;"
30  OUTPUT @Rfps;"I?;"
40  ENTER @Rfps;N
50  PRINT N
60  END

```

Line 10: Assign the preselector address (19) as the value @Rfps.

Line 20: Activate Input 1.

Line 30: Query the preselector for its active input.

Line 40: Enter the value in the computer.

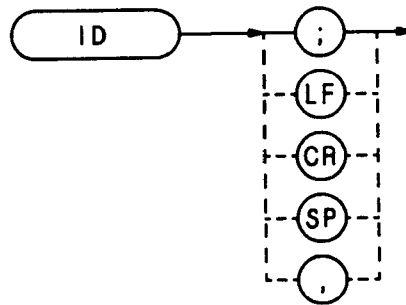
Line 50: Print the value.

## ADDITIONAL INFORMATION

The I command performs the same functions as the LF and HF commands.

**ID****DESCRIPTION**

The ID command returns the preselector's model number as a string to the computer.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"ID;"
30  ENTER @Rfps;N$
40  PRINT N$
50  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Query the preselector for its model number.

Line 30: Enter the model number as a string in the computer.

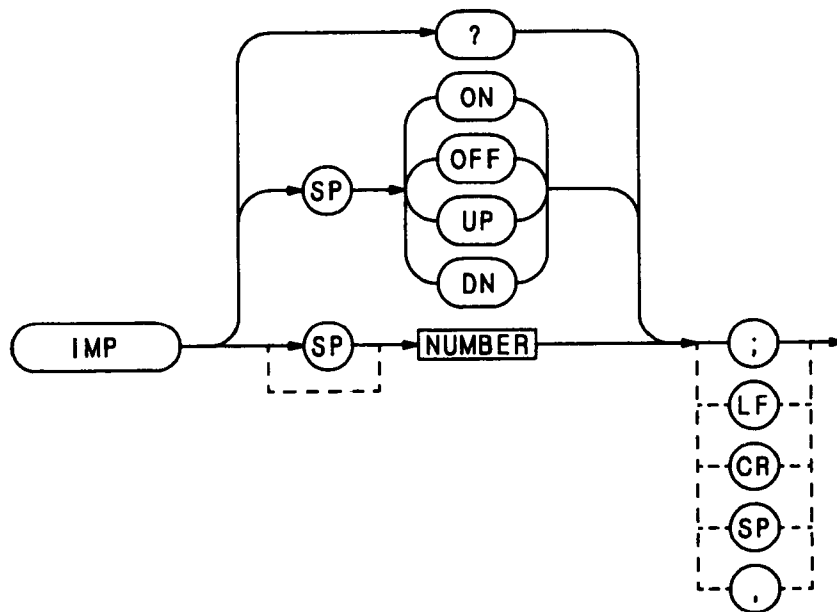
Line 40: Print the model number.

# IMP

## DESCRIPTION

The IMP command controls the state of the comb generator.

## SYNTAX



## PARAMETERS

**Number:** Selects the comb generator frequency as an integer (1 - 4), or deactivates the comb (0).

- 1 = .1 MHz
- 2 = .5 MHz
- 3 = 1 MHz
- 4 = 5 MHz

**ON:** Sets the comb to .1 MHz

**?** Returns the comb generator frequency as an integer (0 - 4).

**ERROR:** If the number range is exceeded, ERROR returns "X OUT OF RANGE", where x is the selected value.

## EXAMPLE

```

10 ASSIGN @Rfps TO 719
20 OUTPUT @Rfps;"IMP 2;"
30 OUTPUT @Rfps;"IMP?;"
40 ENTER @Rfps;N
    
```

## REMOTE OPERATION

```
50 PRINT N  
60 END
```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Set the comb generator to .5 MHz.

Line 30: Query the preselector for the state of the comb generator.

Line 40: Enter the value in the computer.

Line 50: Print the value.

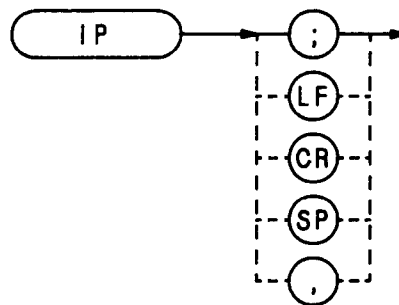
## ADDITIONAL INFORMATION

The comb generator produces combs separated by 100 kHz, 500 kHz, 1 MHz, or 5 MHz. The comb generator is a factory-calibrated signal source and, when used to calibrate the preselector, ensures  $\pm 2$  dB amplitude accuracy.

## DESCRIPTION

The IP command presets the preselector and, if the private bus is active, also presets the spectrum analyzer.

## SYNTAX



## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"IP;"
30  END

