8350B
SWEEP OSCILLATOR

1400 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CA. 95404

MANUAL PART NO. 08350-90034
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LOCAL OPERATION

INTRODUCTION

This Local Operation handbook provides information on the local use (non HP-IB) of the 8350B Sweep Oscillator with 83500 series Plug-ins. Throughout this handbook are blocks of example procedures on implementing some of the information. The front panel controls are divided into function groups. These groups and other information topics are arranged in the following sequence:

- GETTING STARTED – Brief example of control usage.
- INSTRUMENT PRESET – Error codes and preset conditions.
- DATA ENTRY – Numeric, step, units, and shift keys.
- FREQUENCY – Mode selection, vernier and offset.
- FREQUENCY/TIME – Markers and sweep control.
- SAVEn/RECALLn/ALTn – Storage Registers, Step Up Advance.
- DISPLAY FUNCTION – Blanking, Modulation, and Sweep Out/In.
- 83500 SERIES PLUG-INS – Power, signal, and crystal markers.
- USE WITH SPECIFIC MEASUREMENT EQUIPMENT:
  HP 8756A Scalar Network Analyzer
  HP 8755S Frequency Response Test Set
  HP 8410B Network Analyzer
  HP 7010B and other X-Y Recorders
  HP 5343A Frequency Counter
- APPENDIX 1 – Rear panel connector information.
- APPENDIX 2 – Use of 86200 series Plug-Ins with 11869A Adapter.
- APPENDIX 3 – Summary of Sweep Oscillator front panel controls with fold-out front panel drawing.

GETTING STARTED

NOTE

If a 86200 series RF Plug-in and 11869A Adapter are used, the Plug-in coding on the adapter must be set properly to get the correct frequency display.

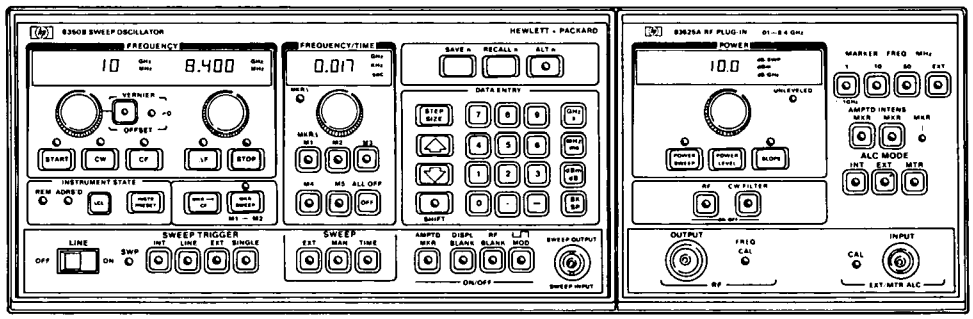
When the 8350B INSTR PRESET key is pressed the front panel of the 8350B is set to the following pre-determined state: The RF output is swept over the full frequency range of the Plug-in at the maximum specified leveled output power, minimum sweep time for the RF Plug-in installed, and the internal square wave amplitude modulation is off.

Example:

8350B with 83525A 0.01-8.4 GHz Plug-in

To change from the INSTR PRESET state to 4.2 to 6.2 GHz sweep (in START/STOP mode), 0.20 second sweep time, +4.5 dBm output power, 27.8 KHz square wave modulation on RF output:

1. Press the **[START]** key and then rotate the START control clockwise to increase the start frequency until the display above the START key reads 4.200 GHz
2. Rotate the STOP control counterclockwise to decrease the STOP frequency to 6.500 GHz.
3. Press the **[TIME]** key, then turn the FREQUENCY/TIME control clockwise to increase the sweep time to 0.2 second (displayed on the FREQUENCY/TIME display).
4. Press [⊔⊓ **MOD**] key to activate the internal 27.8 KHz square wave modulation. The lamp in the center of the key will be on.
5. Press the **[POWER LEVEL]** key, then turn the Plug-in POWER control until the display reads +4.5 dBm.



INSTRUMENT PRESET

This condition occurs when the INSTR PRESET key is pressed.

Turning the 8350B on or performing an INSTR PRESET causes an internal self test to occur. Only after the INSTR PRESET command will the instrument be set to the preset condition. If certain internal errors or failures are detected during the self test or during normal operation they will be indicated via error codes in the form "Ennn" (where n=0, . . . ,9) read from the left FREQUENCY display. For a complete description of the error code listing see the Operating and Service Manual Section 8. The error codes are:

E001	Plug-in interface failure. Check Plug-in.
E002	Sweep voltage DAC/Marker voltage DAC failure
E003	Tuning voltage DAC/Marker voltage DAC failure

Figure 1. Instrument Preset Key (1 of 2)

E004	Power supply failure
E005	Instrument interface bus failure
E006	Front panel bus failure
E007	ROM failure
E008	ROM failure
E009	ROM failure
E010	ROM failure
E011	RAM failure
E012	RAM failure
E013	RAM failure
E014	RAM failure
E015	Microprocessor failure
E016	Insufficient cooling. Check air filter and fan.
E030	A SAVEn Command has been attempted when the SAVE-Lock is engaged.
E050 to E099	Plug-in failure. Refer to appropriate Plug-in manual for troubleshooting information.

If, after INSTR PRESET, the self test completes without errors the instrument presets to:

SWEEP MODE: START/STOP, over full frequency range of Plug-in

SWEEP TIME: fastest allowable for Plug-in

MARKERS: reset/off

MODULATION: off

SWEEP TRIGGER/SWEEP: INT-TIME

VERNIER/OFFSET: 0 MHz

DISPLAY BLANKING: on

SAVE/RECALL: All SAVE registers remain unchanged.

All Other Functions: off

When using 83500 series Plug-ins:

POWER LEVEL: maximum specified leveled value

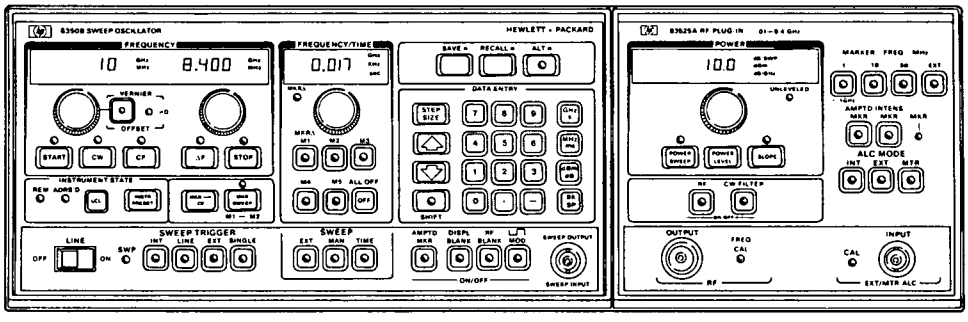
RF: on (Selectable by RF Plug-in configuration switch.)

ALC MODE: INT

CRYSTAL MARKERS: off (83522A, 83525A/B only)

All Other Functions: off

Figure 1. Instrument Preset Key (2 of 2)



DATA ENTRY

The DATA ENTRY section shown above, contains the numeric keyboard, terminators (i.e., GHz, seconds, dBm), step size/up/down, backspace and shift keys. This section allows a specific value to be entered for any Frequency, Time, or power parameter. The entry will modify the active function (last function selected) and must be terminated with the appropriate GHz/seconds, MHz/milliseconds, or dBm/dB Key. The step up [▲] and step DOWN [▼] keys allow the active function to be incremented or decremented. Step size for frequency and Power may be changed to any desired value.

Number/unit keys

These keys are used to enter values of frequency, time or power. Holding a number key down causes it to repeat.

Example:

To enter a START frequency of 1.870 GHz:

Press **[START] [1] [.] [8] [7] [GHz/s]**

or

[START] [1] [8] [7] [0] [MHz/ms]

to enter the equivalent frequency in MHz.

Backspace Key BK SP. Prior to pressing a units key the value entered from the keyboard may be changed via the BK SP key without effecting the current instrument state. The backspace key allows the user to alter digits already entered. Holding down the Backspace key causes it to repeat.

Step UP and Step DOWN keys

These keys increment or decrement the active function (including memory registers) by the STEP SIZE or preset amount. By holding either key down the 8350B will continue to step

Figure 2. Data Entry (1 of 2)

therefore eliminating the need for the user to repeatedly press the step keys. The STEP UP function may be engaged via the remote STEP UP ADVANCE on the rear panel AUX PROGRAMMING connector. The STEP UP ADVANCE is incremented by supplying contact closure to ground or logical 0 to pin 22.

STEP SIZE

Entering a frequency or power increment to be used with the UP or DOWN key. The STEP SIZE key is pressed before the quantity is entered. A frequency step that is entered is common for START, STOP, CF, CW, MARKER and MANUAL SWEEP functions. A power step is used for varying POWER LEVEL. Default values are assigned at instrument preset for step sizes until new values are entered. Note that a step size for SWEEP TIME cannot be entered and always increments in a 1, 2, 5 sequence. The step keys affect the last active function. The entered Step Size is not displayed.

Example:

To set a 250 MHz step size:

Press **[STEP SIZE] [2] [5] [0] [MHz/ms]**

After this, each time the UP or DN key is pressed the active frequency parameter will change by 250 MHz.

SHIFT key (BLUE)

This key is used to activate the functions coded in blue on the front panel and other special SHIFT functions are also explained on the pull out information card. The lamp in the center of this key is on when the key is active.

Example:

To activate all 5 frequency markers: Press **[M1] [M2] [M3] [M4] [M5]**

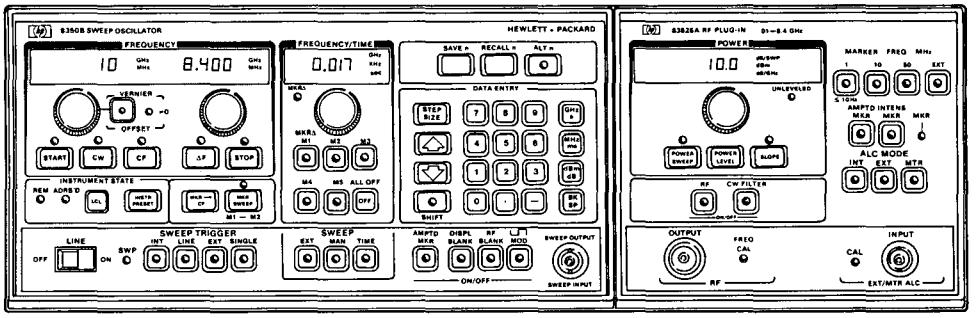
To turn off all 5 frequency markers at once:
Press **[SHIFT] [OFF]**; this activates the (markers) ALL OFF command.

The SHIFT key is also used to set the HP-IB address. Press **[SHIFT] [LCL]**; the FREQUENCY/TIME display will indicate the present HP-IB address number. The address may be changed to any value between 0 and 30 by using the keyboard to enter a number and the GHz, MHz or dBm key as a terminator (It does not make any difference which of the terminator keys is pressed). The 8350B is factory preset for an HP-IB address of 19.

