

## Introductory Operating Guide for the HP 8350A Sweep Oscillator with the HP 9825 Desktop Computer



### INTRODUCTION

This programming note is a guide to the remote operation of the HP 8350A Sweep Oscillator and appropriate HP 83500 Series Plug-in using the HP 9825 Desktop Computers. Included in this guide are the system connections for remote operation and several example programs with descriptions of each step.

The 8350A is fully compatible with the Hewlett-Packard Interface Bus (HP-IB). When used with a controller such as the 9825, complete control of the sweep mode, frequency limits, frequency markers, power level, and all other front panel controls can be achieved.

### REFERENCE INFORMATION

For further information on the HP Interface Bus, the following references should prove helpful:

1. Condensed Description of the Hewlett-Packard Interface Bus (HP Part Number 59401-90030).

2. HP-IB Programming Hints for Selected Instruments/9825 (HP Part Number 59300-90005).

Complete reference information on the 8350A can be found in the 8350A Sweep Oscillator Operating and Service Manual (HP Part Number 08350-90001). For information on operating the 9825B the following references are available:

1. 9825B/T Operating, Programming and Control Manual (HP Part Number 09825-90200).
2. 9825B/T I/O Programming Manual (HP Part No. 09825-90210).

If using the 9825A:

1. 9825A/S Operating and Programming Manual (HP Part No. 09825-90000).
2. 9825A/S General I/O Programming Manual (HP Part No. 09825-90024).
3. 9825A/S Extended I/O Programming Manual (HP Part No. 09825-90025).

## SET-UP

Figure 1 shows the system connection and switch settings for the 98034A Interface and the 9825 Desktop Computer. The following procedure completes the setup:

1. Turn off the power to the 9825.
2. For the 9825 Desktop Computer verify that the ROMS's are installed. If using a 9825A, then check the front panel slots. If using the 9825B these ROM's are internal and may have been disabled by an internal switch.
3. Install the 98034A Interface Card into one of the rear panel slots of the 9825.
4. Verify that the rotary switch on top of the 98034A is set to "7". If not then set it to "7" since this is the select code for the interface card for all programs found within this guide.
5. Connect the 24-pin HP-IB connector of the 98034A to the rear panel HP-IB connector of the 8350A. This connector is tapered to insure proper connection.

### CAUTION

**Do not attempt to connect black metric threaded screws on one connector with silver English threaded nuts on another connector, or vice-versa, as damage may result. A metric conversion kit which will convert one cable and one or two instruments to metric hardware is available by ordering HP Part No. 5060-0138.**

6. All programs within this guide expect the 8350A HP-IB address to be decimal 19. The 8350A HP-IB address switches are located inside the instrument and are factory preset to decimal 19. The present HP-IB address can be found by executing the front panel 'Set HP-IB Address' function by:

Press **SHIFT LCL**

The **FREQUENCY/TIME** display will indicate the present decimal address. If the number displayed is not 19 then reset it by:

Press **1 9 GHz**

This HP-IB address will remain in effect until the instrument is powered off when the internal address switches are read at power on (unless 8350A Option 001 Non-volatile Memory is

used). Since Example 4 requires the 8350A to be powered off and then on, the internal address switches should be reset to 19 if necessary.

## CHECK-OUT

Turn on the 9825 and the 8350A. The 9825 should have a "lazy T" (┌—) in the LED display and the 8350A should undergo an internal self test. The 8350A turn-on self test consists of the red LED numeric displays being blanked and all yellow indicator LED's on, then the 8350A sweep controls are set to the instrument preset state: Start/Stop Sweep over the entire plug-in frequency range, fastest sweep time for plug-in used (typically 10 milliseconds), and maximum leveled output power for the plug-in. If the 8350A fails the power-up self test an error message will be displayed in the far left LED display. Check section 8 of the 8350A Operating and Service Manual for error message decoding.

To verify that the HP-IB connections and interface are functional perform the following on the 9825:

1. Press **RESET**
2. Type 'rem 719'
3. Press **EXECUTE**

Verify that the REMote light on the 8350A is lit. If this fails, verify that the 98034A select code switch is set to "7", the 8350A address switches are set to "19", and the interface cable is properly connected.

If the 9825 display indicates an error message, it is possible that the above remote message was typed in incorrectly or the ROM's are not properly installed. If the 9825 accepts the remote statement and the "lazy T" appears in the display but the 8350A REMote light does not turn on, you could have a defective 98034A or 8350A. Perform the operational checks as outlined in the respective Operating and Service Manuals to find the defective device.

## PROGRAMMING EXAMPLES

The following sample programs show the various ways of controlling the 8350A. In remote control situations the 8350A Sweep Oscillator can interact with the system HP-IB controller in two basic ways:

1. "Listen Mode": The 8350A listens to the control commands as to modifying the present instrument state. This effectively commands the 8350A

## EQUIPMENT REQUIRED

To perform all the example programs described in this programming note, you will need the following equipment and accessories:

1. HP 8350A Sweep Oscillator with any HP 83500 Series Plug-in. Note that an HP 86200 Series Plug-in with the HP 11869A Adapter can be used but all references to power level and power control are not applicable and some functions do not have their full capability.
2. HP 9825B/T Desktop Computer (all ROM's are internal)

or

HP 9825A/S Desktop Computer with:

- a. HP 98210A String-Advanced Programming ROM
- b. HP 98213A or 98214A or 98216A General I/O-Extended I/O ROM

3. HP 98034A HP-IB Interface Card/Cable.

### NOTE

The following equipment is not required for the programs to function but rather for a visual display of the 8350A functions.