```

## ADDITIONAL INFORMATION

The preselector instrument preset routine sets the preselector functions to the following states:

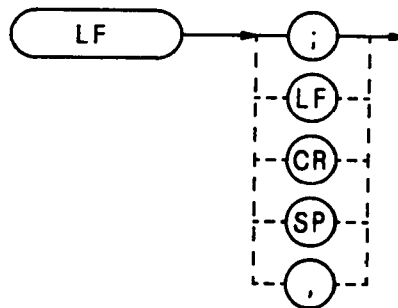
50 MHz - 2 GHz input — active  
 Attenuation — 20 dB  
 All other front-panel functions — disabled

If the preselector private control bus is active (i.e., the preselector address switch is set to an even value), the instrument preset routine also commands the preselector to find a device on the private bus and determine if it is an HP 8566B or 8568B Spectrum Analyzer. After the preselector determines the model of the spectrum analyzer, it commands the spectrum analyzer to perform an instrument preset (for HP 8566B Spectrum Analyzers, a low-band instrument preset is executed), and to notify the preselector of any changes in its frequency settings. Selecting an odd address disables this part of the instrument preset routine and also disables communication between the preselector and spectrum analyzer via the private control bus. Sending instrument preset commands directly to the spectrum analyzer also disables the private control bus; send IP commands only to the preselector. If, however, an instrument preset command is sent directly to the spectrum analyzer, use the preselector COUPLE command to reactivate the bus.

Except for not resetting the HP-IB address, the IP command performs the same function as the front-panel INST PRESET key.

**LF****DESCRIPTION**

The LF command selects Input 1.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"LF;"
30  END

```

**ADDITIONAL INFORMATION**

Input 1 ranges in frequency from 20 Hz to 50 MHz. It is a rugged, fused input and is designed for making conducted emission measurements. The fuse protects the preselector from high-level impulses and Line Impedance Stabilization Network transients.

The LF and I1 commands perform the same function as the front-panel key that selects Input 1.

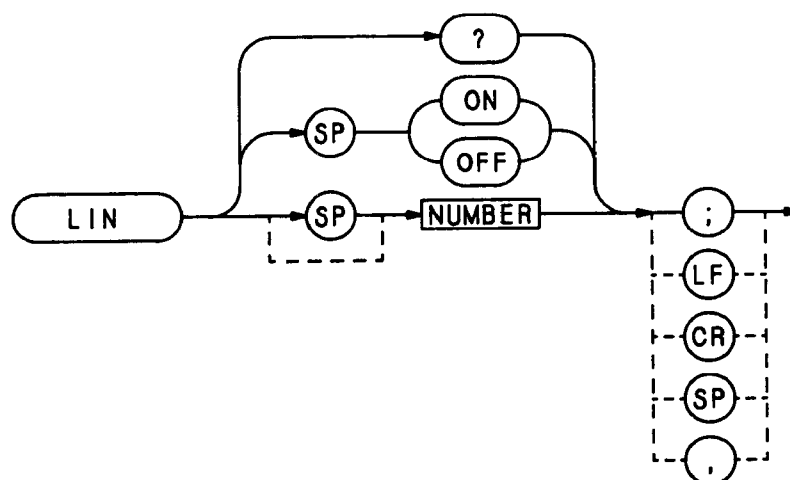


# LIN

## DESCRIPTION

The LIN command controls the 3 dB attenuator

## SYNTAX



## PARAMETERS

Number: Selects the state of the LIN function (1 [on] or 0 [off]).

? If LIN is ON, ? returns a 3 to the computer. If LIN is OFF or if the preselector bypass function is active, ? returns a 0.

## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"LIN ON;"
30  OUTPUT @Rfps;"LIN?"
40  ENTER @Rfps;N
50  PRINT N
60  OUTPUT @Rfps;"LIN OFF;"
70  END
    
```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Activate the 3 dB attenuator.