NOTE

Address number 21 is normally reserved for calculator addressing and HP-IB interface functions and should not be used.

Figure 2. Data Entry (2 of 2)



FREQUENCY

The gray area, shown above, controls the sweep modes and frequency limits.

START/STOP

When either the START or STOP key is pressed the sweep oscillator is put in the START/STOP mode swept RF output begins at the START frequency and ends at the STOP frequency. The START frequency must be less than or equal to the STOP frequency. The left FREQUENCY display shows the value of the start frequency. While the right FREQUENCY display shows the value of the stop frequency. Frequencies may be changed in three ways.

- Frequency control knob – Provides continuous adjustment. Clockwise rotation increases frequency.
- Keyboard data entry – Specific frequency values may be entered for the active frequency mode by Pressing the desired values and units.
- Step Control Key – THE ACTIVE FREQUENCY FUNCTION can be incremented or decremented by pressing the appropriate STEP key. The value of the STEP SIZE can be set to any desired value (see STEP SIZE for setting procedure).

CF/ΔF

The CF/ΔF mode allows the swept output frequency range to be read as a center frequency and a frequency sweep width. The output frequency is swept from CF−ΔF/2 (start frequency) to CF+ΔF/2 (stop frequency). When changing between CF/ΔF and START/STOP modes only the method of display changes. The swept RF output remains the same.

When either CF or ΔF is activated the left display shows the center frequency (CF), the right display shows the delta frequency (ΔF). Both the CF and ΔF can be changed via the appropriate control knob, number/units keyboard or step keys.

CW

When the CW function is activated the 8350B outputs a constant frequency. The value of the CW frequency is displayed on the left FREQUENCY display. The CW frequency is always the same as the center frequency (CF) of the CW/ΔF swept range. The CW frequency value can be changed using the control knob, data entry keyboard or step keys. In CW mode, the SWEEP OUT voltage is equal to a percentage of the full band. Pressing **[SHIFT] [CW]** enters a "swept" CW mode with the SWEEP OUT being a 0 to 10 volt ramp that results in the display trace being a flat horizontal line. This is often useful when reading values (e.g., dB of attenuation) from a CRT screen when at a CW frequency.

Figure 3. Frequency Controls (1 of 2)

CW Fine/Coarse Control Knob Resolution

CW control knob resolution is coarse when CW mode is activated after an INSTRUMENT PRESET. To change from coarse control knob resolution, 0.0015% of band/16,384 points, to fine resolution, 0.00038% of band/262,144 points, press **[SHIFT] [ΔF]**. To return to coarse control knob resolution press **[SHIFT] [CF]**.

FREQUENCY VERNIER

The effective center frequency of any mode (CW or swept) may be adjusted with high resolution up to ±0.05% of the frequency band being used with the vernier. Pressing the VERNIER key activates the function and sets the left FREQUENCY display to read the vernier value in MHz.

1. "≠0" light is on whenever a frequency vernier or frequency offset is present in any mode. After setting vernier, to return to the previous mode, press the appropriate key (e.g., START, CF, etc.) and the display will return to reading the appropriate frequencies and the "≠ 0" lamp will be lit.
2. Frequency vernier can be set by the control knob, Data Entry keyboard, or step keys.
3. The displayed vernier adjustment can be up to ±0.05% of the frequency band being swept. When in a sub-band of a multiband Plug-in (for example, the 0.01-2 GHz band of the 83525A .01-8.4 GHz Plug-in) the adjustment range will be ±0.05% of the sub-band. This feature allows for better frequency resolution than would otherwise be possible with the vernier when using a multiband Plug-in.
4. The vernier adds its value to the appropriate frequency parameter and then resets the vernier to zero when the adjustment exceeds ±0.05% for continuous adjustment.
5. ZEROING VERNIER. To set the vernier to zero, press **[VERNIER] [0] [MHZ/ms]** and the"≠0" lamp will turn off.

FREQUENCY OFFSET

The frequency offset feature allows the CW frequency and/or the effective center frequency of the swept range to be shifted by any amount up to the full range of the Plug-in.

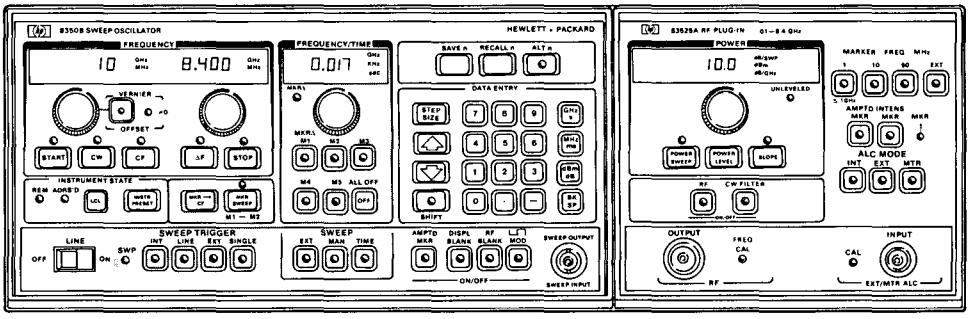
1. To enter an offset press **[SHIFT] [VERNIER]** and enter the offset by either the left FREQUENCY control or data keyboard. The amount of offset (in GHz or MHz) will be shown in the left FREQUENCY display and the "≠ 0" lamp will be lit.
2. To exit the displayed offset mode press the appropriate mode key (i.e., START, CW, etc.). The sweep limits displayed will appear to be unchanged, however the "≠ 0" lamp will be on indicating the offset is present and the actual RF output frequency will be shifted.
3. To display or adjust the frequency offset press **[SHIFT] [VERNIER]**. To zero the offset press **[SHIFT] [VERNIER] [0] [MHz]**.

OVERRANGE

The 8350B will permit frequency sweeps beyond the specified range of the Plug-in by ±2.0% of the Plug-in bandwidth. However, Plug-in performance in the overrange condition is unspecified.

As a warning of the frequency overrange condition the GHz or MHz annunicator will flicker in the appropriate function display.

Figure 3. Frequency Controls (2 of 2)



FREQUENCY/TIME

The FREQUENCY/TIME portion of the front panel shown above enables the control of the SWEEP TRIGGER modes, the SWEEP modes and the frequency markers.

SWEEP

The 8350B SWEEP Mode select keys provide three ways to control the frequency sweep; TIME, MANUAL, and EXTERNAL sweep, described below.

TIME. When the TIME key is pressed the output is swept at the user-specified or default rate. If the time key is lit but the display reads GHz/MHz or is blank, press the TIME key again and the display will read seconds. The mainframe can allow sweep times from 100 seconds to 0.01 second although the minimum sweep time is dependent on the Plug-in being used and the bandwidth being swept.

When display reads seconds, sweep time can be adjusted with the control knob or number/units keyboard. The step keys can be used to adjust the sweep time in a 1-2-5 sequence.

MANUAL SWEEP(MAN). FREQUENCY/TIME display will read GHz/MHz. By using the FREQUENCY/TIME control, step keys or number/units keyboard, it is possible to manually sweep the frequency range with the display indicating the present output frequency.

EXTERNAL SWEEP(EXT). The 8350B can be swept via an external voltage. Apply 0 to 10 volts into the sweep output/input (use BNC connector on front or rear panel) with 0V input corresponding to the lower frequency limit of the sweep range and 10V corresponding to the upper limit. DC sweep input voltages will cause CW frequency outputs. Markers and blanking outputs are disabled when in external sweep mode.

SWEEP TRIGGER

Controls when the sweep will begin in the timed sweep mode. The sweep light, SWP, is lit when the sweep is occurring.

INT. Sweep triggered internally, free running.

LINE. Sweep triggered by power line frequency.

Figure 4. Frequency/Time Controls (1 of 3)

EXT. The sweep can be triggered externally by applying a positive going signal from 0 to 2 volts minimum, +20volts maximum. The trigger signal must be wider than 0.5 microsecond at less than a 1 MHz repetition rate.

SINGLE. This key selects single sweep mode and aborts present sweep when first pressed. Subsequent keying will trigger or abort single sweeps at current sweep time.

MARKERS

Any or all of the five markers (M1 through M5) may be enabled by pressing the marker key corresponding to the marker desired. When a marker is activated it is set to its last active frequency unless INSTRUMENT PRESET has been activated in which case the marker will be set to center of the present sweep. A marker can be in one of three states:

- ACTIVE – Lamp in center of key flashing.
- ON – Lamp on.
- OFF – Lamp off.

The five mainframe markers are available in two forms, Intensity and Amplitude.

Intensity markers are active any time a marker is selected. These markers are available at the Positive Z-axis output (rear panel BNC) and appears as intensified dots on a display.

Amplitude markers are only on when the AMPTD MKR key has been pressed. Amplitude marker circuitry is internal to the 8350B mainframe and RF Plug-ins and causes dips in the RF output power at the selected marker frequencies.

Only one marker at a time, the "active" marker, can have its value altered. Pressing any marker key makes that marker "active".

- When a marker is active the keyboard, FREQUENCY/TIME control knob, step keys, or DATA ENTRY Keyboard can be used to modify its value. The value of the active marker in GHz/MHz is displayed.
- By pressing OFF, the active marker only will be turned off. If multiple markers are on, the remaining lamps will remain lit although the display will go blank.
- A marker may be initially activated or returned to active state by pressing the corresponding marker key.
- All markers may be turned off simultaneously by pressing **[SHIFT] [OFF]**.

Example:

To activate Marker "3":
Press **[M3]**. (Note M3 lamp flashing other lamps off.)

To activate Marker "5":
Press:**[M5]**. (Note M5 lamp flashing, M3 lamp on and other lamps off.)

Figure 4. Frequency/Time Controls (2 of 3)

MKR (Marker) SWEEP. In this mode the RF output is swept between markers M1 and M2. The lamp over the key will be on. Marker 1 must be less than or equal to Marker 2 in frequency (if M1 is greater than M2 the values of M1 and M2 are permanently interchanged). By varying the active marker (1 or 2) or by turning the START/STOP controls the sweep limits can be altered. When both M1 and M2 are not on, the sweep occurs between the most recent values of M1 and M2. To exit this mode press **[MKR SWEEP]** and the lamp over the key will go out. Pressing **[SHIFT] [MKR SWEEP]** causes the values of M1 and M2 to become the START/STOP frequency values permanently.

MARKER-TO-CENTER FREQUENCY (MKR→CF). When this key is pressed the frequency of the active marker becomes the center frequency of the swept output. The frequency span remains unchanged if it is within the frequency limits of the Plug-in. If the original frequency span exceeds the Plug-in limits frequency span will be reduced to retain symmetry.