4. HP 8755S Frequency Response Test Set with:
  - a. HP 8755C Swept Amplitude Analyzer
  - b. HP 180TR or 182T Display Unit
  - c. HP 11664A or 11664B Detector
  - d. Two 120 cm BNC cables (HP 11170C variety)or any appropriate oscilloscope with Detector (Crystal/Schottky), Attenuator and BNC cabling.
5. Any test device over the frequency range of the 83500 Series Plug-in.

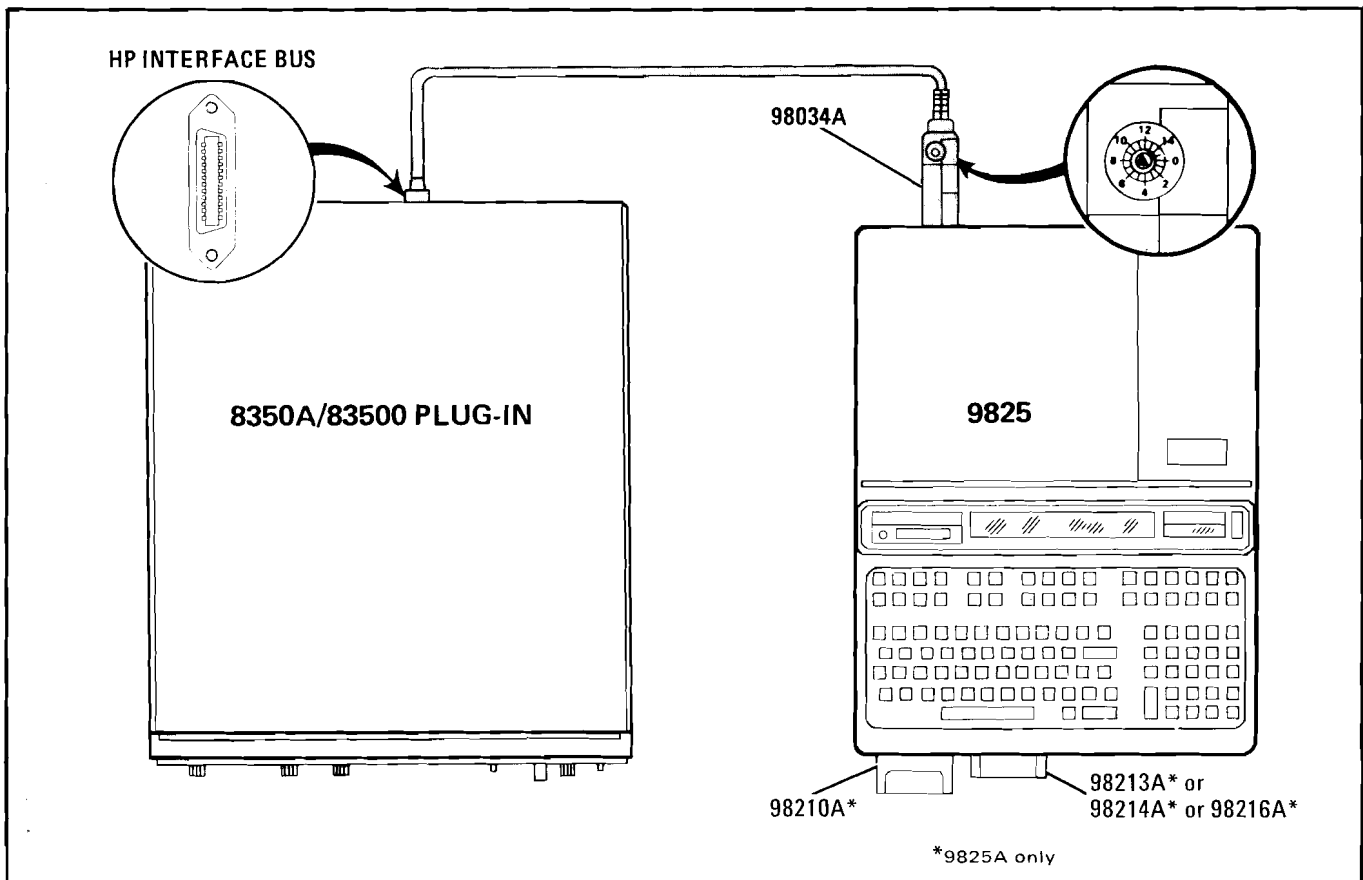


Figure 1. System Connection

to do a specific event much like setting a front panel function.

2. "Talk Mode": The 8350A informs the controller of the present instrument state with a numeric value or a string of characters. This effectively allows the user to interrogate or learn any 8350A function.

Each programming example is structured using the following format:

1. A general description of the functions exercised.
2. A program listing.
3. An explanation of each program line.
4. Detailed instructions for operating the program.

A complete summary of all the 8350A HP-IB program codes is provided at the end of this note.