## REMOTE OPERATION

Line 30: Query the preselector for the state of the 3 dB attenuator.

Line 40: Enter the value in the computer.

Line 50: Print the value.

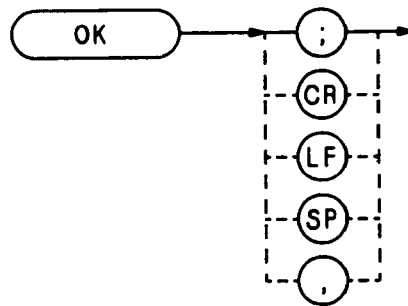
Line 60: Deactivate the 3 dB attenuator.

## ADDITIONAL INFORMATION

The 3 dB linearity check allows you to easily identify test receiver overload. If the amplitude of a signal changes when LIN is activated, signal distortion or overload is present. To correct this, increase the preselector attenuation. An undistorted signal will not change in amplitude when LIN is activated.

**OK****DESCRIPTION**

The OK command returns a value corresponding to the last preselector key pressed to the computer.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  PRINT "PRESS THE PRESELECTOR'S INPUT 2 KEY, THEN PRESS CONTINUE"
30  PAUSE
40  OUTPUT @Rfps;"OK;"
50  ENTER @Rfps;N
60  PRINT N
70  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Prompt the user to press a key.

Line 40: Query the preselector for the last key pressed.

Line 50: Enter the value in the computer.

Line 60: Print the value. This is the value assigned to the key that the user pressed. Check the table for comparison.

**ADDITIONAL INFORMATION**

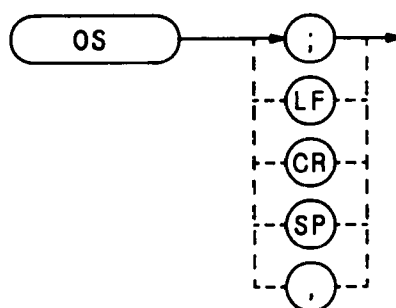
Each preselector front-panel key is assigned an integer value. The OK command returns the value corresponding to the last front-panel key pressed. The following table lists the front-panel keys and their assigned values.

REMOTE OPERATION

KEY	VALUE
INST PRESET	-1
LCL	1
NORMAL	2
BYPASS	3
CAL SEQ	4
ENABLE	5
STEP DOWN	6
STEP UP (ATTEN)	7
LINEARITY CHECK	8
STEP UP (COMB)	9
INPUT 1	10
INPUT 2	11

**OS****DESCRIPTION**

The OS command sends the spectrum analyzer and preselector service request status to the computer, then clears the status.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"OS;"
30  ENTER @Rfps;S0,S1
40  PRINT S0
50  PRINT S1
60  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Query the preselector for the service request status.

Line 30: Enter the preselector service request status in S0. Enter the spectrum analyzer service request status in S1.

Line 40: Print the preselector service request status.

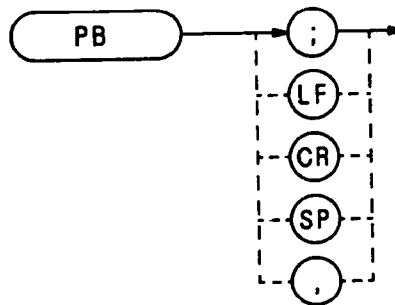
Line 50: Print the spectrum analyzer service request status.

**ADDITIONAL INFORMATION**

The preselector stores not only the preselector service request status, but the spectrum analyzer service request status as well. The OS command reads this information from the preselector, then clears it. Do not use the computer's serial poll command to return spectrum analyzer service request status; the preselector's even address cannot be serial polled. Use the OS command to return spectrum analyzer service request status to the computer. For more information, see Enabling Spectrum Analyzer Service Requests in the **REMOTE OPERATION** section.

**PB****DESCRIPTION**

The PB command returns to the computer the spectrum analyzer displayed trace element that corresponds to the last unpreselected frequency.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"PB;"
30  ENTER @Rfps;N
40  PRINT N
50  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20. Query the preselector for the trace element containing the last unpreselected frequency.

Line 30: Enter the value in the computer.