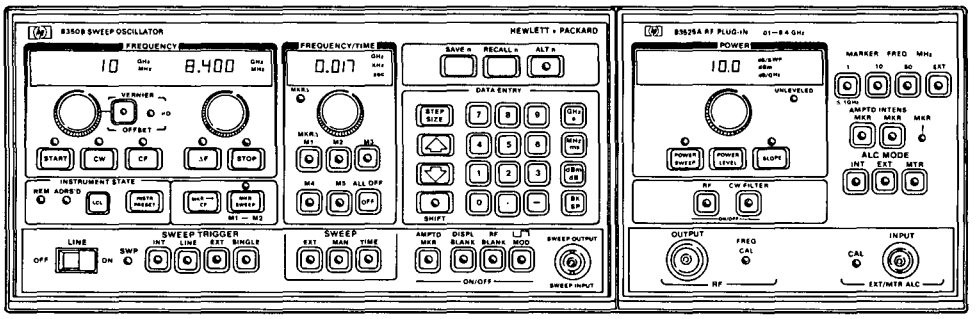
MKR Δ. This function allows the frequency difference between any markers to be displayed and the trace between them intensified (if intensity markers are selected).

1. Press **[SHIFT] [M1]** the display shows the frequency difference between the currently active marker and the one that was previously active.
2. The FREQUENCY/TIME control, DATA ENTRY keyboard, or step keys can change the active marker value.
3. To exit MKR Δ mode press **[OFF]**.

Example:

1. Press **[M4]** and set frequency via DATA ENTRY or Control Knob to 2 GHz.
2. Press **[M2]** and set frequency via DATA ENTRY or Control Knob to 2.4 GHz.
3. Press **[SHIFT] [MKR Δ]** (Note Frequency/Time display reads difference between marker 4 and marker 2, 400 MHz).

Figure 4. Frequency/Time Controls (3 of 3)



SAVEn/RECALLn/ALTn

SAVEn/RECALLn

The 8350B is equipped with memory registers which allow up to nine complete front panel settings (frequency range, markers, power level, etc.) to be stored and later recalled. Instrument settings are stored in memory locations 1 through 9 by pressing **[SAVEn]** and 1, . . ., or 9. To recall a stored instrument setting press **[RECALLn]** and 1, . . ., or 9. The STEP keys may be used to step through the stored registers. The instrument settings stored in memory may be recalled remotely in sequence by using the Step Up Advance on pin 22 of the Auxiliary Program connector on the rear panel of the 8350B. A contact closure to ground or logic 0 is used to implement this function.

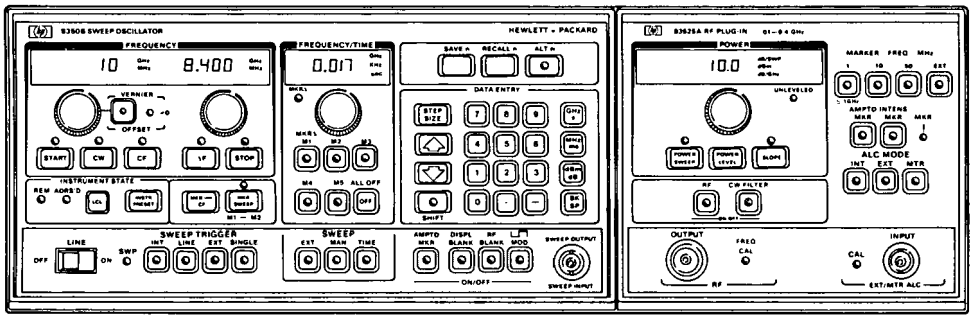
SAVE REGISTER LOCK:

All Save Registers may be write-protected (locked) by pressing **[SHIFT] [SAVEn]**. This command makes it impossible to change the contents of any register until it is unlocked by pressing **[SHIFT] [RECALLn]**. Since the 8350B memory is non-volatile the contents of the Save Registers and the locked/unlocked status are retained even with Line power off. If a SAVEn command is attempted after SAVE LOCK is engaged an Error 30 (E030) is displayed.

ALTn

ALTn causes the 8350B to alternate between the current instrument state and the setting stored in memory location n (where n=1, . . . ,9) on sucessive sweeps. When the 8350B is in this mode the lamp will be on and the SAVE and RECALL keys disabled. To exit from the ALTn mode press the key again, the lamp will turn off and the SAVE/RECALL keys will become operational. When using the 8350B with an HP Swept Amplitude Analyzer, channel 1 displays the current instrument state and channel 2 displays the stored setting (provided the 8350B ALT SWP INTERFACE cable is connected to the analyzer).

Figure 5. Save n, Recall n, and ALT n Keys



DISPLAY FUNCTIONS FOR ANALYZER INTERFACE

AMPT MKR, DSPL BLANK, RF BLANK. (Function in effect when lamp in center of key is lit)

DSPL BLANK ON/OFF. Blanks the display during the retrace via the POS Z BLANK or NEG Z BLANK outputs.

RF BLANK ON/OFF. Blanks (turns off) the RF power during the retrace.

⊓ MOD ON/OFF. Activates the internal 27.8 KHz square wave amplitude modulation of the RF output. This feature makes the 8350B directly compatible with the HP 8756 and the HP 8755 Scalar Network Analyzers. The 8350B may be modified via an internal jumper to provide 1000 Hz square wave amplitude modulation for instruments like the HP 415E SWR Meter (refer to the Operating and Service Manual Section 5).

SWP (Sweep) OUTPUT/SWP (Sweep) INPUT (BNC connection).

SWP (Sweep) OUTPUT. Supplies a 0 to 10 Volt signal when 8350B is in MAN or TIME sweep mode. 0V output is at the start frequency of sweep, 10V output is at the stop frequency of sweep. In CW mode the output is a dc voltage proportional to the percent of the band. This can be used to drive the X-axis on a CRT or X-Y recorder.

SWP (Sweep) INPUT. Used when in EXT sweep mode. Supplying a dc voltage will tune the RF where 0 volts tunes to the lower frequency of the set sweep and 10 volts tunes to the upper frequency. The input can be a ramp for a swept output or DC for a CW frequency.The display and RF blanking must be off when externally sweeping.

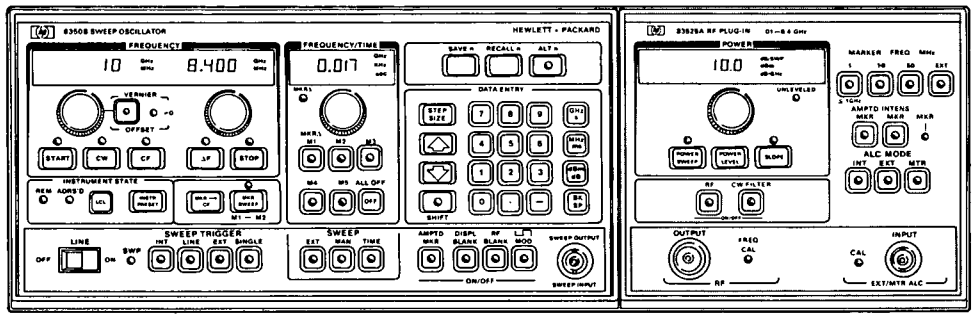
DISPLAY FUNCTIONS FOR FREQUENCY MULTIPLIER OR UP-CONVERTER INTERFACE

Two SHIFT functions located in the Frequency section of the front panel allow the actual RF output frequencies to be displayed when a frequency multiplier or frequency up-converter is used.

DISPLAY MULTIPLIER. This function is activated by pressing **[SHIFT] [START] [n] [GHz]**. The possible values for "n" range from 0 to +99 allowing the appropriate integer multiplier to be entered. This integer (n) multiplier (typically 2 or 3) does not affect the RF output of the 8350B but simply allows the Frequency LED displays to automatically show the final RF output when a frequency multiplier is used.

DISPLAY OFFSET. This function is activated by pressing **[SHIFT] [STOP] [n] [GHz]**. The possible values for "n" range from 0 to +999 GHz enabling an appropriate Frequency LED display offset to be entered. This display offset does not affect the 8350B RF output but only allows the Frequency LED displays to automatically show the final RF output when a frequency up-converter is used.

Figure 6. Display Function Keys



83500 SERIES PLUG-IN

Power Control

POWER LEVEL. When the POWER LEVEL key is pressed, the Plug-in display indicates the RF output power. The output power may be varied using the POWER control knob, keyboard or step keys. Note that the internal leveling must be on and the unleveled light out for calibrated output power. See Plug-in manual for Plug-in calibrated range. ALC dynamic range depends on Plug-in installed and its options, if any.

SLOPE. Compensates for high frequency power losses in external RF cables by increasing power at higher frequencies. This compensation provides a flat RF signal output at the end of a cable or test set. Press **[SLOPE]** and the display will indicate dB/GHz of compensation desired. Use the POWER control knob, keyboard or step keys to enter the amount of slope. Press **[SLOPE]** again to remove all compensation.

POWER SWEEP. This function enables the output power to be swept up. The maximum calibrated power sweep range depends on Plug-in installed. Note that when using Plug-ins withe Option 002 Step Attenuator, the power cannot be swept across the internal attenuator switch points. The procedure for performing a power sweep is:

1. After selecting the output frequency (sweep range or "swept" CW mode) use the POWER LEVEL key to set the starting value for the power sweep.

2. Press the **[POWER SWEEP]** key, the display will now read the dB/SWEEP. By using the POWER control knob, keyboard or step keys set the desired sweep range. The original power setting becomes the lower limit of the Power Sweep. The lower limit plus the entered sweep value is the upper sweep limit. Press the **[POWER SWEEP]** key again to turn the power sweep off.

Figure 7. Plug-in Controls (1 of 2)

Signal Control

RF ON/OFF. Turns the RF power on and off.

CW FILTER ON/OFF. When on, this filters the internal oscillator's tuning voltage to provide a more stable CW output. During swept operation this filter is always disabled.

ALC (Automatic Level Control) Mode: INT, EXT, MTR

INT. Provides internal leveling of output power at the output connector. The 83500 series Plug-in must be on INT leveling for calibrated output power.

EXT. This setting is used when leveling with an external crystal/diode detector. The front panel EXT ALC input accepts negative voltages in the −25 to −250 millivolt range (typically).

MTR. Used when leveling output power with an HP 432A/B/C Power Meter.

CAL. Adjusts the ALC gain so the display can be calibrated by an external power meter or detector.

CRYSTAL MARKERS (83522A, 83525A/B Plug-ins only)

50, 10, and 1 MHz crystal frequency marker combs are available. The 50 and 10 MHz are available in band 0 while the 1 MHz markers are available under 1 GHz.

AMPTD/INTENS. The markers can be set to be amplitude dips (on the RF output) and/or intensified spots (on the Z-axis of the CRT) or both. They are independent of the mainframe markers.

EXT (External Marker). An external frequency marker can be input through the rear panel of the Plug-in. The marker appears when the RF output frequency equals the marker frequency. The external marker input power should be between −10 dBm and −10 dBm.

MKR Lamp. When the 8350B is in CW or manual/external sweep mode the MKR Lamp will light when the CW frequency is at a marker frequency. Useful when an accurate CW frequency reference is desired and to calibrate Plug-ins.

RF OUTPUT CONNECTOR

Type N female. The 83570A 18 to 26.5 GHz Plug-in is equipped with a WR-42 waveguide output connector.