### EXAMPLE PROGRAM 1: Remote, Local, Local Lockout, and Instrument Preset

Before programming the 8350A for different sweep functions, the user should be aware of the extent of remote control that can be used. The Remote Enable ('rem') command sets the 8350A into remote control from the local (manual) mode. In remote the 8350A will perform only as its functions are programmed. However if the LCL button is pressed, the 8350A will return to the remote state to local control. To prevent this from occurring the Local Lockout (llo) command disables all front panel controls, specifically the "Local" key. The Go To Local (lcl) command will return the 8350A to front panel control thereby removing it from the remote and local lockout modes. Note that the above remote and local commands are different from the general HP-IB bus local and remote commands (lcl 7 and rem 7). Finally, in remote control it is periodically desirable to reset the 8350A to a pre-defined state, this is achievable with the Instrument Preset function.

#### PROGRAM 1

```
0: rem 719;dsp "Remote";istp
1: rem 719;llo 7;dsp "Local Lockout";istp
2: lcl 719;dsp "Local";istp
3: wrt 719,"IP";istp
*21323
```

#### PROGRAM 1 EXPLANATION

- Line 0: Sets 8350A to remote, the 9825 displays "Remote", then stops program execution.
- Line 1: Sets 8350A to remote and local lockout, the 9825 displays "Local Lockout", then stops program execution.
- Line 2: Sets 8350A to local, the 9825 displays "Local", then stops program execution.
- Line 3: Sets 8350A to remote and performs an Instrument Preset, then stops program execution.

To verify and investigate the different remote modes perform the following:

1. Press RESET ERASE A EXECUTE on the 9825. This erases the program memory.
2. Press INSTR PRESET on the 8350A.
3. Type in the above program.
4. Press RUN on the 9825.
5. With the 9825 displaying "Remote", verify that the 8350A REMote light is lit. From the front panel, attempt to change the start frequency and verify that this is impossible. Verify that the Instrument Preset key and all other keys except LCL are disabled. Now press the LCL key and verify that the 8350A REMote light is off and that you can modify any of the sweep functions.
6. Press CONTINUE on the 9825. With the 9825 displaying "Local Lockout" verify that the 8350A REMote light is again lit. Again attempt to change the start frequency and perform an instrument preset. Verify that this is impossible. Now press the LCL key and verify that still no action is taken.
7. Press CONTINUE on the 9825. With the 9825 displaying "Local" verify that the 8350A REMote light is off. Also verify that all sweep functions can now be modified via the front panel controls.
8. Press CONTINUE on the 9825. Verify that the 8350A has undergone an Instrument Preset and the REMote light is on. The Write ('wrt 719') statement does two things, one it performs a 'rem 719', and second it passes data to the 8350A.

Note that the 8350A LCL key produces the same result as programming 'lcl 719' or 'lcl 7'. Be careful as the latter command places all instruments on the HP-IB in local state as opposed to the 8350A alone.

## EXAMPLE PROGRAM 2: Programming Functions

To program any function on the 8350A the controller must pass specific program codes and data to the sweeper. The statement that allows this is the Write (wrt) statement. The alphanumeric data string of the write statement can be a concatenation of character strings and/or variables. The data can be specific codes, free field formatted data, or reference a specific format (fmt) statement. For example, to program the CW Frequency (CW), one program code sequence is "CW", followed by the frequency in GHz, then "GZ". If the frequency is to be 7.555 GHz, then the string "CW7.555GZ" will suffice. However if the frequency were to change then a variable 'F' could indicate the frequency in GHz and the program string could be "CW",F,"GZ". Using a format statement also allows a specific number of digits to be passed, thereby avoiding any unexpected round off errors.

### NOTE

This program expects an 83500 Series Plug-in that covers the frequency 7.555 GHz. If using a plug-in that does not cover this frequency range then the value in line 1 should be changed to an appropriate value.

### PROGRAM 2

```
0: wrt 719,"IP";fxd 2
1: wrt 719,"CW7.555GZ";dsp
   "CW = 7.555 GHz";stp
2: ent "CW (in GHz) = ?";F
3: prt "CW = ",F," GHz"
4: wrt 719,"CW",F,"GZ";sto -2
5: fmt 1,"CW",f6.3,"GZ"
6: wrt 719.1,F;sto -4
*19247
```

### PROGRAM 2 EXPLANATION

- Line 0: Puts the 8350A into a predefined state via instrument preset, then fixes data to 2 decimal places.
- Line 1: Puts the 8350A in CW mode and programs a CW frequency of 7.555 GHz, the 9825 displays "CW = 7.555 GHz", then stops program execution.
- Line 2: The 9825 displays "CW (in GHz) = ?". The user is prompted to input a new CW frequency value which is stored in the variable 'F'.
- Line 3: Print on the internal strip printer the programmed CW frequency.

Line 4: Program the CW frequency using the default data format, then go to line 2.

Line 5: Format statement #1 is set up for programming the CW frequency with a 1 MHz resolution.

Line 6: Program the CW frequency via format statement #1, then go back to line 2.