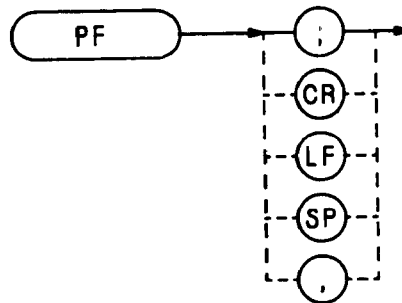
Line 40: Print the value.

**ADDITIONAL INFORMATION**

As the spectrum analyzer frequency span increases, the preselector employs more sweeping filters to preselect the span, and the fraction of the span each filter preselects decreases. Eventually, the frequency span may become too wide to guarantee the tracking accuracy of the preselector's sweeping filters. When this occurs, a low-pass filter is activated to replace the sweeping filter that is too narrow for the span. The PB command returns to the computer the trace element (0 - 1000 points) of the spectrum analyzer display that contains the last frequency covered by this low-pass filter.

**PF****DESCRIPTION**

The PF command returns the last unpreselected frequency to the computer.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"PF;"
30  ENTER @Rfps;N
40  PRINT N
50  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Query the preselector for the last unpreselected frequency.

Line 30: Enter the value in the computer.

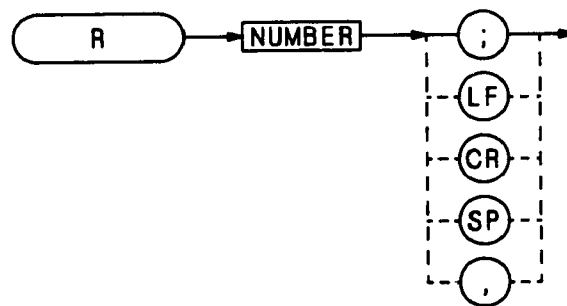
Line 40: Print the value.

**ADDITIONAL INFORMATION**

As the spectrum analyzer frequency span increases, the preselector employs more sweeping filters to preselect the span, and the fraction of the span each filter preselects decreases. Eventually, the frequency span may become too wide to guarantee the tracking accuracy of the preselector's sweeping filters. When this occurs, a low-pass filter is activated to replace the sweeping filter that is too narrow for the span. The PF command returns to the computer the last frequency covered by this low-pass filter.

**R****DESCRIPTION**

The R command allows the preselector to pass on a spectrum analyzer service request to the computer.

**SYNTAX****PARAMETERS**

Number: Selects the type of service request to be enabled (1 - 4).

R1: Passes on a spectrum analyzer illegal command service request.

R2: Passes on spectrum analyzer illegal command and end of sweep service requests.

R3: Passes on spectrum analyzer illegal command and hardware broken service requests.

R4: Passes on spectrum analyzer illegal command, frequency limit exceeded, and units key pressed service requests.

ERROR: If the number range is exceeded, ERROR returns "X OUT OF RANGE", where x is the value selected.

**EXAMPLE**

```

10  ASSIGN @Sa TO 718
20  ASSIGN @Rfps TO 719
30  OUTPUT @Sa;"R4;"
40  OUTPUT @Rfps;"R4;"
50  OUTPUT @Rfps;"OS;"
60  ENTER @Rfps;S0,S1
70  PRINT S0
80  PRINT S1
90  END

```



## REMOTE OPERATION

Line 10: Assign the spectrum analyzer address as the value @Sa.

Line 20: Assign the preselector address as the value @Rfps.

Line 30: Set a bit mask in the spectrum analyzer that enables the illegal command, units key pressed, and frequency limit exceeded service requests.

Line 40: Set a bit mask in the preselector that is identical to the one in the spectrum analyzer.

Line 50: Query the preselector for both its service request status and the spectrum analyzer service request status.

Line 60: Enter the preselector service request status in variable S0. Enter the spectrum analyzer service request status in variable S1.

Line 70-80: Print the service request status. These values decimal equivalents of the preselector's status byte and extended status byte.

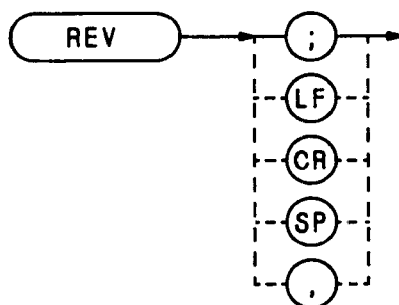
## ADDITIONAL INFORMATION

The commands R1, R2, R3, and R4 enable the preselector to identify and, when requested, pass to the computer the same spectrum analyzer service requests that are enabled by the spectrum analyzer's R1, R2, R3, and R4 commands, respectively. The R command sets a bit mask in the preselector that corresponds to the spectrum analyzer bit mask. This enables the preselector to identify spectrum analyzer service requests and return them when an OS command is sent.