Figure 7. Plug-in Controls (2 of 2)

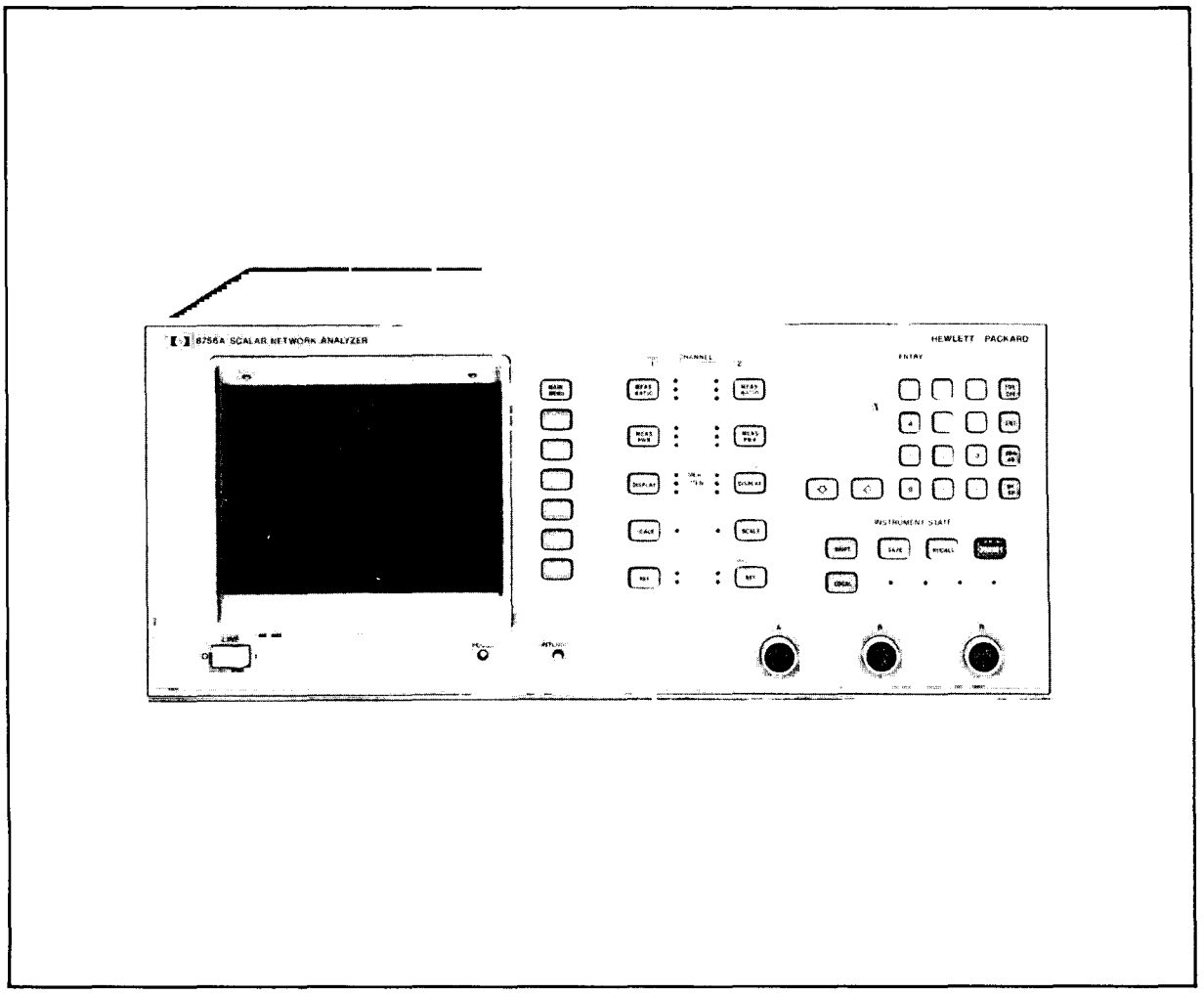


Figure 8. 8756A Scalar Network Analyzer

INTERFACING THE 8350B WITH SPECIFIC MEASUREMENT EQUIPMENT

8756A SCALAR NETWORK ANALYZER

The 8756A is used for scalar transmission and reflection measurements, with 60 dB of dynamic range for ratio measurements, and absolute power measurement from −50 dBm to +10 dBm.

The 8350B has the following features designed for use with the 8756A Scalar Network Analyzer.

RF Square-wave Modulation. By engaging the ⌐¬MOD key an internally generated squarewave modulation of the RF output is available thus eliminating the need for external modulating equipment. A jumper internal to the 8350B enables the square wave modulation frequency to be changed to 1 KHz (see section 5 of the Operating and Service manual for details).

Alternate Sweep Function. The ALTn function of the 8350B allows two different frequency and power settings to be swept on successive sweeps. The front panel setting and the setting stored in a memory register location n (n=1, . . . ,9) can be selected for alternate sweeps. See Figure 9 for a sweep display of the ALTn function when used with a bandpass response at different resolutions and offsets.

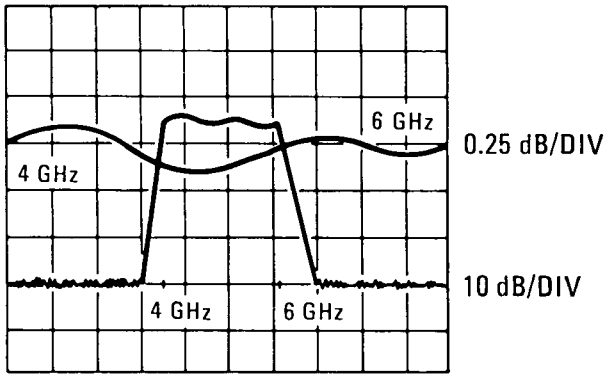


Figure 9. Alternate Sweep Function Display

Some other features enhancing the convenience and versatility of the 8756A are:

Marker Δ. The MKR Δ function reduces the trace intensity between the Active and the previously Active Markers.

Power Sweep. The RF output power may be ramped up when the sweeper is in the swept or "swept" CW mode by using the POWER SWEEP function. See Figure 10 for a gain compression display using power sweep.

Save and Recall. This function allows the storage and recall of nine complete instrument settings.

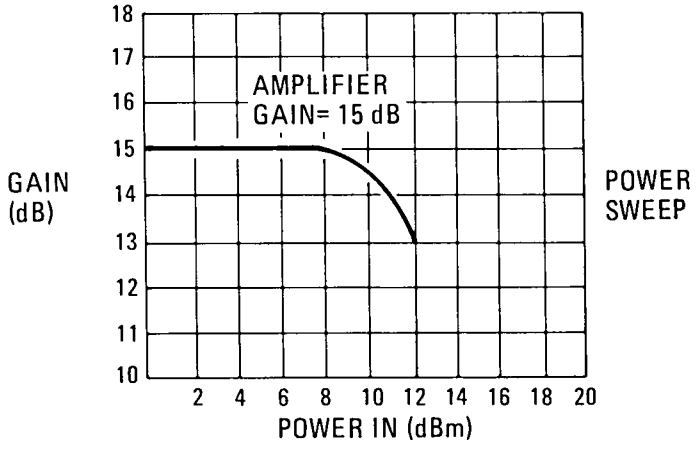


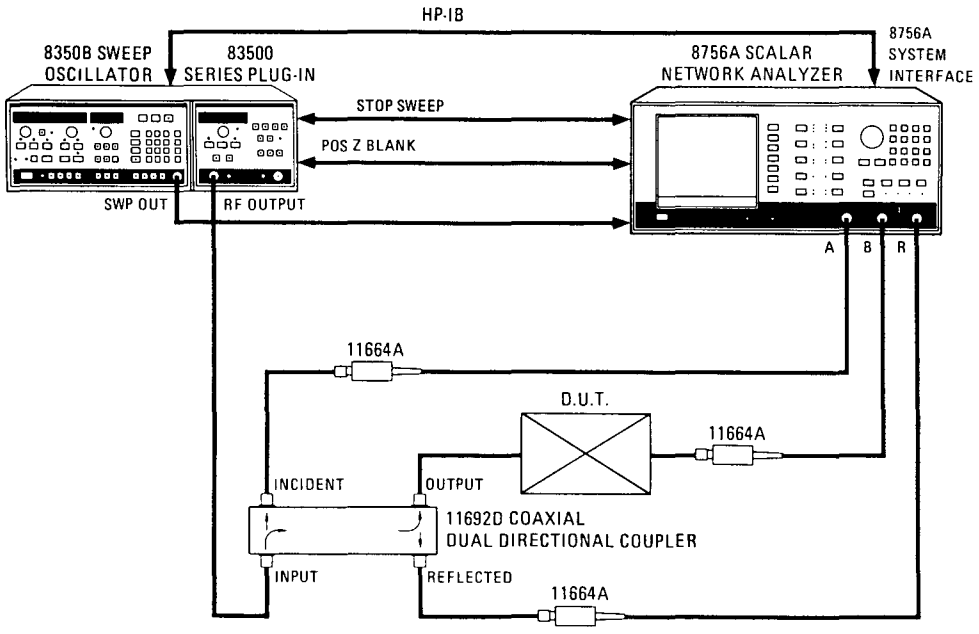
Figure 10. Gain Compression Display

Figure 11 outlines the general procedure used in making a scalar transmission and reflection measurement. The 11692D Dual-Directional Coupler is used in the example but if an 11666A Reflectometer Bridge, a 85020A/B, or a 85021 A/B Directional Bridge is available, it may be used instead of the Coupler and two detectors.

For more information and additional features of the 8756A with the 8350B, refer to the Operating Section of the 8756A Operating and Service Manual.

Example:

1. Connect the equipment as shown in the diagram below. Initially, the 8350B should be set by pressing **[PRESET]** on the 8756A. The sweep time will be set to 150 ms, the 8350B internal square wave modulation and the 8350B INSTR PRESET will be activated.



Notes on connections:

- Either the front or rear panel SWEEP OUT/IN may be used.
- When in ALTn mode both channels 1 and 2 (on 8756A) must be on and receiving inputs.

2. Turn off channel 1 on the 8756A by pressing **[SHIFT] [MEAS RATIO]**. Set the 8350B controls as desired. On channel 2 set the function, dB/DIV and Offset desired for viewing the current sweep setting.

3. Set the 8350B controls as desired then store the current 8350B sweep setting in any available memory location. Then turn off channel 2 of the 8756A by pressing the **[SHIFT] [MEAS RATIO]** pushbuttons.

4. On Channel 1 of the 8756A, set the function, dB/DIV and Offset as desired. Set 8350B controls as desired.

5. Turn on channel 2. Press **[ALTn] [n]** and the 8350B will alternate between the two settings on successive sweeps.

Channel 1 now displays the response due to the current front panel setting while channel 2 displays the response to the setting stored in memory location n. The front panel controls of the 8350B are enabled and the current sweep setting may be altered if necessary.