The equipment setup is the same as the previous example. Reset the 9825, erase the 9825 memory, then type in the above program. Then perform the following:

1. Press RUN on the 9825. The 9825 displays "CW = 7.555 GHz". The 8350A changes from the instrument preset state of Start/Stop sweep to a CW frequency of 7.555GHz.
2. Press CONTINUE on the 9825. The 9825 now displays "CW (in GHz) = ?". Type in a new CW frequency (value in GHz), then press CONTINUE
3. The 8350A will be programmed to the new CW frequency with the new value printed on the internal strip printer. The program jumps back to step 2. above.

When inputting the CW frequency try several values, each with a different number of digits after the decimal point. Notice that the 8350A displays the frequency to 3 decimal places (1 MHz frequency resolution). Values with better than 1 MHz frequency resolution are rounded to the nearest MHz by the 8350A. However when the 9825 is reset all numeric output data defaults to the 'fxd 2' or fixed 2 decimal places format. Thus the 9825 rounds the desired frequency to the nearest 10 MHz. To change this free-field format to more decimal places change the fixed format statement in line 0 to 'fxd 5' then re-run the program. Another approach is to utilize the format statement to set the desired number of decimal places. To use the format statement in the program perform the following on the 9825:

Press STOP FETCH 4 EXECUTE  
then DELETE LINE

This should delete line 4 from program #2 and allow the use of lines 5 and 6 instead. Run the modified program again and use the same steps for operation as before. Now if the value inputted has a frequency resolution greater than 1 MHz the 9825 does the rounding instead of the 8350A. This is the preferred

programming approach. Change the format statement for 10 MHz frequency resolution and verify the results from the 8350A frequency display.

Since a device select code address can be a variable via the Device ('dev') statement, verify that this can be used in the modified or original program #2 by doing the following:

1. Insert before Line 0 a new line using the 'dev' command by:

Press **STOP FETCH 0 EXECUTE**  
 Type 'dev "SWP",719'  
 Press **INSERT LINE**

2. Modify the write statement(s) by fetching the necessary lines, then change the 'wrt 719' to 'wrt "SWP"' and 'wrt 719.1' to 'wrt "SWP.1"'
3. Re-run the modified program using the same operation steps as above.

### EXAMPLE PROGRAM 3: Setting Up A Typical Sweep

Typically the sweeper is programmed for the proper sweep frequency range, sweep time, power level, and marker frequencies for a test measurement. This program sets up the sweeper for a general purpose situation using several dedicated format statements. Note that not all parameters need to be reprogrammed every time.

#### NOTE

This program expects an 83500 Series Plug-in that covers the frequency range of at least 3 to 7 GHz. If using a plug-in with a different frequency range, change the values in lines 5, 8, and 9, to the appropriate values. If using an 86200 Series Plug-in, then do not enter Line 6.

- Line 5: Set a Start/Stop Sweep of 3.0 to 7.0 GHz.
- Line 6: Set the Sweep Time to 50 msec.
- Line 7: Set the Output Power Level to +10 dBm.
- Line 8: Set Marker #1 to 4 GHz.
- Line 9: Set Marker #2 to 6 GHz, then stops program execution.

Set up the equipment as shown in figure 2 by adding the 8755C, the 180TR or 182T, the 11664, and a test device like a 4 to 6 GHz Bandpass Filter. It is important that the two rear panel connections from the 8350A to the 8755C/182T are made for a proper CRT display. For the example measurement set the following front panel controls:

PROGRAM 3	
0:	fmt 1, "FR", f6.3, "GZFB", f6.3, "GZ"
1:	fmt 2, "ST", f5.0, "MS"
2:	fmt 3, "M", f1.0, f6.3, "GZ"
3:	fmt 4, "PL", f6.2, "DM"
4:	wrt 719, "IPMD1"
5:	wrt 719.1, 3, 7
6:	wrt 719.4, 10
7:	wrt 719.2, 50
8:	wrt 719.3, 1, 4
9:	wrt 719.3, 2, 6; stop
	*20341

On the 8755C:

Channel 1:  
 Display ..... OFF (press all the display push buttons so that they are out)

Channel 2:  
 Display ..... B  
 dB/DIV ..... 10 dB  
 Reference Level ..... -10 dB  
 Reference Level Vernier ..... OFF

#### PROGRAM 3 EXPLANATION

- Line 0: Format statement for setting the Start and Stop Sweep frequencies in GHz.
- Line 1: Format statement for setting the Sweep Time in milliseconds.
- Line 2: Format statement for setting a Frequency Marker by marker number and frequency in GHz.
- Line 3: Format statement for setting the Output Power Level in dBm.
- Line 4: Preset the sweeper to a known state via instrument preset and enable the internal 27.8 kHz Square Wave Amplitude Modulation.