For more information, refer to Enabling Spectrum Analyzer Service Requests, in the **REMOTE OPERATION** section of this manual.

**REV****DESCRIPTION**

The REV command returns the preselector firmware revision number to the computer as a string.

**SYNTAX****EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"REV;"
30  ENTER @Rfps;N$
40  PRINT N$
50  END

```

Line 10: Assign the preselector address as the value @Rfps.

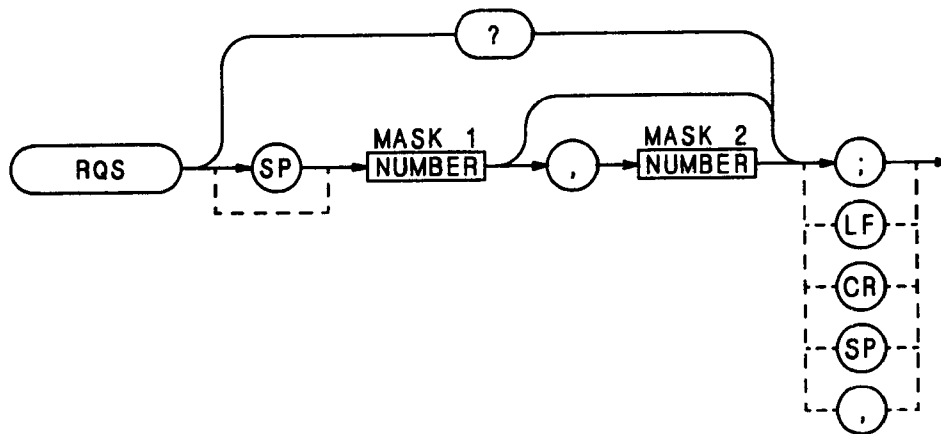
Line 20: Query the preselector for its firmware revision.

Line 30: Enter this value as a string in the computer.

Line 40: Print the value.

**RQS****DESCRIPTION**

The RQS command enables the preselector to send service requests to the computer.

**SYNTAX****PARAMETERS**

Number: Decimal equivalent of the service request. Mask 1 enables preselector SRQs, Mask 2 enables the preselector to identify spectrum analyzer service requests.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"RQS 66;"
30  PRINT "PRESS ANY PRESELECTOR KEY (EXCEPT FOR IP), THEN PRESS CONTINUE"
40  PAUSE
50  OUTPUT @Rfps;"OS;"
60  ENTER @Rfps;S0,S1
70  PRINT S0
80  OUTPUT @Rfps;"CS;"
90  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Set a bit mask that enables the preselector's "key pressed" service request.

Line 30: Prompt the user to press a key. This triggers a service request.

Line 50: Query the preselector for its service request status.

## REMOTE OPERATION

Line 60: Enter the value in S0. Note that the spectrum analyzer service request status is also returned.

Line 70: Print the preselector service request status. The value returned is the decimal equivalent of the preselector status byte.

### ADDITIONAL INFORMATION

Mask 1 of the RQS command sets a bit mask in the preselector status byte that enables preselector service requests. Mask 2 sets a bit mask in the preselector extended status byte that allows the preselector to pass on spectrum analyzer service requests. To enable only preselector SRQs, disregard Mask 2.

The following table lists status bits, decimal equivalents, and SRQ descriptions for both preselector status bytes.

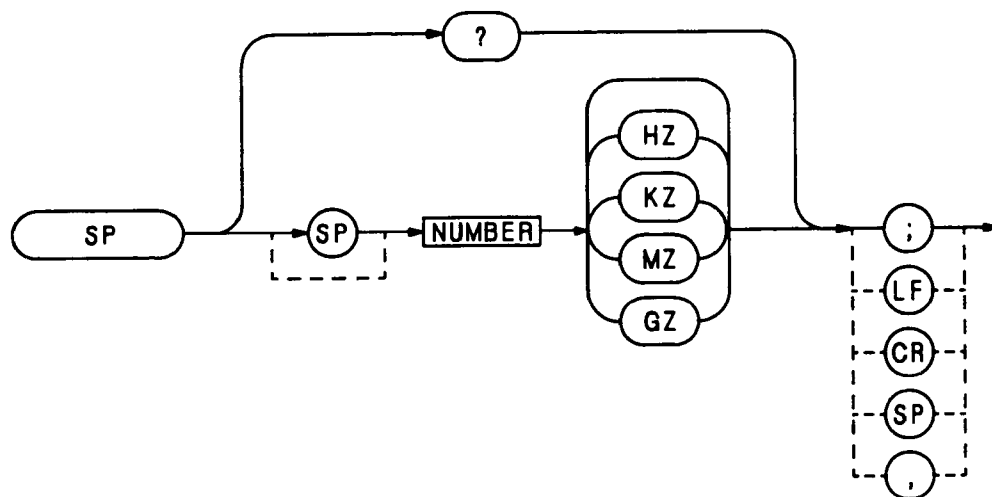
TABLE 4-5. PRESELECTOR STATUS BYTES

STATUS BYTE (#1)								
Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
Function	Preselector Request Service (SRQ)	Request Service (SRQ)	SRQ on Illegal Command		SRQ on Broken Hardware	SRQ on End of Sweep	SRQ on Key Pressed	
EXTENDED STATUS BYTE (#2)								
Bit #	7	6	5	4	3	2	1	0
Decimal Value	128	64	32	16	8	4	2	1
Function		Request Service (SRQ)	SRQ on Illegal Command		SRQ on Broken Hardware	SRQ on End of Sweep	SRQ on Units Key Pressed	

For more SRQ information, refer to Service Requests in the **REMOTE OPERATION** section.

**SP****DESCRIPTION**

The SP command sets the preselector frequency span.

**SYNTAX****PARAMETERS**

**Number:** Selects the preselector frequency span. Must be a real number (0 - 1500 000 000 for HP 8568B, 0 - 2000 000 000 for HP 8566B).

**?** Returns the preselector frequency span to the computer as a real number, in hertz.

**ERROR:** If the frequency span is exceeded, ERROR returns "SPAN >2 GHZ" to the computer.

**EXAMPLE**

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @Rfps;"SP 1MZ;"
30  OUTPUT @Rfps;"SP?;"
40  ENTER @Rfps;N
50  PRINT N
60  END