Figure 11. Typical Test Setup Using 8756A

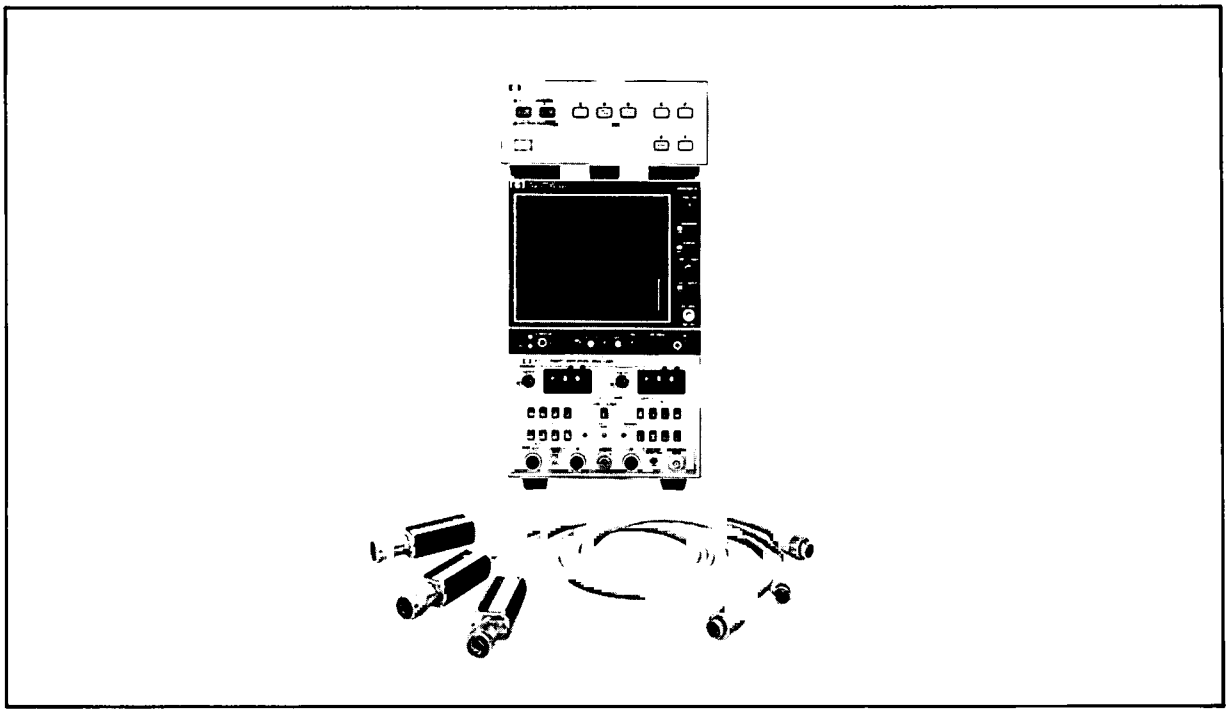


Figure 12. Frequency Response Test Set

8755S FREQUENCY RESPONSE TEST SET

The 8755S consist of:

- 8755C Swept Amplitude Analyzer
- 182T Oscilloscope
- 11664A Detectors (3 each)
- 8750A Storage-Normalizer

The 8755S is used for scalar transmission and reflection measurements requiring up to 60 dB of dynamic range and for absolute power measurement from −50 dBm to +10 dBm.

The 8350B has the following features designed specifically for use with the 8755S Frequency Response Test Set:

RF Square-wave Modulation. By engaging the ⌐⌐MOD key an internally generated squarewave modulation of the RF output is available thus eliminating the need for external modulating equipment. A jumper internal to the 8350B enables the square wave modulation frequency to be changed to 1 KHz (see section 5 of the Operating and Service manual for details).

Alternate Sweep Function. The ALTn function of the 8350B allows two different frequency and power settings to be swept on successive sweeps. The front panel setting and the setting stored in a memory register location n (n=1, . . . ,9) can be selected for alternate sweeps. The Alternate Sweep Function will not work properly with the 8755A or 8755B. See Figure 13 for a sweep display of the ALTn function when used with a bandpass response at different resolutions and offsets.

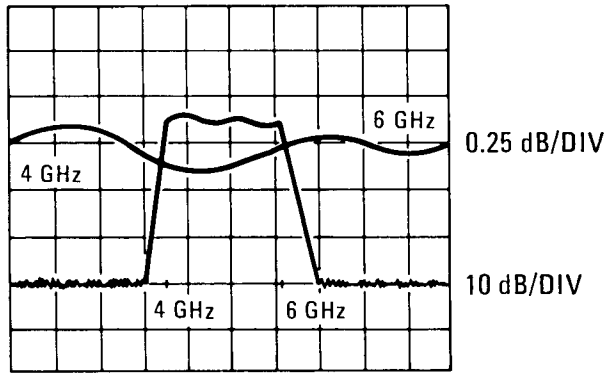


Figure 13. Alternate Sweep Function Display

Some other features enhancing the convenience and versatility of the 8755S are:

Marker Δ. The MKR Δ function increases trace intensity between the Active and the previously Active markers. The 8750A Storage-Normalizer will need to be in BYPASS mode to view Z-axis modulation on the oscilloscope.

Power Sweep. The RF output power may be ramped up when the sweeper is in the swept or "swept" CW mode by using the POWER SWEEP function. See Figure 14 for a gain compression display using power sweep.

Save and Recall. This function allows the storage and recall of nine complete instrument settings.

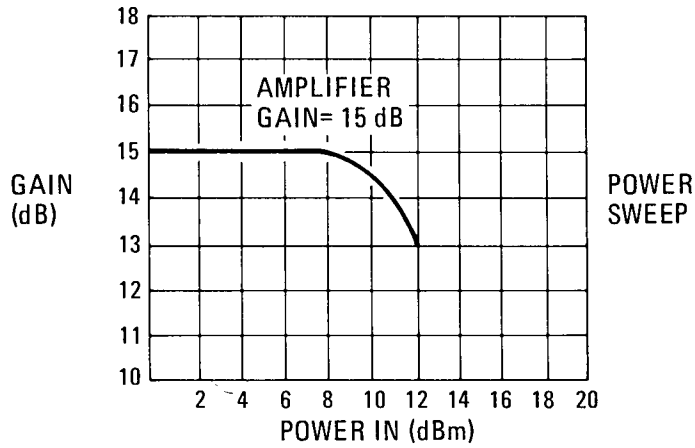


Figure 14. Gain Compression Display

Figure 15 outlines the general procedure used in making a scalar transmission and reflection measurement. The 11692D Dual-Directional Coupler is used in the example but if an 11666A Reflectometer Bridge is available it may be used instead of the Coupler and two detectors (8755S Option 002).

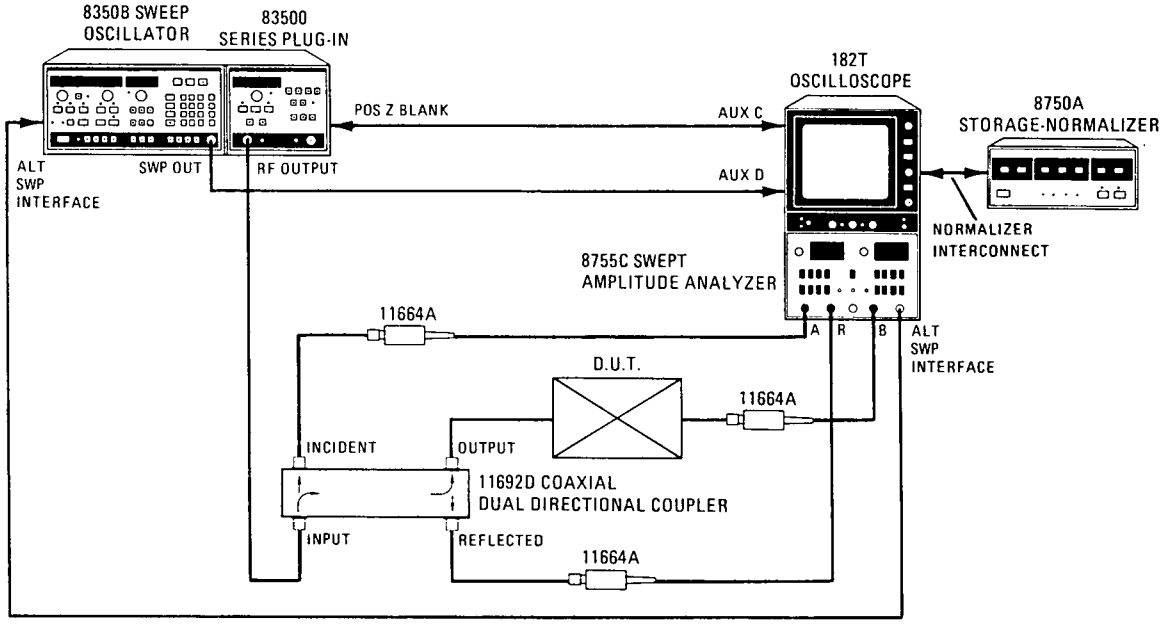
To keep the following procedure brief the 8750A will not be used (switched to BYPASS) in the procedure. The following anomalies exist when using the 8750A with the 8350B Sweep Oscillator:

- The 8350B DISPL BLANK must be engaged to ensure triggering 8750A updating.
- Intensity markers are changed to amplitude markers. In MKR Δ mode they appear as a level shift over the MKR Δ range.

- If an 8755 channel is switched off the trace goes to the reference line (bottom of CRT).

Example:

1. Connect the equipment as shown in the diagram below. Initially, the 8350B should be set by pressing **[INSTR PRESET]** [⊔⊓ **MOD]** (Set to 27.8 KHz) which will set the front panel instrument state and activate the internal square wave modulation.



Notes on connections:

- Either the front or rear panel SWEEP OUT/IN may be used.
- When in ALTn mode both channels 1 and 2 (on 8755C) must be on and receiving inputs.

2. Turn off channel 1 on the 8755C by releasing the display pushbutton. Set the 8350B controls as desired and set [⊔⊓MOD] on. On channel 2 set the function, dB/DIV and Offset desired for viewing the current sweep setting.
3. Set the 8350B controls as desired then store the current 8350B sweep setting in any available memory location. Then turn off channel 2 by releasing its display pushbuttons.
4. Turn on Channel 1 of the 8755C and set the function, dB/DIV and Offset as desired. Set 8350B controls as desired.
5. Turn on Channel 2. Press **[ALTn] [n]** and the 8350B will alternate between the two settings on successive sweeps.

Channel 1 now displays the response due to the current front panel setting while channel 2 displays the response to the setting stored in memory location n. The front panel controls of the 8350B are enabled and the current sweep setting may be altered if necessary.