On the 182T or 180TR:

Magnifier ..... X1  
 Display ..... INT

After connecting the equipment: reset the 9825, erase the 9825 memory, then type in the above program. Then run the program. The 8350A will initially undergo an instrument preset which will set the proper power leveling mode and sweep blanking signals. Since the 8755C requires the RF signal to be modulated at a 27.8 kHz rate, the internal amplitude modulation is enabled. If using a 4 to 6 GHz Bandpass Filter as the test device, the CRT display should reflect the filter transmission

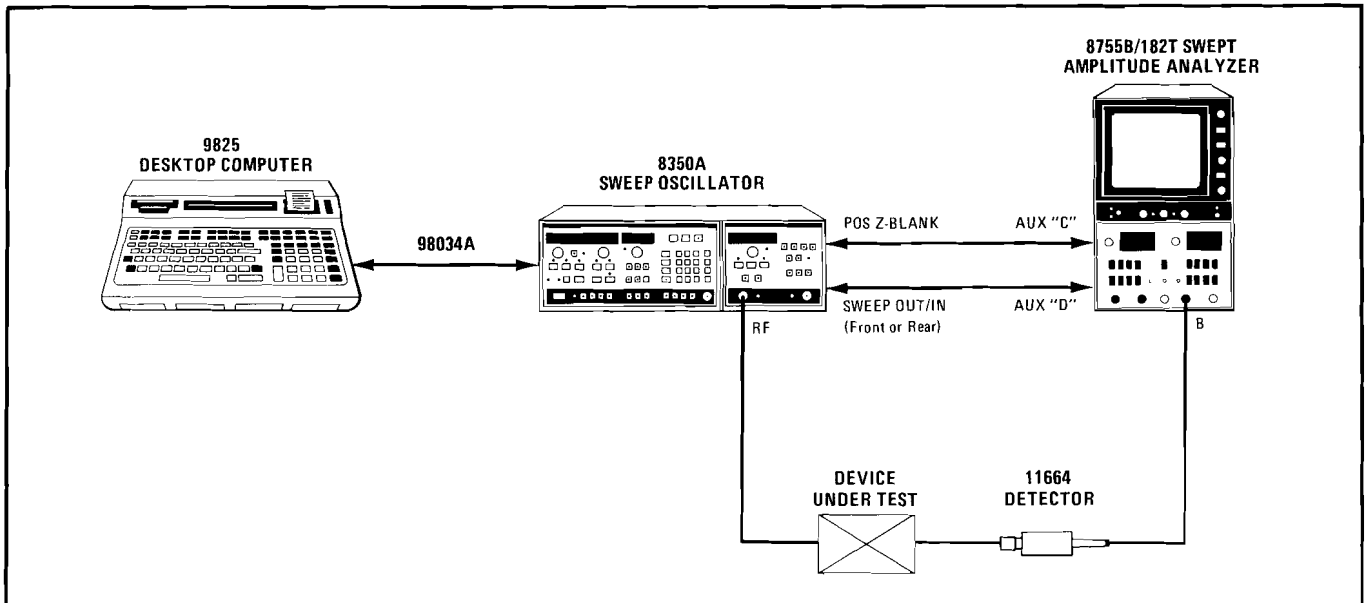


Figure 2. Equipment Setup For Program 3

response over the 3 to 7 GHz range. Two frequency markers of the Z-Axis Intensity dot variety are set to 4 and 6 GHz, hopefully within the passband or near

the 3 dB points. The setup can be modified by changing the values in lines 5, 6, 7, 8, and/or 9, then rerun the program.

#### EXAMPLE PROGRAM 4: Learning An Instrument State

Being able to save a specific instrument state is helpful when it is needed several times in a test or measurement procedure. The user could save the instrument state by manually logging the important sweep parameters such as frequency range, power level, ALC modes, etc., then re-inputting them at the appropriate time. A somewhat simpler approach is to save the instrument state in one of the 8350A internal storage registers, then recall it when needed.

However, this is not a permanent solution unless the 8350A Non-volatile Memory option (Option 001) is used. A more permanent solution is to use the Output Learn String function of the 8350A so that the 9825 can learn then store a data string that describes the present instrument state on a tape cartridge or in its' internal memory. Once an instrument state is stored or learned, the 8350A can then be restored to that state using the Input Learn String function. The power of these instrument Learn/Teach functions are demonstrated by the following program using the 9825 fast data transfer function.

```

PROGRAM 4
0: dim A$[116]
1: buf "Learn",A$,3
2: wrt 719,"IPMD1"ilcl 719;stp
3: wrt 719,"OL"
4: tfr 719,"Learn",90
5: if rds("Learn")=-1fto +0
6: A$[1,90]→A$
7: stp
8: wrt 719,"IL"&A$
9: stp
*23021

```

#### PROGRAM 4 EXPLANATION:

- Line 0: Set the length of the A\$ string to 116 characters.
- Line 1: Set up an I/O buffer named "Learn" that uses the string A\$ for data storage. The buffer type selected is a byte data, fast read/write buffer.
- Line 2: Set the 8350A to a predefined state via instrument preset and enable the square wave modulation. Return the 8350A to local control, then stops program execution.

- Line 3: Program the 8350A to output the Learn String.
- Line 4: Transfer the Learn String information into the 9825 data buffer specifying to transfer only 90 characters.
- Line 5: Check the status of the buffer to determine if the transfer is complete. If it is not, then keep checking the buffer status.
- Line 6: Extract the Learn String information from the buffer by removing the buffer pointers and re-save only the Learn String in A\$.
- Line 7: Stops program execution.
- Line 8: Program the 8350A to accept a new Learn String, then send the new Learn String to the 8350A.
- Line 9: Stops program execution.