```

Line 10: Assign the preselector address as the value @Rfps.

Line 20: Set the preselector frequency span to 1 MHz.

## REMOTE OPERATION

Line 30: Query the preselector for its frequency span.

Line 40: Enter the value in the computer.

Line 50: Print the value.

## ADDITIONAL INFORMATION

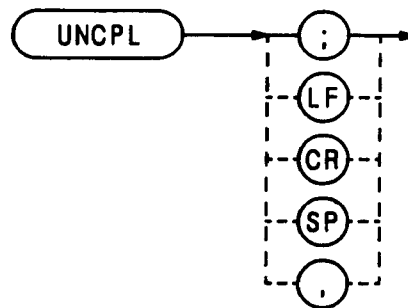
Although the SP command sets the preselector frequency span, if the preselector address is set to an even value, the preselector can automatically track spectrum analyzer frequency settings using the preselector COUPLE command (see COUPLE). If the preselector address switch is set to an odd value (e.g., for alternate remote operation or in a downloadable configuration), only the SP command changes the frequency span.

# UNCPL

## DESCRIPTION

The UNCPL command uncouples the preselector and spectrum analyzer.

## SYNTAX



## EXAMPLE

```

10  ASSIGN @Rfps TO 719
20  OUTPUT @RFps;"UNCPL;"
30  END

```

## ADDITIONAL INFORMATION

When the UNCPL function is active, the preselector and spectrum analyzer cease to communicate over the private control bus. The preselector attenuation and reference level annotation, and the unpreselected frequencies identification are disabled. However, the pass through mode is still activated when commands are sent to the even address (i.e., when the spectrum analyzer is addressed), allowing the spectrum analyzer to continue to be controlled remotely. This allows the preselector and spectrum analyzer to be controlled remotely, yet independently of one another. To reactivate the preselector annotation, use the COUPLE command (see COUPLE). COUPLE will also cause the preselector to automatically track the spectrum analyzer.







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