Figure 15. Typical Test Setup Using 8755S

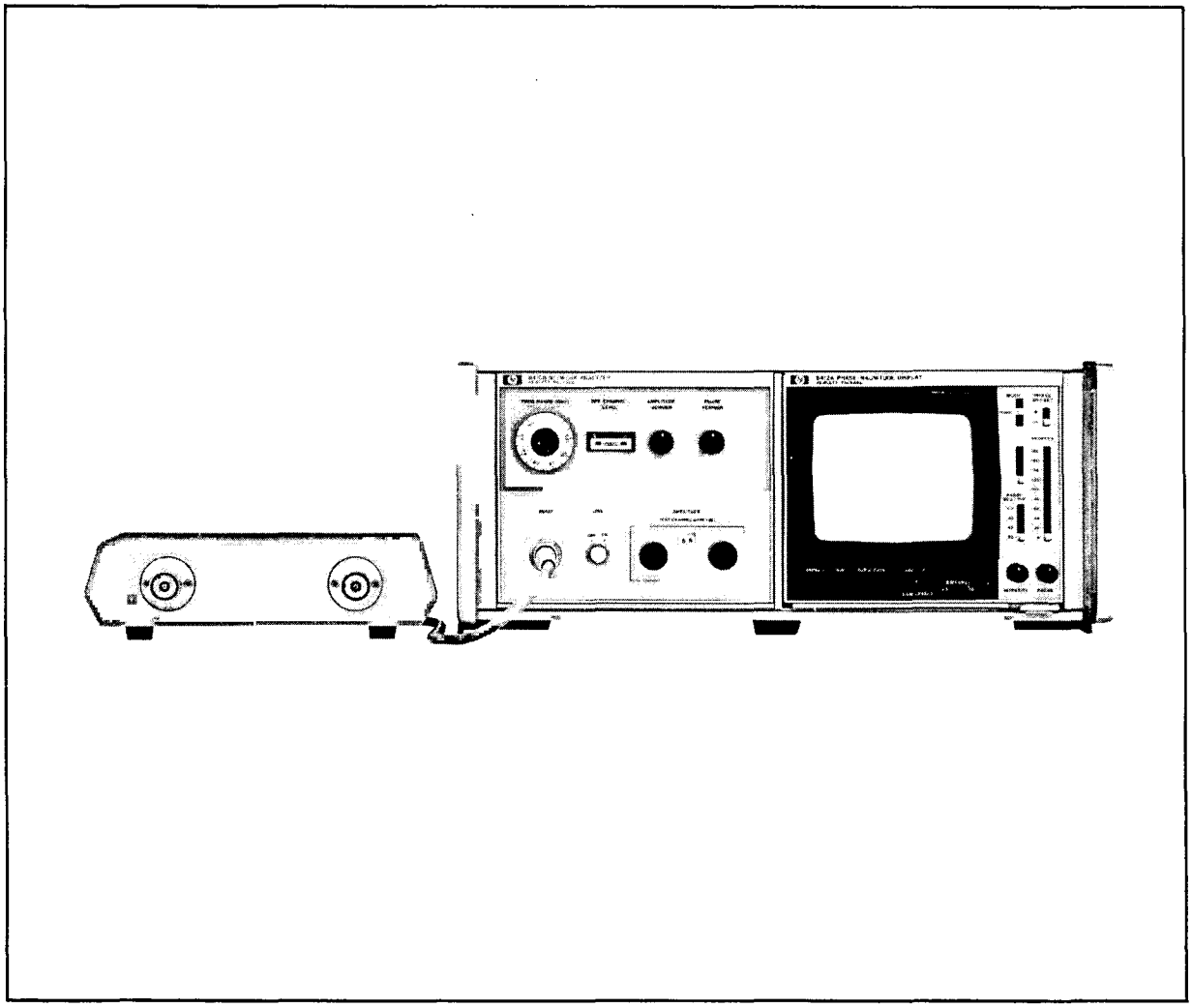


Figure 16. Frequency Response Test Set

8410B NETWORK ANALYZER

The 8350B is compatible with the 8410B Network Analyzer systems and accessories. The Source Control Cable (HP P/N 08410-60146) synchronizes the two instruments to provide continuous multi-octave coaxial magnitude and phase measurement capability from 110 MHz to 18 GHz with 65 dB dynamic range. The frequency markers can be displayed in polar format as intensity dots (Z-axis). Frequency markers derived from crystal oscillators allow frequency measurements to be made with an accuracy of five parts per million.

Waveguide measurements between 18 and 26.5 GHz can be made with the K8747A Reflection/Transmission Test Unit which is designed for use with the 8410B. This test system utilizes two 8350B Sweep Oscillators and 83570A 18 to 26.5 GHz RF Plug-ins. One sweeper is used as a local oscillator while the second is used to sweep the desired frequency range.

See Figure 17 for an example measurement set up using the 8410B with a single 8350B and 83500 series Plug-in.

The 8410B FREQ RANGE should be set to AUTO. In addition, the sweep time on the 8350B should be slow enough and/or sweep range narrow enough to insure phase locking over entire sweep range.

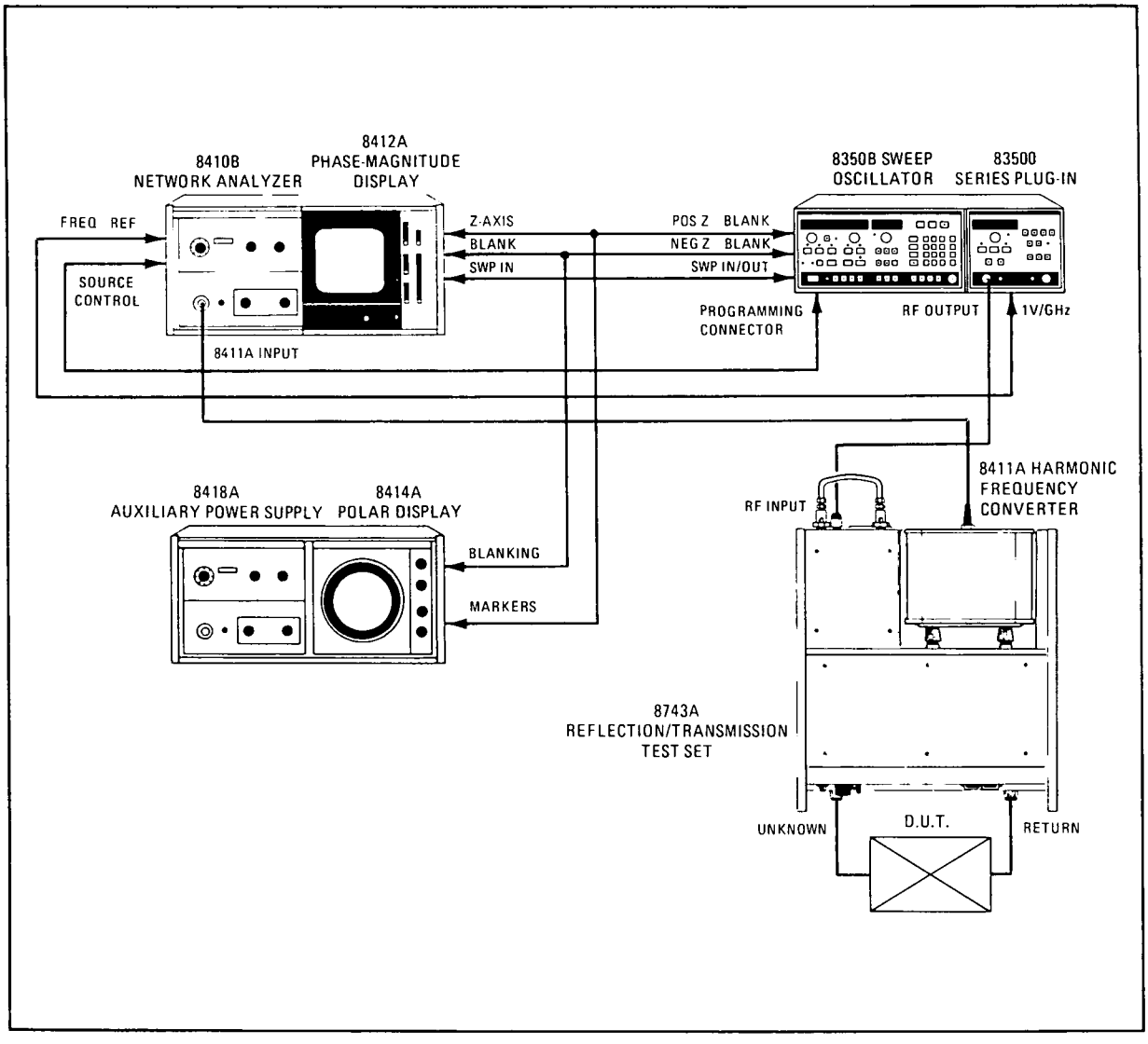


Figure 17. 8350B Connections to 8410

Notes on connections:

- FREQ REF output of the 83500 or 86200 series Plug-ins provides a 1-volt-per-GHz output so that the 8410B may synchronize with the sweep.
- The 8410B display units (8412A, 8414A) require that the NEG Z BLANK from the 8350B be used as the blanking signal.
- POS Z BLANK (from the 8350B) line contain the Z-axis markers. This line connects to the MARKERS input on the 8414A Polar Display and to the Z AXIS input on the 8412A Phase-Magnitude Display.
- SWEEP OUT/IN outputs a 0 to +10 volt signal in proportion to the swept or CW frequency output. 0V corresponds to the lower frequency sweep limit; +10V to the upper. Swept RF output causes a ramp voltage out; CW output causes a dc voltage out.This connection is necessary only when using 8412A Phase-Magnitude Display.
- 8350B/8410B SOURCE CONTROL CABLE. Provides "handshake" lines for synchronization between 8350B and 8410B (HP Part No. 08410-60146).

X-Y RECORDERS

The 8350B is equipped with outputs for controlling X-Y analog recorders.

Some of the HP X-Y recorders that may be used with the 8350B are:

7010B/7015B
7035B
7004B/7034A
7044/7045/7046/7047

The available/required signals for proper operation with an X-Y recorder are:

X INPUT – Typically SWEEP IN/OUT. Supplied by BNC connector on front or rear panel.

Y INPUT – Y axis voltage. On 8755S Frequency Response Test Set this would be AUX A for channel 1 or AUX B for channel 2. For 8410B systems, the 8412A display provides amplitude and phase outputs.

PEN LIFT – Signal line for controlling remote pen up/down. Pen up is open contact or +5 volts. Pen down (current sink) is contact closure to ground or 0 volt. Supplied by BNC connector on rear panel or pin 10 on 8350B Auxiliary Program Connector.

RECORDER (SERVO) MUTE – 7044/7045/7047 only. Control line that mutes the power to the recorder servos for 100 ms at bandswitch (when using multi-band Plug-ins) or designated points. Pin 11 on the 8350B Auxiliary Program Connector.

PEN LIFT REQUEST – Allows a pen lift to be initiated by remote control independent of the present pen lift status. Pin 3 on the 8350B Auxiliary Program Connector.

INVERSE PEN LIFT – Inverse function of Pen Lift, pin 23 on 8350B Auxiliary Program Connector.

The pen lift control line is assigned to a pin on the Remote Control connector of the X-Y recorder. For a complete pin assignment listing refer to the Operating Manual for the particular X-Y recorder being used.