Set up the equipment as in example 3 using the CRT display to verify the sweep settings. Note that the original equipment setup can also be used with the 8350A front panel indicators used for verification. Reset the 9825, erase the 9825 memory, then type in the above program. Run the program. The 8350A will undergo an instrument preset, enable the square wave modulation, then return to local front panel control. Then perform the following:

1. Adjust the 8350A to a preferred instrument state, then press CONTINUE on the 9825.
2. Turn the 8350A line power off. Wait five seconds then turn the 8350A power back on. Press INSTR PRESET on the 8350A.
3. Press CONTINUE on the 9825. Verify on the CRT display and/or the 8350A that the original instrument state has been restored.

### EXAMPLE PROGRAM 5: Interrogating The Present Value Of A Function

While the 8350A Learn String enables the user to completely save a string of characters that define the present instrument state, the information is densely packed and encoded to save memory space. If the user wishes to determine the actual value of a specific parameter, say the Start Frequency, it would require a tedious process to extract a numeric value from several characters within the Learn String. An easier approach is to use the Output Interrogated Parameter function of the 8350A. With this function the 9825 instructs the 8350A to output the present numeric value of a specified function. Any function that has a numeric value associated with it (except Step Size) can be interrogated. Note that if the parameter is not presently active, the 8350A uses a computed value or its previous value. The following program demonstrates the capability of the interrogate function.

PROGRAM 5
<pre> 0: wrt 719,"IPMD1";ilcl 719;stp 1: wrt 719,"OPFA";ired 719,A 2: prt "Start Freq =",A/1e6 3: wrt 719,"OPFB";ired 719,B 4: prt "Stop Freq =",B/1e6 5: wrt 719,"OPST";ired 719,T 6: prt "Sweep Time =",1000T 7: stp *17982 </pre>

#### PROGRAM 5 EXPLANATION

Line 0: Set the 8350A to a predefined instrument state via instrument preset and enable the square wave modulation. Return the 8350A

to local control, then stop program execution.

- Line 1: Program the 8350A to output the present value of the Start Frequency. Read the value into the 9825 and store it in the variable 'A'.
- Line 2: Print on the internal strip printer the present value of the Start Frequency in MHz.
- Line 3: Program the 8350A to output the present value of the Stop Frequency. Read the value into the 9825 and store it in the variable 'B'.
- Line 4: Print on the internal strip printer the present value of the Stop Frequency in MHz.
- Line 5: Program the 8350A to output the present value of the Sweep Time. Read the value into the 9825 and store it in the variable 'T'.
- Line 6: Print on the internal strip printer the present value of the Sweep Time in milliseconds.
- Line 7: Stops program execution.

Set up the equipment as in example 3 using the analyzer's CRT display to verify the sweep settings. Note that the original equipment setup can also be used with the 8350A front panel indicators used for verification. Reset the 9825, erase the 9825 memory, then type in the above program. Run the program. The 8350A will undergo an instrument preset, enable the square wave modulation, then return to local front panel control. Then perform the following:



1. Adjust the 8350A to a preferred instrument state using the Start Frequency, Stop Frequency, and Sweep Time controls.
2. Press CONTINUE on the 9825.
3. The present values of the Start Frequency, Stop Frequency, and Sweep Time are sequentially interrogated and then printed on the internal strip printer of the 9825.

### EXAMPLE PROGRAM 6: A Stepped CW Sweep

Present automatic measurement systems typically make measurements at a sequence of CW test frequencies instead of analog sweeping the frequency range of interest. If swept, the measurement data taking machine would need to sample the RF signal at a very fast rate to maintain accurate frequency information, too. This is typically not accomplished. Stepped CW sweeps can be accomplished in several ways with the 8350A:

1. Program sequential CW test frequencies.
2. Program the frequency sweep range then enable the manual sweep mode. Perform a stepped manual sweep by repetitively programming the step up/increment function.
3. Program the CW frequency to the start frequency, the Step Size to an appropriate value, then repetitively program the step up/increment function.

Considering the speed of programming the above approaches, the third is the most efficient time wise. This program illustrates a stepped sweep using this approach.

PROGRAM 6	
0:	wrt 719,"IPMD1"
1:	ent "Start Freq (GHz) = ?",A
2:	ent "Stop Freq (GHz) = ?",B
3:	ent "Step Size (GHz) = ?",C
4:	(B-A)/C>D
5:	wrt 719,"CWSS",C,"GZ"
6:	wrt 719,"CW",A,"GZ"
7:	for I=1 to D
8:	wrt 719,"UP";wait 20
9:	next I;to -3
	*21490

#### PROGRAM 6 EXPLANATION

- Line 0: Set the 8350A to a predefined instrument state and enable the square wave modulation.
- Line 1: The 9825 displays "Start Freq (GHz) = ?", input prompts for start frequency of the sweep. Store it in the variable 'A'.
- Line 2: The 9825 displays "Stop Freq (GHz) = ?", input prompts for the stop frequency of the sweep. Store it in 'B'.

- Line 3: The 9825 displays "Step Size (GHz) = ?", input prompts for the step size of the sweep. Store it in 'C'.
- Line 4: Determine the number of frequency steps in sweep, store in 'D'.
- Line 5: Set the CW Step Size.
- Line 6: Set the CW frequency to the start frequency value.
- Line 7: Iterate the CW step 'D' times.
- Line 8: Program the Step Increment/Up function, then wait 20 msec for settling.
- Line 9: Continue step iteration, then go to line 6.

The equipment setup is the same as in the previous example. Reset the 9825, erase the 9825 memory, then type in the above program. Run the program. The 8350A will undergo an instrument preset and enable the square wave modulation. Then perform the following:

1. The 9825 will display "Start Freq (GHz) = ?". Answer this prompt by inputting the desired Start frequency (value in GHz) of the sweep, then press CONTINUE
2. The 9825 will display "Stop Freq (GHz) = ?". Answer this prompt with the desired Stop frequency (in GHz) of the sweep, then press CONTINUE
3. The 9825 will display "Step Size (GHz) = ?". Answer this prompt with the desired Step size (in GHz) of the sweep, then press CONTINUE
4. The 8350 CW frequency will be programmed to the Start frequency of the sweep selected. Then the CW frequency is repetitively incremented by the step size value. The sweep is then restarted after reaching the stop frequency.

To stop the program press STOP or RESET.

Part of the time involved in changing CW frequencies is updating the numeric LED display. This time can be reduced by blanking the numeric display via the Display Update On/Off function. This can be implemented by modifying line 0 to: wrt 719,"IPMD1DU0". Re-run the modified program.

## EXAMPLE PROGRAM 7: Using Service Requests, Status Bytes, and Request Mask

Certain error conditions of the 8350A can be detected by the 9825 so that corrective action can be taken. Examples of some detectable error conditions are RF power unlevelled, numeric data entry out of range, and line power failure. If an error condition exists, the user can instruct the 8350A to request service from the 9825 by initiating a Service Request (SRQ). The 9825 can detect whether an SRQ has taken place on the bus by analyzing bit 7 (see note) of the Status Byte of the 98034A HP-IB Interface. Two modes are available for analyzing the 98034A Status Byte: 1) periodically read the Status Byte, or 2) enable bit 7 to interrupt the program when it is set. In either case, once it is determined that the 8350A has requested service, the specific error condition(s) can then be determined by reading and analyzing the Status Bytes of the 8350A. The 8350A has two Status Bytes, each consisting of 8 bits with each bit indicating the present status of a particular function or condition. See Table 1 for a complete description of the conditions associated

with each Status Byte bit. The user can analyze these Status Bytes for every SRQ, or more simply, instruct the 8350A to issue an SRQ only if a specific set of error conditions exists. The set of conditions is determined by a numeric value passed by the Request Mask function. This numeric value is generated by summing the decimal values of each Status Byte bit to be checked. This program demonstrates the capability of the SRQ and Status Bytes to detect an error condition.

### NOTE

This assumes that the status bits are numbered 0 thru 7 with the least-significant bit being number 0. Other references may assume that the bits are numbered 1 thru 8 with the least-significant bit being number 1.

If using an 86200 Series Plug-in, the Status Bytes can provide only limited information. Table 1 indicates which Status Byte function/bits are usable.

Table 1. 8350A Status Byte Descriptions

STATUS BYTE (#1)								
BIT #	7	6	5	4	3	2	1	0
DECIMAL VALUE	128	64	32	16	8	4	2	1
FUNCTION	Front Panel SRQ REQUEST	REQUEST SERVICE (RQS)	SRQ on Syntax Error	SRQ on End of Sweep	*SRQ on RF Settled	SRQ on Change in Extended Status Byte	SRQ on Front Panel Entry Complete	SRQ on Numeric Parameter Altered to Default Value

EXTENDED STATUS BYTE (#2)								
BIT #	7	6	5	4	3	2	1	0
DECIMAL VALUE	128	64	32	16	8	4	2	1
FUNCTION	N/A	*RF Unlevelled	Power Failure	*RF Unlocked	*External Freq. Ref. Selected	*OvenCold	*Over Modulation	Self Test Failed

\*Bit/Functions not usable with 86200 Series Plug-ins and 11869A Adapter.

### PROGRAM 7

```
0: cli 7;clr 719;wrt 719,"IPMD1"  
1: oni 7,"SRQ"  
2: eir 7,128  
3: ent "CW Freq (GHz) = ?",F  
4: wrt 719,"CW",F,"GZ"  
5: wait 100  
6: goto -3  
7: "SRQ":rds(719)+A  
8: if bit(6,A)=0;goto +4  
9: if bit(0,A)=1;prt "Value Altered"  
10: if bit(5,A)=1;prt "Syntax Error"  
11: clr 719  
12: eir 7,128;iret  
*32644
```

### PROGRAM 7 EXPLANATION

Line 0: Clear the status of the HP-IB and the 8350A. Preset the 8350A to a predefined instrument state and enable the square wave modulation.

Line 1: Indicate that if an interrupt from the 98034A HP-IB Interface is received that program execution will branch to the interrupt service routine located at the line labelled "SRQ".

Line 2: Enable the controller to accept an interrupt from the 98034A if bit 7 (decimal value 128) is set.

Line 3: The 9825 displays "CW Freq (GHz) = ?", input prompts for the desired CW frequency value in GHz. Store it in the variable 'F'.

Line 4: Set the CW frequency as determined by 'F'.

Line 5: Wait 100 milliseconds to allow the 8350A to interrupt.

Line 6: Go to line 3.

Line 7: Location of the interrupt service routine. Read the Status Byte of the 8350A and store it in 'A'.

Line 8: Check bit 6 of the 8350A Status Byte to see if it generated the SRQ, go to line 12 if not.