Pen lift pin location on X-Y recorders:

Recorder	Pen Lift Pin No.
7010B/7015B	3
7035B	18
7004B/7034A	18
7044A/45A/47A	1
7046A	34

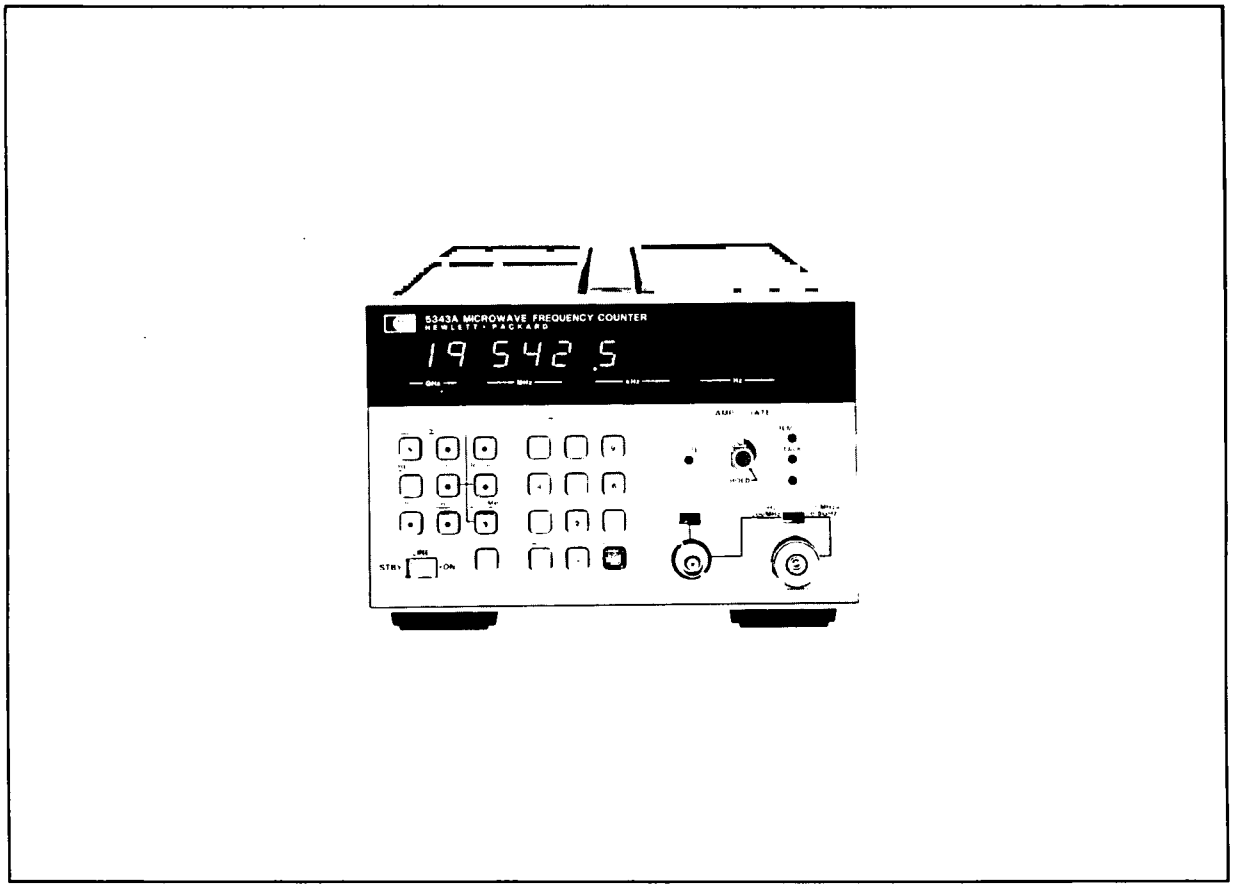


Figure 18. 5343A Microwave Frequency Counter

5343A FREQUENCY COUNTER

The 5343A Microwave Frequency Counter can be used with the 8350B to measure frequencies in swept mode in addition to normal CW frequency measurements.

During swept operation the 5343A will stop the 8350B sweep and count a selected frequency parameter such as the START frequency, STOP frequency or any frequency markers in the sweep range. To accomplish this, the 8350B and 5343A communicate via two signal lines (Counter Trigger, Stop Sweep on the 8350B and Sweep Interface A and B on the 5343A) that enable the 8350B to externally trigger the 5343A and then allow the 5343A to stop the sweep long enough to gate and count the selected frequency parameter.

See Figure 19 for the test set up.

Measuring CW frequencies

When measuring CW frequencies the CNTR TRIG and STOP SWEEP connections are not necessary. The 5343A should be in the AUTO mode and the internal square wave modulation on the 8350B must be off.

Auxiliary Output

The auxiliary output of an RF Plug-in (if available) may be used with the 5343A. When using the auxiliary output of a multi-band Plug-in such as the 83592A (0.01-20 GHz) the frequency multiplier feature of the 5343A may be used so that the proper RF frequency is displayed.

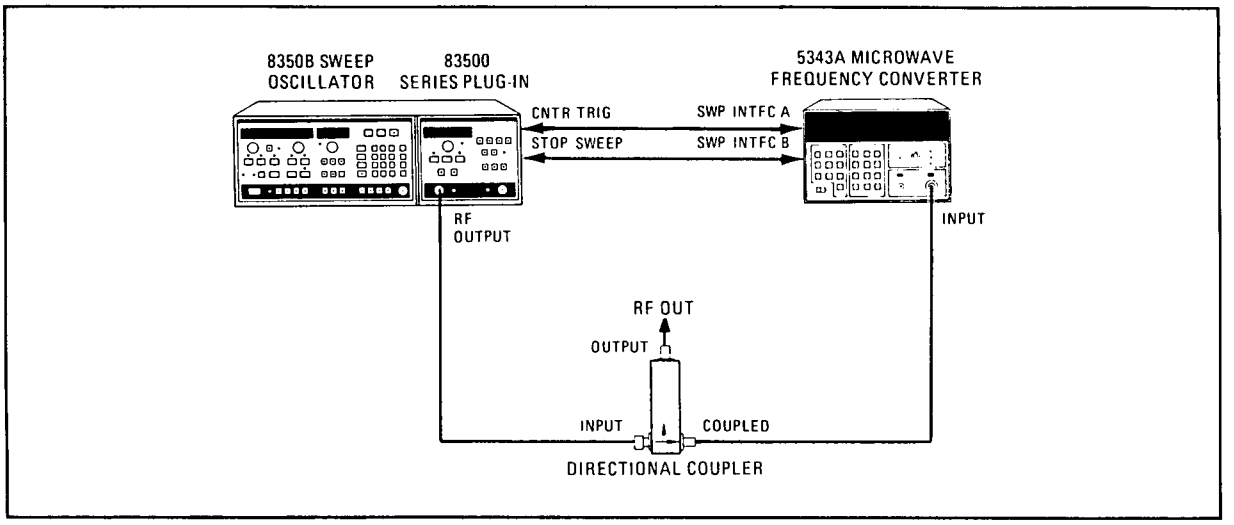


Figure 19. 5343A Test Setup

Notes on connections:

- A power splitter or directional coupler may be used as long as the input to the 5343A does not exceed +7 dBm or go below the minimum sensitivity.
- CNTR TRIG (Counter Trigger): Output for controlling the HP 5343A Microwave Frequency Counter. This allows a frequency count of the selected marker, START or STOP frequency of the present sweep. Connects to the SWP INTFC A (sweep interface, on the rear panel of the 5343A) to externally trigger the counter.
- STOP SWEEP: Input for stopping the progress of the forward sweep. When connected to the SWP INTFC B (sweep interface, on the rear panel of the 5343A) the 5343A stops the sweep long enough for the counter to gate and measure the selected frequency marker, START or STOP frequency. If the internal modulation on the 8350B is on, it is momentarily disabled so that the counter may measure the frequency.

To measure a START, STOP, or marker frequency during a sweep:

5343A: Set to AUTO, SWP M and set desired frequency resolution. Set the rear panel ACQ TIME switch to MED.

8350B: Select the frequency parameter to be measured by pressing the appropriate key, START, STOP, or any marker Mn (where n=1, ...,5) and then press **[SHIFT] [M2]**

If the sweep setting is changed or it is desired to exit this mode, disable the 5343A by pressing **[SHIFT] [M3]** on the 8350B front panel.

Example:

To measure the START frequency.

1. Connect equipment as shown in Figure 19. Set the 5343A to AUTO, SWP M and set desired frequency resolution.
2. Press the 8350B **[INSTR PRESET] [START] [SHIFT] [M2]** keys. The 5343A will temporarily stop the sweep, measure the frequency and display it at the desired resolution.

NOTE

Improve Frequency Accuracy and Stability With HP 5344A Source Synchronizer.

The 8350B can be used with the HP 5343A Microwave Frequency Counter and the HP 5344A Source Synchronizer to achieve 1 KHz frequency accuracy with 1Hz frequency resolution in a CW mode. Analog swept frequency accuracy can also be improved by the wideband Lock-and-Roll techniques and narrowband (40 MHz) phase-lock sweep capabilities controlled by the 5344A Source Synchronizer. Added stability is possible by phase-locking the 8350B RF output to the 10 MHz time-base crystal of the 5343A Counter. For more information see a HP 5344S Source Synchronizer data sheet or Operating and Service Manual.

APPENDIX 1
REAR PANEL CONNECTIONS.

For a diagram of the rear panel see Figure 20.

POS Z BLANK. Positive Z axis blanking signal. Supplies a rectangular pulse of approximately +5V into 2500 ohms during the retrace and bandswitch points of the RF output. Also supplies a −4V (−8 volts for active marker) pulse when the RF is coincident with a marker frequency if intensity markers are selected.

NEG Z BLANK. Negative Z-axis blanking signal. Supplies a negative rectangular pulse (−5V into 2500 ohms) during the retrace and bandswitch points of the RF output.

PEN LIFT. Output to control the pen lift function of an X-Y recorder. Maximum pen-up level is +40V and maximum pen-down sink current is 150 mA (at +0.7V).

SWEEP OUT/IN. Wired in parallel with sweep out/in BNC connector on front panel. See Display Functions Control group for a description.

CNTR TRIG. Counter Trigger (HP 5343A Frequency Counter only). Output for controlling the external trigger input of the HP 5343A frequency counter.

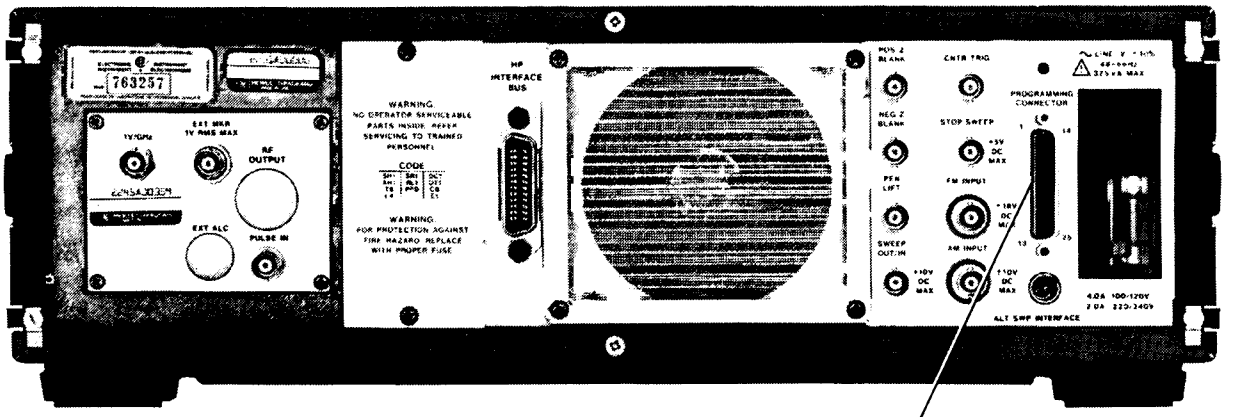
STOP SWEEP. Input for stopping the progress of a forward sweep. When input is 0 to 0.8 volt, sweep is stopped – RF output is a constant CW frequency. Sweep continues when input voltage returns to greater than 2 volts or open circuit. Usable with the HP 5343A Frequency Counter and CNTR TRIG to select and measure frequency points along the sweep.

FM INPUT. Input for frequency modulation or phase lock error signal for the Plug-in. This input is passed through to the Plug-in and processed by the Plug-in only. See Plug-in specifications for frequency deviation and sensitivity.

AM INPUT. Input for external amplitude modulation of the Plug-in. This input is passed through to the Plug-in. See Plug-in specifications for amplitude input range.

ALT SWP INTERFACE. Connects via cable HP Part No. 8120-3174 to 8755C to provide Alternate Sweep function.

PROGRAMMING CONNECTOR. See Figure 20 for pin designation.



PROGRAMMING CONNECTOR

Pin No.	Description		Pin No.	Description	
1			15 −	Marker Pulse Request	(I)
2 −	Marker Pulse	(O)			
3 −	Pen Lift Request	(I)	16 −	Retrace	(O)
4 −	Sweep Alternate	(O)	17 −	Alternate Sweep Enable	(O)
5 −	Stop Fwd. Sweep Request	(I)	18 −	Stop Sweep Request	(I)
6	+5 Volt (100 ma MAX)	(O)			
7 −	RF Blanking	(O)	19	Digital Ground	(I/O)
8 −	RF Blank Request	(I)	20 −	Blanking Pulse Request	(I)
9 −	Ext. Trigger Input	(I)	21 −	Counter Trigger	(O)
10 +	Pen Lift	(O)	22 −	Step Up	(I)
11 −	Recorder Mute	(O)	22 −	Advance	
12	—	(O)	23 −	Inverse Pen Lift	(O)
13	—		24 +	8410 Ext. Trigger	(O)
14 −	Blanking	(O)	25	—	

− Negative Logic (True is logical "Ø") (I) Input
+ Positive Logic (O) Output

Figure 20. Rear Panel Connections

APPENDIX 2:

86200 SERIES PLUG-INS WITH 11869A ADAPTER

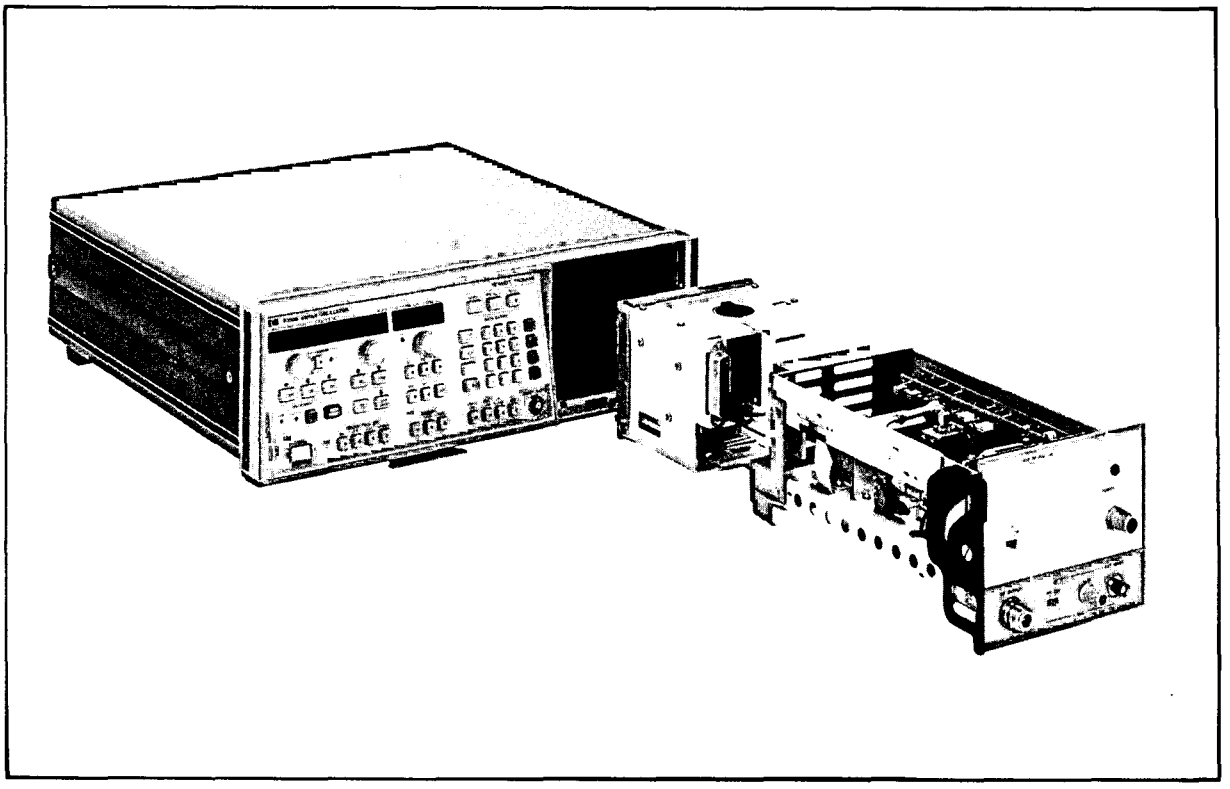


FIGURE 21. Connecting 11869A Adapter to 86200 series Plug-in

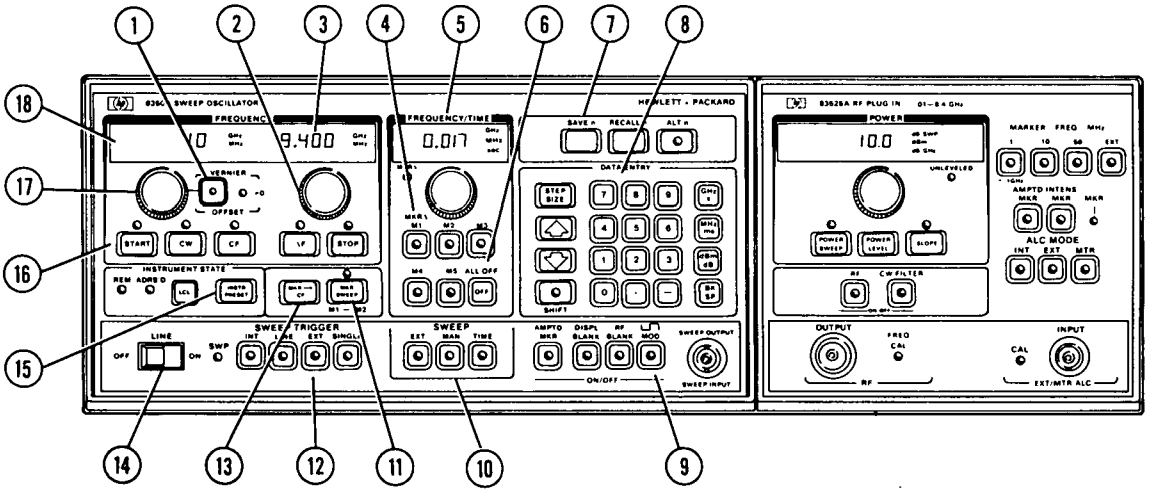
Although designed for the 8620 Sweep Oscillator, the 86200 series RF Plug-ins can be used in the 8350B Sweep Oscillator with the addition of the 11869A Adapter.

The 11869A Adapter provides the electrical and mechanical interface between the 8350B and an 86200 series Plug-in. A switch on the 11869A allows the user to select the appropriate interface code (from the code listing on the adapter) so that an 86200 series Plug-in can be used in the 8350B mainframe.

All of the standard performance and control of the 8350B is available when using an 86200 Plug-in with the 11869A Adapter. However, Plug-in functions (e.g. output power, RF on/off, Plug-in markers) will not be programmable and will not respond to keyboard and step keys. On the rear panel of the 11869A Adapter are several hole plugs that allow connection to be made to the back panel of the Plug-in. 11869A Option 004 provides two semi-rigid cables to allow connection of 86200 series rear panel output to 11869A rear panel output.

Special Plug-ins: **(Plug-ins with Option HXX)**

When using 86200 series Plug-ins that have been factory modified for a non-standard frequency range, a PROM obtained from the factory must be used in the 11869A Adapter. The PROM is inserted in the 16-pin socket on the PC board of the adapter and is needed for proper interfacing and controlling of a non-standard plug-in.



APPENDIX 3
FRONT PANEL CONTROLS SUMMARY

1. **Vernier/Offset.** Vernier function offsets sweep ranges, CW or CF frequencies. ≠0 lamp lit when non-zero offset or vernier present.

2. **Right Frequency Control.** Adjusts ΔF or STOP frequency.

3. **Right Frequency Display.** Displays STOP or ΔF frequency in GHz or MHz.

4. **MKR-Δ.** Allows user to display frequency difference between any two markers and intensifies the appropriate portion of the display.

5. **Frequency/Time Display.** Display Marker or manual sweep frequency in GHz or MHz. Sweep Time in seconds and HP-IB address.

6. **Markers.** Controls the five independent, mainframe supplied frequency markers.

7. **Save n/Recall n/Alt n.** Can save and recall up to nine different settings.

8. **Data Entry Keyboard.** Can enter exact values or step sizes for most sweep parameters via the keyboard.

9. **Output Controls.** Can control marker display mode, RF and display blanking and internal square wave modulation (of the RF output).

10. **Sweep Mode.** Selects External, Manual, or Timed sweep mode.

11. **MARKER SWEEP.** Causes Marker 1 frequency to temporarily become start of sweep, Marker 2 frequency to become stop of sweep.

12. **Sweep Trigger.** Determines how sweep will trigger.

13. **MKR→CF.** Causes center frequency of sweep to be shifted to the frequency of the currently active marker.

14. **Line switch.** Turns on/off 8350B mainframe and plug-in.

15. **Instrument Preset.** Selects a pre-determined instrument state.

16. **START/CF/CW/ΔF/STOP Sweep mode keys.** Selects mode of output and display.

17. **Left frequency Control.** Adjusts START, CW, CF, VERNIER or OFFSET.

18. **Left Frequency Display.** Displays START, CW, CF, VERNIER or OFFSET frequency in GHz or MHz, depending on mode selected, plus self test error codes.

Figure 18. Front Panel Controls