Line 9: Check bit 0 of the 8350A Status Byte for a Parameter Value Altered error indication. Print on the internal strip printer "Value Altered" if one exists.

Line 10: Check bit 5 of the 8350A Status Byte for a Syntax error. Print on the internal strip printer "Syntax Error" if one exists.

Line 11: Clear the 8350A status to enable another SRQ.

Line 12: Re-specify and re-enable interrupts from bit 7 of the 98034A, return from the interrupt service routine to the main program.

The equipment setup is the same as the previous example. Reset the 9825 memory, then type in the above program. Run the program. The 8350A will undergo an instrument preset and enable the square wave modulation. The 9825 then displays "CW Freq (GHz) = ?". Answer this prompt by inputting the desired CW frequency in GHz, then press CONTINUE. Verify that the 8350A CW frequency has been properly programmed. Try several values that are out of range of the plug-in's frequency limits and verify that an error message was printed on the strip printer. The program repeats the above input prompt. To stop the program press STOP or RESET.

### † NOTE

For Program 7 to function properly, change line 0 to:  
0: cli7; clr 719; wrt 719, "IPMD1RM" & char (97).  
This change enables status bit 5 (SRQ on Syntax Error) and bit 0 (SRQ on Numeric Parameter Altered to Default Value).

## HP-IB PROGRAM CODES

CODE	DESCRIPTION	CODE	DESCRIPTION
AKm	Amplitude Marker On/Off	MZ	MHz
ALmn	Alternate Sweep On/Off	M0	Marker Off
A1	Internal Leveling	M1	Marker #1
A2	External Crystal Leveling	M2	Marker #2
A3	External Power Meter Leveling	M3	Marker #3
BK	Backspace	M4	Marker #4
CAm	Amplitude Crystal Marker On/Off (83522/ 83525 Only)	M5	Marker #5
CF	Center Frequency	NT	Network Analyzer Trigger (8410B)
CI <sub>m</sub>	Intensity Crystal Marker On/Off (83522/ 83525 Only)	OA	Output Active Parameter
CW	CW Frequency	OL	Output Learn String
C1	1 MHz Crystal Marker Frequency (83522/ 83525 Only)	OM	Output Mode String
C2	10 MHz Crystal Marker Frequency (83522/ 83525 Only)	OP	Output Interrogated Parameter
C3	50 MHz Crystal Marker Frequency (83522/ 83525 Only)	OS	Output Status Bytes
C4	External Crystal Marker Frequency (83522/ 83525 Only)	OX	Output Micro Learn String
DF	Delta F Frequency Span	PL	Power Level
DM	dBm	PS <sub>m</sub>	Power Sweep On/Off
DN	Step Down/Decrement	RC <sub>n</sub>	Recall Register
DP <sub>m</sub>	Display Blanking On/Off	RF <sub>m</sub>	RF Power On/Off
DU <sub>m</sub>	Display Update On/Off	RM	Service Request Mask
E	Exponent Power Of 10	RS	Reset Sweep
FA	Start Frequency	SC	Seconds
FB	Stop Frequency	SH	Shift Function
FI <sub>m</sub>	CW Filter In/Out	SL <sub>m</sub>	Slope On/Off
GZ	GHz	SM	Manual Sweep
HZ	Hz	SS	Step Size
IL	Input Learn String	ST	Sweep Time
IP	Instrument Preset	SV <sub>n</sub>	Save Register
IX	Input Micro Learn String	SX	External Sweep
KZ	KHz	TS	Take Sweep
MC	Marker To Center Frequency	T1	Internal Sweep Trigger
MD <sub>m</sub>	Square Wave Amplitude Modulation On/Off	T2	Line Sweep Trigger
MO	Marker Off	T3	External Sweep Trigger
MP <sub>m</sub>	Marker 1-2 Sweep On/Off	T4	Single Sweep
MS	Milliseconds	UP	Step Up/Increment
		VR	CW Vernier
			0-9 + - Acceptable Numeric Data

### NOTES

1. Program codes of the form "XXm" use "m" to turn the function On or Off (1 or 0). For the storage register functions the "n" is 1 through 9.
2. The 8350A ignores spaces, plus signs, negative signs (except for vernier, offset, and power values), and any unexpected characters. Program codes can be upper or lower case alpha characters.

For more information, call your local HP Sales Office or nearest Regional Office: Eastern (201) 265-5000; Midwestern (312) 255-9800; Southern (404) 955-1500; Western (213) 970-7500; Canadian (416) 678-9430. Ask the operator for instrument sales. Or write Hewlett-Packard, 1501 Page Mill Road, Palo Alto, CA 94304. In Europe: Hewlett-Packard S.A., 7, rue du Bois-du-Lan, P.O. Box, CH 1217 Meyrin 2, Geneva, Switzerland. In Japan: Yokogawa-Hewlett-Packard Ltd., 29-21, Takaido-Higashi 3-chome, Suginami-ku, Tokyo 168.

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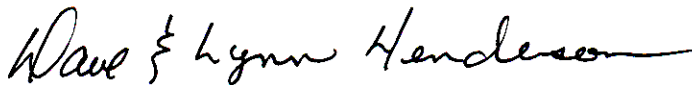
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